NOVEMBER 1, 2021

MASSACHUSETTS JOINT STATE WIDE ELECTRIC AND GAS

THREE-YEAR ENERGY EFFICIENCY PLAN

2022-2024

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

We, the Massachusetts Program Administrators (Massachusetts PAs, Program Administrators, or PAs),[1] are proud to submit this Massachusetts 2022-2024 Energy Efficiency Plan (2022-2024 Plan, Energy Efficiency Plan, or Plan) which represents our largest and most ambitious investment in energy efficiency and greenhouse gas (GHG) emissions reductions since the passage of the *Green Communities Act of 2008*.[2] The development of the 2022-2024 Plan comes at a transformational moment in the state's policy making and approach to energy and the environment and coincides with a concentrated effort by the General Court and the Baker Administration to place Massachusetts on the path to net zero GHG emissions by 2050 and to prioritize equitable program delivery and participation.

Electrification, equity, and workforce development are our top priorities for the 2022-2024 term. Our energy efficiency programs will help the Commonwealth meet its zero emissions goal by 2050.

At the end of 2020, the Commonwealth's Executive Office of Energy and Environmental Affairs (EEA) released a roadmap to outline multiple technical and policy pathways to achieve net zero GHG emissions by 2050 (the 2050 Roadmap). On March 26, 2021, Governor Baker signed into law Chapter 8 of the Acts of 2021, *An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy* (the Climate Act), codifying the Administration's commitment to achieve net zero emissions in 2050 and furthering the Commonwealth's nation-leading efforts to combat climate change and protect vulnerable communities.

The Climate Act establishes new mandates for GHG emissions reductions by 2030 and 2040 and directs the EEA Secretary to set a GHG emissions reduction goal, expressed in million metric tons of carbon dioxide equivalent ($MMTCO_2e$), for three-year Energy Efficiency Plans. The Act also requires the social value of GHG emissions to be included in our cost-effectiveness calculations for all energy efficiency measures (excluding fossil fuel heating and cooling) and allows us to propose, and the Energy Efficiency Advisory Council (EEAC) to approve, a mechanism that prioritizes GHG emissions-reducing projects. These actions will help us meet the GHG emissions target goals adopted under the *Global Warming Solutions Act* (GWSA).[3] On July 15, 2021, the EEA Secretary established the aggregate reductions in GHG emissions to be achieved as part of the 2022-2024 Plan.[4]

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[1] The PAs are: The Berkshire Gas Company, Fitchburg Gas & Electric Light Company d/b/a Unitil, Liberty Utilities (New England Natural Gas Company) Corp. d/b/a Liberty, Massachusetts Electric Company, Nantucket Electric Company, Boston Gas Company and former Colonial Gas Company, each d/b/a National Grid, NSTAR Electric Company, NSTAR Gas Company and Eversource Gas Company of Massachusetts, each d/b/a Eversource Energy, and Cape Light Compact JPE (the Compact). As a public entity and municipal aggregator, the Compact does not participate in performance incentives. Accordingly, any reference to or discussion of performance incentives in this Plan does not pertain to the Compact.

[2] *Massachusetts Green Communities Act of 2008,* which was passed by both chambers of the Massachusetts General Court, Jul. 2, 2008, legislation accessible online at: https://malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter169.

[3] *An Act Establishing the Global Warming Solutions Act,* which was passed by both chambers of the Massachusetts General Court, Aug. 7, 2008, legislation accessible online at: https://malegislature.gov/laws/sessionlaws/acts/2008/chapter298.

[4] See Appendix D. EEA Secretary, *Letter regarding Greenhouse Gas Emissions Reduction Goal for Mass Save*, Jul. 15, 2021, available online at: https://www.mass.gov/doc/greenhouse-gas-emissions-reduction-goal-for-mass-save/download.

We, the Massachusetts PAs, fully support the Commonwealth's ambitious goal of net zero GHG emissions by 2050. We have the expertise, relationships, and delivery infrastructure to build on our prior achievements and deliver long-term energy savings and GHG emissions reductions with an emphasis on equitable access for all residents and businesses. For the past 10 years, we have been effective contributors to the achievement of the state's climate change and energy goals. Using our energy efficiency programs, Commonwealth residents and businesses have reduced their carbon dioxide emissions by 3.7 $MMTCO_2e$ which is equivalent to taking 795,650 cars off the road.[5] As demonstrated throughout this Plan, electrification and equity are two of our top priorities. Consistent with the goals of the Climate Act, we "constructed [the 2022-2024 Plan] to meet or exceed the EEA's goal" for GHG emissions reductions.[6]

Simultaneously, due to the growing recognition of societal inequities systemic in the Commonwealth and our nation, we conducted a close examination of how participation in our energy offerings is distributed across the state. This focus has been informed by a set of comprehensive evaluation studies identifying *which* groups of customers participate at relatively lower levels and *why* they participate less. Our work on equity has also been informed by discussions with stakeholders through the Equity Working Group (EWG), convened by the EEAC. These rich sources of quantitative and qualitative information set the stage for our comprehensive and aggressive commitment to increasing equitable participation in our programs.

A priority in our design of the Plan was equitable program investments that ensure the weatherization and electrification of homes and businesses in environmental justice communities[7] and low-and-moderate income households.[8] Thus, this Plan reflects the general premise that energy efficiency does not stand in isolation, but is intimately connected to other Commonwealth policy goals, including GHG emissions reductions and increasing equity. While we will continue to focus on delivering energy-related benefits, our Plan adopts a more nuanced and broader definition of success than previous Three-Year Plans. Specifically, we will prioritize electrification and equity, in the upcoming term. In addition, we will significantly increase workforce development investments through close coordination with the Massachusetts Clean Energy Center (MassCEC) to increase diversity and expand the workforce. Elevating these goals is critical for supporting complementary Commonwealth policy priorities, ensuring the long-

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[5] Mass Save, *The Path to Carbon Neutrality*, Fall 2021, available online at: https://www.masssave.com/-/media/Files/PDFs/Learn/Path-to-Carbon-Neutral.pdf.

[6] M.G.L. c. 25, § 21(d)(4).

[7] In Massachusetts, beginning in June 2021, a census block group is defined as an environmental justice population if any of the following are true: (1) the annual median household income is equal to or less than 65 percent of the statewide median ($81,468 for a household of four in 2021), (2) minorities compromise 40 percent or more of the population, (3) 25 percent or more of households lack English language proficiency (English-isolated), or (4) minorities compromise 25 percent or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 percent of the statewide annual median household income. Further, the EEA Secretary may determine that a neighborhood shall not be designated an environmental justice population if she finds the following: (1) the annual median household income of that neighborhood is greater than 125 percent of the statewide median household income, (2) a majority of persons age 25 and older in that neighborhood have a college education, (3) the neighborhood does not bear an unfair burden of environmental pollution, and (4) the neighborhood has more than limited access to natural resources, including open spaces and water resources, playgrounds, and other constructed outdoor recreational facilities and venues. More information is available at: https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts. The PAs and DOER have jointly developed a list of a municipalities with prevalent environmental justice populations, and those municipalities are referred to as environmental justice communities for the purpose of this Plan. The process for selecting these municipalities is described in a highlight box in Section 1.1.2.

[8] For the purposes of the 2022-2024 Plan, the Commonwealth defines low income as households with incomes at or less than 60 percent of the state median income. The Commonwealth defines moderate income as households with incomes greater than 60 percent and equal to or lesser than 80 percent of the state median income.

term effectiveness of our work and meeting the needs and expectations of customers. These themes are woven throughout this Plan.

The 2022-2024 Plan represents the most distinct shift in how we define success since our development of the first three-year Energy Efficiency Plan following the passage of the *Green Communities Act of 2008.*[9] While we constantly look to expand and refine our offerings and respond swiftly to quickly evolving market conditions and priorities, the three-year planning process offers an opportunity for us to step back, reflect, and more deliberately reevaluate our program goals and the resources needed to achieve them. The scale of the benefits that we have delivered to the Commonwealth, in close partnership with the Department of Energy Resources (DOER), the Office of the Attorney General (AGO), the EEAC, the Low Income Energy Affordability Network (LEAN), contractors, and other stakeholders, represents both a source of pride and a welcomed challenge. We and other stakeholders are continuously looking to raise the bar to deliver sustainable and equitable energy savings, GHG emissions reductions, and benefits to customers, stakeholders, and the Commonwealth.

We will face notable challenges during the upcoming term, including energy prices and baselines. The increasing baseline efficiency of equipment and buildings in Massachusetts is a success story, but it also reduces claimable energy savings. Higher energy prices put further pressure on cost effectiveness and changes the customer economics of efficiency investments. Ensuring more equitable participation across all customers is a critical goal, but success will require resources and our working closely with MassCEC to establish a diverse and well-trained workforce will take time. Educating customers on technologies that are new to them will be critical to our success and will involve strategic planning and outreach. Some of these factors will result in increased costs to achieve our goals and will require that we redouble our dedication to innovation and recommit to a shared vision of success with our stakeholders and regulators.

The budget increase required to meet the ambition of the Climate Act is material. We expect that additional and significant outside funding will be required to achieve the Plan's electrification goals, such as funding for mitigating substantial commercial and industrial (C&I) pre-electrification barriers. The bill impacts associated with climate goals can be lessened if the Commonwealth identifies and provides the PAs with additional funding to offset costs and support its decarbonization goals. We are eager to work with the Commonwealth and the EEAC to obtain their commitment to providing us significant additional funding in the 2022-2024 term.

The urgency of issues like the climate crisis and the heightened understanding of, and need to respond to, societal inequity related to energy is unquestionable. As this Energy Efficiency Plan documents, we are dedicated to contributing toward progress on these issues, while also balancing the need to do so in a sustainable and affordable way for customers. We particularly sought to create a Plan that is sensitive to the reality that many of the Commonwealth's residents and businesses find themselves in more financial uncertainty than ever before due to COVID-19 and the economic downturn. Accordingly, the Plan strives to ensure that customers are realizing the benefits of energy efficiency that they expect. The delivery of sustained benefits that continue to exceed spending is critical for maintaining the broad-based support for one of the most comprehensive energy efficiency and demand

[9] *Massachusetts Green Communities Act of 2008,* which was passed by both chambers of the Massachusetts General Court, Jul. 2, 2008, legislation accessible online at: https://malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter169.

response portfolios in the nation. In this Plan, we describe our priorities, relevant context and trends, and the work we will undertake to achieve the proposed goals over the next three-year term.

The 2022-2024 Plan draws on our experience as implementers, the passion of stakeholders, and the insight of customers. The Plan contains both exciting innovation and critical incremental improvements and details our strategy to achieve a bold vision, acknowledging the need to continuously evaluate, test, and improve processes and offerings along the way. We are proud to submit this Plan and are eager to get to work on reducing energy use, improving equity, and contributing to the continuing decarbonization of the Commonwealth's economy.

1. Overview

SECTION 1: OVERVIEW

1.1 PLAN PRIORITIES

The *Green Communities Act of 2008,* as amended[10] and codified at G.L. c. 25, §§ 19, 21, 22 (GCA), mandates the Massachusetts PAs to "pursue all cost-effective energy efficiency that is less expensive than supply" and to construct the Energy Efficiency Plan to meet or exceed the GHG emissions target goals set by the EEA Secretary pursuant to G.L. c. 21N, § 3B. This mandate has created a broad framework for planning and implementation. Given the breadth of their programs and offerings, the PAs must clearly define key priorities to help focus their efforts, establish alignment with stakeholder interests, and signal a clear direction to Massachusetts customers and the marketplace. For the 2022-2024 term, the PAs have identified electrification, equity, and workforce development as their three key priorities.

1.1.1 ELECTRIFICATION

After the transportation sector, the state's largest source of GHG emissions is the building sector. Therefore, any plan to mitigate GHG emissions must include a pathway for decarbonizing space and water heating. Electrification will play a significant role in reducing the carbon intensity of heating, and energy policies such as the Renewable Portfolio Standard, Solar Massachusetts Renewable Target (SMART) program (photovoltaic feed-in tariff), offshore wind procurement, and imports of hydroelectric power will increase the proportion of low-carbon electricity on the grid. An increase in these lower carbon sources of electricity will make the electrification of heating a key contributor to reaching the Commonwealth's decarbonization goals. Electrification can enable incremental efficiencies and benefits beyond what is possible with delivered fuel systems and represents an opportunity for the PAs to continue to play a significant role in meeting the GHG emissions target goals of the Climate Act, 2050 Roadmap, and 2030 Interim Climate Energy Plan (2030 Interim CEP).[11]

The PAs recognize the importance of decarbonizing the building sector, and this Plan represents a necessary and measurable shift to electrification and away from traditional fossil-fuel based heating and cooling measures. The PAs will execute this shift in a measured, data-driven manner to ensure they continue to fulfill statutory requirements to pursue all cost-effective savings that benefit customers and provide opportunities for customers to engage in energy efficiency. With the passage of the Climate Act, the PAs will continue to prioritize net zero GHG emissions and equity across the energy sector. Electrification is consistent with the goals of the Climate Act and the PAs have designed the Energy Efficiency Plan to "meet or exceed the EEA Secretary's goal" for reducing GHG emissions through the installation of energy efficiency measures.[12] For the 2022-2024 term, the PAs will focus on increasing the scope and scale of building retrofits, through a focus on weatherization and efficient electrification.

For the upcoming term, the PAs will seek to prioritize higher savings opportunities and place a greater emphasis on electrification. For example, given the small incremental savings available for replacing condensing natural gas, oil

[10] Acts of 2012, c. 209, Acts of 2018, c. 227 § 20; Acts of 2021, c. 8.
[11] Commonwealth of Massachusetts, *Request for Comment on Clean Energy and Climate Plan for 2030,* Rel. Dec. 30, 2020, at 9, available online at: https://www.mass.gov/doc/interim-clean-energy-and-climate-plan-for-2030-december-30-2020/download.
[12] M.G.L. c. 25, § 21(d)(4).

(furnaces only) and propane heating systems with new condensing systems, the PAs will eliminate incentives for these replacements in residential buildings in the 2022-2024 term. Additionally, the PAs will eliminate residential incentives for oil-fired boilers (as the code has set efficient baselines) and central air conditioning systems that are not heat pumps. The PAs will closely follow the data as the market evolves to determine appropriate incentives throughout the three-year term.

Increased electrification under the Plan will help the Commonwealth achieve its net zero GHG emissions goals and potentially reduce heating expenses for some customers. During the upcoming three-year term, the PAs will make a concerted effort to promote electrification, particularly in instances in which customer economics and building characteristics (e.g., in the displacement of delivered fuels or in specific new construction scenarios) favor the use of high-efficiency heat pump technologies including air source, water source, ground source (geothermal), and variable refrigerant flow heat pumps.[13] Further, the most successful heat pump installations take place in buildings that are already weatherized; therefore, the PAs will bolster their efforts to weatherize buildings as a critical component of a larger electrification strategy that ensures buildings are ready to accommodate heat pumps when customers are installing new heating, ventilation, and air conditioning (HVAC) equipment.

The PAs believe that ensuring positive customer outcomes among early adopters, including reducing heating costs and maintaining comfort, is critical for the long-term success of electrification. For these reasons, the PAs will

Types of Heat Pumps

Air source heat pumps use outside air as a heating source (when in heating mode) or heat sink (cooling mode) and consist of an outdoor unit paired with one or more indoor units. The most common are air-to-air systems (transfer heat between outside/indoor air) and air-to-water systems (outside air/water loop inside).

Water source heat pumps use a water loop as a heating source (heating mode) or heat sink (cooling mode). The water loop may connect to one or more heat pumps and the loop's temperature can be managed to within a specific temperature range by a traditional boiler/chiller plant or by a ground loop acting as a heat source or heat sink from the earth.

Ground source or geothermal heat pumps are a type of water source heat pump which uses a ground loop from the earth/reservoir as a heating source (when in heating mode) or a heat sink (when in cooling mode). These units can be either *closed loop* where water is contained within a network of pipes (only heat is exchanged with the earth) or *open loop* where water is pumped to/from a reservoir and both water and heat are directly exchanged with the reservoir and the earth.

Variable refrigerant flow heat pumps are typically a type of air source heat pump (sometimes water source) which uses outside air (or a water loop) as a heating source or heat sink. This system can modulate the amount of refrigerant to each zone and allows a single outdoor unit to support multiple indoor units simultaneously operating in cooling and heating modes to meet the building's varying needs. This ability to have some indoor units in heating mode and others in cooling mode is referred to as "heat recovery" as heat is being moved between indoor units (cycled) within the conditioned space.

[13] Planned heat pump measure quantities for retrofit programs can be found in the benefit-cost ratio (BCR) models for each PA.

prioritize transitioning customers who are more likely to experience reduced heating costs and a seamless installation, while simultaneously working to address the technical and financial hurdles that make electrification more challenging for other customers. Specifically, customers who currently heat with oil, propane, or electric resistance are more likely to realize reduced heating costs from transitioning to a heat pump technology. Switching heating from oil to heat pumps also produces greater reductions in GHG emissions than switching from natural gas to electricity, further supporting a strategy of switching delivered fuel customers first. To support customer acceptance of heat electrification, the PAs will work with manufacturers and installation contractors to increase their confidence, comfort, and capability in proposing and installing efficient electric heat where it can provide customer benefits, regardless of fuel type.

The PAs note that the relatively high penetration of natural gas in the Commonwealth presents challenges from both a programmatic and customer standpoint. For natural gas-to-electric fuel switching, the customer economics can be tenuous. In almost all cases, a customer switching from natural gas to a heat pump as their primary source of space heating would realize an increase in the cost to heat their home or business, in addition to the incurred capital cost for the system's installation. In instances where customers may choose to switch from natural gas to electric (despite the cost implications), the PAs plan to offer an enhanced incentive and claim the resulting natural gas savings while continuing to engage with stakeholders on the programmatic impacts. The PAs anticipate that changing economics during the 2022-2024 term and beyond (both for system installation and energy supply), may support a broader range of scenarios where natural gas to electric fuel switching is economic.

At the same time, the PAs will prioritize immediate investments in improving building envelopes and readying the customer base and the workforce to prepare for these likely situations in the future. The PAs will continue to focus on weatherization, a foundational measure that reduces energy use and prepares residential and commercial buildings for electrification. The PAs will also optimize HVAC incentive levels to promote heat pump technologies in retrofit applications and prioritize measures consistent with the 2050 Roadmap and 2030 Interim Clean Energy and Climate Plan (CECP), such as insulation. Additional electrification strategies will include the introduction of an all-electric new construction pathway for residential buildings (New Construction Path-to-Zero offering), increased technical assistance and financial support for customers constructing all-electric new construction commercial buildings that minimize overall energy consumption, and continued promotions of Passive House certifications for commercial and residential new construction projects.

Given the substantial difference between the status quo and the vision detailed in the Commonwealth's 2050 Roadmap, building electrification is an excellent candidate for market transformation efforts. Therefore, the PAs will prioritize implementing tactics that boost the pace of space and water heating electrification in the short term, while also creating an environment for a larger market transformation over time. The implementation of this strategy will entail multiple approaches, such as pairing incentives with customer education, and contractor training alongside workforce development investments.

Market Transformation to Support Building Electrification with Heat Pumps

The PAs are committed to understanding and addressing market barriers to heating electrification, so that the *entire market* shifts to favor heat pumps, not just the portion of the market directly receiving Mass Save incentives. The PAs will specifically address the following market barriers, and will also conduct research to identify additional barriers they can address:

- Low levels of customer awareness of heat pump technology.
- Customer misperceptions regarding heat pump performance.
- Upfront equipment and installation costs.
- Contractor lack of familiarity with heat pump technology and resistance to promoting heat pumps given concerns over higher risk of customer dissatisfaction, longer sales cycles, and higher likelihood of call-backs/repeat service calls.
- Supply chain constraints and contractor tendency to sell equipment that is readily available.
- Insufficient skilled workforce necessary to design, sell, and install heat pumps.
- Distributors continuing to stock HVAC equipment not aligned with desired program outcomes.

The PAs recognize that relative fuel prices and customer economics present a barrier to heat pump adoption for customers who heat with natural gas. Although it is beyond the PAs' ability to influence fuel prices, the overall market transformation efforts that the PAs undertake will help make heat pumps more available, and contractors more able and willing to install them, so that these customers can more readily adopt them if they so choose. The PAs will work to address these barriers through market-wide strategies directed toward customers, contractors, distributors, and manufacturers. Strategies will include, but not be limited to:

- Establishing focused marketing and education campaigns to increase awareness and understanding of heat pumps.
- Creating online tools to help customers gain actionable information about heat pumps.
- Establishing additional support for customers to gain actionable information about heat pumps through virtual consultations with HVAC specialists.
- Providing new resources and support to community and volunteer-based organizations that are interested in establishing town campaigns.
- Ensuring that customers who weatherize their homes through Mass Save and would benefit from heat pumps have appropriate follow-up by preferred contractors.
- Cross-promoting weatherization and heat pumps and promoting contractor investment in cross-promotion to encourage customers to adopt complementary measures.
- Developing a network of preferred contractors (Participating Heat Pump Installer Network) trained in heat pump technology, and who can access Mass Save heat pump incentives.
- Connecting customers with preferred contractors.
- Developing a cold climate heat pump curriculum available to heat pump installers at no cost which will include training on the importance of weatherization, integrated controls, and sizing and selection.
- Partnering with trade and vocational schools to offer trainings and support and help grow qualified heat pump installer base.
- Partnering with manufacturers and distributors to promote and deliver trainings and provide certifications to all contractors (including those outside the Participating Heat Pump Installer Network).
- Expediting rebate processing and payments directly to preferred contractors.
- Partnering with MassCEC on workforce development investments and training.
- Offering midstream incentives to distributors to encourage them to stock and promote heat pumps.
- Working with manufacturers to expand their training offerings, build out channel sales teams, and convince more distributors to sell heat pumps.
- Establishing complementary marketing campaigns with manufacturers.

The PAs expect that these activities will increase demand for heat pumps and lead to increased heat pump adoption by customers, including those who do not take advantage of incentives. Specifically, the PAs expect these activities will increase customer awareness and product availability of heat pumps, increase contractor design and installation capacity and capability, drive cost reductions, and reduce the prevalence of competing technologies, particularly for air conditioning.

In the first half of 2022, the PAs will work with evaluation to establish a full-scale program theory and logic model for their heat pump market transformation initiative. This process will establish market indicators to track progress toward market transformation and help the PAs prepare to measure baseline conditions for these indicators in the market. Evaluation will work with implementation to track market indicators over time and will conduct an evaluation of market effects achieved by the end of 2024.

The PAs remain committed to promoting electrification within the bounds of the energy efficiency programs; however, for the electrification of heat to proceed at the scale and pace envisioned by the Commonwealth, additional policy support that tilts the relative economics in favor of electrification will be necessary. Electrification also will be a sustained effort over time; heating systems are not replaced frequently, but a sizable portion will be replaced naturally before 2050. Customers who have recently invested in a heating system may not consider any further upgrades in the near term. However, as the market begins to transform during the upcoming term due to the PAs' sustainable approach to building a solid foundation for electrification, the PAs expect to see a significant increase in air source, water source, ground source (geothermal), and variable refrigerant flow heat pumps installations over time, providing critical assistance to the Commonwealth as it works to meet its net zero GHG emissions goals.

Due to the nature of their programs, the PAs' primary electrification efforts during the 2022-2024 term will be focused on space and water heating. The PAs, however, recognize that transportation is the largest source of carbon emissions and that there are a number of opportunities for electrification outside of just space and water heating. Although direct transportation interventions are being pursued by the electric distribution companies through rate cases and stand-alone dockets, the PAs will pursue additional opportunities to bolster electrification in other areas, which may include electrifying end uses, such as residential and C&I lawn and garden equipment, forklifts, and other small engine-driven equipment, where cost-effective. The PAs will scale up their active demand response (ADR) program delivery infrastructure to help drive incremental adoption of electric vehicles (EVs) and charging equipment.

The residential and small business-scale heat pump offerings are fitting examples of how the PAs work across sectors to develop high-quality energy efficiency offerings. Since the equipment and HVAC contractor base for installing heat pumps in both homes and small businesses are largely similar, the PAs leveraged the implementation and evaluation work conducted at the beginning of the 2019-2021 term to expand the Residential program structure (i.e., minimum efficiencies, qualified products list, and incentive structure) to small commercial buildings. During the 2022-2024 term, the PAs expect to continue this coordination and manage these offerings in parallel. In addition to coordinating program design, the PAs will also focus on workforce and market development efforts that increase the speed and quality with which HVAC systems can be electrified. Further evaluation efforts should help to resolve any issues or questions (e.g., how to efficiently specify and operate heat pumps in different building configurations) and the PAs will apply the evaluation findings across all the sectors, wherever applicable.

ELECTRIFICATION STRATEGIES

RESIDENTIAL AND INCOME ELIGIBLE SECTORS

The PAs will introduce the following electrification strategies to the Residential and Income Eligible Sectors during the Plan term:

- Enhanced efforts to increase scope and scale of residential building retrofits, through a focus on weatherization and efficient electrification.
- Increased general and targeted customer education and outreach as it pertains to air source, water source, ground source (geothermal), and variable refrigerant flow heat pumps and their benefits.
- Introduction of a heat pump contractor network with a focus on quality installations that optimize heat pump usage.

- Increased installation of heat pumps to delivered fuel customers in Income Eligible programs.
- Targeted outreach to customers whose homes have already been weatherized to promote insulation and heat pump technologies.
- Introduction of a bundled weatherization and heat pump incentive.
- Optimization of HVAC incentive levels and program delivery to ensure prioritization of heat pumps.
- Continued workforce development and training to increase contractor comfort in recommending and installing heat pumps.
- Increased engagement with manufacturers and distributors to create allies and allow for direct feedback from market actors.
- Migration of heat pump water heater incentives to midstream pathways.
- Introduction of an all-electric new construction offering—the New Construction Path-to-Zero.
- Introduction of an induction cooktop incentive displacing fossil fuel.
- Scaling up of ADR offerings for EVs, establishing make-ready requirements in residential new construction, and exploring the use of energy efficiency infrastructure to promote EVs.
- Consideration of new incentives for electrification of other end uses displacing fossil fuels at customer's homes, such as lawn and garden equipment.

COMMERCIAL & INDUSTRIAL SECTOR

The PAs will introduce the following electrification strategies to the C&I Sector during the upcoming term:

- Enhanced efforts to increase scope and scale of commercial building retrofits, through a focus on weatherization and efficient electrification.
- Significant increase in the level of financial and technical support offered for heat pumps and electrification through the harmonization across all participation pathways—midstream, downstream, prescriptive, and custom.
- Continued workforce development and training to increase contractor confidence and capability in recommending and installing heat pumps.
- Increased engagement with manufacturers, distributors, and installers to better characterize the scenarios in which heat pumps are being installed and to streamline the application process.
- Consideration of new incentives for electrification of other end uses displacing fossil fuels, such as commercial lawn equipment, forklifts, and other small engine-driven equipment.

- Increased commercial weatherization services to facilitate economic electrification of heating systems, both in the present and as systems are replaced in the future.

- Increased technical assistance and financial support for customers constructing new buildings minimizing overall energy consumption, especially all-electric new construction projects.

1.1.2 EQUITY

The PAs have made equity one of the key strategic priorities of the 2022-2024 Plan. Equity, as used herein, is defined as the process of establishing more equal access to and participation in energy efficiency, particularly among those groups who have historically participated at lower rates, including renters/landlords, moderate-income customers, English-isolated families,[14] and microbusinesses.

Across all sectors, the PAs are working to increase participation among the above-referenced groups by researching and deploying the most effective strategies to engage these customers, including through increased collaboration with community partners, enhanced incentives, improved language access, and targeted messaging. The first step to reducing inequities in energy efficiency is understanding where they exist. During the 2019-2021 term, the PAs commissioned a series of studies that were completed in 2020, including the *Residential Non-Participant Customer Profile Study*,[15] the *Residential Non-Participant Market Characterization and Barriers Study*,[16] and the *C&I Small Business Non-Participant Customer Profile Study*.[17] As depicted in Figures 1-1, 1-2, and 1-3 below, these studies showed that some groups of customers are less aware of the PAs' programs and therefore less likely to participate than others.

For example, renters are less likely to participate than homeowners (Figure 1-1), while moderate-income customers are less likely to participate than those with higher than moderate incomes (Figure 1-2).[18] Additionally, customers who speak English "not at all" or "not well" are less likely to participate in the PAs' programs than those that speak English "well" or "very well" (Figure 1-3). The largest differences are among renters versus owners (a 10 percentage-point difference in participation), while for the other groups, the differences are smaller but still statistically significant. Renters face challenges to participating since they are not the decisionmakers for installing measures such

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[14] In Massachusetts, the EEAC and the PAs refer to customers where 25 percent or more of their household has *no one* over the age of 14 who speaks "English only" or "very well" as "English-isolated families." Being classified as an English-isolated family is one of the Commonwealth's three criteria for a geographic area/community to be designated as an Environmental Justice community. The Environmental Protection Agency (EPA) defines the same population of customers as "linguistically-isolated customers." For the 2022-2024 Plan document, the Massachusetts PAs will use the term "English-isolated families" to remain consistent with the Commonwealth's and EEAC's policies.

[15] *Residential Non-Participant Customer Profile Study (MA19X06-B-RESNONPART*), produced for the Massachusetts PAs by DNV GL, Feb. 6, 2020, available online at: https://ma-eeac.org/wp-content/uploads/MA19X06-B-RESNONPART_Report_FINAL_v20200228.pdf.

[16] *Residential Non-Participant Market Characterization and Barriers Study (*MA19X06-B-RESNONPART), produced for the Massachusetts PAs by Navigant, Illume, and Cadeo, Feb. 27, 2020, available online at: https://ma-eeac.org/wp-content/uploads/MA19R04-A-NP-Nonpart-MarketBarriersStudy_Final.pdf.

[17] *Commercial and Industrial Small Business Non-Participant Customer Profile Study (MA18X11-B-SBNONPART)*, produced for the Massachusetts PAs by DNV GL, Apr. 15, 2020, available online at: https://ma-eeac.org/wp-content/uploads/Final-MA19X11_B_SBNONPART-Report-20200415-1.pdf.

[18] See *Residential Non-Participant Market Characterization and Barriers Study.*

as weatherization and heating system upgrades. If renters pay the utility bills, landlords may not see the value in funding upgrades that would reduce costs only for the tenants.

During the 2019-2021 term, the PAs worked collaboratively with EEAC Councilors and other stakeholders to form the EEAC's EWG to make recommendations regarding improving the equity of outcomes achieved within the programs, expand their understanding of the barriers customers encounter when engaging in energy efficiency, and establish a set of metrics by which the PAs will benchmark and measure success over time toward achieving the intended equity-related outcomes from improved program design. One of the key objectives of the EWG was to conduct a series of focus groups to solicit feedback from public and private organizations, and businesses who engaged with renters, landlords, and English-isolated families.

The *Non-Participant Market Characterization and Barriers Study* also identified several consistent themes around barriers to customer participation, including lack of trust in government and landlords, prioritizing basic needs, lack of understanding/awareness of offers, and perceptions that offers are not relevant to them. Customers who do not trust the legitimacy of the programs may prioritize other areas of their lives, and customers who do not understand the benefits that energy efficiency offers may not see the relevance of program participation to their lives. The most common reasons that non-participants give for not participating in Mass Save programs are: (1) not being aware of the program offers (27 percent), (2) thinking that their house is already energy efficient (23 percent), (3) not wanting to deal with the hassle of participating (22 percent), or (4) not having the time (18 percent). Financial barriers were less commonly cited, with 10 percent of non-participants saying they did not have financing options and 7 percent saying they could not afford to implement the energy efficiency project.[19]

The PAs conclude from this data that successful efforts must address both financial and non-financial barriers. The PAs actively identified external stakeholders to support this important initiative and facilitated several listening sessions to help foster inclusion. Dozens of stakeholders representing various customer segments throughout the Commonwealth shared ideas on how the Massachusetts PAs can improve equitable participation in energy efficiency programs.[20] The PAs also benefitted from valuable insight and received feedback from participants to launch the second iteration of the Municipal & Community Partnership Strategy, an initiative first scaled statewide by the PAs in 2019 to work with local partner communities to increase the reach of energy efficiency savings, especially among renters, moderate-income residents, English-isolated families, and small businesses, with an emphasis on environmental justice communities.

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[19] See *Residential Non-Participant Market Barriers Study*, at C-10.

[20] *EEAC EWG Summary to EEAC on Moderate-Income, Renter and Landlord, Small Business, and Community Partnerships Recommendations*, Jan. 2021, available online at: https://ma-eeac.org/wp-content/uploads/Workshop-5-Equity-Working-Group-Process-and-Recommendations-01.08.21-MM-Final-002.pdf. In February 2021, the EEAC EWG updated these recommendations. See *Updated EWG Recommendations 2/19/2021*, Feb. 19, 2021, available online at: https://ma-eeac.org/wp-content/uploads/EWG-Recommendations-2.19.21.pdf.

Results of 2020 Residential Non-Participant Market Characterization and Barriers Study

Figure 1-1: Participation Data (Renters vs. Owners)

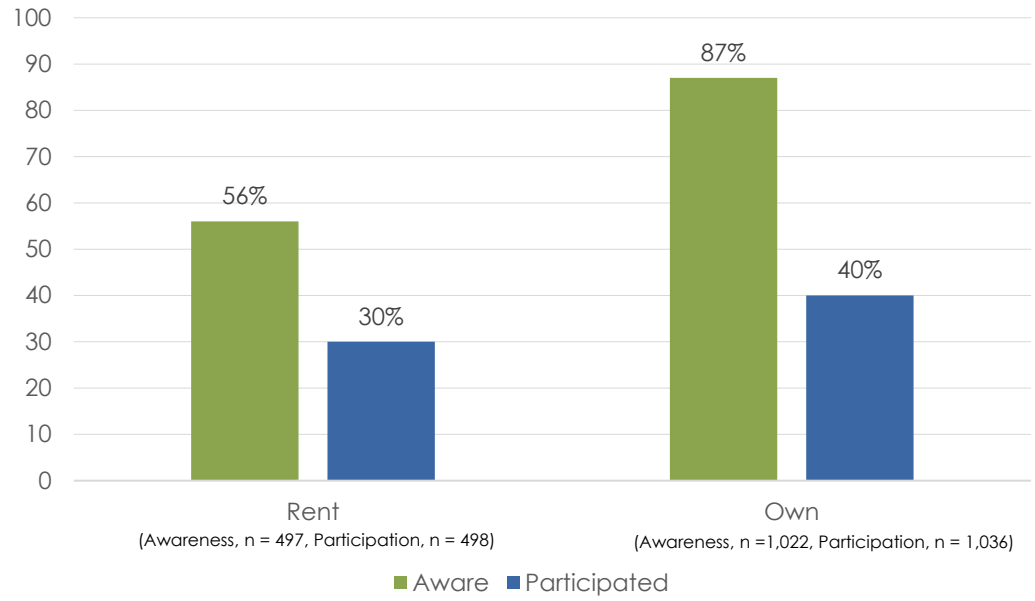
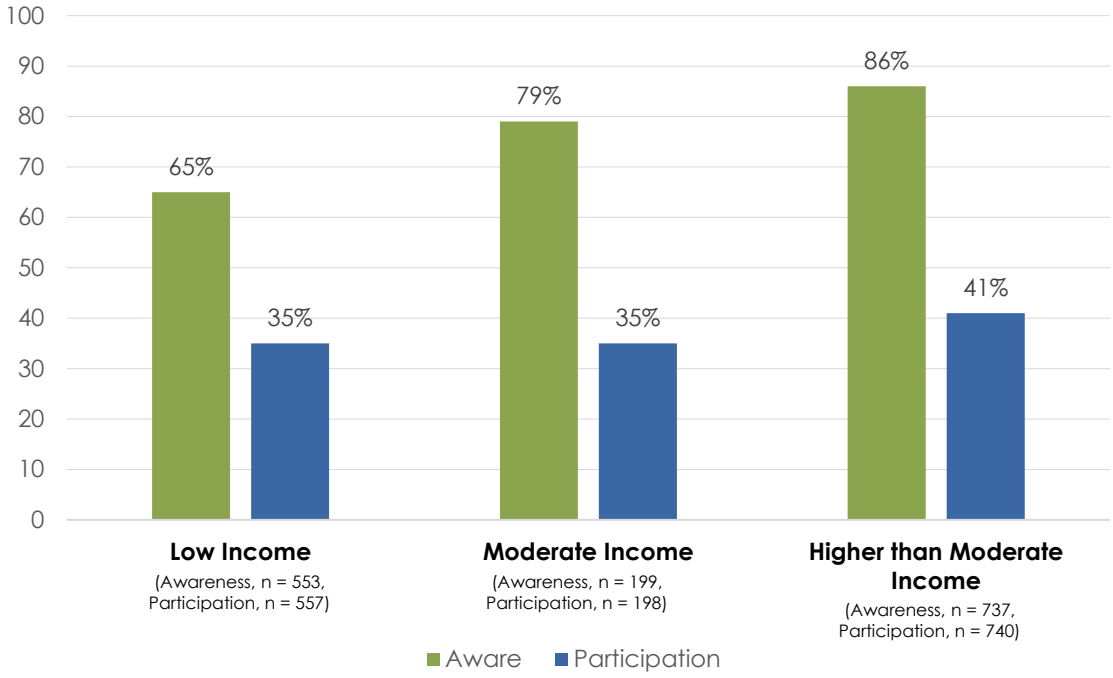
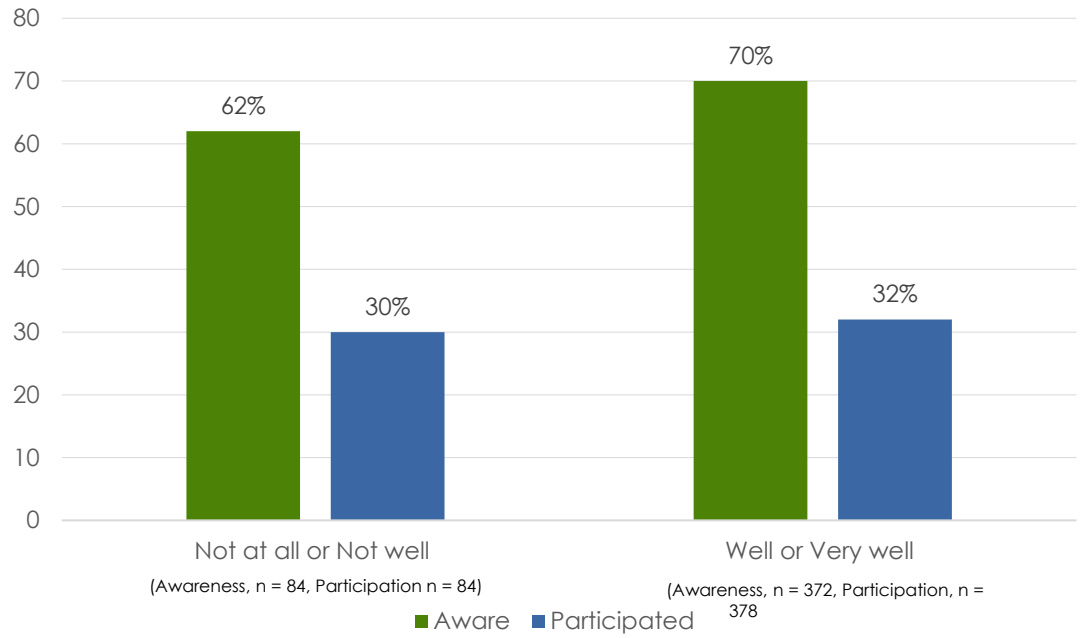


Figure 1-2: Participation Data (Income Levels)



Results of 2020 Residential Non-Participant Market Characterization and Barriers Study (continued)

Figure 1-3: Participation Data (English Proficiency)



The recommendations resulting from the EWG focus groups and the PAs' experience in implementing the Municipal & Community Partnership Strategy greatly informed and guided the approaches to achieving equity that the PAs will pursue during the 2022-2024 term. The Residential Management Committee and C&I Management Committee have convened several cross-sector implementation groups to implement the PAs' Workforce Development Strategy (see Section 1.1.3 below) and Municipal & Community Partnership Strategy (called the Community First Partnership Program for the 2022-2024 term).

The other key objective of the EWG was to develop a comprehensive set of equity metrics across programs and sectors (see Appendix E). The PAs worked closely and collaboratively with the rest of the EWG to develop this list of ambitious targets to be reported on regularly to the EEAC in order to guide investments in equity and assess performance in the Plan. Throughout the 2022-2024 term, and in accordance with the reporting schedule laid out in the metrics document, the PAs will track and report on the full list of equity metrics created by the EWG. Additionally, the PAs will provide narrative updates on these efforts in quarterly reports to the EEAC.

The PAs will continue to work in partnership with the EWG during the 2022-2024 term to determine how they can enhance equity and inclusion in their planned efforts. These efforts will serve to increase external stakeholder input in program development and delivery. The PAs' approach is to treat equity as a lens through which to view everything that they do, rather than a discrete set of activities. The PAs have highlighted several of their planned strategies to increase equity below and these strategies are woven throughout the 2022-2024 Plan. Where equity overlaps with workforce development, the PAs' planned efforts are highlighted in Section 1.1.3 (workforce development overview).

Further details regarding the PAs' equity efforts are included in the Residential and Income Eligible Sector descriptions (see Section 2) and the C&I Sector description (see Section 3).

STRATEGIES

RESIDENTIAL, INCOME ELIGIBLE, AND C&I SECTORS

The PAs will introduce the following equity strategies to the Residential, Income Eligible, and C&I Sectors during the Plan term:

- **Enhanced community partnership programs.** Central to this effort is the Community First Partnership Program, as well as other innovative partnerships. All partnerships will be focused on an enhanced place-based approach, increased focus on Commonwealth-designated environmental justice communities, increased partnership with community-based organizations, and greater flexibility of program design to be more inclusive of the state's diverse population.

- **Enhanced incentives for moderate-income customers.** The PAs will focus on increased participation by moderate-income customers, including the continuation of 100 percent weatherization measures, new enhanced HVAC incentives, support to address and mitigate barriers to weatherization, streamlined coordination between HVAC and Residential Coordinated Delivery programs to help pair HVAC and weatherization opportunities in moderate-income customer homes, and increased partnerships delivered through the Community First Partnership Program. By the end of 2024, the PAs plan to spend more than $60 million on weatherization and heating system incentives for income-qualified, moderate-income customers,

Environmental Justice Communities

The PAs and DOER have worked together to identify 38 environmental justice communities throughout the Commonwealth. These are municipalities that are a priority for investment in energy efficiency because they meet the following criteria:

- Greater than 33% of the municipality's population resides in block groups meet the criteria for an environmental justice population as defined by the EEA (see https://www.mass.gov/info-details/environmental-justice-populations-in-massachusetts for more information);
- At least one census block group in the municipality meets the state's environmental justice population income criteria and at least one additional criterion (e.g., minority or English isolation);
- Past energy efficiency program participation rate does not exceed 32% (where participation is consumption weighted location participation from the *Residential Non-Participant Customer Profile Study*);
- Median household income is less than 100% of state median household income; and
- The municipality is served by PAs for electric and/or gas accounts.

The 38 environmental justice communities include: Attleboro, Boston, Brockton, Chelsea, Chicopee, Eastham, Everett, Fall River, Fitchburg, Gardner, Gloucester, Great Barrington, Haverhill, Holbrook, Lawrence, Lowell, Lynn, Malden, Methuen, Montague, New Bedford, North Adams, Northampton, Palmer, Peabody, Pittsfield, Quincy, Randolph, Revere, Southbridge, Springfield, Stoughton, Taunton, Wareham, Webster, West Springfield, Williamstown, and Worcester. Within the city of Boston, eight neighborhoods are considered environmental justice communities because at least one census block group in the neighborhood meets the state's environmental justice population income criteria and at least one additional criterion, past energy efficiency program participation rate does not exceed 32 percent, and neighborhood median household income is less than 100 percent of the Boston median household income. These neighborhoods include Allston, Brighton, Dorchester, East Boston, Fenway, Mattapan, Mission Hill, and Roxbury.

with a projected total of $115 million spent over the three-year term. Importantly, these figures are just for enhanced weatherization and heating system incentives and do not include other incentive and non-incentive spending benefitting moderate-income families. The PAs are also committed to addressing the non-financial barriers highlighted in the *Residential Non-Participant Market Characterization and Barriers Study*. For the upcoming term, the PAs propose to increase spending on incentives for heating systems, pre-weatherization barrier mitigation, and weatherization for moderate-income customers.

- **Targeted programming to communities.** The PAs will target Main Streets programming for environmental justice communities, explore partnerships with diverse business groups, and expand Main Streets materials to be available in several languages spoken in those communities.

- **Address customer language barriers.** The PAs will work to address customer language barriers through the creation and implementation of a Language Access plan, partnering with inclusive and multilingual community-based organizations and driving toward the closure of gaps in the customer journey for the most commonly spoken languages in Massachusetts—Spanish, Portuguese, and Mandarin. The PAs will also establish a process so that customers who primarily speak other languages not referenced above have access to and are able to participate.

- **Increased outreach to renters.** The PAs will provide a statewide 100 percent weatherization incentive for rental units, increase promotion to renters, improve strategic outreach to multifamily properties of 5-25 units, and complete and implement a rental unit strategic plan to reach renters statewide.

In parallel with the above-referenced strategies, the PAs have also reviewed program budgets across the customer sectors to determine an expected level of investment that will be associated with the full suite of equity strategies. The final numbers are detailed in the figure below.

Figure 1-4: Investments in Equity Across Sectors (2022-2024 Plan)(e)

Metric	Investments (b)	Participants	Net Lifetime MMBtu
Moderate-Income Customers (a)	$136,074,730	15,636	8,769,488
Renters and Landlords (a)	$44,306,061	38,030	4,016,133
Income Eligible Renters & Landlords	$208,238,560	51,227	11,221,235
Language-Isolated Customers (d)	$9,141,743	N/A	N/A
Small Businesses (f)	$185,108,288	17,574	10,722,738
Pre-weatherization Barriers, Market Rate	$22,965,893	N/A	N/A
Pre-weatherization Barriers, Income Eligible	$6,331,445	N/A	N/A
Partnerships	$6,300,000	20 teams in 30 municipalities	N/A
Workforce Development (c)	$49,585,533	N/A	N/A
Total	**$668,052,254**	**522,817**	**34,729,594**

(a) There will be some overlap of moderate-income, renter/landlords, and pre-weatherization incentives.

(b) Investments referenced above are for incentive spending, excluding the Partnership Program and workforce development.

(c) This includes $12 million a year allocated to MassCEC.

(d) This includes projected marketing spend, language access plan, and costs associated with interpretation services for customers. There is no participant number associated with language-isolated customers because there are no specific energy efficiency measures offered to customers because of their language status. Rather, these customers will receive outreach across all programs.

(e) These numbers do not include any additional planned full-time equivalents (FTEs) that may be required for implementation or evaluation of equity initiatives.

(f) Participants in small business is defined as number of individual measures installed.

Further details regarding the PAs' equity efforts are included in the Residential and Income Eligible Sector description (see Section 2) and the C&I Sector description (see Section 3).

1.1.3 WORKFORCE DEVELOPMENT

The PAs recognize that a stable, trained, diverse, and adaptable workforce is fundamental to the continued success and growth of their Residential, Income Eligible, and C&I programs. A robust workforce will also increase equity across the energy efficiency portfolio and help achieve the Commonwealth's decarbonization goals as they relate to building efficiency. Over the last decade, the Massachusetts energy efficiency workforce has grown rapidly—over 86 percent between 2010 and 2020, to nearly 112,000 workers—and there are opportunities for growth in future years.[21] Current and future workforce growth projections indicate the need for new HVAC and weatherization workers is greatest; this is a direct effect of the PAs' ambitious goals to increase heat pump installations during the 2022-2024 term.

While the PAs have historically invested in upskilling the current energy efficiency workforce to meet the evolving needs of the industry and are also consistently engaged with business and community partners in ongoing workforce development efforts, they recognize the immediate need to shift to a more proactive, future-oriented role in workforce development. To that end, the PAs are developing and putting in place a statewide Workforce Development Strategy and several new efforts to grow and diversify the Commonwealth's energy efficiency workforce and provide opportunities for workers in the delivered fuels industry to transition into building electrification. These efforts are designed to help enable the PAs to meet aggressive energy savings goals during the upcoming three-year term.

Throughout the 2019-2021 term, the PAs learned from the *Workforce Development Needs Assessment* and ongoing contractor surveys that there is a high degree of difficulty hiring qualified candidates for some occupations, especially weatherization installers, HVAC technicians, and plumbers.[22] Prior to the pandemic, over 90 percent of employers reported that it was "somewhat" or "very difficult" to find qualified candidates for these positions.[23] As many of the PAs' programs that rely on these occupations continue to expand, the need for new workers in these fields is likely to become more acute and critical in meeting energy savings goals.

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[21] *Massachusetts Energy Efficiency Workforce Development Needs Assessment*, produced for the Massachusetts PAs by BW Research, Mar. 2020, available online at: https://ma-eeac.org/wp-content/uploads/Massachusetts-Energy-Efficiency-Workforce-Development-FINAL-REPORT-CAREER-PROFILES.pdf.

[22] See *Workforce Development Needs Assessment*, Rel. 2020, at 4.

[23] See *Workforce Development Needs Assessment*, at 15.

Moreover, the *Workforce Development Needs Assessment* found that workplace diversity is low, and few employers have formal diversity initiatives.[24] Most energy efficiency workers are Caucasian men who primarily speak English, though the percentage of energy efficiency workers that are Caucasian is slightly lower than in the population overall. The proportion of Hispanic and Latinx individuals with energy efficiency jobs is higher than in the overall statewide population, while the proportion of Black or African American energy efficiency workers is lower compared to the overall state population. A small minority (13 percent) of energy efficiency workers are women. However, race, ethnicity, and gender demographics vary widely by job type. The study also noted that potential candidates, especially young adults, have low levels of awareness of both entry-level job opportunities and long-term career paths in energy efficiency.[25]

To be more equitable in reaching customers, it is vital that the workforce supporting the PAs' programs reflects the diversity of the communities served. A diverse workforce will enable contractors to understand the varied experiences of customers, allowing them to reach more customers in their neighborhoods and communities, and making customers more comfortable implementing energy efficiency. It is also important that the PAs help to increase the number of individuals and companies attracted to working in energy efficiency so that the programs continue to grow and achieve robust savings goals and support the Commonwealth's targets for decarbonization. Further, ongoing opportunities for upskilling and growth continue to be critical so that the energy efficiency workforce supporting PA programs can adapt to changing conditions and support customers in saving energy. Finally, the PAs want to ensure that the energy efficiency workforce continues to move the market to adopt the latest efficient building technologies.

Similar to the approach the PAs are taking to achieve equity, cross-sector collaboration will be key to the success of their workforce development efforts. The PAs have established a Cross-Sector Workforce Development Working Group, overseen by the Residential and C&I Management Committees, to coordinate on implementation strategies. This ensures an emphasis on sector-specific goals, as well as overall management. Additionally, the PAs will continue to engage other stakeholders and groups, including the Contractor Best Practices Working Group, Income Eligible Best Practices Working Group, key trade allies, and the EWG.

Over the last few years, the PAs have worked collaboratively with the MassCEC to share insights and future planning to ensure that any collective efforts benefit the overall energy efficiency workforce. Due to recently enacted legislation, MassCEC will have a clearer and more focused role in workforce development efforts in the Commonwealth during the 2022-2024 term. Over the next three years, the PAs plan to work collaboratively with the MassCEC to continue providing in-field experience and expertise to advance energy efficiency throughout the Commonwealth and to ensure investments made by MassCEC in workforce development are informed by the PAs' energy efficiency programs. This collaboration with the MassCEC will help increase diversity and expand the workforce necessary to achieve the Commonwealth's net zero GHG goals and provide economic opportunities.

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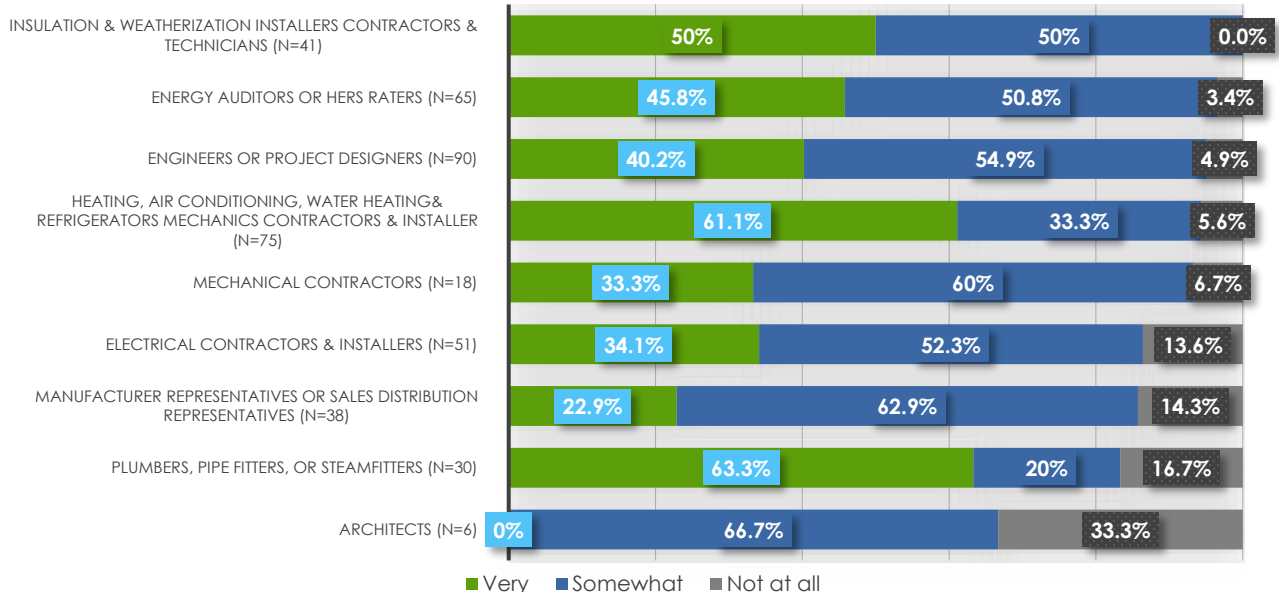
[24] See *Massachusetts Workforce Needs Assessment*, at 4

[25] See *Massachusetts Workforce Needs Assessment*, at 51-52.

Figure 1-5: Employer Survey—Hiring Difficulty by Occupation



For a more detailed discussion of workforce development activities that the PAs will engage in during the 2022-2024 term, please see the strategic interventions discussions in the Residential and Income Eligible Sector description (see Section 2) and C&I Sector description (see Section 3). Below, the PAs have highlighted several planned strategies to improve workforce development.

WORKFORCE DEVELOPMENT STRATEGIES

RESIDENTIAL, INCOME ELIGIBLE, AND C&I SECTORS

The PAs will introduce the following workforce development strategies to the Residential, Income Eligible, and C&I Sectors during the 2022-2024 term:

Train New and Diverse Candidates

Through the Clean Energy Pathways internship program, the PAs will train new and diverse candidates, targeting multilingual 18- to 24-year-olds from backgrounds underrepresented in the energy efficiency workforce for nine-month internships in partnership with place-based community workforce development organizations in environmental justice communities and with vendors in high-growth industries. Interns will receive training to prepare them for their new roles, ongoing professional development, mentorship, and team building opportunities. Both interns and intern hosts will receive diversity, equity, and inclusion training. Upon successful completion of their internship, interns will be offered full-time positions with contractors. The PAs plan to host one to two Clean Energy Pathways internship cohorts annually training new energy professionals and targeting a $20,000 per participant investment to successfully transition participants into an energy efficiency career.

The PAs recognize that training new and diverse candidates may require additional investments in resources to support reducing barriers to training and entering the energy efficiency workforce. The PAs will sponsor up to

$250,000 annually in scholarships for energy efficiency training and certification programs. These scholarships will prioritize supporting diverse individuals in environmental justice communities who are enrolled in a high school, community college, and or vocational training school program. The goal for this scholarship program will be to increase training and certification completion rates amongst diverse program participants by alleviating the financial hardship that may pose as a barrier to participation. PAs will coordinate with the MassCEC to ensure that the scholarship design and implementation is complementary to any present and future efforts planned by the organization.

Grow and Diversify a Pool of Business Partners

The PAs plan to grow and diversify their pool of business partners, including putting goals and strategies in place to track and increase the number of certified minority-owned enterprises, women-owned enterprises, and veteran-owned businesses, collectively referred to as diverse business enterprises (DBEs), contracting and subcontracting in PA programs, as well as providing a path for firms working in the delivered fuels industry to transition into work on electrification in buildings. In the 2022-2024 term, the PAs plan to achieve this by employing several strategies including developing and hosting educational contractor workshops, establishing an online vendor network on the Mass Save website with easy-to-follow information regarding how vendors can engage and contract with the PAs, and increasing outreach and encouragement of DBEs to participate in Request for Proposals (RFP), Request for Information (RFI), Request for Quotes (RFQ), as well as meeting their commitment to additional DBE metrics (see Appendix E: Equity Metrics) developed by the PAs and the EWG.

Increase Coordination with Vocational/Technical and Other Public High Schools

The PAs will increase their coordination with vocational/technical and other public high schools to offer energy efficiency career education curriculum and pathways into internships and the workforce. The PAs will engage high schools as community partners in the Clean Energy Pathways internship program and offer energy efficiency career exploration workshops to middle and high school students. Schools in environmental justice communities and communities participating in the Community First Partnership Program will be prioritized. A comprehensive online training platform will provide participants access to information, materials, and registrations for instructor-led trainings, webinars, and self-paced trainings. To build workforce capacity related to electrification and heat pumps, the PAs will conduct outreach to schools and other HVAC certification programs statewide. Participants who complete a workshop will be connected with HVAC contractors to receive information on job and internship openings in order to create a pipeline of new HVAC talent familiar with heat pump technologies.

Grow and Upskill Contractors, Existing Workers, and New Entrants

Using the Online Vendor Network, the PAs will grow and upskill contractors, existing workers, and new entrants through additional training and education to recruit new contracting companies to work in energy efficiency. The PAs will continue to upskill the workforce in new technologies such as Passive House certification, Building Operator Certification, automated controls, building codes and standards, and HVAC equipment. The PAs' efforts for upskilling of existing workers and new entrants will include:

Cross-Cutting

- **Codes & standards compliance and technical support.** The Codes & Standards Compliance and Technical Support Initiative (CSCS) provides education and outreach to various building industry actors to reduce observed gaps in energy code compliance. Workforce development related services include topical training sessions, project-specific "hotline" support, and development and delivery of useful tools and resources.

Residential

- **Residential Retail HVAC training.** The PAs will continue to host contractor conferences to educate contractors on program offerings and provide various technical and program trainings. The PAs will leverage relationships with local trade allies, including technical schools, trade unions, Massachusetts Home Builder Associations, the Boston Society of Architects, and the US Green Building Council's Massachusetts Chapter to provide a broad platform for training, demonstrations, and other initiatives. The PAs also plan to offer a special curriculum of workshops dedicated to help new and existing HVAC professionals develop their heat pump expertise via their online training platform.

- **Residential Coordinated Delivery Initiative training.** Lead vendors, independent installation contractors, and home performance contractors, can access workforce development training to train new workers and upskill their existing teams. Sponsored certifications typically include weatherization boot camps, Building Performance Institute certifications (e.g., Building Analyst, Building Envelope, and Infiltration & Duct Leakage), Occupational Safety & Health Administration (OSHA) Attics & Crawl Spaces, and ResCaz 3D Combustion). The PAs will offer workforce subsidies for new trainees and re-certification costs for approved trainings.

- **Passive House and All-Electric Path to Zero training.** The PAs offer robust Passive House training to support workforce development and market transformation in the building construction industry. The PAs will place an added emphasis on low-rise, single-family construction, as well as customer, contractor, architect, realtor, and other professional education on all-electric homes to encourage adoption of the new All-Electric Path to Zero offering. The PAs offer cost reimbursement toward Passive House Institute/Passive House Institute US accreditation trainings for professionals who successfully certify. Lunch & learn style trainings and building science workshops are offered at no cost to participants. The Passive House Learning Center, a comprehensive online training platform, provides participants with materials and registration access for instructor-led trainings, webinars, and self-paced trainings.

- **Income Eligible energy specialist training.** The PAs will support local Community Action Agency partners (CAPs) and also collaborate with local workforce development community-based organizations to train new entrants interested in becoming CAP energy specialists. Candidates will be identified by CAPs to fill open energy specialist positions and will receive fully subsidized training to support their new role. The goal will be to recruit multilingual candidates and other candidates whose backgrounds are currently underrepresented in the energy efficiency workforce.

- **Income Eligible heat pump training.** Ongoing training will be offered to all existing and new CAP energy specialists to ensure they are well equipped to identify heat pump opportunities in customer homes and fluently discuss with customers the full range of heating system options available to them. Additional

trainings will support heat pump skill capacity building for the Income Eligible Sector, support to recruit additional contractors to partner with CAP agencies, as well as additional opportunities that may be identified by the Income Eligible Lead Vendors and partners in the LEAN network.

- **Electric HVAC Participating Heat Pump Installer Network.** The Mass Save Heat Pump Installer Network aims to foster a network of quality installers with the training, experience, and knowledge necessary to effectively talk to customers about the benefits of heat pumps and ensure a properly sized and quality installation. Through this network, the PAs will promote and provide training on heat pump technologies, quality cold climate heat pump installations, Mass Save programs and incentives, and the importance of weatherization. Moreover, the PAs plan to promote and collaborate with heat pump manufacturers, distributors, trade schools, and Massachusetts energy associations on both heat pump installation and cold-climate heat pump sizing and design training (virtual and in person) with the goal of increasing the pool of new HVAC entrants who are equipped to enter jobs that require skills and knowledge related to heat pumps.

Commercial & Industrial

- **Massachusetts Energy Efficiency Partnership (MAEEP).** MAEEP is a partnership between the PAs and the University of Massachusetts-Amherst. Trainings include an introduction to advanced technologies, tools for understanding the benefits of implementing improvements, and opportunities to make use of resources available through the PAs. In-person and virtual format trainings are held approximately every six weeks and participants can earn professional development hours/continuing education units for credential maintenance.

- **Building Operator Certification (BOC).** The PAs partner with the Northwest Energy Efficiency Council to bring BOC trainings to building and facility operators. The BOC works to elevate the profession of the building operator through training in energy efficiency and smart building technologies, continued education, and certification. Participants who successfully complete the course are eligible for 100 percent tuition reimbursement. Examination fees are an additional cost. Attendees who successfully complete the Level 1 course are eligible to sit for the BOC exam to earn their Certified Building Operator certification.

Engage Stakeholders to Achieve More Success Through Collaboration

In the 2022-2024 term, the PAs will continue to collaborate and engage with the MassCEC, state agencies, community-based organizations, and educational institutions on statewide workforce development efforts. As codified in recent legislation, the MassCEC will administer an annual $12 million budget to achieve new strategic workforce development goals. The PAs will serve in an advisory capacity on the newly-established MassCEC Workforce Development Advisory Board and have provided the following recommendations to the MassCEC on investments to make in the energy efficiency workforce with the new budget they will administer, all of which complement the PAs' workforce development efforts and priorities. PAs have requested MassCEC to provide quarterly and annual workforce development reports on the key performance indicators that will be determined for each of the MassCEC's planned programs.

- **Energy Efficiency Workforce Skill Development Partnership.** The Partnership should provide financial support to stakeholders to increase the sustainability of the energy efficiency workforce with a focus on

recruitment, training, internships and apprenticeships, temporary job placement, staff development, capacity building, barrier reduction, and scholarships for diverse applicants.

- **Energy Efficiency Workforce Staff Development Funding Initiative.** This initiative provides opportunities via the Online Vendor Network for contractors to establish connections with PA staff. The goal is to hire additional full-time staff to support workforce development efforts and ensure there is staffing capacity to execute all programming associated with workforce development efforts.

- **Energy Efficiency Workforce Pathway Development Initiative.** This effort's objective is to build on the existing MassCEC internship program and the PAs' Clean Energy Pathways internship program and expand pathway development to continue wraparound support for young people and career changers from environmental justice communities entering vocational job paths. The goal is to increase the number of young adults and career changers in the energy efficiency workforce and expand pathways to increase industry awareness and retention.

- **Workforce development marketing and outreach funding.** This effort will prioritize environmental justice communities to market, outreach, and engage young adults, existing workers from other industries, organizations, and companies to raise awareness about employment opportunities in energy efficiency. This effort is designed to attract new talent to the energy efficiency workforce among seasonal workers through relationship building and coordination with complementary industries, and measurably increase awareness and interest in the energy efficiency workforce among middle, high school, vocational/technical school, and community college students.

- **Supplier diversity development.** This effort will provide support for DBEs in energy efficiency, including certification, business development, upskilling, and mentorship. In addition, the effort is designed to serve as a matchmaker to help contracting companies connect with local workforce development/educational organizations for ongoing supply of talent, particularly talent from environmental justice communities.

- **Workforce tracking and monitoring.** This effort will provide support to coordinating workforce development stakeholders, track and evaluate workforce development data, work with stakeholders to align goals to reach recruits, increase retention in the workforce, and create an annual employment report that includes employers, employment vacancies, wages, trainings, demographic, regional data, challenges, and successes in the workforce.

Further details regarding the PAs' workforce development efforts are included in the Residential and Income Eligible Sector description (see Section 2) and C&I Sector description (see Section 3).

1.2 CONTRIBUTING TO STATE POLICY GOALS, CONTINUING INNOVATION UNDER THE GREEN COMMUNITIES ACT

The initial passage of the GCA transformed energy efficiency efforts in Massachusetts, and the GCA, as amended,[26] continues to lead the Commonwealth on a path of innovation. The enactment of the GCA expanded energy efficiency mandates by requiring the PAs 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."[27] To date, the GCA's framework and statewide collaborative approach has produced unprecedented results. Due to the GCA, the PAs 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 net zero GHG emissions goals.

Following updates enacted in 2018, the GCA maintained the same scope and objective to pursue all available cost-effective energy efficiency and demand reduction resources, with amendments for clarification purposes and to provide additional opportunities to deliver holistic energy efficiency services and GHG emissions reductions. These amendments include the clarification that the electric PAs may deliver non-electric energy efficiency services, ADR strategies (including energy storage), and other clean energy technologies. Additionally, since 2018, the amended GCA has allowed the PAs to pursue electrification measures that are designed to result in cost-effective reductions in GHG emissions while minimizing ratepayer costs and conversions to renewable energy sources or other clean energy technologies. For the 2022-2024 term, the PAs will continue to use all strategies available to achieve the outcomes of energy and GHG emissions reductions.

In May 2021, Governor Baker signed the Climate Act into law which requires the Commonwealth to achieve net zero GHG emissions by 2050 and makes various provisions for meeting this climate goal, including amendments to the GCA. The 2021 GCA amendments focus on ways to further leverage the energy efficiency framework to reduce GHG emissions. First, three-year energy efficiency plans will have to be constructed to meet the GHG reduction target goals set by the EEA Secretary. Second, calculations of program benefits must include a calculation of the social value of GHG emissions reductions, except for instances where the conversion is from fossil fuel heating and cooling equipment to another fossil fuel heating and cooling system.[28] Third, three-year energy efficiency plans may now prioritize projects that will result in substantial GHG reductions. The PAs also must transfer $12 million to the MassCEC every year to implement a clean energy equity workforce and market development program.

The new amendments to the GCA complement the strategy documents released by the Commonwealth in late 2020, which outline the importance of energy efficiency in achieving the state's goal of net zero GHG emissions by 2050. Both the 2030 Interim CECP and the 2050 Roadmap highlight the decarbonization strategies needed to help achieve the Commonwealth's net zero emissions by 2050 goal. In the 2030 Interim CECP, the buildings sector is slated to reduce emissions by 9.4 $MMTCO_2$ over the next decade to help the Commonwealth achieve its decarbonization goals. For the buildings sector, the key focus is on the decarbonization of buildings through widespread weatherization measures, clean heating and cooling technologies (with a focus on electric heat pumps, including air source, water

[26] Acts of 2012, c. 209; Acts of 2018, c. 227 § 20; Acts of 2021, c. 8.
[27] G.L. c. 25, § 21.
[28] For discussion of how the social value of GHG emissions reductions are reflected in this Plan, refer to the AESC Study section of A.4.2.

source, variable refrigerant flow, and geothermal), implementation of high-performance stretch codes that advance building code closer to net zero, and deep energy retrofits. Similarly, the *2050 Roadmap* outlines the need to use the energy efficiency programs to help decarbonize the building sector in a coordinated manner.

As noted above, the Climate Act builds upon the Commonwealth's 2050 Roadmap and 2030 Interim CECP and requires the EEA Secretary to set a goal, expressed in $MMTCO_2e$, every three years for the succeeding Energy Efficiency Plan's necessary contribution to meeting GHG emissions reduction targets adopted under the GWSA. In July 2021, the EEA Secretary established the aggregate reductions in GHG emissions to be achieved with energy efficiency measures implemented as part of the 2022-2024 Plan.[29] These new GHG emissions reduction targets are detailed in the figure below.

Figure 1-6: Planned 2030 Greenhouse Gas Emissions Reductions (Metric Tons CO_2e) Targets

	Electric Portfolio	Natural Gas Portfolio
Residential + Income Eligible	504,000	341,000

In addition, on October 29, 2020, the Massachusetts Department of Public Utilities (Department) issued a Notice of Inquiry (NOI) in D.P.U. 20-80, opening an investigation into the role of natural gas distribution companies (LDCs) in achieving the Commonwealth's target 2050 climate goals. The investigation will focus on exploring "strategies to enable the Commonwealth to move into its net zero GHG emissions energy future while simultaneously safeguarding ratepayer interests; ensuring safe, reliable and cost-effective natural gas service; and potentially recasting the role of the LDCs in the Commonwealth."[30]

In addition, on September 20, 2021, Governor Baker signed an Executive Order which, "establishes a Commission on Clean Heat to advise the Administration on strategies and policies to achieve deep emissions reductions from the use of heating fuels in the Commonwealth. The Commission, the first-of-its-kind in the United States, will establish a framework for a long-term decline in emissions from heating fuels, consistent with the findings from the Administration's 2050 Decarbonization Roadmap, and help the Commonwealth meet the ambitious emissions reduction targets signed into law by Governor Baker in March 2021."[31]

The Plan takes each of these executive agency initiatives into account. For example, over the 2022-2024 term, the PAs will prime the HVAC market for a transformation to clean heating and cooling technologies, with a focus on the advancement of heat pump technologies including air source, water source, variable refrigerant flow, and geothermal, while taking into account issues that must be addressed to facilitate customer adoption. The Energy Efficiency Plan also includes a continued focus on weatherization, a foundational measure that reduces energy use and prepares buildings for electrification, which will significantly contribute to the Commonwealth's goals as outlined

[29] The Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, *Letter regarding Greenhouse Gas Emissions Reduction Goal for Mass Save*, Jul. 15, 2021, available online at: https://www.mass.gov/doc/greenhouse-gas-emissions-reduction-goal-for-mass-save/download.

[30] NOI at 1.

[31] Press Release: Governor Baker Signs Executive Order Establishing First-in-the-Nation Commission on Clean Heat, Sep. 20, 2021, available online at: https://www.mass.gov/news/governor-baker-signs-executive-order-establishing-first-in-the-nation-commission-on-clean-heat.

in the Climate Act and 2030 Interim CECP. Additionally, the PAs will continue to advocate for the advancement of codes and standards which help the Commonwealth achieve greater savings for appliances and new buildings.

In delivering energy efficiency programs under the GCA, the PAs have already achieved almost $29 billion in total benefits. Using the strategies set forth in this Plan, including building a sustainable market for building electrification and pursuing energy efficiency opportunities among historically underserved populations, the PAs plan to deliver at least another $7 billion in total benefits during the 2022-2024 term. The benefits delivered under the PAs' programs directly tie to customer savings, GHG emissions reductions, and other benefits. 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 and balancing short-term and long-term customer bill impacts. 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.

1.3 KEY CROSS-SECTOR ACTIVITIES

1.3.1 ACTIVE DEMAND REDUCTION STRATEGIES

BACKGROUND

The Independent System Operator-New England (ISO-NE) is responsible for the reliability of New England's generation and transmission infrastructure available to meet the system load at every hour of the day, year-round. In order to do this, ISO-NE assesses the needs of the system during peak demand. By working with customers to actively reduce loads during these peak hours through ADR strategies, the PAs can influence both the long-term forecasting methodology ISO-NE uses to establish the Installed Capacity Requirement, as well as the price of capacity in the forward capacity market (FCM). As a result, all customers benefit from the lower costs of a smaller generation, transmission, and distribution system. These peak demand reductions also provide immediate benefits to all customers in the form of suppressing wholesale power prices during times of high demand, by reducing the system's reliance on what would otherwise be the most economically and environmentally expensive forms of generation. Even customers who do not pay demand charges directly benefit from ADR offerings in the form of avoided capacity, transmission, and distribution costs that are incorporated into their electric rates on a long-term basis.

ADR offerings depend on discrete actions that a customer would not have otherwise taken to reduce their electrical load for a specified and limited period of time. The so-called "passive" demand reductions that result from traditional asset-based energy efficiency programs generate reductions in load year-round, simply because their higher efficiency produces energy savings and demand reductions. These demand reductions are aggregated and bid into ISO-NE's FCM, earning revenue that offsets energy efficiency program costs. The PAs can derive additional value from implementing ADR offerings, which incentivize brief reductions in customer load during targeted periods of high system demand.

ACTIVE DEMAND REDUCTION DISPATCH STRATEGIES

The PAs' C&I Interruptible Load offering is specifically intended to target the system peak hour. This is the hour of the year during which the New England electrical system experiences its highest overall demand and is typically in the afternoon during the summer months of July and August. The majority of the total Installed Capacity Requirement for

the present year is determined by this single peak hour and the cost of this capacity and related transmission is borne by all-electric customers (costs are proportionally split across all load-serving entities).

The PAs rely on system forecasts to predict which days are likely to be peak days, which hours are projected to be peak hours, and provide customers and curtailment system providers with day-ahead notifications prior to calling a dispatch event. Dispatch is the period of time when electric utility or grid operators can call upon participants to reduce electricity consumption. By calling dispatch events for only a few hours, on days that the electric system is likely to peak, the PAs can reduce the Installed Capacity Requirement and associated marginal costs. The New England electrical system is a summer peaking system, and the PAs will continue to monitor ISO-NE's load forecasts and are prepared to make future changes to their ADR strategies to continue to implement offerings that provide system benefits to ratepayers.

While all ADR offerings target the system peak hour, many of the dispatch strategies target significantly more hours during the summer season. While the peak hour is the primary determinant of the Installed Capacity Requirement, the ISO-NE's regression model assesses each of the 62 daily peak hours during July and August in order to build its long-term forecasting model. The degree to which demand is consistently and repeatedly reduced on these days increases the confidence that those reductions are "firm" and can be counted on in future forecasts.

In determining how often to call events, the PAs must balance the potential value of curtailment with the disruption that the event may cause for customers. If the PAs call too many events that adversely impact comfort or operations, then the PAs risk having customers opt out of events or unenroll from the program entirely. However, batteries, thermal storage, and some other types of equipment can lend themselves to repeated dispatch *without* substantially altering the comfort or operations of a customer's home or facility. These technologies are typically used in daily dispatch offerings because they can be called on many of the peak days during July and August with limited event fatigue.

Residential and C&I customers who sign up for ADR offerings receive incentives for reducing their energy consumption during PA-called dispatch events. The PAs' ADR incentives are just one financial offering available that rewards customers for shedding load and reducing energy consumption during seasonal peak demand periods. Other similar financial benefits available primarily to C&I customers include ISO-NE market revenue, Installed Capacity (ICAP) tag cost avoidance, Massachusetts Clean Peak Energy Standard revenue, and demand charge management. While the PAs strive to create ADR offerings that allow customers to stack various revenue streams, reducing the level of incentives needed, the targeted system peaks may not always line up with the behavior required to maximize these other sources of revenue.

The PAs do not claim significant energy savings from these events. In most instances, total energy consumption is unchanged because the activity associated with the controlled load is simply shifted away from the peak period, not eliminated entirely. However, customers may experience increased consumption in some cases. Specifically, with respect to batteries, overall consumption generally increases due to the "round-trip losses" associated with charging and discharging the battery.

CURTAILMENT STRATEGIES

The PAs' ADR offerings can be grouped into two main strategies for reducing demand during peak load events: (1) "device-specific" demand reduction strategies and (2) "metered" demand reduction strategies. While not intended to

be exclusive to either sector, device-specific strategies are deployed more for residential customers and metered strategies tend to favor C&I customers.

Device-specific demand reduction strategies use connected device telemetry to temporarily adjust control settings in a way that results in lower demand during the event, such as smart thermostats, storage, and EVs. Because device-specific strategies rely on telemetry from the devices themselves to assess performance, these strategies do not require interval metering. This is especially important in Massachusetts as interval metering for residential customers and the majority of C&I customers has not yet been approved and implementation of any future approvals will likely take several years, at a minimum.

A challenge with the device-specific approach is that the PAs cannot rely on access to a meter to assess performance; therefore, they need to develop relationships with device manufacturers in order to implement curtailment offerings and receive data documenting participation and verifying performance. The PAs work with their Distributed Energy Resource Management System (DERMS) providers to integrate as many products as feasible, but some product manufacturers are not motivated to integrate with a DERMS, for a variety of potential reasons (see the section below for more details regarding DERMS).

"Metered" demand reduction strategies are aimed at customers with existing interval meters, or with enough load to justify the installation of third-party meters by curtailment service providers. This approach assesses the total reduction in facility load relative to a baseline that approximates the facility load if no demand reduction had occurred. The baseline methodology is aligned with how ISO-NE calculates their baseline for the FCM, and customers are provided with performance-based incentives which reflect the incremental curtailment the PAs were able to affect.

CONSIDERATION FOR PRODUCT INCLUSION IN ACTIVE DEMAND REDUCTION OFFERINGS

The first key criterion when considering new products or technologies to add to the ADR offerings is whether the product has load that is curtailable and coincident with peak periods. For C&I Sector applications, any load is theoretically curtailable through a metered approach. For other applications that are device specific, there must be a means for the PA to cause the device to reduce load during peak events. Safety is another consideration, as there are some end uses in which a load may be hypothetically curtailable; however, there may be safety concerns associated with the load curtailment. Further, the technology must be one that is often drawing power during these peak periods (high coincidence), or there would be little load to be reduced. Lower coincidence may be acceptable for technologies that have a large potential load reduction, such as EVs. Products that have curtailable, coincident load should be considered because they have the potential to deliver meaningful demand reductions.

Another key consideration is the persistence of a potential demand response product. As an example, several PAs have experimented with using plug load controllers to reduce demand from window air conditioners. While results in the first year are sometimes promising, most of these offerings found that few people properly installed the plug load controllers the second year, leading to a low persistence. Low persistence compromises the total value that a device might deliver through ADR.

The last key value component that is evaluated when considering a new ADR product is whether the load is discretionary. Batteries are nearly fully discretionary because there are no direct impacts to a customer from cycling it, aside from roundtrip losses and the potential for a reduced state of charge if there is an outage. Dryers, on the

other hand, are not a discretionary load; customers who have started a load of laundry are usually not willing to delay the drying of their clothes by several hours. Loads that are not discretionary may be curtailable and coincident, however, they do not deliver reductions because customers will be more likely to opt out of events.

After the potential ADR benefits have been established, the costs to achieve those benefits must be understood. The incentive cost is a variable cost that scales with the number of responding participants. Incentives are often separated into enrollment and performance incentives, especially for Residential Sector measures. These must address both the value a customer would place on not having their product curtailed and any incremental costs for controllable technologies (e.g., purchasing a smart thermostat or adding a load controller). The incentive must also overcome any time or convenience barriers to participation. For example, an existing pool pump could be a source of substantial curtailable load, but customers may struggle to see the value in hiring an electrician to install a wireless load controller. There are customer acquisition costs in addition to enrollment incentives, such as marketing and sales commissions.

For technologies that are controlled through a DERMS, there are also integration costs. These are the costs (i.e., legal, technical, and administrative) of adding new technologies to the DERMS. These costs are often fixed, regardless of the number of devices or total curtailable load. Further, these fixed costs are generally for each additional device manufacturer or, in some cases, each additional product for a given manufacturer. If for instance, there is a technology with some curtailable load that is highly fragmented across many device manufacturers, these fixed integration costs may make adding that technology less cost effective.

After establishing these potential benefits and costs, the PAs can determine whether a technology or device should be included in the ADR offerings. The PAs commissioned a study to evaluate the cost effectiveness of potential residential end uses based on many of these criteria. While such evaluations are very helpful in addressing most costs and benefits, they may not always accurately identify integration costs, as these costs may be considered proprietary by DERMS providers. Still, the evaluations provide a good starting point for identifying which measures should be included in ADR offerings. Over the course of the 2022-2024 term, the PAs will continuously review new technologies and device manufacturers for inclusion in their ADR offerings.

ENROLLMENT STRATEGIES AND CROSS-PROMOTION

Most large C&I customers are served by dedicated account managers who are familiar with the operational specifics of each site. To that end, these account managers can identify customers who may be good candidates for participation in demand reduction offerings and bring in the appropriate partners to implement their curtailment strategy. The PAs recognize that the Commonwealth has established multiple policies intended to incentivize the installation of storage technologies (i.e., ACES grants, SMART incentives, and Clean Peak Energy Standard).[32] To the extent that the PAs invest customer funds to achieve *additional* load reduction that would not have occurred in the

[32] The Advancing Commonwealth Energy Storage (ACES) program is managed by DOER and MassCEC. ACES projects are aimed at piloting innovative, broadly replicable energy storage use cases/business models with multiple value streams in order to prime Massachusetts for increased commercialization and deployment of storage technologies. In 2017, ACES awarded $20M in grants to 26 projects. The SMART program is a photovoltaic feed-in tariff. The Massachusetts Clean Peak Energy Standard is designed to provide incentives to clean energy technologies that can supply electricity or reduce demand during seasonal peak demand periods. See https://www.mass.gov/clean-peak-energy-standard.

absence of their offering, they will continue to work with evaluation staff to assess their incremental impact and will monitor their incentives in the context of the value stack available to owners of storage assets. As part of the approved addition of daily dispatch to the ADR portfolio in 2020, the PAs continued to offer the five-year "incentive lock" for commercial projects that meet and maintain certain development milestones. For projects with new interconnection agreements, the PAs will guarantee a fixed per-performed-kW incentive for five years, even if the published incentive changes in the interim. This guarantee is intended to provide a measure of financial certainty for new projects in the development phase, even if the offering is discontinued.

As described in greater detail in the Residential Behavior Initiative description (see Section 2), residential enrollment strategies are generally tied to the device manufacturer. The PAs have not always, however, effectively integrated the value of demand reduction into the promotions of demand reduction-capable devices, such as smart thermostats. During the next term, the PAs will make this connection stronger through promotions, allowing devices to be enrolled in demand reduction offerings while purchasing them, and potentially by netting enrollment incentives from the purchase price when purchased through a PA's online retail marketplace. These strategies have two benefits: (1) increasing the universe of potentially controllable devices, and (2) increasing the percentage of devices that are enrolled.

The PAs may also offer higher incentives for purchasing some controllable tiers of technologies. This strategy will allow the PAs to increase the number of controllable devices in instances in which there are insufficient installed devices to justify integration costs. Offering tiered incentives may also allow the PAs to increase the purchase of devices, which may not yet be cost effective as an ADR offering but is one the PAs reasonably believe will have a path to cost effectiveness in the near future. To help support these higher incentives, the PAs will look for every opportunity to identify devices in which connectivity delivers additional energy efficiency (kWh) and passive demand reduction (kW) savings and has the option for incremental ADR (kW) reductions.

WINTER DEMAND RESPONSE

During the 2019-2021 term, the PAs have incentivized winter demand reduction efforts in order to test customer acceptance in responding to winter dispatch signals and to continue exploring claimable values that may result from winter demand reduction performance. During the winter of 2019-2020 the PAs called two events, and during the winter of 2020-2021, the PAs called a number of events (events called varies by PA). While performance was significantly lower during the winter than what was observed during the summer, the PAs found that customers were able to curtail load during events and paid out incentives accordingly.

As part of this effort, the PAs contracted with a consulting firm to explore potential value streams from winter curtailment as part of the *2019 Avoided Energy Supply Cost (AESC) Supplemental Study*.[33] The resulting memorandum confirmed that ISO-NE does not consider winter demand in determining the Installed Capacity Requirement. This value is used to establish the amount of generation capacity that must be procured to meet system needs. In New

[33] The AESC is a regional avoided energy supply cost study that is used by the Massachusetts PAs and other New England program administrators to calculate electric and fossil fuel avoided costs. See Appendix A.1.3 and the eTRM for more information about AESC studies and calculations.

England, the winter peak is roughly 20 percent lower than the summer peak, curtailing winter load has no impact on the Installed Capacity Requirement, and therefore curtailment in winter does not result in avoided capacity costs.

As a result of their findings and implementation experiences during the previous three-year term, the PAs have determined that there are no material benefits from winter demand reduction and are not planning to provide winter electric demand reduction offerings during the 2022-2024 term. However, the PAs have demonstrated both customer interest and the ability to curtail load during the winter in response to demand reduction events. The PAs will continue to monitor the dynamics of the New England electric grid and ISO-NE's forecasting methodologies and if there is a point in the future at which there are avoided costs that the PAs can claim, they will reassess winter demand reduction offerings.

NATURAL GAS DEMAND RESPONSE

The topic of natural gas demand response has generated considerable interest. Both National Grid and Eversource have proposed natural gas demand response demonstrations through their most recent rate cases and Eversource has already been approved to conduct a natural gas demand response demonstration through its recent acquisition of Columbia Gas.[34] The PAs have considered the Department's orders and guidance on the appropriate role and filing mechanism for natural gas demand response and have not found any cost-effective gas demand response opportunities of innovative and differentiated opportunities to pilot, and are therefore not proposing any additional gas demand response programs or demonstrations in the 2022-2024 Plan. National Grid, Berkshire, Liberty, and Unitil will closely monitor the results of the approved Eversource demonstration, as well as any other efforts undertaken in the 2022-2024 term and any other innovative opportunities, in consideration of potential program offerings in the future. National Grid commits to continuing discussions with DOER on possible natural gas demand response demonstrations in 2022. If any PA determines that this is a viable option, it will file a Mid-Term Modification during the 2022-2024 term or submit the demonstration or program as part of a future energy efficiency filing.

1.3.2 CODES & STANDARDS COMPLIANCE AND TECHNICAL SUPPORT INITIATIVE

OVERVIEW

While the majority of the programs seek to save energy by spurring voluntary action by customers, the PAs also seek to drive energy savings through supporting mandatory efficiency policies. The CSCS saves energy by: (1) increasing overall market compliance with current minimum energy efficiency codes and standards, and (2) increasing the level of energy efficiency required by such policies. The PAs have employed the former strategy for roughly a decade and introduced the latter with the 2019-2021 Plan.

CSCS develops and delivers technical guidance on the energy efficiency policies applicable to the state's building sector to a wide variety of stakeholders, including private industry and public entities. This technical support, which is delivered anywhere from the individual project or company level up to the jurisdiction or state level, generates energy savings that can be estimated at the market level. The PAs have a unique role to play in providing this support,

[34] This natural gas response demonstration is part of the settlement agreement pursuant to Eversource's acquisition of NiSource's Columbia Gas of Massachusetts assets.

and the resulting energy savings are attributable to this intervention. Savings from these efforts are claimed through the Residential New Homes & Renovations Initiative, the C&I New Buildings & Major Renovations Initiative, the Residential Retail Initiative, and the C&I New & Replacement Equipment Initiative that are further detailed in Sections 2 and 3 of the 2022-2024 Plan.

CSCS is a valuable component in the pursuit of all cost-effective energy efficiency and more equitable distribution of benefits across customers. CSCS is a highly cost-effective initiative that unlocks sources of typically long-lived energy savings not addressable by other programs. Additionally, CSCS primarily impacts historical nonparticipants and customer segments considered "hard to reach" (HTR) by raising efficiency baselines market wide instead of requiring individual customers to participate.

SCOPE OF BENEFITS

Unlike other programs offered by the PAs, CSCS does not include the participation of individual customers. Instead, customers automatically realize the benefits of this initiative when their energy consumption is reduced due to a CSCS intervention. Since CSCS interventions target energy end uses across all sectors and markets covered by this Plan, all customer segments stand to benefit. CSCS advances the development and adoption of, and increases compliance with, building sector energy efficiency policies where there are energy-saving opportunities. The policies within the scope of CSCS include, but are not limited to:

- State, local, and national building energy codes.
- State and federal appliance and equipment standards.
- State and local existing building performance standards.

While compliance support services are offered continuously, advancement support activities are scheduled in alignment with relevant state and national codes and standards development cycles.

DESIGN

There are two distinct delivery pathways:

- **Codes & Standards Advancement Support** accelerates the adoption of more stringent efficiency requirements than would have otherwise been adopted through tactics such as an analysis of market data, research and development of policy proposals, and presentation of results to stakeholders.
- **Codes & Standards Compliance Support** reduces energy savings lost due to noncompliance with such policies through tactics such as delivery of training and outreach events to the building and design community, staffing of on-demand codes and standards "hotline" support, and development and dissemination of tools and resources.

In both cases, CSCS uses relevant evaluation studies, input from local stakeholders, and best practices from other jurisdictions to target these services based on the demonstrated need or opportunity. Each of these delivery

pathways is applicable to local, state, and national level policies that impact energy use in Massachusetts's building sector.

In the 2022-2024 term, all planned savings from Code Advancement Support are the result of successful efforts to strengthen the state's energy code completed during the 2019-2021 term. This delay between program implementation and savings realization is due to the multiple year lag between when a code if finalized and when homes and buildings permitted under this new code are completed. Codes Compliance Support savings planned to be realized in the upcoming term have been incorporated into the net-to-gross ratio for the Residential New Homes and Renovations Initiative and the C&I New Buildings and Major Renovations Initiative. Standards Advancement and Compliance Support savings in the 2022-2024 term are described in the following section.

STRATEGIC ENHANCEMENTS

The level of investment in this initiative is expected to increase relative to the 2019-2021 term. While this initiative has historically focused on energy code support, more investment in supporting appliance standards (at both the state and federal level) is planned in the 2022-2024 term. This increased investment is warranted given the PAs' successful demonstration of the Codes & Standards Advancement Support element of this initiative.[35] Active pursuit of appliance standards opportunities will help the Commonwealth achieve its climate and decarbonization goals, and the PAs will continue to coordinate with stakeholders to develop a clear path to attribution for these activities.

PA activities conducted during previous Three-Year Plan terms helped to generate savings that will be realized during the upcoming term. Specifically, the PAs supported the Commonwealth's adoption of efficiency standards for 15 products that were ultimately promulgated as part of 2021 legislation.[36] The PAs consistently supported these standards and similar standards packages considered in previous legislative cycles. The PAs intend to claim the savings attributable to this support (which are expected to be less than 1 percent of the electric portfolio savings and approximately 2 percent of the natural gas portfolio savings, after accounting for attribution) starting in 2023, when these standards go into full effect. The PAs propose an attribution rate of 10 percent for the resulting savings, but the PAs have also proposed a quick-hit study be conducted in 2022 to better inform savings claims in 2023 and 2024. While this study would focus on attribution, gross savings planning assumptions can also be updated by a separate study investigating commercial food service equipment, the savings from which constitute most of these forthcoming PA savings claims.

In addition, the PAs will continue to coordinate with DOER to determine if there is sufficient opportunity to merit PA involvement in Compliance Support for this new package of state standards, as well as federal standards where there is demonstrated noncompliance.

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[35] Final Report: Code Promulgation Attribution Study (MA19X07-B-CDPROMATT) produced for the Massachusetts PAs by NMR Group, Inc. and The Cadmus Group, Sep. 15, 2020, available online at: https://ma-eeac.org/wp-content/uploads/MA19X07-B-CDPROMATT_OverallReport_Final_2020.09.15.pdf.

[36] *An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy,* May 2021, at Chapter 8.

1.4 CROSS-SECTOR TRENDS

In developing the 2022-2024 Plan, the PAs have considered a wide variety of policy, market, and technology trends and drivers and how they will affect energy efficiency program implementation. Each trend and driver referenced below has the ability to influence the direction and focus of the PAs during the upcoming three-year term.

1.4.1 Policy

Several policy drivers were considered in developing the 2022-2024 Plan, including state legislation and priorities. These policies and priorities present opportunities to expand and improve on the PAs' already successful, nation-leading energy efficiency portfolio.

- **Net zero GHG emissions by 2050.** The development of the Plan coincides with the Commonwealth's concentrated effort to place Massachusetts on the path to net zero GHG emissions by 2050. The passage of the Climate Act established a legal requirement for the Commonwealth to reduce GHG emissions by 50 percent below the 1990 baseline level by 2030 and to achieve net zero emissions by 2050. In July 2021, the EEA Secretary established the aggregate reductions in GHG emissions to be achieved with energy efficiency measures implemented as part of the 2022-2024 Plan (see Section 1.2).[37] Reducing building energy consumption through weatherization, electrification, and demand reduction efforts is a key component of achieving GHG reductions in the building sector. The energy efficiency programs also will directly contribute to the Commonwealth's climate and decarbonization goals through an increase in the number of heat pumps (e.g., air source, water source, and ground source heat pumps) installed in homes and businesses, along with a strong focus on creating a sustainable market for building electrification, including consumer education and workforce development and training.

- **Greater emphasis on equitable services.** The PAs recognize there are groups of customers that participate to a relatively lesser extent in the efficiency programs and have been collaborating with stakeholders to identify and address barriers facing these customers and communities. For the upcoming term, the PAs will continue to explore and implement creative solutions to alleviate participation barriers, emphasizing efforts for equitable services for all customers. Serving customers who have participated at lower rates may increase the cost to achieve, but the imperative to ensure greater equity in participation in the PAs' offerings warrants these higher costs. The PAs are committed to increasing the participation of relatively lesser served and HTR customers, such as renters, moderate-income customers, and small and microbusinesses, and will continue to assess the bill impacts of the programs overall so as not to further increase the burden on these customers, who may already have significant energy burdens.

- **Expanding codes and standards.** The success of the PAs' energy efficiency programs has presented new challenges and opportunities when evaluating potential claimable savings opportunities. As technologies and building efficiencies have improved, so have the codes and standards that determine the minimum efficiency levels of new construction or new technologies. This has, in turn, resulted in higher baselines and a reduction

[37] See G.L. c. 25, § 21(d)(4). EEA, *Letter regarding Greenhouse Gas Emissions Reduction Goal for Mass Save*, Jul. 15, 2021, available online at: https://www.mass.gov/doc/greenhouse-gas-emissions-reduction-goal-for-mass-save/download.

in claimable savings. The PAs support adoption of more efficient codes and standards and will remain active in their development and deployment, working with stakeholders to develop and quantify attributable savings from these efforts while also advocating for removal of existing disincentives to their promotion.

1.4.2 MARKET

Program offerings are shaped by local, state, and federal policies, as well as exogenous factors driven by consumers and businesses, energy markets, and the changing landscape.

- **COVID-19 and the economy.** Perhaps the biggest driver of current business investment behavior is the considerable uncertainty that remains regarding the full impact of COVID-19. To date, the impact has been large and very uneven, with some businesses, like those in the life sciences and manufacturing, experiencing a significant improvement, while others in retail, leisure and hospitality, and office markets experiencing enormous declines. Regardless of the timing and speed of economic recovery, there will be lasting, uneven impacts and it will be important, more so than ever, for the PAs to target those segments with the greatest appetite for investment in energy efficiency. For many residential customers, the pandemic has increased financial challenges and uncertainty. To assist, the PAs will strive to use and adapt their programs to deliver as much benefit to these households as possible. For other residential customers, increased time spent at home has driven higher consumption and an elevated interest in home improvement projects, providing an opportunity for the PAs to help customers address these changes through energy efficiency. For all customer types, the experience of the pandemic permanently affects some customers' attitude towards on-premise work and increased comfort with and appetite for virtual interactions.

- **Evolution of commercial building stock.** While average building sizes have been increasing for years, the vast majority of buildings (roughly 70 percent) still have floorspace under 10,000 square feet. Conversely, buildings with more than 10,000 square feet of floorspace account for less than 5 percent of the entire building stock. In aggregate, the number of commercial buildings and square footage have decreased over the last decade by roughly 10 percent. Additionally, as the economy has continued to shift toward a more service-based composition (rather than manufacturing), the largest increases in building stock have come from the lodging, warehouse and storage, and service industries. As the building stock evolves further, perhaps more quickly and in unexpected ways given the impact of COVID-19 on business closures and occupancy rates, the PAs will continue to adapt their efforts to targeting and serving C&I customers.

- **Personalization and changing customer expectations.** Customer expectations for how products are marketed and delivered continue to evolve. For the upcoming term, the PAs' goal is to anticipate and meet customers' needs, ensuring the right solution is made available to the right customer in the right way at the right time, increasing the likelihood of effectuating the desired outcome.

- **Shifting value of energy savings.** Delivering high-quality products and services to customers remains a top priority. Avoided costs, which drive claimable savings and benefits, have decreased for the 2022-2024 term and in turn, reduced cost effectiveness. The PAs will continue to identify ways to maintain high levels of benefits for customers while continuing to deliver the products and services expected. While avoided costs for some fuels are declining, there is also a shift in values for reduced electricity usage with greater emphasis being placed on reducing peak load even if it only produces a shift, rather than a reduction, in energy use.

1.4.3 TECHNOLOGY

In addition to the policy and market trends, there are shifts occurring in the technologies available for residential and C&I customer adoption and which, despite limitations to adoption, represent opportunities for efficiency and ADR offerings.

- **Electrification.** Over the next decade, adoption of heat pump technologies, such as air source, water source, variable refrigerant flow, and geothermal, for heating and cooling purposes will increase considerably and the PAs' energy efficiency programs will make these technologies more affordable and more easily accessible for customers. The PAs' heat pump activities are simultaneously driving and responding to this quickly evolving market and while changes in the technology itself are important, the efficiency and efficacy of heat pumps are sensitive to appropriate equipment selection and installation. Additionally, the PAs must build upon their ongoing work to influence the local and regional inventory and sales force (contractors and distributors) to promote heat pump technologies. The PAs continue to help establish best practices in these areas and promulgate them throughout the market, as discussed in Sections 2 and 3 of this Plan.

- **Building optimization and controls**. Monitoring and control of building conditions and operations has advanced significantly. Despite its potential, however, challenges in terms of cost, capability, and complexity have prevented widespread adoption of sensors and controls in building operations that could ensure achievement of maximum savings from lighting, HVAC equipment, and other core systems and processes. Lighting controls now exist in over 50 percent of commercial buildings and HVAC controls are present in more than 70 percent. However, more sophisticated building energy management systems and associated controls exist in only roughly 5 percent of commercial buildings with the vast majority in larger buildings with more sophisticated building management operations and capabilities. Enabled by improvements in sensor size and functionality, along with continued reductions in cost, the PAs plan to expand efforts focused on building optimization and controls across all end uses in the 2022-2024 term.

- **Clean energy technologies**. The PAs envision the incorporation of new clean energy technologies into energy efficiency programs as one of the key areas where the PAs can help address the ambitious GHG policies set forth by the Commonwealth. In the past, some of these technologies have been cost prohibitive for customers or not ready for broader adoption. With some progress in terms of both reduced costs and technical improvements, more of these technologies will be included in the PAs' offerings, either as incentivized measures or technologies co-delivered with incentivized measures. For example, the falling price of battery storage and solar photovoltaics (PV) have made them better candidates for widespread adoption, so the PAs are using incentives for demand response from storage to encourage the pairing of storage with solar PV. The PAs will continue to support the inclusion of new technologies that cost effectively result in energy savings, demand reductions, and GHG emissions reductions.

1.5 HIGH-LEVEL METRICS

The following energy savings, demand reductions, GHG emission reductions, benefits, and related metrics represent the PAs' best estimates of the resources required, and the outcomes resulting therefrom, to achieve their vision for the energy efficiency portfolio described in this Plan.

1.5.1 HIGH-LEVEL METRICS BY SECTOR

Figure 1-7: Combined 2022-2024 Plan Goals (Combined Natural Gas & Electric)

Sector	Incentives Spend	Net Annual MMBtu Savings	Adjusted Gross Annual GHG Emission Reductions (Metric Tons)	Total Benefits
Residential	$1,369,571,413	9,340,649	471,352	6,186,173,933
Income Eligible	$461,272,735	1,857,464	86,778	1,736,832,377
Commercial & Industrial	$1,162,798,814	8,457,040	287,787	5,023,513,986
Total	**$2,993,642,962**	**19,655,153**	**845,916**	**12,946,520,296**

1.5.2 HIGH-LEVEL METRICS BY YEAR

Figure 1-8: Statewide Budgets, Savings, GHG Emissions Reductions & Benefits (Comb. Natural Gas & Electric)

Metric	2022	2023	2024	2022-2024
Total Statewide Budget	$1,108,556,663	$1,274,634,983	$1,566,128,195	$3,949,319,841
Net Annual All-Fuel MMBtu Savings	6,366,776	6,533,790	6,754,586	19,655,153
Net Lifetime All-Fuel MMBtu Savings	73,148,194	80,014,814	87,523,497	240,686,506
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	224,011	272,411	349,494	845,916
Total Benefits	3,818,469,749	4,212,996,198	4,915,054,349	12,946,520,296

Figure 1-9: Statewide Budgets, Savings, GHG Emissions Reductions, and Benefits (Electric)

Metric	2022	2023	2024	2022-2024
Total Statewide Budget	$744,740,610	$871,489,861	$1,120,326,808	$2,736,557,278
Net Annual All-Fuel MMBtu Savings	3,928,696	3,991,771	4,134,827	12,055,294
Net Lifetime All-Fuel MMBtu Savings	37,486,556	42,369,308	48,495,564	128,351,429
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	108,790	149,247	216,982	475,018
Total Benefits	2,607,282,988	2,927,436,725	3,560,121,006	9,094,840,718
Active Peak Demand Reduction (MW)	193,408	235,503	280,049	280,049

Figure 1-10: Statewide Budgets, Savings, GHG Emissions Reductions, and Benefits (Natural Gas)

Metric	2022	2023	2024	2022-2024
Total Statewide Budget	$363,816,053	$403,145,122	$445,801,387	$1,212,762,563
Net Annual MMBtu Savings	2,438,081	2,542,019	2,619,759	7,599,859
Net Lifetime MMBtu Savings	35,661,638	37,645,506	39,027,933	112,335,077
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	115,222	123,164	132,513	370,898
Benefits	1,211,186,762	1,285,559,473	1,354,933,343	3,851,679,578

2: Residential and Income Eligible Sectors

SECTION 2: RESIDENTIAL AND INCOME ELIGIBLE SECTORS

2.1 VISION

For over two decades, the Massachusetts PAs' Residential and Income Eligible programs have served as a national model for other energy efficiency efforts across the country. Among many other accomplishments, the PAs introduced a new pathway to promote Passive House new construction, created the first integrated controls specification for heat pumps in the country, and quickly pioneered virtual Home Energy Assessments (HEAs) during the COVID-19 pandemic. To maintain their national leadership role and to provide the highest level of benefits and service to customers, the PAs will continue to evolve and improve their energy efficiency solutions and delivery during the 2022-2024 term.

At the highest level, the vision for the Residential and Income Eligible Sectors is to provide a comprehensive set of services that benefit all of the PAs' residential and income-eligible customers across the state. The PAs design energy efficiency offerings to pursue all cost-effective opportunities. With innovation and customer service at the center, the PAs are continuously testing new products and delivery approaches, to reach impactful scales and ultimately transform markets. The PAs see their work in the Residential and Income Eligible Sectors as an essential tool in helping to meet the Commonwealth's climate goals but are also proud of their contributions in other areas, such as helping customers manage energy burdens, providing consumer energy education, supporting a robust energy efficiency workforce, and improving the health and comfort of homes.

To reach all of their customers, the PAs must provide services that meet customers' unique needs, based on the kind of building they live in, whether they own or rent, their income, what languages they speak, where they are located in the state, and other key demographic characteristics. This diversity of the PAs' customers affects who they trust, which benefits from energy efficiency are meaningful to them, and what barriers they might face in trying to participate in energy efficiency. The PAs recognize that designing programs addressing such an array of needs and preferences is an immense challenge, requiring constant refinement over time.

The PAs provide services that address almost every residential building end use, including the home's building envelope, HVAC and domestic hot water (DHW) systems, small appliances and electronics, and the enrollment of connected devices in ADR offerings. In order to effectively address all of these end uses, the PAs' solutions must be available when these decisions are being made, across the lifecycle of residential occupancy. Customers need efficiency solutions when building a new home, making renovations or upgrades to an existing home, replacing a failed piece of equipment, or purchasing a new appliance or electronic device. Addressing a wide set of end uses in different types of interactions is not just a way to comply with the PAs' obligation to deliver all cost-effective energy efficiency; it is also part of how the PAs ensure that all types of customers can find ways to benefit from programs that suit their specific circumstances.

For most customers, even those who may struggle paying their utility bills, pursuing energy efficiency is not a priority. To overcome this hurdle, the PAs must intervene in various ways and pursue education, marketing, and partnerships that increase customer awareness of the PAs' energy efficiency offerings, the benefits they can provide, and how customers can participate in them. The PAs provide technical support, such as HEAs and useful web-based resources, to enable customers to make informed decisions. Contractor trainings and programs build capacity, encourage selling efficient equipment, and improve work quality, translating into greater customer satisfaction and savings. Incentives

and rebates can tip the financial scales in favor of energy-efficient options, leading distributors and contractors to change what they stock and sell and making the efficient choice the better deal for the customer. And, at the highest level, the PAs influence codes and standards to increase baseline efficiency across the board.

Influencing customers' decisions is contingent upon trust. For some customers, this means ensuring customers believe the PAs have their best interest in mind and that the information provided is reliable. Fortunately, after a neighbor, relative, or friend, the PAs are the most trusted source of information on energy efficiency.[38] Still, there is more work to be done, and trusted resources can vary by community and population. For example, the perception of customers who speak a language other than English at home is that state and local governments are trustworthy sources of information about energy savings.[39] For the 2022-2024 term, the PAs' primary strategy for building trust is to identify the entities that customers already trust, and to work with them to promote the benefits of energy efficiency. These trust-building efforts are reflected in the Municipal & Community Partnership Strategy, which is built around the PAs forming relationships between municipal governments and trusted community organizations to reach residents and small businesses with information about energy efficiency from neighbors and local leaders they know. Maintaining trust requires that the PAs provide accurate, useful, and transparent information. When customers act on the information provided and find that their experience matches their expectations, that customer becomes a potential advocate for energy efficiency. Individuals sharing their experiences continue to be the most powerful and effective means of inspiring others to engage with the PAs' energy efficiency offerings.

When engaging with customers, the PAs always try to guide them toward a path that leads to an optimal outcome (e.g., for a customer who resides in an uninsulated house heated with propane, this would mean weatherizing their home and upgrading to heat pumps). The PAs acknowledge that some customers may not always be interested or able to pursue this ideal path of all cost-effective energy efficiency. In these instances, it is the individual PA's role to help guide their customers in making the most energy-efficient and economical choice possible. If this means continuing to heat with propane, the individual PA's role is to move the customer to use the most efficient propane-fired equipment possible or to have their home weatherized. While some of these actions may not always be optimal, they still produce real, near-term climate benefits, and allow the customer to make the decision that is right for their circumstances, while still allowing for further future improvements.

Over the years, the PAs' most impactful benefits achieved through energy efficiency are those delivered in close partnership with LEAN to Massachusetts income-eligible customers. The accumulation of decades of efforts to address these customers' energy burdens and to make their homes safer and more comfortable requires that the PAs focus attention during the 2022-2024 term on new energy-efficient measures and building types that have been less comprehensively served. This includes an increased focus on installing heat pumps for customers with electric resistance or delivered fuels and serving smaller, naturally-occurring (unsubsidized) affordable housing buildings that have had lower levels of engagement with the PAs and local CAPs. The PAs also acknowledge the challenges associated with serving buildings that house both income-eligible and market-rate customers and will continue to collaborate with LEAN and CAPs on how to better serve all residents of these buildings.

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[38] See *Residential Non-Participant Market Characterization and Barriers Study,* Table 69, at C-55.
[39] See *Residential Non-Participant Market Characterization and Barriers Study,* Table 71, at C-57.

The PAs recognize that this is an ambitious vision. Providing comprehensive programs that benefit all customers is not just the PAs' obligation, it is also fundamental to their mission and purpose. The offerings described in this Plan detail how the PAs will deliver on this vision for all of their residential customers throughout the 2022-2024 term. The figure below details the complexities the PAs must consider when designing the Residential and Income Eligible Sectors' programs, including customer characteristics, home characteristics, end uses, points of intervention, and customer motivations.

Figure 2-1: Examples (not exhaustive) of Dimensions Across which Residential and Income-Eligible Programs are Designed to Work

Customer Characteristics	Home Characteristics	End Uses	Points of Intervention	Customer Motivations
Demographics: age, language, geography, etc.	Heating fuel, style, size, date constructed, and home configuration	Envelope	New purchase	Financial savings
Sources of trusted information	Number of units	HVAC	Customer-initiated interest in energy efficiency	Environment, climate
Rent or own	Previous participation	Appliances	Product/system failure or new product/system purchase	Property value, tenant recruitment and retention
Income: income eligible, moderate income, etc.	Pre-weatherization barriers	Demand response enrollment	Renovation or addition	Comfort and health

2.2 KEY LEARNINGS FROM 2019-2021 PLAN

The 2022-2024 Plan builds upon key learnings from the 2019-2021 term and further refines customer energy solutions to equitably achieve deeper energy savings for all customers across the state. The PAs were presented with unique challenges to overcome during the recent three-year term, resulting in new and unexpected program modifications and learnings that will be carried into the 2022-2024 term to further enhance delivery. Below are the key lessons learned from implementation of the 2019-2021 Plan that the PAs will use for the 2022-2024 term.

- **Meet the customer where they are.** This was a key priority for the 2019-2021 term, and experiences during this term reinforced its importance. One example was enrolling customers in the ADR offering for smart thermostats. While the PAs did execute dedicated promotions through marketing channels such as email, enrollment on the device itself or through an email from the device manufacturer were by far the most effective means to recruiting participants to the ADR offerings. The PAs will continue to look for creative ways to present opportunities for education and participation wherever the customer is making energy-

related decisions (e.g., increasing efforts to enlist solar PV contractors to pair battery storage with solar when making their sales pitch to customers).

- **Understanding the value of remote tools.** The COVID-19 pandemic challenged the PAs to quickly develop and leverage virtual solutions that provide customers the flexibility to participate on their own schedules. The PAs offer a variety of virtual solutions, including, but not limited to virtual HEAs, online HEAs, remote inspection opportunities, an online marketplace for energy efficiency purchases, heating solutions calculators, and online submission portals. The PAs will continue to leverage these virtual tools during the 2022-2024 term.

- **Leaning into municipal and community partnerships.** The PAs recognize that municipal and community partners have the local knowledge and trust from the community needed to educate and encourage residents to pursue energy efficiency opportunities. For the 2022-2024 term, the PAs plan to modify their community approach based on stakeholder feedback and key learnings from the previous three-year term and further leverage these valuable community relationships to access HTR populations including renters, moderate-income customers, English-isolated families, and small businesses. More information on the PAs' Community First Partnership Program can be found in Section 2.9.2.

- **Trade ally support.** Support from partners is paramount to the PAs achieving their aggressive energy savings goals. Together with their trade ally partners, the PAs plan to continue encouraging high-efficiency equipment stocking practices, motivating contractors to offer energy-efficient equipment, encouraging weatherization measures prior to the installation of HVAC equipment, providing education to partners on the proper installation of newer technologies, working collaboratively on new customer paths to participation, and striving to make access to customer incentive dollars as streamlined as possible to reduce customers' financial burdens.

- **COVID-19 pandemic.** In March 2020, the PAs were challenged to quickly rethink new virtual options for service delivery. The virtual HEA offering was developed in March of 2020 and remained a primary offering for customers in 2020 and 2021. The PAs plan to continue refining the virtual HEA as a permanent delivery offering during the 2022-2024 term. There are many benefits to this pathway including reaching additional customers in a more convenient and time sensitive way, reacting to the diversity in the PAs' customer base by offering a friendly virtual solution, reducing challenges with customer rescheduling, and eliminating Energy Specialist travel time allowing PAs to reach more customers in a day. The one-on-one walkthrough with the customer also enhances the repertoire and education opportunities between the Energy Specialist and customer.

- **Creating comprehensive and effective end-to-end language support is challenging.** While the PAs have invested in translating key points of customer communications, including MassSave.com and the residential phone hotline, the scope and complexity of offerings combined with the number of contractors the PAs work with pose critical challenges to ensuring an end-to-end in-language experience. While maintaining the translation of some of these key customer touchpoints, the PAs are focused on improving the most common customer journeys. This more focused approach will allow the PAs to provide seamless experiences, learn from vendors and customers, and apply feedback to the next participation pathway. In addition, the PAs are working with independent evaluators to develop customer journey maps depicting how English-isolated

customers currently interact with certain residential programs, along with insights into barriers to participation among these customer groups. This research will help PAs continue to improve customer experience for English-isolated customers.

- **Energy savings packages may not deliver substantial savings, but they are a useful tool for engaging and serving customers.** The PAs had envisioned energy savings packages, which included measures typically installed during an in-home HEA, such as light bulbs, faucet aerators, and smart strips, as a means to engage with customers with limited technical opportunity or without the authority to make changes to their home. The elimination of most claimable lighting savings further reduces their potential to deliver savings. Still the PAs believe that energy savings packages can help reach customers who may not otherwise participate. During the 2022-2024 term, energy savings packages will continue to evolve as the PAs continue to learn about which customers benefit most from them and how they can complement other offerings.

- **Customers are willing to trade financial incentives for simplicity.** Specifically, the PAs continue to find that the current income-verification process is a barrier for participation in the moderate-income insulation offer, despite the 100 percent incentive. While maintaining confidence that ratepayer funds are being reserved for those in the greatest need and ensuring that as many potential income-eligible customers are being identified as possible, the PAs will focus on streamlining the income-verification process as a means to increase participation in moderate-income offerings.

- **Understanding barriers to participation.** The *Non-Participant Study* provided some key insights to the PAs' customer base, including roadblocks for participation.[40] The PAs continue to look for solutions to address these participation barriers and more information on the PAs' plans to address them are addressed in Section 2.9.1 (Strategic Intervention: Increasing Equitable Service). Some findings from the *Non-Participant Study* include:

    - *Populations of interest tend to cluster together geographically*. For example, Census block groups that have a high proportion of renters are more likely to have a similarly high percentage of multifamily homes and households that speak limited English. The PAs can use this information to geographically target these areas to increase participation across the three identified HTR segments.

    - *Nonparticipants are more likely to be renters and reside in smaller multi-unit buildings*. The PAs continue to identify methods to streamline delivery for small multi-unit buildings and will explore additional tactics in the 2022-2024 term.

    - *Characteristics of non-participants*. These include:

        1. Often expressed a lack of trust in the government and their landlords and have a fear of scams.

[40] Navigant, Illume, and Cadeo. *Residential Non-Participant Market Characterization and Barriers Study,* at 16-29, available at: https://ma-eeac.org/wp-content/uploads/MA19R04-A-NP-Nonpart-MarketBarriersStudy_Final.pdf.

2. Prioritized their time and resources on needs that they considered more fundamental to living (i.e., food and shelter).

3. Needed more information or understanding of Mass Save offerings, participation processes, and benefits.

4. Perceived energy efficiency as irrelevant or not applicable to them.

5. Believed Mass Save offerings are government-funded, therefore deterring participation.

Understanding these underlying characteristics can help the PAs to develop targeted strategies to address each area of concern. For example, the PAs could consider additional strategies to minimize time and resources needed to participate in energy efficiency so that it does not compete with customers' needs that they consider to be more fundamental. The PAs are also continuing to research how to reach and engage HTR customers, including non-traditional outreach methods.

2.3 2022-2024 STRATEGIC INTERVENTIONS OVERVIEW

As noted earlier, during the 2022-2024 term, the PAs will prioritize equity, electrification, and workforce development, in addition to their fundamental pursuit of delivering energy-related benefits. Taking into account these goals, learnings noted above, and sector challenges (discussed below), the PAs will take on a set of strategic interventions in the 2022-2024 term, as described below and in greater detail in Section 2.9.

- **Equity.** Increased focus on new strategies to reach renters, moderate-income customers, and English-isolated families.

- **Workforce development.** Growing and diversifying the energy efficiency workforce supporting PA programs using five strategies:

  – Train diverse candidates.

  – Engage stakeholders.

  – Retain diverse entrants.

  – Grow and upskill small contractors and new entrants.

  – Increase capacity to meet demand for electrification.

- **Scaling up residential electrification.** Achieving the widespread adoption of electrification of space heating requires deliberate and careful growth. The PAs plan to draw on lessons learned from the 2019-2021 term, as well as contractor, distributor, and manufacturer feedback to continue to develop such growth. To achieve this, the PAs plan to build a market – customers, contractors, distributors, and manufacturers – that supports a sustained ramp up in electrification, including focusing workforce development efforts on transitioning the HVAC market to electrification.

- **Easing participation and virtualization.** New virtual options introduce access to customers who may not have participated otherwise. Building upon their newly developed virtual offerings, the PAs can provide shorter, more tactical and personalized interactions with customers, serving their immediate needs like collecting data and laying groundwork for future interactions. The PAs plan to **c**ontinue to using feedback from customers and contractors to inform the design of new offerings and the refinement of existing ones.

- **Engaging contractors in the market.** Continued education and outreach tactics to trade allies and contractor partners. The PAs will explore new and streamlined ways to partner in reaching customers with energy efficiency solutions.

- **Community partnership programs**. Strengthen and expand on partnerships with municipalities and community-based organizations to address customer participation barriers together and achieve shared goals building on the 2019-2021 term strategy (known as the Municipal & Community Partnership Strategy). This includes a focus on exploring new -placed- based partnerships that include prioritizing environmental justice communities, expanding the involvement of community-based organizations, increasing the flexibility of design to encourage innovative proposals, and aligning goals, data, and outcomes shared between the PAs and partners.

2.4 GOALS, SPENDING, GHG EMISSIONS REDUCTIONS, AND BENEFITS

As part of their three-year planning process, the PAs must develop energy and demand savings goals, budgets, cost-effectiveness models, and cost-efficiency forecasts that represent their best estimates to realize their vision for the Residential and Income Eligible Sectors. Additionally, as set forth in the Acts of 2021, c. 8, § 106, the EEA Secretary set a GHG reduction goal for the 2022-2024 Plan on July 15, 2021. The PAs will need to meet multiple objectives and outcomes for the Residential and Income Eligible Sectors, including meeting electric savings, natural gas savings, demand reduction, and GHG reduction goals. The programs also yield considerable non-energy-related benefits, such as improved health outcomes. These different types of value are all converted into dollars as a common denominator and summed as benefits.

Figure 2-2: Residential and Income Eligible Budgets, Savings, GHG Emissions Reductions, and Benefits

Metric	2022	2023	2024	2022-2024
Total Statewide Budget	$709,590,027	$802,229,770	$936,273,174	$2,448,092,971
Net Annual All-Fuel MMBtu Savings	3,493,855	3,730,047	3,974,212	11,198,114
Net Lifetime All-Fuel MMBtu Savings	44,954,393	49,940,017	55,404,101	150,298,510
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	150,410	181,473	226,247	558,130
Total Benefits	2,260,534,700	2,610,155,599	3,052,316,012	7,923,006,310

Figure 2-3: Residential Budgets, Savings, GHG Emissions Reductions, and Benefits (Electric)

Metric	2022	2023	2024	2022-2024
Total Statewide Budget	$316,794,948	$383,669,528	$484,154,090	$1,184,618,566
Net Annual All-Fuel MMBtu Savings	1,595,885	1,775,148	1,981,525	5,352,558
Net Lifetime All-Fuel MMBtu Savings	18,097,938	21,591,171	25,877,900	65,567,009
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	73,125	99,713	139,950	312,788
Total Benefits	1,143,976,430	1,437,998,175	1,819,939,567	4,401,914,172

Figure 2-4: Income Eligible Budgets, Savings, GHG Emissions Reductions, and Benefits (Electric)

Metric	2022	2023	2024	2022-2024
Total Statewide Budget	$111,829,638	$115,589,025	$121,447,823	$ 348,866,487
Net Annual All-Fuel MMBtu Savings	337,052	330,990	318,808	986,850
Net Lifetime All-Fuel MMBtu Savings	3,977,365	4,110,404	4,285,899	12,373,669
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	12,634	13,698	15,248	41,579
Total Benefits	308,387,864	318,912,408	333,654,686	960,954,958

Figure 2-5: Residential Budgets, Savings, GHG Emissions Reductions and Benefits (Natural Gas)

Metric	2022	2023	2024	2022-2024
Total Statewide Budget	$205,201,685	$219,861,261	$239,090,468	$664,153,415
Net Annual All-Fuel MMBtu Savings	1,286,760	1,333,469	1,367,862	3,988,091
Net Lifetime All-Fuel MMBtu Savings	17,202,014	18,207,388	18,874,319	54,283,721
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	50,448	52,989	55,126	158,563
Total Benefits	561,861,353	595,878,372	626,520,036	1,784,259,761

Figure 2-6: Income Eligible Budgets, Savings, GHG Emissions Reductions, and Benefits (Natural Gas)

Metric	2022	2023	2024	2022-2024
Total Statewide Budget	$75,763,756	$83,109,955	$91,580,792	$250,454,503
Net Annual All-Fuel MMBtu Savings	274,157	290,439	306,018	870,614
Net Lifetime All-Fuel MMBtu Savings	5,677,075	6,031,054	6,365,983	18,074,111
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	14,203	15,072	15,924	45,198
Total Benefits	246,309,053	257,366,643	272,201,723	775,877,419

2.5 OVERVIEW

There are approximately 2.5 million and 1.5 million residential electric and natural gas customers, respectively, served by the Massachusetts PAs. These customers are served with energy efficiency solutions through a variety of initiatives to ensure comprehensive, whole-home energy evaluations, recommendations, and supporting financial incentives. A brief description of the Core Initiatives is included below with additional details in the program description sections.

2.5.1 BUILDING STOCK HIGHLIGHTS

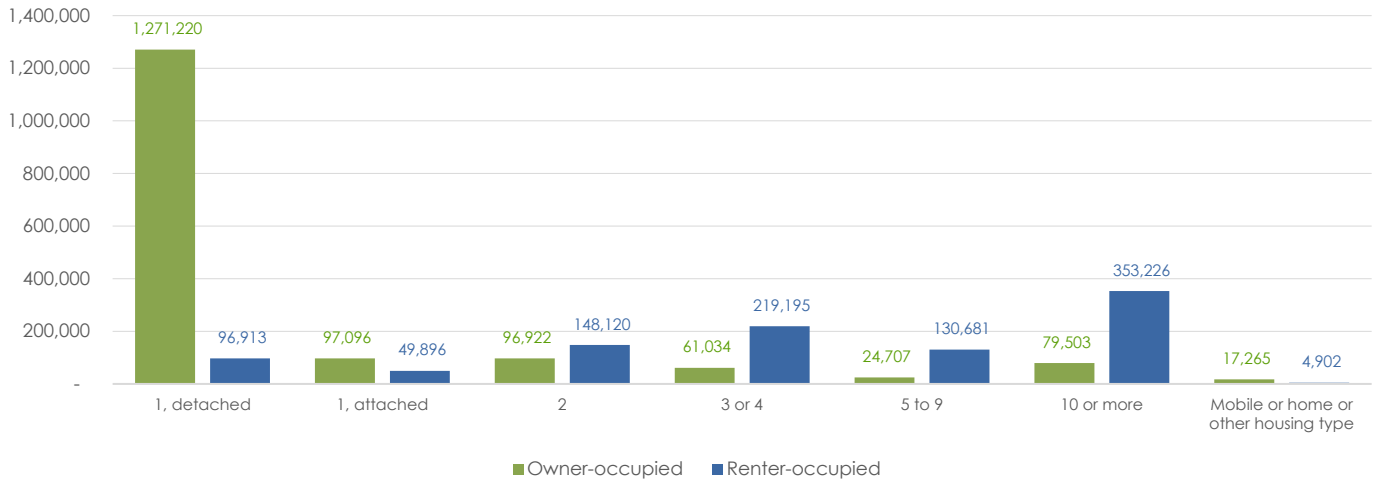
Massachusetts residents and the homes that they live in are diverse. Approximately 38 percent of housing units are renter occupied and more than half of these rental units are in buildings with four units or fewer (see figure below). This means that while a substantial number of renters live in larger buildings, many live in buildings that may traditionally be thought of as being predominantly owner occupied.

While natural gas is the primary heating fuel in the state, oil still maintains a substantial share, heating approximately 24 percent of Massachusetts homes. Oil is more prevalent in single-family, owner-occupied housing. Approximately 17 percent of units are heated with electricity, concentrated primarily in renter-occupied homes in multifamily buildings. The share of homes heated with fuel oil has declined over time, with customers switching to electricity, natural gas, and propane. See the figures below.

The appliances that use the most electricity, on average, in customers' homes are refrigerators, air conditioners, electric clothes dryers, and electric water heaters. The figure below demonstrates that some appliances, such as refrigerators, consume less electricity than end uses such as air conditioners on an individual basis; however, because refrigerators are present in almost every home, they consume more electricity when looking at statewide data. Still, less common high-usage appliances, such as pool pumps and electric water heaters, are excellent targets for energy efficiency. Customers also continue to add more internet-connected devices to their homes, with the most common devices being smart speakers, cameras, thermostats, televisions, outlets, and lights. Though becoming increasingly

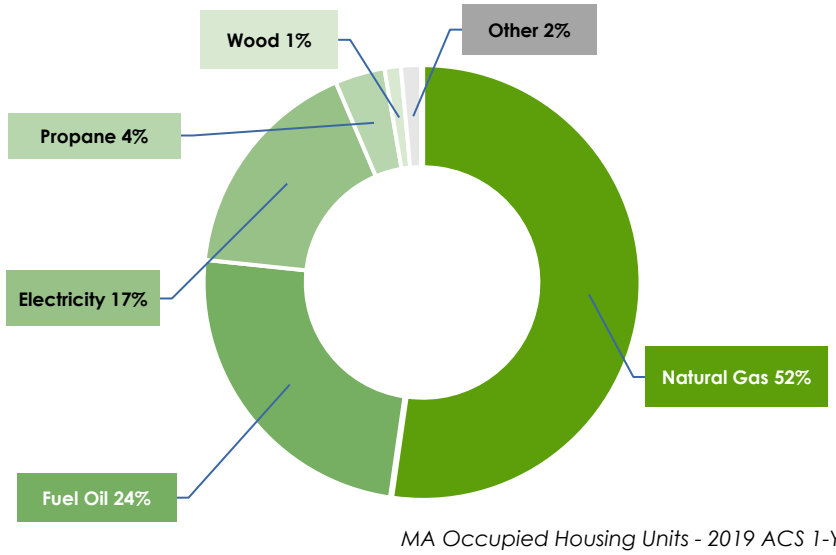
prevalent, smart thermostats were actually present in only 20 percent of Massachusetts homes.[41] At the same time, 42 percent of homes still report having at least one manual thermostat.[42] More details on end use consumption and the PAs' customer base can be found in the Residential Baseline and Residential Customer Profile studies, respectively.[43]

Figure 2-7: Residential Units by Own vs. Rent and Number of Units in Structure



MA Occupied Housing Units - 2019 ACS 1-Year Estimates

Figure 2-8: Primary Heating Fuel for Occupied Residential Units



MA Occupied Housing Units - 2019 ACS 1-Year Estimates

41 2020 Massachusetts Residential Baseline Study, p. 9. https://ma-eeac.org/wp-content/uploads/RES-1-Residential-Baseline-Study-Ph4-Comprehensive-Report-2020-04-02.pdf.

42 Ibid.

43 Residential Baseline and Profile studies, as well as other valuable evaluations can be accessed at: https://ma-eeac.org/studies/.

Heating Fuel Characteristics

Figure 2-9: Historical Trends for Primary Heating Fuel in Occupied Residential Units

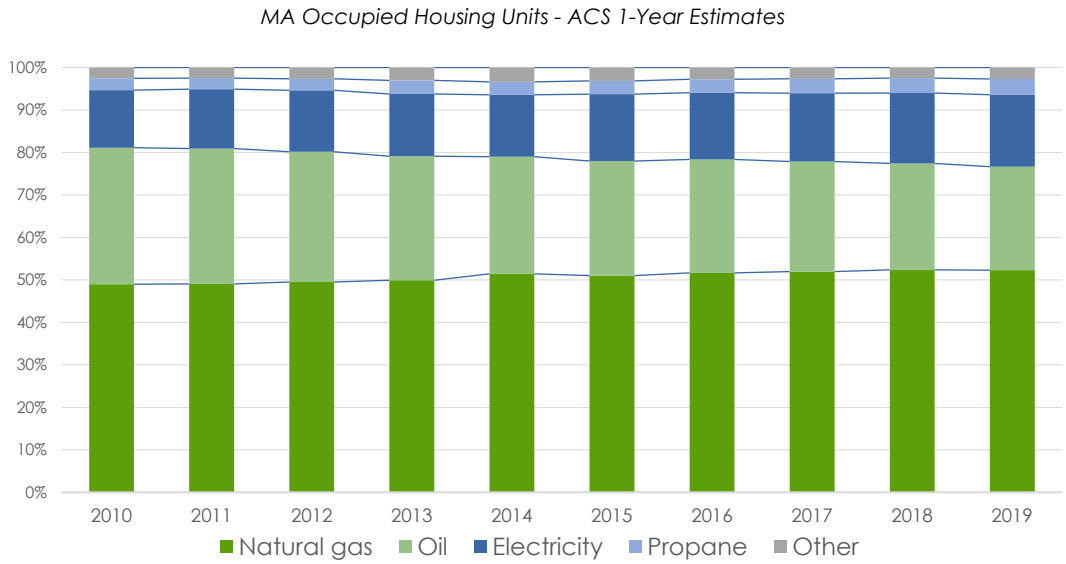
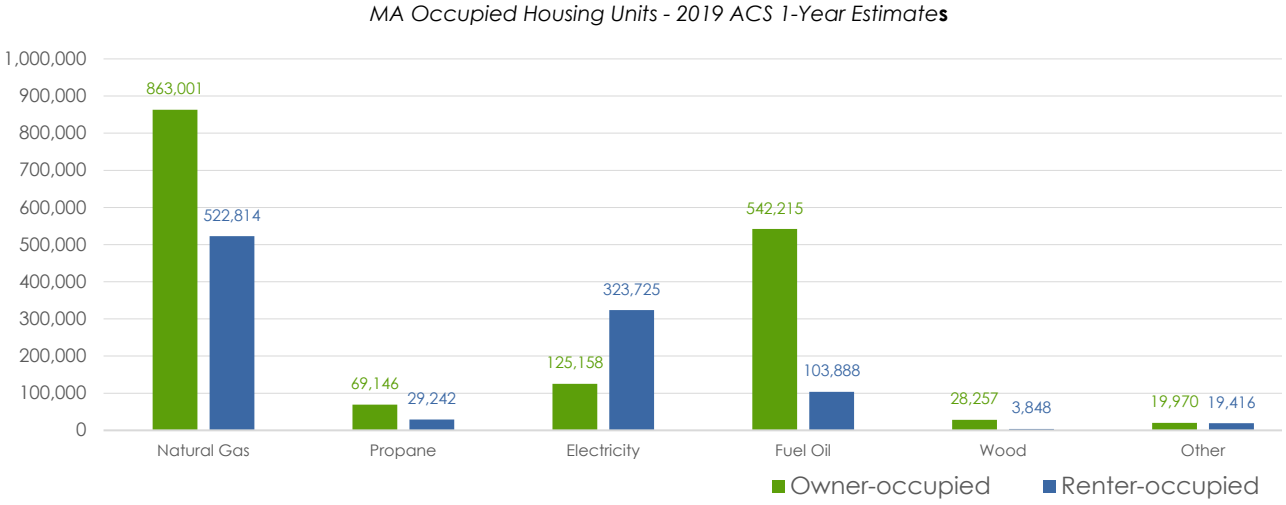


Figure 2-10: Primary Heating Fuel (Own vs. Rent)



Heating Fuel Characteristics (continued)

Figure 2-11: Changes in Saturation of End Uses (2020 MA Residential Baseline Study)

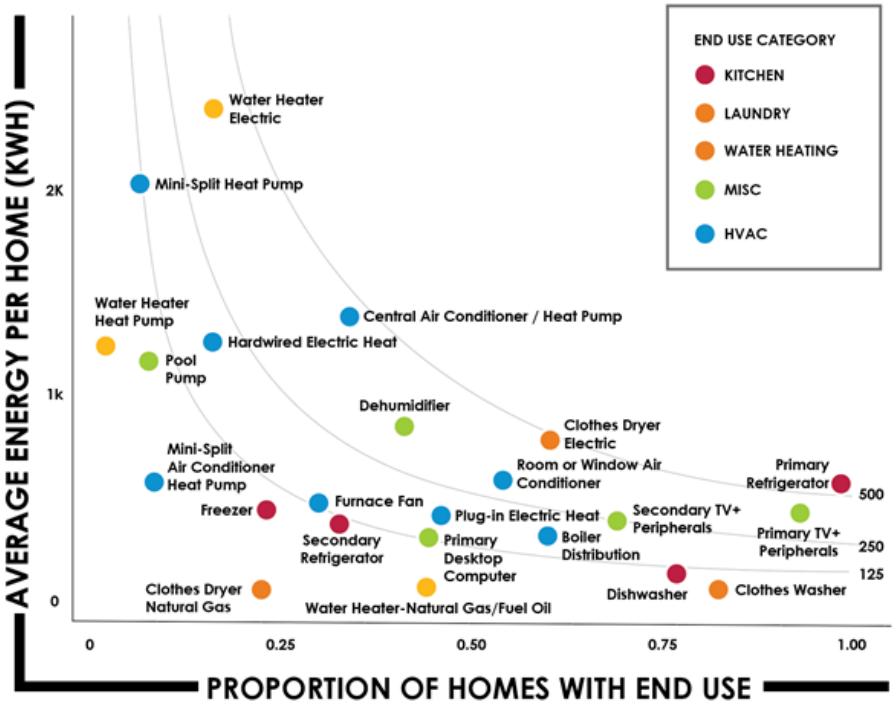
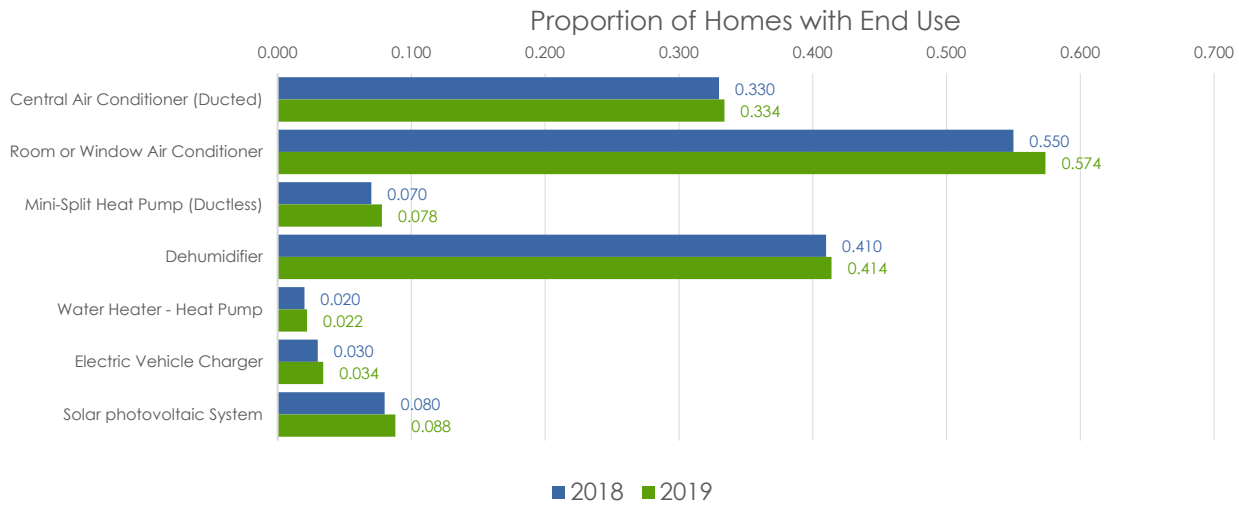


Figure 2-12: Electric Annual End Use Consumption and Saturation (2020 MA Residential Baseline Study)



Source: Guidehouse analysis

2.5.2 CUSTOMER HIGHLIGHTS

Aside from the buildings they live in, the characteristics of customers themselves influence how the PAs think about designing and implementing programs that reach a diverse set of customers. One key attribute is the preferred language of customers. Approximately 75 percent of Massachusetts households only speak English at home. The figure below illustrates the following most common languages, as well as what percent of respondents would describe themselves as speaking English "very well." The languages listed, in addition to English, represent 94 percent of Massachusetts households.

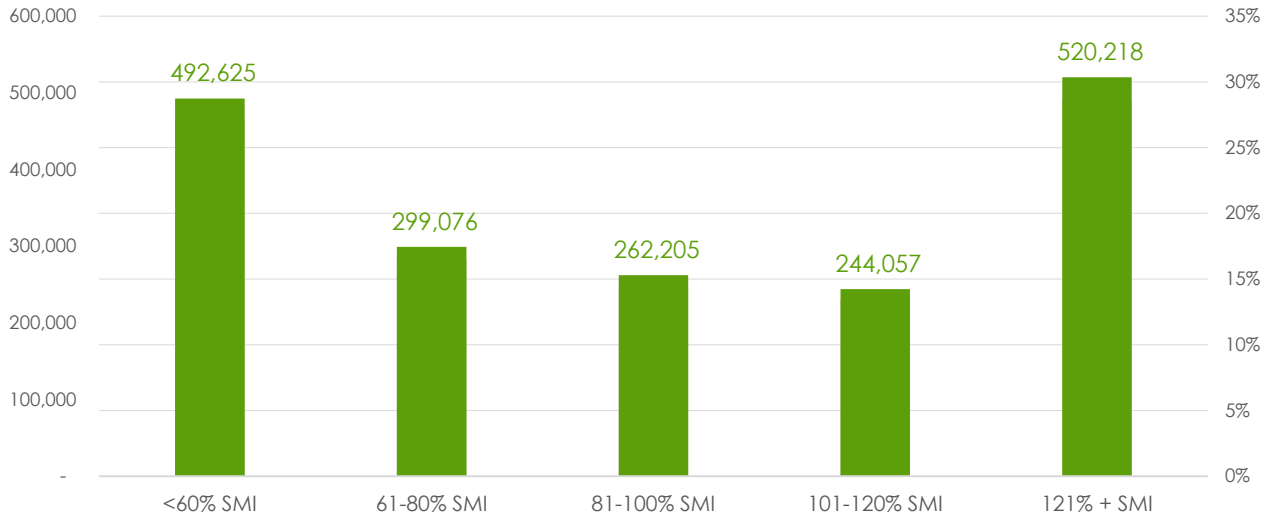
Figure 2-13: Languages Spoken at Home in MA Households and Level of English Proficiency

Language Spoken at home	Population	% of MA Population	% Speaking English "Very Well"
Spanish	632,230	9.7%	59.8%
Portuguese	206,232	3.2%	56.1%
Chinese (incl. Mandarin, Cantonese)	148,270	2.3%	51.4%
Haitian	89,731	1.4%	64.6%
French (incl. Cajun)	49,442	0.8%	82.6%
Vietnamese	41,986	0.6%	48.3%
Russian	37, 092	0.6%	60.8%
Arabic	33,369	0.5%	76.7%

All MA – 2019 ACS 1-Year Estimates

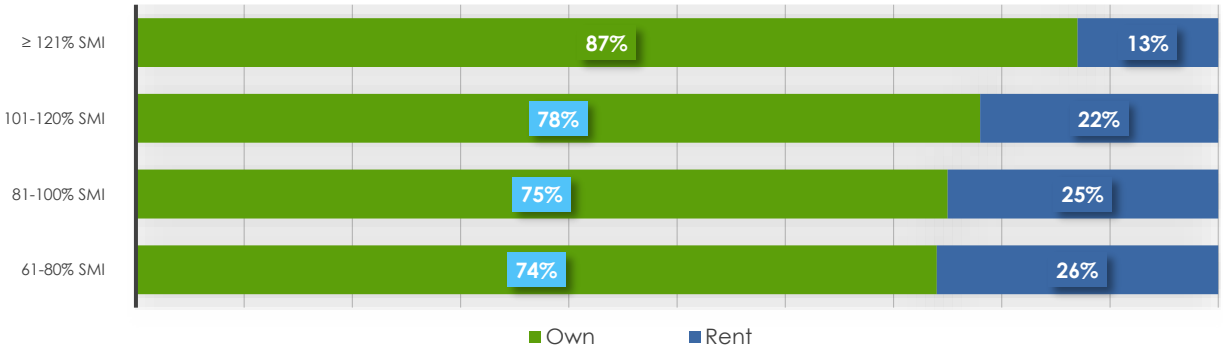
Figure 2-14: Household Income as % of State Median Income for Households Living in 1-4 Unit Buildings

Source - 2018 Moderate Income Market Characterization Study



Household income is another key characteristic in informing the delivery of the PAs' offerings, as it affects their eligibility for certain incentives and their ability to shoulder the costs of energy efficiency upgrades. In general, the PAs focus on household income as a percent of the state median income, which takes household size into account. Because this does not perfectly overlap with how US census data is collected, this can make estimating customer income challenging. One useful source of data is the *2018 Moderate Income Market Characterization* study. This evaluation focused on customers living in homes with 1-4 units, so while it may not be perfectly representative, the study still provides useful information. The study found that approximately 27 percent of households in these buildings are at or below 60 percent of state median income, making them eligible for income-eligible programs, with an additional 16 percent greater than 60 percent and equal to or less than 80 percent, which the PAs consider moderate income.[44] The study also found that while home ownership rates are lower at lower income levels, most income-eligible and moderate-income customers in 1-4 unit buildings do own their own homes. Additional valuable information on residents in Massachusetts is available from the US Census Bureau, the *Moderate-Income Market Characterization Study*, the *Customer Profile Study*, the *Non-participant Market Characterization & Barriers Study*, and the *Residential Non-participant Customer Profile Study*.[45]

Figure 2-15: Own vs. Rent by Household Income for Those Living in 1-4 Unit Buildings



Source: 2018 Moderate Income Market

2.5.3 ENERGY EFFICIENCY POTENTIAL

The PAs have each undertaken potential studies to assess the remaining cost effective energy efficiency potential in their service territories as directed by the Department (see Appendix F for the PAs' potential studies). The potential studies for the 2022-2024 term indicate that the type of measure that historically has made up the bulk of the Residential and Income Eligible Sectors' electric savings—lighting—will have virtually no potential in 2024 and beyond due to the transformation of the residential lighting market. This transformation is due in part to the efforts of the PAs over the past decade and represents substantial energy and cost savings for customers. Now, the PAs must pursue opportunities for growth in electric savings in other measure types, particularly HVAC and building envelope

[44] Moderate Income Market Characterization Survey Findings, p. iv, available online at: https://ma-eeac.org/wp-content/uploads/Moderate-Income-Market-Characterization-Report-Final-16Mar2018.pdf.
[45] These studies, with the exception of the US Census data, are available online at: https://ma-eeac.org/studies/.

measures. Residential delivered fuel savings and natural gas savings have the potential to grow in the next term, primarily due to building envelope and HVAC measures in the single-family, market-rate segment.

2.6 RESIDENTIAL SECTOR OVERVIEW

For the Residential Sector, the PAs offer a comprehensive set of programs, initiatives, and offerings designed to pursue the market opportunities described above. Below is a brief description of some of the key Residential Sector offerings. Additional program details are provided in Section 2.10.

2.6.1 RESIDENTIAL NEW BUILDINGS PROGRAM

RESIDENTIAL NEW HOMES & RENOVATIONS INITIATIVE

The primary objective of the Residential New Homes & Renovations Initiative is to reduce energy use and demand (kW) in the construction of new homes and existing homes undergoing renovation. The Initiative's secondary objective is to support the transition of the residential new construction market toward the highest efficiency building standards and equipment installations.

2.6.2 RESIDENTIAL EXISTING BUILDINGS PROGRAM

RESIDENTIAL COORDINATED DELIVERY INITIATIVE

The Residential Coordinated Delivery (RCD) Initiative is designed to promote and facilitate the implementation of energy efficiency upgrades in existing homes to help customers reduce their overall whole-home energy usage, with a particular focus on improvements to the building envelope. RCD provides customers with information and technical assistance to help them understand their specific energy efficiency opportunities, paired with aggressive incentives. The Initiative strives to provide flexibility in delivery of services to best match each customer's unique needs and preferences and align with the technical opportunities for the home and the customer's authority to implement recommended improvements.

RESIDENTIAL RETAIL INITIATIVE

The Residential Retail Initiative provides a broader integrated marketplace where energy-efficient products and equipment are positioned as attractive, primary choices for customers making purchasing decisions, whether online, in-store, or through independent contractors and distributors. The Initiative offers education to help customers make informed decisions, incentives to make efficient choices more financially attractive, and training and support for the market actors, to help shift contractors toward more efficient, correctly installed equipment.

RESIDENTIAL BEHAVIOR INITIATIVE

The Residential Behavior offering includes behavioral-based interventions that are designed to motivate and help customers to reduce energy consumption through changes in behavior (e.g., using fans to reduce cooling needs) and ADR offerings, which help reduce customer demand during system peaks. The figure below provides a comparison of some of the key offerings that are focused on efficiency improvements in existing buildings.

Figure 2-16: 2022-2024 Market Rate Residential Initiatives

Initiative/ Offering	Renovations and Additions	RCD	Retail – Upstream and Midstream	Retail - Downstream
Customer interface	HERS auditor	Energy specialist	Contractor or retailer	Online marketplace, retailer, contractor, or rebate processor
Approach	Project based: technical assistance and incentives	Project based: technical assistance and incentives	Point-of-sale	Equipment based
Project types	Additions or renovations that trigger code	Pure energy retrofit (does not trigger code)	Replacement on failure and early replacement	Replacement on failure and early replacement
Scalability	Low: triggering code limits opportunity	Medium: closed market addresses many concerns but limits scalability	High	Medium
Transaction costs	High	High	Low	Medium: depending on type of transaction
End uses available	Almost all	Benefits are primarily from envelope improvements	Some DHW, pool pumps, boiler reset controls, and related	Almost all, except envelope
Customer types	Primarily customers who have already decided on renovation or addition, increases efficiency of their project	Generally, customers exploring energy efficiency specifically. Focused on envelope or seeking general energy feedback	Focus is often on the contractor, promoting them to sell equipment to customers who may have not have actively sought efficient equipment themselves	Wide variety, but often focused on a single transaction (e.g., new dehumidifier). Some are also leveraging these incentives for larger projects (e.g., part of RCD)
Process mechanics	HERS Rater influences owner, architect, or contractor to increase the project's efficiency. HERS Rater models consumption of project relative to a baseline	Energy specialist conducts HEA, creating weatherization scope and recommendations for other opportunities If customer signs weatherization contract, work is completed by program contractor and incentive is netted against project cost	Incentive paid directly to distributor and "embedded" as discount in retail price at point of sale. No paperwork required of customer	Various: Downstream, instant incentives, and online marketplace allow customer to purchase product net of incentive. Rebates: customer fills out application, provides any required documents, and receive rebate after review
Incentive strategy	Incentive designed to make it easier for homeowners to roll slightly higher cost for efficiency into their larger renovation or addition project	Incentive designed to be attractive enough to inspire customers to pursue elective, fairly-involved work (e.g., insulating attic)	Incentive designed to motivate distributors and contractors to stock, promote, and sell energy-efficient products	Incentive calibrated to mitigate some or most of the incremental cost energy-efficient equipment relative to standard efficiency alternatives
Incentive structure	Incentive for HERS Rater complaint projects and to customer based on delta between modeled consumption and baseline	Primarily set as a % of total job cost. Most job costs are set for customers, as they have been negotiated between the PAs and participating contractors	$ per widget/unit	$ per widget/unit
Savings methodology	Modeled savings	Modeled savings	Deemed savings	Deemed savings

2.7 INCOME ELIGIBLE SECTOR OVERVIEW

2.7.1 INCOME ELIGIBLE EXISTING BUILDINGS PROGRAM

INCOME ELIGIBLE COORDINATED DELIVERY INITIATIVE

The Income Eligible Coordinated Delivery Initiative provides cost-effective, energy efficiency products and services in a fuel-blind approach to income-eligible, residential customers. “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.

2.8 CHALLENGES

Successfully designing and implementing a set of offerings requires understanding obstacles that may hinder progress toward set goals. To that end, the PAs have identified some of the key challenges they expect to face during the 2022-2024 term as they pursue benefits goals, the three-year plan priorities, and other objectives. Some are standing challenges (and thus were mentioned as key learnings from the 2019-2021 term), while others are new.

- **Trust gap.** While most customers do trust the PAs for information related to energy efficiency, as noted above, the *Nonparticipant Market Barriers Study* highlighted the importance of establishing trust in order to serve segments that have historically participated at lower levels. The PAs’ offerings are sometimes conflated with government programs, which can be a problem for customers who do not trust governmental entities. The PAs must work to bridge this trust gap, as each customer trusts different entities and may have varied reasons for their lack of trust.

- **Perceived relevance.** Some customers may not intuitively understand how energy efficiency might benefit them or may not think that services offered by the PAs are applicable to them. Relevance is a spectrum – a customer may understand that they could participate in the program but believe that the benefits that would accrue to them may be limited. In addition, customers attribute different value to the same set of benefits (e.g., some may be motivated by financial savings, others sustainability, and others comfort).

- **Customer bandwidth and priorities.** Whether a customer is likely to participate in energy efficiency is driven by how relevant and beneficial they perceive the offering to be to them. In addition, customers have a limited bandwidth, tied primarily to their available time and how they prioritize energy efficiency relative to other tasks. Regardless of how affluent a customer is, time often outranks finances as a barrier to participation.

- **Program complexity.** Providing a comprehensive set of services to customers is a key component of the PAs’ vision, but it also can create a barrier. The many ways that customers can engage in energy efficiency offerings can lead to confusion, which, in turn, can lead a customer to not participate. Further, the complexity of individual participation pathways (e.g., complicated eligibility criteria or excessive number of steps) can deter customers from engaging or lead them to drop out before completing their energy efficiency action. In some instances, even if participation is in fact fairly seamless, customer perception of complexity

can be a barrier. As the PAs offer increasingly targeted initiatives, managing complexity will be a critical priority.

- **Sequencing energy efficiency improvements.** In retrofitting a home for energy efficiency, certain actions are best taken in a specific sequence. Most importantly, envelope measures should, whenever possible, precede HVAC upgrades in order to ensure proper design and sizing, which in turn drive comfort and efficiency. Certain circumstances, like a desire to add cooling or the need to replace a broken system, however, often lead customers to address their HVAC system before their envelope. This creates challenges for the PAs who want to promote ideal sequencing, but who also would like to push customers toward the most efficient equipment possible.

- **Customer finances.** While many energy efficiency actions are inexpensive or offered at no cost to the customer, many others involve substantial capital investment. During the 2022-2024 term, the Residential Sector portfolio will be more heavily weighted toward expensive measures, like heat pumps. The tools that the PAs offer to try to overcome financial barriers, namely incentives and financing, are themselves expensive. Further, the PAs are committed during this term to further improving participation by moderate-income customers, many of whom will have a higher energy burden and competing financial priorities. The dynamics of trying to increase participation among customers who may require higher incentives for an increasingly expensive set of measures results in substantial challenges in creating budgets.

- **Language support.** Key elements of the PAs' initiatives are already being translated into the most common non-English languages. During the 2019-2021 term, the PAs introduced in-language marketing, creating campaigns that were not only created in another language, but drafted in scratch with the intent of resonating with customers who speak that language. Still, there are challenges associated with maintaining in-language services across all offerings. The sheer number of offerings, pieces of collateral, partnering contractors and vendors, and the frequency with which they change will require the PAs to be deliberate and adaptable in serving English-isolated families.

- **Renter participation options.** Renters have always been fundamentally constrained in how they can pursue energy efficiency because they lack the authority to make most capital improvements. With the reduction of claimable lighting savings, a key means to deliver direct benefits to this customer group is now lost. The remaining measures that may be within a renter's control (e.g., portable appliances and behavior changes) all have modest impacts on their utility bills. This may justifiably reinforce the feeling among some renters that energy efficiency is not relevant for them. The PAs plan to pursue additional options to engage with landlords for capital improvements for the benefit of the renter tenant.

- **Recruiting landlords.** The energy efficiency programs provide value to landlords, such as reduced consumption on common meters, more satisfied tenants with less turnover, fewer complaints and emergency calls from tenants. However, the split incentive, namely that the benefits from efficiency investments behind tenant-specific meters accrue to the tenants, is a fundamental challenge.

  The PAs have experience with helping to overcome other critical barriers to landlords agreeing to participate in energy efficiency programs, including coordinating access to units with minimal tenant disruption, preference for equipment that landlords know how to service themselves, and potential code and safety concerns. Similar to other customers, landlords may use their limited time and financial resources to pursue

other building upgrades, especially ones that attract renters, like granite countertops. COVID-19 has also introduced new issues for landlords, like reduced rent collection and eviction moratoria. Getting landlords to prioritize energy efficiency in the face of these barriers will continue to be a challenge for the PAs.

- **Workforce availability and diversity.** As discussed throughout this Plan, access to a sufficient, qualified, and diverse workforce is a challenge for many of the partners that help deliver the PAs' programs. Any other plans for increased and improved service to the PAs' customers is contingent upon a skilled and representative workforce.

- **Loss of claimable lighting.** With a few exceptions (lighting for income-eligible customers, some fixtures, and potential renter and moderate income offers), the PAs will no longer offer residential lighting incentives in the 2022-2024 term. While these changes highlight the success of transforming the lighting market, it has substantial impacts on the initiatives offered. First, lighting was an abundant source of very cost-effective savings, for which there is no comparable substitute. Second, lighting did serve as one marketing hook for HEAs, though the PAs have reduced their emphasis on lighting over time. Though the PAs have been planning for these changes for years, the impact is still notable.

- **Cost-effectiveness challenges.** Increasing baselines and falling commodity prices are challenging the cost effectiveness of some measures, initiatives, and programs. This may force the PAs to no longer support measures that customers and the market have become accustomed to seeing incentives for in previous terms. Managing this transition in a way that does not alienate customers or contractors is critical.

- **Lower commodity prices.** In addition to their impact on cost effectiveness, falling commodity prices affect customer economics for investing in energy efficiency. As an example, high oil prices have been a driver of increased weatherization interest in the past while lower energy prices tend to reduce customer interest in energy efficiency across the board.

- **More challenging weatherization opportunities.** For over a decade at this point, the PAs have been implementing aggressive weatherization programs. While opportunity remains, it becomes increasingly challenging to reach and serve the customers and homes not already addressed. This is because those customers most inclined to pursue weatherization have already participated and, to a lesser extent, homes with the fewest barriers have already been served. This means that recruitment and services of the remaining customers and markets will be more challenging, and likely, expensive.

2.9 STRATEGIC INTERVENTION DESCRIPTIONS

Building on the above-referenced goals, trends, and key learnings in the Residential and Income Eligible Sectors, the PAs will focus many of their new efforts and strategic interventions on six key categories. While the interventions and tactics outlined below are not inclusive of all the new activities planned for the 2022-2024 term, the PAs believe that they are the most important undertakings necessary to achieve the vision and priorities discussed throughout this Plan document. Please note that several tactics may also show up more than once, because they are designed to help overcome more than one type of barrier.

2.9.1 STRATEGIC INTERVENTION: INCREASING EQUITABLE SERVICE

The PAs are committed to pursuing the more equitable distribution of their programs' benefits to all customers, making equity one of the key strategic priorities of the 2022-2024 Plan. In the context of energy efficiency, PAs define equity as the process of establishing more equal access to and participation in energy efficiency programs, particularly among those groups who have historically participated at lower rates, including renters/landlords, moderate-income customers, and English-isolated families. The PAs are working to increase participation among these groups by researching and deploying the most effective strategies to engage these customers.

During the next three years, the PAs will use equity as a lens through which they will view all initiatives, ensuring they are considering and addressing how initiative design translates into the distribution of benefits to customers. The PAs will collaborate with industry and community leaders to reach more moderate-income customers, renters, English-isolated families, and small businesses, recognizing that these groups often overlap. The PAs will continue to serve customers through a place-based approach by collaborating with community-based organizations and municipalities as partners to offer a tailored engagement experience for residents and small business owners.

As described in Section 1.1.2, both financial and non-financial barriers to participation are critical challenges for moderate-income customers. To help address financial barriers, the PAs will continue to offer a 100 percent incentive for insulation for moderate-income customers and will extend a 100 percent incentive for insulation for rental units with residential heating accounts. In addition, for moderate-income customers, the PAs will introduce new incentives for addressing pre-weatherization barriers and will offer higher incentives for heating systems (initially amounting to approximately 70 percent of the average installed cost of natural gas and propane systems and 80 percent of heat pumps). Customers taking advantage of these incentives will be encouraged to consider using the HEAT Loan to finance their remaining out-of-pocket expenses. In order to ensure as many customers as possible have access to responsible credit, many PAs have partnered with the Capital Good Fund, which specializes in providing financing to customers with less than perfect credit. The PAs will closely monitor the impact of these new incentives and make adjustments as needed. In 2024, the PAs are planning to spend more than $60 million on weatherization and heating system incentives for income-qualified moderate-income customers, with a total of $115 million over the term. Importantly, these figures are just for enhanced weatherization and heating system incentives and do not include other incentive and non-incentive spending benefitting moderate-income families.

In addition to these enhanced incentives, the PAs will promote all available incentives to moderate-income customers, including those for appliances. The PAs will continue to host appliance turn-in events in environmental justice communities, including increased promotion and emphasis on these communities, as another means to serve these customers and generate awareness of enhanced incentives.

The PAs will partner with contractors, community-based organizations, and workforce development organizations to coordinate statewide workforce development goals and expand residential education efforts to include a workforce development component. As leaders in the energy industry, the PAs will strive to set supplier diversity goals across the energy efficiency initiatives and increase the participation of certified minority-owned business enterprises, women-owned business enterprises, LGBTQI+, veteran-owned business enterprises, and small business enterprises (DBEs) in the PAs' programs, recognizing that a more representative workforce is key to them serving customers equitably**.** As the PAs continue to prioritize serving customers, they recognize that they are more than a convener of energy services and play a vital role in helping communities thrive.

Figure 2-17: Strategic Interventions for Residential and Income Eligible Sectors (Equity)

Equity: Moderate Income Customers			
Goals			
• Increase the number of moderate-income customers participating in energy efficiency programs. • Introduce new incentives that make energy efficiency upgrades more affordable for moderate-income customers. • Create greater ease of access to weatherization and HVAC incentives for moderate-income customers. • Streamline the verification process to income qualify for enhanced incentives.			
Barriers	**Example Tactics**	**Applicable Initiative(s)**	**Short, Mid, Long-Term**
• Customer awareness of services and incentives. • Customer understanding of priority and relevance. • Customer lack of time to participate in a HEA. • Lack of disposable income limits customer ability to install measures. • Lack of disposable income limits customer ability to address pre-weatherization barriers.	Continue to offer 100% weatherization incentive for moderate-income customers and make adjustments as necessary.	RCD	S
	Offer new enhanced incentive on HVAC equipment for moderate-income customers and in conjunction provide information about the HEAT Loan to cover the balance. Each PA may target geographic areas for the enhanced incentive. The PAs plan to offer an enhanced incentive to cover 80% of installed costs for heat pump systems, including fuel switching, and 70% of installed costs for natural gas systems.	Retail	S
	Streamline the moderate-income verification process, offering verification options that minimize customer effort, based on which verification options are applicable to the customer. Introduce an opportunity for bundling the enhanced weatherization and HVAC incentives to support moderate-income customers taking maximum advantage of income-based incentives.	RCD	S
	Bundle weatherization and HVAC equipment by requiring installation of recommended weatherization measures as a prerequisite to receiving the enhanced HVAC incentive.	RCD, Retail	S
	Market the enhanced weatherization and HVAC equipment offers together to customers and ensure that home performance and independent installation contractors are trained to promote them to all customers.	RCD	S
	Engage in proactive outreach to moderate-income customers who have already completed weatherization and may benefit from a new HVAC system.	Retail	S
	Market the enhanced incentive together with a virtual HEA option with flexible evening and weekend hours to complete to minimize customer time needed to participate in energy efficiency while maximizing comfort and savings.	RCD	S
	Consider covering the cost of major barriers to weatherization for moderate-income customers, including: • Cost for electrician to check for live or inactive knob and tube wiring. • Incentive toward knob and tube replacement. • Incentive toward flooring removal and platform buildup. • Incentive toward vermiculite remediation.	RCD	S

Figure 2-18: Strategic Interventions for Residential and Income Eligible Sectors (Equity)

Equity: Rental Properties			
Goals			
• Increase the number of rental properties that are served by Residential and Income Eligible Sector programs. • Create greater ease of access to Residential and Income Eligible Sector programs for owners of rental properties.			
Barriers	**Example Tactics**	**Applicable Initiative(s)**	**Short, Mid, Long-Term**
• Split incentive whereby the landlord is the decisionmaker and the tenant pays the utility bills affects customer interest and engagement. • Lack of customer awareness of services and incentives, especially landlords of smaller (5-25 unit) buildings. • Customer lack of time to participate in an HEA. • Landlord concern for code violations limiting unnecessary access to the property. • Lack of priority for property owner.	Create a rental unit strategic plan with additional tactics to increase renter customer outreach and unit participation.	RCD	S
	100% weatherization incentive for individually-metered rental units.	RCD	S
	Updated approach for 3–4-unit homes where only one unit is income eligible (Mixed-Income Protocol) to both streamline delivery of services by both RCD contractors and CAP agencies.	RCD, Income Eligible	S
	Continue to leverage online assessments and virtual HEAs for renters, while continuing to try to reach the landlord to serve the whole building.	RCD	S
	Consideration of no cost high-efficiency lighting provided to renters in addition to other instant savings products delivered via the Online Store.	RCD, Retail	S
	Use of data and alignment with Community First Partnership Program for targeted outreach to owners of 5–25-unit buildings in municipalities with an above-average density of rental units.	RCD, Income Eligible	S
	Provide owners of rental properties and customers who are renters information about income-based HVAC and pre-weatherization barrier incentives, in addition to the 100% weatherization incentive.	RCD, Retail	S
	• Explore a targeted marketing approach through the use of visual aids to better inform and connect renters and landlords to energy efficiency offerings. • Foster opportunities with external stakeholders to deepen understanding of varying incentive models to increase renters' and landlords' program participation rates. • Work with local industry partners who service and engage landlords to market energy efficiency programs.	RCD	S, M, L

Figure 2-19: Strategic Interventions for Residential and Income Eligible Sectors (Equity)

Equity: Customer Language Access			
Goals			
• Increase the number of customers who participate in Residential and Income Eligible Sector programs in their language of choice for the most commonly spoken languages in MA after English, including Spanish, Portuguese, and Mandarin. • Create greater ease of access to Residential and Income Eligible Sector programs for customers who primarily speak a language other than English. • Connect energy specialists and contractors who speak another language with customers in that language when possible.			
Barriers	**Example Tactics**	**Applicable Initiative(s)**	**Short, Mid, Long-Term**
• Lack of customer awareness of services and incentives. • Lack of customer awareness of programs generates mistrust in programs. • Customers may be discouraged from completing installation of measures because of steps in the customer journey that are not in their primary language.	Develop a Language Access plan that spells out how to provide services to individuals who are non-English speaking or have English-isolated families. This plan will include Language Access Policy directives, implementation plan, and procedures to address language access across the customer journey. In order to address any existing gaps, the Language Access plan will be implemented in conjunction with a map of the customer journey.	RCD, Income Eligible	M
	Administer a community-based social marketing strategy that is place-based and data-driven to address community-level behavior and reduce program participation barriers by addressing behavior challenges and beliefs by enhancing motivation through social influences.	Statewide Marketing, RCD	M
	Through the Community Partnership Program, partner with community-based organizations whose constituents primarily speak the three most commonly spoken languages in MA after English (Spanish, Portuguese, Mandarin) to co-create culturally appropriate and in-language marketing materials and additional delivery channels for customers, as well as increase trust in energy efficiency programs.	RCD, Income Eligible	M
	Ensure that new centralized LEAN call center and single-family website are available in the same languages as Mass Save website and Mass Save hotline.	Income Eligible	M

2.9.2 STRATEGIC INTERVENTION: COMMUNITY FIRST PARTNERSHIP PROGRAM

The PAs define partnerships as intentionally designed relationships with public and private entities to decrease all customers' energy burden and increase decarbonization. The PAs prioritize partnerships that focus on increasing program participation rates, increase engagement with environmental justice communities, and reaching low to moderate-income customers, renters and English-isolated customers. A cornerstone of the PAs' efforts to increase equity and program participation of HTR customers over the next three years will be to strengthen and expand on partnerships with municipalities and community-based organizations, including educational institutions to address customer participation barriers together and achieve shared goals. The PAs will continue to build on the 2019-2021 term's Municipal Partnership Strategy, with the introduction of an updated offering, the Community First Partnership Program and include a focus on environmental justice communities. This focus will include improvements to expand the involvement of community-based organizations, increase the flexibility of design to encourage innovative proposals, and align goals, data, and outcomes shared between the PAs and their partners. The ultimate goal of these efforts is to increase participation among HTR customer segments, especially renters and owners of rental properties, moderate-income customers, English-isolated families, and small businesses.

Figure 2-20: Strategic Interventions for Residential and Income Eligible Sectors (Equity)

Equity: Community First Partnership Program			
Goals			
• Increase participation in energy efficiency programs in geographic areas shown to have the lowest program participation rates and among customers that are HTR, including owners of rental properties and their tenants, moderate-income customers, English-isolated families, and small businesses. • Increase customers' trust in energy efficiency programs and greater understanding of program benefits.			
Barriers	**Example Tactics**	**Applicable Initiative(s)**	**Short, Mid, Long-Term**
• Lack of customer awareness of services and incentives • Lack of customer awareness of programs generates lack of trust in programs • Customers' need to prioritize basic necessities; perception that energy efficiency is not a priority • Customers may be discouraged from completing installation of measures because of steps in the customer journey that are not in their primary language	PAs will enter into partnerships with municipalities, community-based non-profit organizations, and/or other community-based organizations working at the local, regional, or state level, or combinations therein and are increasing the number of community partner teams to be accepted in 2022-2024 to at least 20. PAs will hire a lead vendor to coordinate implementation of the Community First Partnership Program, streamline communication with and assistance to community partner teams, and support community partner teams with data collection and tracking. The updated program will include a number of updates to the model used in the 2019-2021 term in order to better achieve the goal of increasing participation of HTR customer groups. The Community First Partnership Program plans to: • Require goals to increase participation among renters/landlords, English-isolated families, moderate-income customers, small businesses, or a combination of some of these customer segments, as well as improved tracking of customer participation as a result of Community Partnership Program efforts. • Require that the focus of outreach efforts be on communities that meet multiple environmental justice community indicators designated by the Commonwealth and give priority to geographic areas with high levels of non-participation in PAs' programs and high energy burdens. • Provide a financial incentive to each community partner team that is fixed annually based on their participation goals, along with annual review of achievement, rather than determined at the end of the calendar year based on their achievement in order to provide greater certainty. • Allow flexibility in proposed initiative structure and approach for the partnering entities, provided that they agree to participation goals, data collection, and shared evaluation mechanisms. • Encourage three-year partnership contracts to foster long-term relationships. • Build long-term local knowledge of energy efficiency offerings through development of Energy Advocates, who will be compensated members of each community partner team, will receive training from PAs on energy efficiency offerings, and will coordinate with PAs to support customers to overcome barriers to participation. • Include training and support for each community partner team to complete initial research to inform their outreach strategy and engage in community-based social marketing. • Provide training on available data resources, as well as regular access to data on achievement, to inform community partner teams' outreach strategies • Include greater opportunities for community partner teams to develop their own marketing materials with streamlined PA approval. • Negotiate sufficient compensation and technical assistance from PAs for the partnering entities to accomplish their goals	RCD, HVAC, Small Business Turnkey, Income Eligible	M

The Companies plan to deploy other strategies to increase program awareness and participation through strengthened collaboration with community-based organizations and municipalities and these are highlighted in the Residential and C&I Equity Strategic Interventions. Community-based organizations will be integral partners in the PAs' Workforce Development Strategy, particularly the Clean Energy Pathways internship, to ensure that PAs are recruiting new talent to the energy efficiency workforce from communities and populations that are currently underrepresented in the workforce, especially people of color, women, and first-generation young people. PAs will also coordinate with immigrant and first generation-serving community-based organizations with cultural and linguistic fluency in the most commonly spoken languages in the state besides English (including Spanish, Portuguese, and Mandarin) in order to improve the customer journey for English-isolated families.

2.9.3 STRATEGIC INTERVENTION: WORKFORCE DEVELOPMENT

Another key component of the PAs' efforts to increase equity and program participation of HTR customers over the next three years will be to implement a statewide strategic workforce development plan. To help reach more customers and achieve increasing energy savings targets, the PAs want to ensure that their investments in workforce development are both growing and diversifying the workforce supporting energy efficiency programs. A strategy to reach these goals will also involve addressing the major barriers outlined in the PAs' *2020 Workforce Development Needs Assessment* which found that most contractors struggle to find qualified talent in key jobs, many potential candidates are unaware of the career opportunities in energy efficiency, and that in many cases the energy efficiency workforce does not fully reflect the diversity of the Massachusetts communities it serves. In all of these efforts, the PAs will collaborate closely with MassCEC to ensure that the collective workforce development efforts of the PAs and MassCEC are well aligned.

The PAs' statewide strategy is focused on five key areas:

- **Train new and diverse candidates**, particularly young adults, people with fluency in multiple languages, people of color and women, and candidates based in communities with historically low participation. The PAs plan to:
    - Recruit and train diverse new entrants to enter the trade ally network and participate in PA programs.
    - Continue to build the Clean Energy Pathways internship to connect young adults (including a focus on environmental justice communities) with internships with contractors in high-growth job areas.
    - Plan to increase coordination with public vocational/technical high schools, including offering career discovery programming.
- **Engage stakeholders for bigger wins** such as community-based organizations, including educational institutions, which specialize in workforce development. The PAs will engage with workforce development, education, and industry stakeholders to ensure program effectiveness toward meeting the PAs' goals of diversifying, expanding, and upskilling the energy efficiency workforce.
    - Continue to partner with the MassCEC on workforce development initiatives

- **Retain diverse entrants** through mentorship and support for both entrants and their employers. The PAs plan to provide a mentorship component for participants in the Clean Energy Pathways internship program, as well as diversity, equity, and inclusion training for participants and employers.

- **Build market capacity to scale electrification** through recruitment and training of HVAC contractors in the participating heat pump installer network, access to no-cost heat pump training through the online training platform. The PAs will also partner with vocational/technical high schools, and other HVAC training providers to expand no-cost access to the heat pump training available through the online training platform and link HVAC trainees with information on job opportunities with HVAC contractors performing heat pump upgrades. Through this initiative, the PAs hope to scale access to heat pump training and measureQuick certification to HVAC trainees statewide and provide a pathway for these trainees to become familiar with energy efficiency programs and the contractors engaged in heat pump installations. More details on the electrification workforce development upskilling strategy can be found in Section 2.9.6.

- **Grow and upskill small contractors and new entrants**, including growing the pool of contractors working on programs and including more certified DBEs working on the PAs' programs. The PAs will:

    - Plan to establish a contractor network and facilitate upskilling within that network through virtual resources and strategically subsidized/sponsored training.

    - Explore putting processes in place through contracting that encourage vendors to hire and subcontract with diverse talent.

For all five aspects of this strategy, the PAs will set targets, measure progress, and evaluate success. The PAs are currently engaged in an evaluation of the Clean Energy Pathways program and will use findings to adapt and refine programs over time. In addition, the PAs are conducting evaluation research to identify non-participating contractors who serve English-isolated customers, what measures they recommend, what market share these contractors represent, and how the Massachusetts PAs can support these contractors to engage English-isolated customers in energy efficiency programs.

Figure 2-21: Strategic Intervention for Residential and Income Eligible Sectors (Workforce Development)

Workforce Development: Train New and Diverse Candidates			
Goals • Grow the total size and diversity of the workforce supporting the PAs' Residential and Income Eligible programs, so that the energy efficiency workforce more closely reflects the customers in communities served by the PAs' programs. • Improve the ability of contracted and subcontracted vendors to identify qualified talent to support the achievement of the PAs' program goals. • Increase language capacity of contracted and subcontracted vendors to meet customer demand.			
Barriers	**Example Tactics**	**Applicable Initiative(s)**	**Short, Mid, Long-term**
• Young people especially, and potential entrants in general, lack awareness of job opportunities and career growth potential in energy efficiency. • Contractors and CAP agencies report challenges recruiting qualified entry-level talent to meet increasing demand of the PAs' programs. • "Traditional" recruitment strategies, such as word of mouth and standard employment websites are not leading diverse applicants to apply. • There is no formal, centralized link to connect entities with job seekers, such as community-based organizations and vocational/technical schools, with energy efficiency employers.	Clean Energy Pathway internship for entry-level HVAC and weatherization professionals, building operators, and weatherization crew chiefs, with the goal of training 120 individuals over three years. Career tracks may be added or shifted to accommodate the changing market and needs of PA programs. The Clean Energy Pathway internship involves: • Developing relationships with trusted CBOs in key geographies where PAs see both low participation in residential programs and including a focus on environmental justice communities. CBOs, which could include K-12 and post-secondary educational institutions and 501(c)(3) non-profits, will facilitate recruitment of candidates. • Targeting participants as young adults ages 18-25 who are fluent in at least one language other than English or who identify as people of color and/or women. • Involving contracted vendors for internship placement and job opportunities. • Providing participating individuals and contracted vendors with training on diversity, equity, and inclusion to support retention and upskilling. • Mentorship for Clean Energy Pathways participants with experienced energy efficiency professionals. • Provide an hourly wage for participants during their training and internship, and a subsidy for initial post-internship period.	RCD, Income Eligible, Retail (HVAC)	L
	Coordinate with LEAN to establish an annual training and recruitment plan with CAP agencies for new energy specialists, heating, and weatherization staff, as well as upskilling plans for existing CAP energy specialists, such as training on heat pump technologies.	Income Eligible	M
	PAs will seek to integrate K-12 educational programming with workforce development through engagement with vocational/ technical high schools, and other public high schools and youth development programs so that more middle school and high school students are aware of and have pathways to pursue careers in energy efficiency. PAs will work with K-12 Residential Education program vendor to implement this new offering. Programming could include energy efficiency career days and courses spread out over part of the academic year.	Residential Education	L

Figure 2-22: Strategic Intervention for Residential and Income Eligible Sectors (Workforce Development)

Workforce Development: Increase Number of Workers			
Goals			
• Increase the number of entry-level energy efficiency workers who are still working in an energy efficiency role after three years. • Clarify pathways to career advancement for entry and mid-level energy efficiency professionals.			
Barriers	**Example Tactics**	**Applicable Initiative(s)**	**Short, Mid, Long-Term**
• Existing contractors and potential contractors are not always aware of trainings subsidized by PAs. • Lack of centralized source for training and workforce information limits knowledge about career advancement opportunities in the PAs' programs. • In-person trainings and certifications for contractors limit geographic diversity of participants. • Lack of readily available information about how to become a high-performance, low-rise builder and how to maximize involvement with New Construction program.	Explore a contractor network platform on MassSave.com and facilitate upskilling within that network through virtual resources and virtual training offers. This platform could include: • A calendar of training opportunities supported by the PAs for new entrants and for upskilling existing staff. • Information for contractors interested in being involved directly with PAs' programs that are not currently involved. • Links to virtual trainings. • Information about how to certify as a DBE. • Information about energy efficiency career pathways for vendors and other workforce development partners to share with staff and prospective employees.	All Residential Sector Programs	M
	Upskill 90 building professionals, including subsidizing the certification from Passive House International and Passive House U.S., over 3 years as part of the All-Electric Path to Zero low-rise new construction offer, Passive House offer, and Zero Energy Modular Home offer. This should enable and speed greater market adoption of the highest performance low-rise new construction methods.	Residential New Construction	L

Figure 2-23: Strategic Intervention for Residential and Income Eligible Sectors (Workforce Development)

Workforce Development: Increase Number of Contractors			
Goals			
• Increase the number of contractors participating in energy efficiency programs, both in programs with an open market structure and programs with a lead vendor structure, in order to continue meeting statewide energy savings goals. • Increase the number of certified DBEs participating in energy efficiency programs in order to meet increasing program goals and ensure that staff working on the PAs' programs best reflect the communities they serve.			
Barriers	**Example Tactics**	**Applicable Initiative(s)**	**Short, Mid, Long-Term**
• Vendors unsure of how to go about diversifying their subcontractor base. • Potential DBEs unsure of or face barriers to officially certifying as a DBE; are unsure of how to connect with PAs' programs. • CAP agencies need to locate more contractors willing to work in Income-Eligible Sector programs to meet customer demand.	To the extent permitted by applicable law, for new and, when possible, existing contracts, establish target goals in PA contracts requiring a vendor to subcontract with more certified DBEs and monitor their progress.	All Residential Programs	S
	Connect vendors with technical assistance to locate more DBEs with whom they can subcontract, such as connections with ethnic and gender-based business associations, as well as technical assistance on how to become a certified DBE.	All Residential Programs	S
	Include at least one certified DBE on the bidder list for all RFPs, RFIs, and Requests for Quotes (RFQs) whenever feasible.	All Residential Programs	S
	Connect contractors with online platform for information about how to connect with PAs' programs.	All Residential Programs	M
	Outreach and recruitment plan to attract more weatherization and HVAC installers to contract directly with CAP agencies.	Income-Eligible	S

2.9.4 STRATEGIC INTERVENTION: SCALING UP RESIDENTIAL ELECTRIFICATION

The 2019-2021 term was the first in which the PAs began actively promoting and incentivizing heat pumps specifically for space heating. During this term, the PAs introduced several innovations supporting delivery. The PAs introduced the first integrated controls specification and requirement, ensuring that heat pumps installed to augment existing systems operate efficiently. In addition, the PAs introduced and refined aggressive heat pump incentives that substantially improved the customer economics of choosing to install heat pumps for space heating and also established additional incentives for customers switching from delivered fuel water heating to heat pump water heaters. The PAs collaborated with contractors and energy specialists to train them on heat pump technologies, how to discuss them with customers, and how to specify and install these technologies effectively. The PAs developed customer-facing materials and guides to help inform customers on how the technology works, how a heat pump might affect their heating bills, and what the best next steps are if they are interested in pursuing a heat pump. Based

on performance through the end of 2020, the PAs are on track to meet their goals for heat pumps for customers switching from electric resistance and delivered fuels and are excited to build on this success in the next term.

Electrifying space heating will play a key role in contributing toward meeting state policy goals. The PAs recognize that it is critical to increase the pace with which heat pumps, including air source, water source, and ground source (geothermal), are installed. At the same time, the PAs believe that achieving the widespread adoption of electrification of space heating requires sustainable growth. Ensuring that customer comfort is not compromised by the installation of heat pumps and that the costs to operate their new equipment are in line with their expectations are critical to the long-term success of this effort. This helps inform the PAs' heat pump strategy, which includes a three-pillar approach:

1. Customer Awareness and Acceptance
2. Contractor Enablement and Adoption, and
3. Manufacturer/Distributor Engagement.

CUSTOMER AWARENESS AND ACCEPTANCE

The PAs recognize the need to create demand from customers for heat pump technologies and have already begun the process of understanding current customer perceptions through awareness and perception surveys. As the PAs garner a better understanding of how customers perceive this technology, statewide activities addressing current perceptions will be coordinated and implemented. Examples of these activities include a statewide heat pump education campaign, which includes statewide heat pump awareness marketing and dedicated heat pump webpages on MassSave.com. These webpages are intended to be a one-stop-shop for customers to learn about heat pump technologies, the importance of weatherization prior to heat pump installation, available rebates, equipment installation and maintenance best practices, and to connect customers with HVAC specialists for support and qualified installers for next steps. Moreover, these dedicated heat pump webpages will house the heating comparison calculator, which customers can use to understand the costs and benefits of switching from fossil fuel and electric resistance heating to heat pumps.

CONTRACTOR ENABLEMENT AND ADOPTION

The PAs understand that contractors are the face of the heating and cooling sub-initiative since they have a direct line to customers and create the primary demand generation channel. With the increased focus on heat pump technologies, the PAs intend to establish a participating heat pump installer network of HVAC contractors trained on program offerings, heat pump technologies, and quality heat pump installations, including the importance of weatherization prior to heat pump installation. The PAs aim to foster a network of quality installers with the training, experience, and knowledge necessary to effectively talk to customers about the benefits of heat pumps and ensure proper sizing and quality installation. The PAs will also engage vocational/technical high school and HVAC training programs by encouraging the inclusion of heat pumps and integrated controls in their training programs. Moreover, the PAs will design an HVAC student heat pump curriculum on the online training platform designed to help prepare students to enter the workforce. The PAs plan to take additional steps to ensure the contractor community feels enabled to promote heat pumps, which includes efforts to lower upfront costs to customers and pre-heat pump barriers and heat pump financing opportunities.

MANUFACTURER/DISTRIBUTOR ENGAGEMENT

The goal of engaging manufacturer and distributors is to create allies in driving all pillars of the market transformation strategy. More specifically, generating demand for existing training and certification pathways and driving changes in stocking practices. The PAs have and will continue to convene industry partner working groups to continually promote the exchange of ideas and information. Other strategies the PAs are adopting are:

- Increase the share of new construction homes that are all-electric.
- Focus outreach on homes where electrification outcomes are likely to be most positive, namely those where customer comfort will be maintained or improved, and heating costs will be reduced.
- Use these outcomes to increase awareness, favorable customer sentiment, and contractor confidence in heat pumps, creating momentum for heat pump installations.
- Simultaneously, work to address the technical and financial challenges associated with other heat pump applications, with a particular focus on enabling the equitable distribution of the benefits of electrification.
- Incentivize customers to weatherize their home before installing heat pumps.

Adhering to these strategies will lay a strong foundation in the earlier years and creates the conditions necessary for aggressive future growth rates and longer-term success.

Figure 2-24: Strategic Intervention for Residential and Income Eligible Sectors (Residential Electrification)

Electrification: Scaling Up Residential Electrification			
Goals			
• Increase pace of retrofits from delivered fuels and electric resistance to heat pump space and DHW heating, focusing on homes with attractive customer economics and the greatest likelihood of highly satisfied customers. • Increase percent of new construction homes that are all-electric. • Continue focus on weatherization both for those homes ready to electrify, and those that will electrify in the future. • Build a market – customers, contractors, distributors, and manufacturers – that supports a sustained ramp in electrification, including workforce development efforts focused on transitioning the HVAC market one focused primarily on electrification.			
Barriers	**Example Tactics**	**Applicable Initiative(s)**	**Short, Mid, Long-Term**
• High upfront cost of heat pumps. • Coordination of multiple heating fuels, in some applications. • Customer concerns about selecting a contractor. • Customer comfort concern. • Distribution challenges for hydronic systems. • Variable quality in heat pump specifications and installations. • O&M requirements associated with heat pumps. • Developer and contractor discomfort with heat pumps. • Importance of weatherizing before installing heat pumps – results in a large project. • Proclivity to always replace like-for-like when a system fails.	Continue to provide aggressive heat pump incentives that are easy for customers to understand and contractors to sell, helping to address concerns regarding capital cost and encouraging contractors to prioritize selling heat pumps.	Retail	S
	Monitor and adjust, as needed, qualified products over time. Consider desired efficiency levels, available equipment, and need to provide clear signals to the market.	Retail	S
	Continue to require integrated controls in applicable installations in order to ensure coordination between existing and new systems and to ensure that the desired heat load is picked up by the heat pump.	Retail	S
	Roll out an all-electric home offering through the Residential New Buildings program, incentivizing the construction of homes with no fossil fuel-based heating, water heating, or cooking.	New Buildings	S
	Create a network of participating heat pump installers, including training and other requirements that promote properly sized, specified, and installed heat pumps. Give these contractors access to perks such as listing on the Mass Save website. Promote this network of contractors to customers to increase confidence in heat pumps.	Retail	S
	Refine existing customer education and decision-making tools, such as a dedicated heat pump webpage on MassSave.com, the heating comparison calculator, an incentive calculator, and recommendations included in the Home Energy Reports delivered through HEAs. Ensure they provide current information and clear pathways to action.	Retail, RCD	S
	Target heat pump promotions to previous RCD Initiative participants who are ideal heat pump candidates (e.g., those who have completed weatherization and have an oil or propane furnace). When data is available, tailor message to take into account the likely remaining life in the existing heating equipment, encouraging early replacement when appropriate. Depending on responsiveness of customers to this offer, consider offering incremental incentives to these customers.	Retail, RCD	S
	To ensure positive customer outcomes and to inform adjustments to overall strategy, closely monitor customer sentiment and use of heat pumps in recent installations.	All	S

Figure 2-24: Strategic Intervention for Residential and Income Eligible Sectors (Residential Electrification)(continued)

Electrification: Scaling Up Residential Electrification			
Barriers	**Example Tactics**	**Applicable Initiative(s)**	**Short, Mid, Long-Term**
	Expand the set of customers who can more easily choose to switch to electric heat by promoting air, water, and ground source (geothermal) heat pump installations through contractor training and targeted promotions.	All	S
	Work with the LEAN network and affordable housing entities to overcome barriers to installation of heat pumps in income-eligible properties, large and small. Specifically, ensure CAP agencies are identifying/recommending heat pumps when customer economics and comfort are favorable and provide, as needed, incentives to help defray any increased O&M expenses that may be borne by affordable housing entities.	Income Eligible, RCD	S
	Continue aggressive push to weatherize homes across the Commonwealth. Weatherizing a home before installing heat pumps increases the likelihood that the customer will be comfortable and realize reduced heating costs. While not all customers may be ready to install heat pumps, by continuing to aggressively weatherize homes across the Commonwealth, the PAs can make it simpler for a customer to choose to electrify in the future, eliminating the need to consider adding weatherization to an already substantial investment and change to their home.	Income Eligible, RCD	S
	Move heat pump water heaters midstream to encourage distributors to stock and upsell this equipment.	All	S
	Increased focus on customer education and outreach as it pertains to heat pumps and their benefits.	All	M

2.9.5 STRATEGIC INTERVENTION: EASING PARTICIPATION

The PAs know that they must intervene in every part of the market to be successful and educate customers and provide incentives so they understand, desire, and can afford heat pumps. The PAs must continue to train contractors to make heat pumps and heat pump water heaters a core part of their business which they can specify and install effectively. Additionally, they must continue to influence distributors to change their stocking practices, favoring high-efficiency heat pumps and heat pump water heaters over less-efficient alternatives. Collaboration with manufacturers is essential to ensure that future products help address the market's needs and that the PAs are prepared for new products as they arrive. The PAs are confident that their proposed strategy and associated work will help them build toward a future of widespread electric space and water heating.

First, as noted above, the PAs will introduce a new all-electric home offering to the Residential New Construction program. Designing and constructing a new all-electric home, as opposed to retrofitting a home for electrification, yields a number of benefits. Optimizing the building envelope, the distribution system, and the size of the HVAC system allows the customer to realize capital cost reductions that are not achievable by customers retrofitting their

home. As a result, the long-term cost to electrify the housing stock can be lowered by focusing efforts on new construction. Similarly, designing a home specifically to be all-electric allows for strategies that ensure occupant comfort. This reinforces the larger strategy of ensuring positive outcomes for customers and the market. Taken together, these benefits make achieving an increase of all-electric new construction homes critical.

The PAs will continue to focus their retrofit electrification efforts where, as noted above, the outcomes are likely to be most positive for the customer. Within this strategy, the PAs see the partial displacement of delivered fuel heating as the best near-term solution. The PAs expect that, on average, partial displacement installations will still offset the majority of fossil-based heating load, delivering customer savings and carbon reductions. These experiences contribute toward the overall momentum noted in the strategy above as well as allowing the specific customer to become more comfortable with heat pumps in their own home. This sets the stage for them to move to fully electric heating in the future, as new practices, improved pricing, and new technology may make a fully all-electric home more achievable.

In this paradigm, customers heating with natural gas will not be a priority for electrification; however, the PAs will offer natural gas heating customers an enhanced incentive if they choose to displace their central heating with heat pumps. The reality of current commodity prices makes it nearly impossible for a heat pump to deliver operational savings, even before taking into account the substantial capital investment. Customers with incomplete information or working with less integrous contractors may result in customers who expect, but do not realize, bill savings. The PAs have fielded complaints from customers in this very situation.

The PAs will continue to focus on retrofit water heating electrification efforts, as noted above, by moving heat pump water heaters into a midstream delivery model. The PAs will work with heating and cooling distributors to encourage them to stock and up-sell high-efficiency heat pump water heaters. The intended result is that contractors will be more apt to install this equipment in customer homes.

The PAs' enthusiasm for electrification also comes within the context of their obligation to pursue all cost-effective energy efficiency, regardless of underlying fuel choice. As long as they provide a path to cost-effective savings and benefits, this will include the ongoing provision of incentives for high-efficiency fossil-based equipment. As they are no longer cost effective, the PAs are not including incentives for oil-fired boilers for the 2022-2024 term, with the potential exception of Income Eligible custom applications. The PAs will offer incentives for propane, oil (furnaces only), and natural gas-fired space heating equipment when a customer is upgrading from a non-condensing (low efficiency) system. While there may be a higher savings potential in switching from these delivered fuels to a heat pump, moving customers to the higher efficiency fossil-based system also delivers short-term carbon benefits that can contribute toward the state's net zero GHG emissions goals. There will be opportunities to replace these systems again in coming years, at a point when the grid will be further decarbonized, and the carbon benefits of electrification will be even greater. Still, the PAs see it as their duty to guide customers toward the benefits and savings associated with heat pumps when applicable. The PAs will also set incentives that favor electrification over high-efficiency propane and acknowledge that some customers may not be ready to switch to heat pumps. In these instances, the PAs will continue to provide incentives, where cost effective, for customers to select higher efficiency-fossil-based equipment than they may have otherwise selected.

The PAs are committed to ensuring that the benefits of electrification are realized as equitably as possible. The challenges here, however, are notable. Most importantly, the installation cost of heat pumps is a challenge, with costs often double that of the fossil-based alternative. Even if the incremental cost might be offset by operational savings,

finding ways to pay for that upfront cost may not be possible for many lower-income customers. To increase access to electrification, the PAs will make the HEAT Loan available to customers installing heat pumps, regardless of if they have used this loan in the past to finance other energy efficiency upgrades. The PAs will also allow customers to use the HEAT Loan to finance electrical panel upgrades, which are often a barrier to heat pump installations. Moreover, the PAs are focused on increasing the installation of heat pumps through their Income Eligible programs, providing aggressive incentives to moderate-income customers, and looking for ways to responsibly finance remaining out-of-pocket costs. The PAs also anticipate that as the prevalence of heat pumps increases, costs will decrease, reducing the differential between heat pumps and their traditional alternatives.

Figure 2-25: Strategic Intervention for Residential and Income Eligible Sectors (Residential Electrification)

Electrification: Easing Participation			
Goals			
• Encourage participation by designing offerings and implementation of those offerings that are easy to participate in and comprehend. • When possible, offer customers multiple channels to communicate with us and participate in offerings. • Ensure programs are designed to accommodate customers with different tolerances and resources to take on large, complicated projects.			
Barriers	**Example Tactics**	**Applicable Initiative(s)**	**Short, Mid, Long-Term**
• Customers unable to find sufficient time to participate. • Offerings require engagement during certain hours (e.g., HEAs) that may not work for some customers. • Complexity discourages participation – customers may walk way if they do not understand. • Multi-step processes offer more points at which a customer may drop out. • Customers may struggle to select a contractor with confidence. • Many customers may prefer to interact electronically/remotely for health reasons or simply personal preference. • More granular eligibility requirements require more verification, adding complexity and steps. • Additional education needed to simplify any technical complexity of the recommended improvements.	Continue to offer and evolve virtual home energy assessments. Virtual HEAs may be the preferred choice for some customers. They also offer great flexibility for future changes that can even better fit customer preferences.	RCD	S
	Continue to expand use of remote verification options wherever applicable, such as verifying that current heating system is non-condensing for gas furnace incentives.	All	S
	Consider options to extend facilitated services for addressing knob and tube and combustion safety issues to customers working with home performance contractors.	RCD	M
	Pre-enroll smart thermostats in ADR offerings when sold through PA marketplace for eligible customers to agree to participate.	Behavior (ADR)	M
	Simplify Home Energy Report, particularly the presentation of recommended weatherization measures, to further focus customer on next steps.	RCD	M
	Wherever possible, simplify eligibility criteria for incentives and other offerings.	All	S
	Enable contractors to perform weatherization up front, with remaining functions of the HEA completed either remotely or at the time of the weatherization work itself	RCD	M
	Introduce a participating heat pump installer network, helping customers to identify a set of well-trained contractors	Retail	S
	Explore alternative pathways for HVAC rebate delivery, including the facilitation of rebates payments directly to contractors or exploring alternative upstream options with the intent to reduce the customer's out-of-pocket costs.	Retail	M
	Introduce additional, easier options for income verification for moderate-income offerings.	RCD, Retail	S
	Simplify and reduce the cycle time of rebate application process, especially for smaller purchases with straightforward eligibility criteria, and instant rebate opportunities.	Retail	M
	Test alternative approaches to implementing the HEAT Loan, with an emphasis on reducing the number of steps required to secure financing.	All	M
	Allow customers to use HEAT Loan for heat pump installations and electrical panel upgrades regardless of if they have used the HEAT Loan for past energy efficiency upgrades.	Retail	S

2.9.6 STRATEGIC INTERVENTION: ENGAGING CONTRACTORS AND THE MARKET

Almost every process evaluation that the PAs conduct confirms what we all intuitively know to be true – one of the greatest barriers to participation in energy efficiency programs is time. That is why this theme has been emphasized in each of the most recent Three-Year Plans. Still, several trends will make focusing on simplifying the process for customers to access the benefits of energy efficiency programs particularly critical during the 2022-2024 term.

Complexity can take several forms, such as unclear descriptions of offerings, an offering with too many steps, or eligibility criteria that are nonintuitive. Each of these issues, in turn, can have different impacts on participation in the programs. Customers may be reluctant to participate because they do not fully understand the program or because it seems overwhelming. Customers may be less likely to complete an engagement after starting because there are multiple steps where they can fall out of the process. Customers may choose not to participate because they do not have enough time to navigate the program. Any of these experiences could cause a customer to not recommend the opportunity to family and friends. Each of these issues can affect the cost to implement a program and the ability to deliver benefits.

Several key elements of the Plan drive substantial upward pressure on the PAs' budgets. One response to program complexity may be to increase incentives. A customer may be more willing to dedicate more of their own time if the financial incentive is more generous. Given the ambitious goals for the 2022-2024 term, the PAs will redouble their efforts to increase participation by complementing proposed incentives and delivery to motivate participation.

Some elements of the 2022-2024 Plan may increase the prospect of complexity and therefore the PAs will also continue to focus on refining delivery to simply the process. Electrifying the space heating of a home, for instance, may be a daunting task for some customers. Ideally, the customer would weatherize their home first, select the right heating solution for their home, identify a trustworthy contractor who will size and install the system correctly, and change how they use temperature setbacks to optimize the efficiency of their new type of system. This is a fundamentally demanding process, which makes it even more important for the PAs to look for ways to simplify it for customers. Another example is the PAs' increased emphasis on equity. Achieving equity goals will, in some cases, require additional differentiation in the programs along demographic characteristics, such as income. Introducing more differentiation into the PAs' offerings will challenge them to ensure that the right message reaches the right customer, and that more involved eligibility criteria does not depress participation.

To combat these challenges, the PAs will constantly strive to design and implement offerings that are and appear to be easy to participate in. The PAs will continue to build on lessons learned by delivering more services remotely during the pandemic, incorporating remote options wherever possible. The PAs will further refine decision support tools that reduce the amount of information customers need to gather by themselves to gain confidence in making an energy efficiency investment. And more generally, the PAs will place the customer at the center of program design.

While several specific tactics are listed below, running accessible programs requires constant attention to meeting customer needs. The PAs will continue to use feedback from customers and contractors through mechanisms like surveys, evaluations, and meetings to inform the design of new offerings and the refinement of existing ones. The cumulative impact of larger, visible changes and smaller tweaks can noticeably change the PAs' success to serving their customers.

Figure 2-26: Strategic Intervention for Residential Electrification

Electrification: Engaging Contractors and the Market			
Goals • Empower contractors with knowledge about Mass Save programs so they can engage customers. • Encourage distributors/supply houses to stock high-efficiency equipment. • Ensure manufacturers are producing equipment that is eligible for Mass Save incentives and that the PAs are aware of new technologies coming to market.			
Barriers	**Example Tactics**	**Applicable Initiative(s)**	**Short, Mid, Long-Term**
• Complex, but necessary program requirements. • High upfront equipment costs for customers. • Open HVAC and plumbing contractor market – challenges to engage and affect such a larger number of market actors. • National/international manufacturers with many interests.	Continue to conduct contractor training, which include the annual Heating and Cooling Conference, annual Contractor Heating and Cooling Kickoff Event, and the Energy Efficiency Online Training Center.	Retail	s
	Continue supply house, distributor, and contractor outreach and support through a myriad of channels across program delivery partners including contractor newsletters, distributor/supply house trainings and outreach, program trainings, and account manager outreach.	Retail	s
	Explore alternative pathways for HVAC rebate delivery including the facilitation of rebates payments directly to contractors or exploring alternative upstream options with the intent to reduce the customer's out-of-pocket expenses. Lowering the high upfront cost of HVAC equipment benefits the customer and can be used as a sales tool by contractors.	Retail	s
	Establish a participating heat pump installer network for heat pump measure installation. After completing a series of trainings, contractors can be included on this list, which will be hosted on MassSave.com. Trainings will focus on program requirements, quality installation, and right-sizing.	Retail	S
	Move heat pump water heaters mid-stream to encourage distributors and supply houses to stock and up-sell high efficiency equipment.	Retail	S
	Mass Save logo for contractors to use on website and marketing material.	Retail	S
	Continue to engage with the elected Home Performance Contractors and Independent Installation Contractors at the Best Practices Working Group.	RCD	S
	Continued coordination with HVAC and electricians via the facilitated services offer.	RCD	S
	Leveraging heat pump trainings developed for HVAC partners, to further education Energy Specialists on the technology.	RCD	S
	Continue to engage HERS Raters in quarterly meetings and the HERS Rater best practices panel for ongoing feedback on customer engagement and program implementation.	RNC	S
	Continue to engage Massachusetts Home Builders Associations regionally and provide training through those organizations on building science, building codes, program structure and benefits of participating.	RNC	S

The PAs recognize that the purchase and installation of energy-efficient equipment in customers' homes is heavily influenced by independent contractors and the supply chain behind them. Outreach to manufacturers informing them there is a market for efficient equipment, continuing to influence distributors/supply houses to stock high-efficiency equipment, and educating contractors about programs so they promote efficient equipment to customers, are all imperative to the success of the programs. The PAs will therefore focus on working with and engaging these market actors on a regular basis.

Contractors have direct contact with customers and are the face of the energy efficiency programs. For this reason, the PAs will continue the education and outreach tactics that have proven to be successful engagement tools. One successful tactic includes contractor training through an online training platform that offers multiple trainings aimed at educating contractors about the Mass Save work flow, quality installation processes, high-performance equipment tune-ups, as well as other topics aimed at empowering contractors to be as successful as possible in selling and installing high-efficiency equipment. Certain technical trainings are accredited for CEUs by national organizations like RESNET, Building Performance Institute, and the Air Conditioning Contractors of America. Other courses also provide CEUs from state and local trade and professional organizations, such as local National Association of Home Builders, American Institute of Architects, and building/construction licensure boards.

In addition to the online training center, the PAs will offer in-person trainings when appropriate and safe. The annual Contractor Breakfast is held at the beginning of each program year to inform contractors about any program changes for the upcoming program year. Contractors will also continue to receive newsletters throughout the program year, so they can stay up-to-date with the latest relevant program information. Finally, the PAs will continue to host their annual Fall Conference, which includes manufacturer and distributor, program, and other relevant trainings for contractors.

As stated above, the PAs understand the importance of engaging other market actors such as manufacturers and wholesale distributors. The PAs participate in regular outreach to manufacturers to keep them well-informed about energy efficiency programs, engaging them in discussions before making any major changes to the programs. These discussions also help ensure that the PAs are aware of new technologies or equipment that could be incorporated into the programs. The PAs also conduct outreach and visits to wholesale distribution partners to educate and train staff about Mass Save programs.

The PAs will be introducing new engagement tactics in the 2022-2024 term, which include establishing a Direct Contractor pathway and a participating heat pump installer network. Both tactics are meant to empower contractors – by both helping them attract customers by lowering upfront costs and increasing customer satisfaction through knowledge of efficient equipment, Mass Save programs, and quality installation.

2.10 RESIDENTIAL SECTOR PROGRAM DESCRIPTIONS

The vision, goals, and strategic interventions described above outline where the PAs will be focusing their efforts in this Plan thematically. The delivery of these efforts within the Residential and Income Eligible Sectors are organized into Programs and Core Initiatives. These offerings align with the functional implementation of the PAs' efforts, in support of the themes noted above and their descriptions are below. Please note that two efforts categorized as Hard-to-Measure Initiatives (financing and education) are included below. For a complete list of Hard-to-Measure Initiatives, please refer to Section 6.

2.10.1 RESIDENTIAL NEW BUILDINGS PROGRAM

The following figure summarizes the PAs' projected energy savings, program costs, benefits, and cost-effectiveness for the Residential New Buildings Program, including both electric and natural gas values.

Figure 2-27: 2022-2024 Planned Performance Summary (Combined Electric and Natural Gas)

Planned Results	Projection
Total Statewide Budget	$102,138,496
Net Annual All-Fuel MMBtu Savings	462,806
Net Lifetime All-Fuel MMBtu Savings	10,798,853
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	36,014
Total Benefits	505,938,688
Projected Cost Effectiveness (BCR)	5.3

RESIDENTIAL NEW HOMES & RENOVATIONS INITIATIVE

The primary objective of the Residential New Homes & Renovations 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 available.

The greatest opportunities to maximize the performance of a home, particularly its shell (the exterior walls, foundation, and roof), come during the initial design and construction, and secondarily, when the home is undergoing renovation. The Residential New Homes & Renovations Initiative provides financial incentives, coupled with education, training, and technical support to developers, architects, builders, and homeowners, to help residential new construction and renovation projects meet significantly higher energy performance standards than is typical in our region and for local trade allies. For some builders, this will mean being pushed from current standard practice to building at 20-30 percent savings from that standard; for others it will mean being encouraged to build to the highest achievable performance standard, such as Passive House certification.

ELIGIBILITY

Participation in the Residential New Homes & Renovations Initiative is available to all active residential natural gas and electric PA customers who are building a new residential home or building or undertaking a renovation. Residential multifamily buildings can be either individually metered or master metered.

Incentives are determined by calculating the amount of electric savings and fuel savings (natural gas, propane, or oil) and comparing the overall performance of the home to that of the average new home in Massachusetts. This incentive structure is called a pay-for-savings approach. To qualify for incentives, single-family (1–4-unit) homes and low-rise multifamily buildings of 5+ units must meet a minimum threshold of percentage total savings per unit above

the average home. High-rise multifamily building projects must also achieve a minimum threshold of percentage total savings per unit above the average commercial multifamily building.

OFFERINGS

The Initiative provides two pathways: (1) a Low-Rise pathway for homes that are three stories and under, including single-family and multi-unit projects, and (2) a Master-Metered/High-Rise pathway for residential master-metered buildings and/or those homes with four or more stories or a centralized HVAC plant. The pathways provide tailored technical support, outreach, recruitment, training, verification, and incentive structures that encourage and support participation from all residential new construction projects in the state. In addition to the two pathways, the Residential New Homes & Renovations Initiative also includes two other offerings: (1) a Renovations and Additions offering and (2) a Passive House offering. Apart from the Renovations and Additions offering, the Residential New Homes & Renovations Initiative is unique in the Residential Sector in that the ultimate occupant of the home is rarely the decisionmaker on core choices of construction and mechanicals impacting energy efficiency; program outreach and operations are a reflection of this fact that builders, developers, and architects are the primary customers for all but the renovations portion of the Initiative.

Incentives are directly tied to a dwelling's modeled energy performance, and all participating homes must pass a final verification. 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, as well as each percentage of savings achieved, driving participants to want to consider each additional incremental savings opportunity.

For the Low-Rise pathway, the PAs will continue working with the Home Energy Rating System (HERS) rater infrastructure. HERS Raters serve as the primary point of contact for all participants engaging in this pathway. They play a critical role in recruiting builders to enroll projects in the Low-Rise pathway and in advising participants on the value of additional efficiency upgrades. HERS Raters can directly enroll projects into the Initiative via an online intake tool and provide verification of savings at project completion.

The Renovations and Additions offering provides customers with all the technical support of the Residential New Homes & Renovations 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 have the opportunity, while their builder and rater support are in place, to add building envelope, mechanical systems, appliances, HVAC systems, and other energy-efficient measures to their project, securing the maximum energy savings presented by the renovation opportunity. The savings are modeled, and incentives reward participants for each unit of energy savings secured.

In the Master-Metered/High-Rise pathway, a PA-contracted vendor works directly with developers and trade allies to enroll projects. The High-Performance Housing Working Group includes residential and commercial new construction technical experts from PA staff and the Initiative's competitively procured implementation vendor. This working group assists in recruiting and defining performance targets while providing guidance on maximizing incentives, energy-efficient construction practices, and high-efficiency technologies and systems.

The Passive House offering provides an option to achieve the highest building performance standard for any new residential buildings with five or more units. This offer covers the full cost of the required feasibility study, 75 percent of energy modeling costs, offsets pre-certification and post-certification costs for certification through either Passive House Institute US (PHIUS) or Passive House Institute (PHI) and provides a net performance bonus on a per kWh and per therms basis for the buildings that achieve the deepest level of energy efficiency.

To ensure early intervention and guarantee more design teams and owners are ready to make a commitment to Passive House projects (including single-family projects pursuing the All-Electric Path to Zero as described in the innovations section below), the PAs will continue to 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, Rater and Verifier certifications. The PAs will require a small cost share from participants for these trainings and certifications. In addition, the PAs will continue to 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.

Also included within the Residential New Buildings Initiative is the CSCS offering. The CSCS offering includes education and outreach to the building industry to improve compliance with the current energy code and technical support to accelerate the development and adoption of more efficient codes and standards.

DESIGN AND DELIVERY

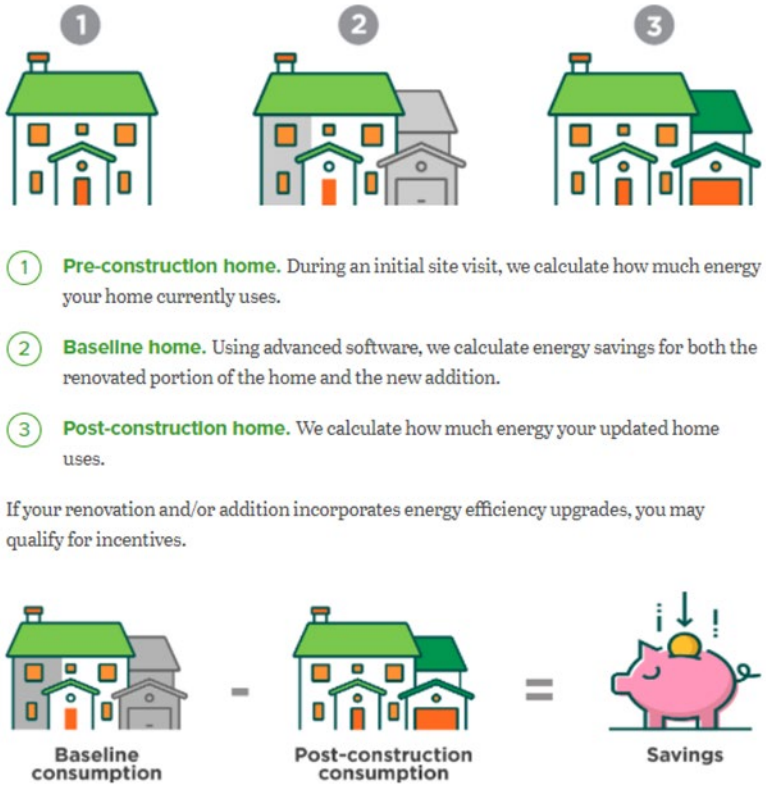
Marketing and Customer Acquisition

PAs employ a variety of marketing techniques tailored across offerings in order to target customers for participation. A key component of low-rise marketing and customer acquisition is through HERS Raters, who receive a referral fee for every customer who successfully participates in the Initiative. Meetings are held every quarter with HERS Raters from around the state to provide continuous updates on the Initiative's progress and any programmatic changes, as well as to receive feedback from Raters.

Important for high-rise customer acquisition is the annual outreach and engagement strategy that the Initiative employs to reach design and construction companies across the state to educate them on the benefits of participation. As part of this outreach, the PAs' lead implementation vendor includes a strategy to expand the number of DBEs that are aware of and participating in the Initiative. Beyond traditional marketing and outreach for the High-Rise pathway, the PAs organize specially-tailored marketing and outreach for the Passive House offering. The PAs hold Passive House 101 lunch-and-learn trainings multiple times a month, in both on-site and virtual formats, to educate the market about Passive House design and the PAs' offering. These lunch-and-learns are offered to architectural firms, builders, engineering firms, and other interested stakeholders.

PAs and their lead implementation vendor also employ comprehensive digital marketing campaigns throughout the year. Digital marketing in social media and through paid search is particularly beneficial for acquiring customers in the Renovations & Additions pathway. The PAs also employ use of historical and current permit data for geographic targeting, annual recruitment, and engagement of design and construction companies across the state.

Figure 2-28: Program Delivery Process for the Residential New Construction & Renovations Initiative



STRATEGIC ENHANCEMENTS

The three major innovations planned for the 2022-2024 term include:

- Introduction of a new All-Electric Path to Zero 1-4 Initiative.
- Introduction of a new Zero Energy Modular Homes offering.
- Integration of ADR measures.

All-Electric Path to Zero 1-4 Initiative

The PAs will introduce the All-Electric Path to Zero 1-4 Initiative (All-Electric Initiative), a new high-performance offering for the 1–4-unit building sector; showing their intent to establish a gold standard for home efficiency in Massachusetts. The All- Electric Initiative will include two incentive tiers, in order to maximize accessibility for builders, on balance with the appropriate standards to achieve high-performance construction. The All-Electric Initiative will be ready to launch during the first quarter of 2022.

Both tiers will require homes to use all-electric heating and domestic hot water, along with an easy to follow check list of advanced construction standards for smaller building projects. Projects will be required to achieve savings of 30 and 50 percent, respectively, for the two tiers, as compared with standard practice. The standards for this Initiative

will focus on critically advanced building shell techniques and mechanical systems to dramatically reduce heating and cooling loads and prepare these homes for carbon neutrality, while increasing occupancy comfort year-round (similar to other high-performance building standards, such as Passive House).

These advanced homes will also include an additional 240-volt outlet and larger electrical panel to enable readiness for demand reduction programs if the occupant later decides to install an EV charger. With substantially reduced space conditioning requirements, homes built to All-Electric Initiative requirements will use electricity for their energy needs and will be better positioned to achieve net zero performance, compared with homes built using current standard building practices.

As with the PAs' current multifamily Passive House offering, the All-Electric Initiative will provide both financial and technical support, spread over key milestones of decision making and construction. Thus, the Initiative may include design incentives intended to encourage development of high-performance design plans, as well as training for architects, builders and other trade allies, and specific incentives for achieving the checklist of performance criteria.

Given current standard practice, it is unlikely that all builders, architects, and developers will be prepared to immediately build to the PAs' proposed All-Electric Tier 1 level. A two-tiered approach will encourage builders to explore the practices required by the All-Electric Initiative and work up to the super-efficient standard set by Tier 1. The PAs believe that few builders are comfortable with and experienced building to this level of energy efficiency, and that the higher incentive levels of both Tier 1 and Tier 2 will encourage more builders to explore more advanced building practices by mitigating risk in doing so. As standard building practices improve, this approach enables broad participation while always encouraging participants to identify upgrades through their HERS Rater's modeling of their building plans.

Figure 2-29: All-Electric Initiative (1-4)

Target (% savings over baseline or HERS score)	Tier 2: ≤ HERS 45 or ≥ 30% savings	Tier 1: ≤ HERS 35 or ≥ 50% savings
Incentive	$15,000 per home + $2,500 for each additional unit	$25,000 per home + $5,000 for each additional unit
Infiltration rate	≤1.5 ACH50	≤1.0 ACH50
Balanced Heat Recovery Ventilator/Energy Recovery ventilator (HRV/ERV)	Required	Required
EV-ready check list	Required	Required
Continuous envelope insulation	Optional	Required
Heat pumps for space heating	Required	Required
Domestic hot water	Electric DHW required, heat pump water heater optional	Heat pump water heater required

Zero Energy Modular Homes Offer with Income Testing

As part of their efforts to increase the depth of savings in the Residential New Buildings program in the 2022-2024 term, the PAs propose to also implement a Zero Energy Modular (ZEM) Homes offering. The goal of this offering is to increase the participation of ZEM buildings, particularly in the single-family market, by developing an offer designed to make high-efficiency home ownership more accessible to low– and moderate-income housing sectors. The PAs know that high-performance stick-built homes come at a cost premium that puts them even further out of reach to low- and moderate-income customers than standard construction built just to code. Because off-site modular construction can reduce some of that incremental premium and bring costs down to within range of a code-level site-built home, modular construction has the potential to make zero energy home ownership a greater possibility for lower income customers, while at the same time making it a more attractive option for prospective home builders and homeowners across all income brackets. The PAs propose to roll out the ZEM offering in 2023.

Integration of ADR Measures

The PAs will monitor ADR program participation, particularly the integration of battery storage and EV readiness among customers. Additionally, the PAs plan to study how ADR offerings, such as battery storage and EV charging, can best be integrated into the single-family new construction pathway, including consideration of how ADR strategies can support the more general goal of reducing consumption. New Residential Construction & Renovations Initiative participants will receive information regarding the PAs' connected devices offerings through HERS Raters or lead vendor account representatives, depending on whether the customer is building a low-rise or a high-rise project.

2.10.2 RESIDENTIAL EXISTING BUILDINGS PROGRAM

The following figure summarizes the PAs' projected energy savings, program costs, benefits, and cost-effectiveness for the Residential Existing Buildings Program, including both electric and natural gas values.

Figure 2-30: 2022-2024 Planned Performance Summary (Combined Electric and Natural Gas)

Planned Results	Projection
Total Statewide Budget	$1,510,226,720
Net Annual All-Fuel MMBtu Savings	8,877,844
Net Lifetime All-Fuel MMBtu Savings	109,051,877
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	435,338
Total Benefits	5,680,235,245
Projected Cost Effectiveness (BCR)	2.8

RESIDENTIAL COORDINATED DELIVERY INITIATIVE

OVERVIEW

The RCD Initiative is designed to promote and facilitate the implementation of energy efficiency upgrades in existing homes to help customers reduce their overall, whole-home energy usage. The Initiative provides customers with information and technical assistance, primarily through home energy and facility level assessments, to help them understand their specific energy efficiency opportunities, and which financial incentives can help defray the costs of their investments. Customers are served in a fuel-blind manner, with PAs coordinating a streamlined experience for customers, even if they are served by two different PAs. The Initiative strives to provide flexibility in delivery of services to best match each customer's unique needs and preferences and align with the technical opportunities for the home and the customer's authority to implement recommended improvements.

The RCD Initiative includes incentives for some measures installed directly by program contractors, such as water savings devices, and for air sealing and insulation. Additionally, the RCD Initiative promotes a wide array of energy-efficient technologies which are incentivized through the PAs' other initiatives such as Retail (energy-efficient products, HVAC and DHW systems) and the HEAT Loan (zero percent financing). The PAs work with Lead Vendors selected through competitive solicitations, to administer the Initiative. The Lead Vendors work with trade ally partners, including Independent Installation Contractors (IICs) and Home Performance Contractors (HPCs), along with other contractors such as electricians and HVAC companies to deliver the RCD Initiative.

ELIGIBILITY

Participation in the RCD Initiative is available to all active, market-rate, residential natural gas and electric customers, regardless of ownership status or the type of residence. The RCD Initiative serves the full range of residence types including single and multifamily homes, townhomes, condominiums, and apartments, regardless of heating fuel type. When serving residential spaces with commercial meters, services are still provided in an integrated manner to customers, while savings and spending associated with commercial accounts are associated with the C&I Existing Building Retrofit Initiative. While all residential market-rate customers are eligible to participate and access available incentives, the Initiative seeks to tailor the delivery approach to align with each customer's opportunity and authority to implement the recommended energy efficiency improvements.

Please note that income-eligible customers (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) are served through the Income Eligible Coordinated Delivery Initiative, which is further described in Section 2.11. The PAs collaborate with LEAN to best serve mixed-income properties, as discussed below.

OFFERINGS

The RCD Initiative offers customers comprehensive support and education to better understand the energy use of their home and provides technical opportunities for efficiency solutions. The goal of these solutions is to help customers identify and fund energy efficiency improvements resulting in a more comfortable home for the customer, as well as whole home energy savings and costs and GHG emissions reductions.

Technical assistance and support are primarily provided through HEAs. In 2020, in response to the COVID-19 pandemic, the PAs developed and implemented a new method for delivering assessments, the virtual HEA. Virtual services have proven to be an effective way to engage with many customers enabling increased flexibility and convenience for the customer. The PAs intend to continue to offer multiple forms of HEAs during the 2022-2024 term including online, in-person, virtual, or hybrid (virtual plus on-site) to provide options that are flexible and best meet the customer's technical needs and preferences. For large multi-unit buildings with complex systems, engineering support and technical assessments are available to identify and evaluate energy efficiency opportunities. Regardless of the type of HEA the customer completes, the goal is to identify the site-specific energy efficiency opportunities that exist, educate the customer of the value proposition of the opportunities, determine which ones the customer is interested in implementing, and define next steps for the customer to complete the improvements.

All energy savings opportunities applicable to the customers' residence will be promoted through the RCD Initiative through one of the HEA offerings. The largest opportunities for energy savings identified through the RCD Initiative are weatherization (air sealing and insulation) and HVAC equipment; however, other eligible measures include duct sealing, programmable and smart thermostats, water-saving devices, water heating equipment, and other qualified efficient products. The PAs may also explore the opportunity to influence customers' decision to choose an EV and facilitate the installation and use of charging equipment.

Larger multi-unit buildings may contain residential and/or commercial metering, with building envelope and mechanical systems more complex and similar to those found in C&I facilities. The intent is for the delivery of services to be seamless for the customer. In these types of residential buildings, commercial-type measures may include HVAC systems and controls, variable speed drives (VSDs) and motors, chillers, air compressors, energy management systems, advanced lighting controls, and custom measures. 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 larger buildings are served through a combination of prescriptive (pre-defined for specified measures) and custom incentives.

To help cover the costs of recommended improvements, the PAs offer multiple types of financial assistance for customers. For residentially metered customers who reside in residential buildings, the incentives are prescriptive in design.

1. Weatherization incentives include no-cost targeted air sealing and 75 percent or more off the cost of insulation improvements.

2. Weatherization incentives for residentially-metered, rental-occupied units, and moderate-income customers (as defined by 61-80 percent of the state median income) are offered at no cost.

3. Incentives to evaluate pre-weatherization barriers (i.e., knob & tube wiring, combustion safety concerns, etc.).

4. Additional incentives are available for pre-weatherization barrier mitigation on select barriers for qualified moderate-income customers.

5. Select barrier mitigation costs are eligible for zero percent financing via the HEAT Loan.

6. No-cost instant savings measures (i.e., low-flow faucet aerators and showerheads, power strips, etc.) via direct install or shipped as an Energy Savings Package. No cost lighting is also available to be shipped to qualified moderate-income customers and renter-occupied units.

7. Customers may be eligible to apply for zero percent financing through the HEAT Loan.

For commercially-metered residential buildings, financial assistance consists of a range of options including prescriptive rebates for some measures, custom incentives depending on the type of project, as well as cost sharing for engineering support services. The PAs intend to continue to offer enhanced incentives for HTR customer segments including renters, landlords, and moderate-income customers. Additionally, the PAs will continue to work with the Massachusetts Technology Assessment Committee (MTAC) to include new measures or technologies whenever possible and appropriate for the market-rate residential sector.

During the 2022-2024 term, the PAs will continue to push to increase the number of homes weatherized across the state. Weatherizing a home before installing heating upgrades increases the likelihood that the customer will be comfortable and realize reduced heating costs. While the RCD Initiative does provide a holistic view of a residential building, envelope improvements are the core of the program, especially for single-family and low-rise buildings. Thus, the RCD Initiative will play a key role in preparing customers for electrification, even if the customer is not yet ready to move to heat pumps.

One significant change in RCD Initiative offerings for the 2022-2024 term is the elimination of lighting measures, with the exception of some fixtures. While no-cost bulbs offered abundant, cost-effective savings for the Initiative and were often featured in marketing materials, the PAs anticipate minimal impact from this change on the overall ability to recruit customers. Free light bulbs were not explicitly called out as a primary reason for participation by customers, and the PAs have been reducing emphasis on no-cost bulbs over time.[46] Still, the PAs will closely monitor their ability to recruit customers.

DESIGN AND DELIVERY

The RCD Initiative promotes and helps to support customers' efforts to complete comprehensive home energy efficiency solutions, with a primary focus on identifying and installing weatherization and identifying opportunities for high-efficiency HVAC systems. The PAs promote the Initiative through ongoing trade ally partners and ongoing marketing and outreach. The PAs utilize education, technical support, incentives, and financing to simplify the process for customers to implement recommended energy efficiency upgrades.

Marketing & Customer Acquisition

In addition to the comprehensive marketing strategies developed by the PAs to reach customers, the RCD Initiative also benefits from many years of historical service to customers making word of mouth the primary driver of participation. Due to this long history of serving market-rate customers, the RCD Initiative is widely known by customers and benefits by having a large percentage of participants come from word-of-mouth referrals of satisfied

[46] Navigant, Illume, and Cadeo. *Home Energy Service Process Evaluation (Res 35),* available at: https://ma-eeac.org/wp-content/uploads/MA-RES-35-HES-Process-Evaluation-Comprehensive-Report_FINAL_31MAR2018.pdf.

customers, as well as repeat customers who re-engage for assistance when they change residences. Further, the large number of trade allies that work directly in the RCD Initiative as IICs or HPCs, as well as HVAC contractors throughout the Commonwealth whose businesses benefit from the PAs' generous consumer rebates, are all valuable sources of leads through their own independent marketing and promotional efforts.

Along with strong customer and trade ally referrals, the PAs will continue to seek to drive further customer participation through comprehensive marketing efforts collaboratively developed through the Statewide Marketing Group, as well as through individual PA campaigns. The PAs will continue to refine their data analytics capabilities to better target different customer segments with tailored messaging and imagery that resonates with target audience to continually improve customer response and participation. In this work, the PAs will consider both building characteristics associated with high energy savings potential (e.g., larger, older homes) and customer demographics, to ensure the equitable delivery of the Initiative.

The Mass Save website is leveraged in marketing efforts and is maintained as a "go to" source of information for customers. This site includes key information such as descriptions of offerings, ways to participate in the RCD Initiative, and lists of participating contractors.

Customers can also access the Residential Online Assessment via the Mass Save website. This online assessment collects basic, readily available information from customers and uses this information to identify potential savings opportunities. This includes both estimated savings for the various recommendations in addition to clear next steps for each of the recommended actions. Customers with likely weatherization opportunity are excellent RCD Initiative candidates, and the online assessment makes the appropriate recommendation. Other recommendations might include a purchase through the online marketplace, upgrading a piece of HVAC equipment, or participating in the PAs' ADR programs. In addition to providing actionable next steps, the data collected through the online assessment can be used for targeted remarketing and to build customer profiles, if customers provide their contact information or associate with an active PA account.

The goal of RCD marketing is to reach all eligible customers to solicit participation, including HTR customer segments (i.e., moderate income, English-isolated families, renters, landlords, and Environmental Justice communities). These customer segments are discussed further in Section 2.9.1. The PAs intend to continue to work with communities and community-based organizations as part of their overall marketing strategy, particularly where those channels can help recruit participation from HTR customer segments. The PAs will also build upon the lessons from the Municipal & Community Partnership Strategy's implementation during the 2019-2021 term to further refine their efforts for the 2022-2024 term. The PAs understand the importance of reaching HTR customers through placed-based and community outreach. More information on the Community First Partnership Program can be found in Section 2.9.2.

Delivery Infrastructure

The core principle of the RCD Initiative delivery infrastructure is to provide flexible participation pathways for customers to best meet their wants and needs in consideration of the type of building in which they reside, the technical opportunity available, and their authority to implement the recommended improvements. The PAs recognize that the Residential Sector is very diverse, both in terms of the extensive variety of styles, types, sizes, and complexity of buildings, as well as the diversity of the customers themselves.

Historically, the RCD Initiative almost exclusively served customers via an in-home HEA or on-site Facility Level Assessment for multi-unit properties. The PAs have learned, through the development of virtual HEAs in response to the COVID-19 pandemic, that alternate means of serving customers can be done effectively and efficiently, while delivering high levels of customer satisfaction and strong adoption of energy efficiency improvements. Virtual HEAs offer greater scheduling flexibility for customers, both in terms of when (time, day of the week) they are scheduled and how much of a customer's time they require. While not appropriate for all customers and all technical situations, virtual HEA services are an appropriate alternative for many customers and the PAs intend to continue refinement and expansion of alternate service offerings in the 2022-2024 term. Of course, the PAs will continue to offer on-premise assessments to meet the needs and preferences of customers.

Customers who have general interests in the benefits of energy efficiency but have not already identified specific technical opportunities or do not have self-identified "wants" will always likely be best served via a comprehensive HEA, whether that be fully virtual, hybrid, or in-person. However, for those customers that have specific needs and/or wants, alternate service options can achieve high levels of customer satisfaction, reduce a customer's time commitment to participate, deliver savings and benefits, and reduce program-related administrative costs. This enhanced flexibility provided by different service options allows for a customized approach to meet the needs of the customer, keeping it simple and straightforward when that is all that is needed while having the ability to support more comprehensive or complex projects for any given customer when warranted. The objective is to keep it simple when that is all that is needed or wanted and scale the level of engagement and support as warranted by the customers' interests and technical opportunities.

Regardless of the assessment type or delivery partner, each customer receives a personalized home energy report summarizing the findings of the assessment and detailed recommendations. The home energy report includes estimated savings, and information on available incentives (for each recommended energy efficiency improvement). The home energy report is designed to provide customers with motivational and actionable information to encourage implementation of the recommendations.

The RCD Initiative offers a turnkey offering for customers whose homes have technical opportunities for weatherization. Customers are provided a formal contract for the work at established set prices. The set pricing for all recommended program weatherization eliminates the need for a customer to obtain multiple bids for their weatherization work. The customer will receive the same pricing, and the same quality installation, regardless of the participating IIC or HPC they choose to complete the weatherization work.

For customers that have identified pre-weatherization barriers (i.e., knob & tube wiring, combustion safety concerns, etc.), the PAs offer financial incentives for the customer to support having those barriers evaluated and mitigated so that the weatherization work can proceed. To make it convenient for the customer, some PAs offer direct Facilitated Services and can assign a participating electrician or HVAC contractor to evaluate the electrical or combustion safety-related barrier. If the customer already has a relationship with a contractor, they may choose to work with their own qualified contractor to evaluate the pre-weatherization barrier(s). In some instances, if the barrier is evaluated and unmitigated, as in a situation with live knob & tube wiring, customers can take advantage of financing through the HEAT Loan to mitigate the barrier.

The following are examples of a few typical customer journeys:

- A customer contacts the RCD Initiative with specific interests and/or needs that do not require an HEA or consultation. The PA Customer Service Representative (CSR) fulfills the customer's immediate need at the initial phone call, chat, or email inquiry and no further immediate action is needed. Examples include: providing information on available rebates where no HEA is required (e.g., HVAC rebates), providing the customer the necessary documentation to utilize the HEAT Loan, facilitating fulfillment of an Energy Savings Package, or referring the customer to a specialty contractor for support. While this type of interaction may yield less customer data, it simplifies customer participation, increasing the likelihood that the customer will take advantage of energy efficiency offerings now and in the future.

- A customer contacts RCD with specific interests and/or needs or with a general interest in energy efficiency that warrants a consultation with an Energy Generalist or Specialist.

  – The CSR schedules the customer for an initial virtual consultation with an Energy Generalist.

  – The Energy Generalist completes the initial virtual consultation and determines next steps depending on customer interest and specific technical opportunities resulting in one of the following outcomes.

  – Customer's immediate needs are met, any immediate follow-up information and/or material fulfillment is arranged (e.g., sends HEAT Loan information, sends weatherization contract that was specified virtually, sends any additional relevant information and/or rebate applications, etc.) and initial customer service is complete.

  – Customer needs an on-site visit (Hybrid) to complete the technical analysis of the home and/or to complete a weatherization specification.

  – Customer has interest in a major measure and/or has specific technical questions beyond the Energy Generalist's area of expertise.

  – The online assessment is another path for customers with general interest to identify potential efficiency opportunities with actional next steps identified for each of these opportunities. This path also enables highly targeted re-marketing efforts by the PAs.

Ongoing Engagement and Follow-Up

The PAs are committed to ongoing customer engagement and follow-up to minimize the potential for customer drop off and lost opportunities. Throughout their engagements with each customer, the PAs collect information and maintain a customer and site-specific profile of technical opportunities based on building attributes (e.g., age, style, already completed upgrades, etc.) as well as customer-specific attributes to inform tailored targeted marketing messaging. Ongoing engagement may be customer driven or driven by the PAs.

Based on the outcomes of an effective and convenient initial engagement with the RCD Initiative, the customer gains an understanding of what the PAs can offer and recognizes them as their "go to" resource for all future energy-related needs. The customer then re-engages proactively in the future as their needs dictate. All customers will be tracked for specific follow-up activities as the different engagements with the customer builds a profile of customer

interest and technical opportunity. Outreach through various marketing channels will occur over time to persuade customers to act on recommendations and to market special, targeted, and limited time promotions as part of a continuous engagement strategy.

In the 2019-2021 term, the PAs began differentiating single-family, attached low-rise, and high-rise buildings. The intent behind this change was to better align the organization and delivery of offerings with the needs of customers and technical opportunities in different types of buildings. During the 2022-2024 term, the PAs will continue to report measures, savings, and incentive costs by these same categories. While the PAs believe that these categories better align with customer needs and technical opportunity, the numerous permutations of building type, ownership structure, and other key characteristics require the PAs and their vendors to be flexible, accommodating customers and buildings according to their specific needs. The PAs intentionally avoid referencing these building types in customer-facing communications, as they may breed confusion. Instead, the PAs focus on presenting RCD Initiative offerings to customers with a focus on the recipient's role (e.g., the owner of a single-family residence, a renter in an apartment building, or the owner or manager of a larger residential facility).

Quality Assurance

The PAs ensure high-quality services are provided to customers participating in the RCD Initiative through a multi-tiered Quality Assurance (QA) structure. While each Lead Vendor and Participating Contractor is responsible for their own internal QA, the PAs utilize the Lead Vendor structure to provide training, mentoring, and QA for the participating contractors. Additionally, the PAs contract with a third-party QA vendor to provide an additional layer of "umbrella QA" over both the Lead Vendors and the Participating Contractors. QA is performed on all critical aspects of RCD, including key performance indicators (KPIs), assessments, and on the implemented energy efficiency measures. QA is performed in a variety of ways including customer and contractor surveys, data review and analysis, and virtual and in-person inspections. QA results are routinely reviewed by PAs and shared with each Lead Vendor or Participating Contractor as a means to support a culture of continuous improvement.

STRATEGIC ENHANCEMENTS

The PAs are committed to continuous innovations, leveraging past lessons learned, and building on the historical success of the RCD Initiative. The PAs plan to introduce several new strategic enhancements for the 2022-2024 term including:

- Expanded insulation solutions.
- Enhanced incentives for comprehensive projects.
- Streamlined process for serving customers in mixed-income buildings.

Expanded Insulation Solutions

While the core RCD Initiative measure and service offerings have proven to be attractive and appealing solutions for the vast majority of market-rate residential customers, the PAs recognize that there are some technical opportunities where alternate methods and/or materials may be a better technical solution or preferred customer approach.

An example of this is spray foam insulation. Historically, spray foam was more of a niche product that was cost prohibitive and only offered by a limited pool of contractors. Currently, with wider adoption in the market and a broader trade ally network installing spray foam, the PAs believe the time is right to add this product to the RCD Initiative. There are many types of spray foam; each with its own pros and cons for specific applications, each having manufacturer-specific installation requirements, and costs still at a premium to conventional methods and materials, such as targeted air sealing and cellulose insulation. For these reasons, the PAs intend to introduce spray foam as an eligible measure for specific applications when it is clearly the best technical solution such as for "hot roof" applications when there is mechanical equipment and/or ducts in attics, for crawl space treatments, and for antique homes where framing dimensions and spacing are irregular.

Incentives for these new weatherization measures may differ from those that are already offered, in order to motivate customers to select the most economical solution that can appropriately serve the need. The ultimate goal is to have a framework that is easy for customers and contractors to understand, has minimal administrative burden to implement, provides incentives to custom projects that are equitable to the core offerings, provides a pathway to reduce lost opportunities for efficiency solutions, and meets cost-effectiveness requirements.

Enhanced Incentives for Comprehensive Projects

In conjunction with core RCD Initiative offerings or the expanded insulation solutions as previously described, the PAs intend to offer enhanced incentives for comprehensive projects, specifically those that include weatherization combined with high-efficiency cold climate heat pumps offsetting heat from electric resistance or delivered fuels. These enhanced incentives are intended to not only help encourage customers to achieve greater savings and environmental impacts, but to also foster contractor development through business expansion or through strategic partnerships with other contractors. The PAs acknowledge that this larger scope may not be appealing to all customers but introducing incentives to encourage weatherization prior to the installation of heat pumps is part of a longer-term strategy to normalize among customer and contractors, that weatherization should precede heat pump installation.

Streamlined Process for Serving Customers in Mixed-Income Buildings

Due to some differences in the customer offerings, and delivery differences for the market-rate RCD Initiative and the Income Eligible Coordinated Delivery Initiative, completing comprehensive projects in multi-unit, mixed-income buildings has proven to be challenging. Historically, this has resulted in the property owner having to engage with multiple parties from both the RCD Initiative and the Income Eligible Coordinated Delivery Initiative to complete a project for the entire building, ensuring that each tenant received all the appropriate energy solutions.

The PAs have collaborated with LEAN to develop a refined process to serve residential buildings that have both market-rate and income-eligible residents more seamlessly.

RESIDENTIAL RETAIL INITIATIVE

OVERVIEW

The goal of the Residential Retail Initiative is to provide a broader integrated marketplace where energy-efficient products and equipment are positioned as attractive, primary choices for customers making purchasing decisions,

whether online, in-store, or through independent contractors and distributors. The Residential Retail Initiative offers education to help customers make informed decisions, incentives to make efficient choices more financially attractive, and training and support for the market actors, to help shift contractors toward more efficient, correctly installed equipment.

The Residential Retail Initiative ensures that all residential customers can access high-efficiency HVAC and DHW equipment, smart thermostats, appliances, and other energy-efficient products. The Initiative works to place the most energy-efficient options in front of customers and assists customers in transitioning from traditional electric resistance or fossil fuel systems for home heating and domestic hot water to energy efficient heat pump systems.

ELIGIBILITY

Participation in the Residential Retail Initiative is available to all active residential natural gas and electric PA customers. Incentive levels may vary based on income levels, existing energy source, and/or whether the existing equipment is being displaced or replaced. To encourage contractors to be engaged in training and practices that yield the best outcomes for customers, some offerings are only available through contractors who meet the PAs' requirements.

OFFERINGS

The Residential Retail Initiative offers customers rebates on energy-saving appliances, products, and HVAC equipment. Appliances and products include ENERGY STAR-certified window air conditioning units, room air cleaners, dehumidifiers, electric dryers, and windows. A number of smaller energy-saving devices are also incentivized, including Tier 1 and Tier 2 advanced power strips, low-flow showerheads, faucet aerators, and thermostatic shutoff valves. The Initiative also incentivizes the recycling of working old or inefficient refrigerators, freezers, and dehumidifiers.

Additionally, the Residential Retail Initiative offers customers rebates for installing high-efficiency HVAC equipment, water heating equipment, HPWH technologies, and associated controls such as wireless and programmable thermostats, integrated controls and outdoor reset controls. For the 2022-2024 term, the PAs will build upon the success of the previous Plan and will scale the installation of heat pumps to replace/displace delivered fuel heating and water heating in addition to electric resistance heat. New for the 2022-2024 term, natural gas heating customers will be eligible for fuel switching incentives when they transition to heat pumps. As noted earlier, the PAs will discontinue incentives for some equipment in the 2022-2024 term because it is no longer cost effective, including oil boilers and gas oil (furnaces only) and propane space heating equipment when the existing equipment is condensing. The PAs will also cease offering central air conditioner incentives to encourage customers to install central heat pumps, even if they are only interested in using it for cooling. The PAs' intension is to create an infrastructure for customers to be able to seamlessly transition off fossil fuel heating to their central heat pump if and when they choose to do so. Additional products are continuously being evaluated via the PAs and/or MTAC and added to the Residential Sector portfolio.

Also included within the Residential Retail Initiative is the CSCS offering. The CSCS offering includes technical support to accelerate the development and adoption of more efficient codes and standards. CSCS may also include industry education and outreach to improve compliance with newly adopted appliance and equipment standards if there is a demonstrated opportunity for energy savings.

DESIGN AND DELIVERY

Residential Retail Initiative incentives are available to customers via multiple modalities. At some larger retailers across the state, customers can access instant rebates at the point of sale. This is available for smart thermostats, window air conditioners, dehumidifiers, and room air cleaners. In addition to instant rebates, the PAs offer an Online Marketplace which applies the incentive instantly to qualifying products at the time of checkout. Products on the marketplace include smart thermostats, dehumidifiers, room air cleaners, window air conditioners, and advanced power strips, as well as non-incentivized energy saving products such as lighting, pipe wrap, and various "smart home" devices. As a customer's eligibility can be verified instantly and the rebate applied automatically to the cost at checkout, the customer experience is streamlined, circumventing the need to complete additional rebate forms or waiting to receive a check in the mail. The Online Marketplace also allows the PAs to offer special manufacturer promotions. When paired with the instant incentive, this can significantly lower the cost of the eligible products and drive participation in the Initiative.

Following their eligible purchase, customers can also apply for a downstream rebate, which is available either online via the PAs' rebate processing portal or via a hard copy that can be mailed in using the US Postal Service. Lastly, PAs partner with manufacturers, distributors, and retailers to offer smaller products such as advanced power strips and water-saving devices through an upstream model where the products are offered at a discounted price for customers at the time of purchase, without any additional steps required of the customer.

HVAC equipment is also incentivized through downstream rebates, both via mail-in rebate forms and online submissions through the rebate portal. Some equipment such as heat pump water heaters, boiler reset controls, electronically commutated motors (ECM) circulator pumps, heat and energy recovery ventilators, and room-to-room response controls will be offered through a midstream model where the incentive is applied at the distributor level.

The PAs are always evaluating the most effective ways to incentivize the installation of energy-efficient appliances and equipment, whether that is at the customer, contractor, distributor, or manufacturer level, as well as exploring new solutions to provide customers more streamlined access to incentives. For example, the PAs chose to move boiler reset controls midstream because these measures are an aftermarket technology that customers may not be familiar with. By moving these measures midstream, the PAs can influence a large portion of the market through fewer communication points while impacting the greatest possible number of purchasing decisions. Some measures may be a better fit for downstream rebates which involve the customer directly. This is particularly true for measures that may require additional information to ensure eligibility. The PAs may make changes based on how incentives are delivered throughout the term.

Marketing and Customer Acquisition

The Residential Retail Initiative's offerings are marketed to eligible customers through several different channels. The PAs educate customers about the available rebates through email, paid and organic social media, digital, paid search, and point-of-purchase brochures and flyers. The creative used for each of these channels is optimized to address customers based on where they are in the customer acquisition funnel. Customers at the top of the funnel are educated about the energy and cost saving benefits of energy-efficient equipment and appliances through social media, blog posts, emails, and brochures. When a customer goes to purchase eligible equipment and products, in-store point-of-purchase materials educates the customer regarding available rebates and the options for redemption. For customers searching online for purchases, paid search advertisements help direct customers to the Mass Save

website for access to the available rebates. Marketing planning and implementation is administered statewide through a selected marketing vendor, as well as by each of the PAs' marketing departments.

The Residential Retail Initiative will also be building out educational resources that will assist customers in making the decision to switch to a heat pump system. These materials will be online and available for customers and for contractors to leverage as handouts when discussing options with a customer. These materials will cover available incentives, the general principles of system operation, average lifecycle cost savings, installation best practices, system maintenance, and education about the different types of heat pump technologies and systems available.

Home energy assessments are also a key pipeline for customers to learn about the Residential Retail programs. While Home Energy Specialists have also played a key role in educating customers about HVAC and appliance options, Home Energy Specialists will play a pivotal role in educating customers about the benefits of switching to heat pumps for space and water heating.

Trade Ally Training and Education

The Residential Retail Initiative seeks to create opportunities for customers to access efficient options by working with big box and other retailers, manufacturers, distributors, and supply houses, and through the Mass Save Online Marketplace. In addition to working with traditional retail outlets, a major focus of Initiative activity is to provide support to plumbing and HVAC contractors and others in the supply chain (manufacturers, distributors, and suppliers) to ensure the availability, promotion, and proper installation of the highest efficiency equipment.

The PAs continuously engage their partners and train retail associates about the Residential Retail Initiative, in addition to placing and maintaining effective placement of point-of-purchase materials. The PAs 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. In practice, these contractors become the face of the PAs' offerings during these conversations. 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 engage them as true partners with the PAs 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, the PAs promote installation best practices for a wide assortment of energy-efficient equipment, including air source heat pumps, water source heat pumps, ground source (geothermal) heat pumps, hot water boilers, warm air furnaces (with ECM or equivalent advanced furnace fan systems), select heating system controls (including after-market boiler reset controls and programmable and wireless enabled thermostats, and integrated controls), water heating equipment, and heat-recovery ventilator (HRV) equipment. This contractor education is done online through the EELC and in-person classes, as well as manufacturer and distributor trainings offered at the annual Fall Heating and Cooling conference and in supply houses.

The PAs train contractors to use measureQuick, a software-based diagnostic tool that tests air flow and refrigerant charge to ensure that heat pumps have been properly commissioned to deliver optimal comfort, efficiency and savings. Once a contractor has completed the measureQuick training requirements, they are included in a searchable database of measureQuick certified contractors located on MassSave.com. In addition to the trade ally training and

interventions mentioned above, the Residential Retail Initiative will use and provide continuing education to the pipeline of new contactors generated through the Workforce Development efforts discussed in Section 1.

STRATEGIC ENHANCEMENTS

The PAs are considering a number of strategic enhancements to the Residential Retail Initiative for the 2022-2024 term, including:

- Leveraging midstream channels.
- Developing an alternate HVAC rebate delivery pathway.
- Formalizing a heat pump installer network.
- Introducing enhanced incentives for bundled weatherization and heat pumps.
- Providing guided customer HVAC support.
- Increased education and awareness of heat pump technology.
- Introducing a whole-home incentive for full displacement.

Leveraging Midstream Channels

For the 2022-2024 term, the PAs plan to work with heating and cooling distributors to encourage stocking of high-efficiency equipment and to better understand the potential impacts of current supply chain conditions. The PAs will offer HPWHs as a midstream measure, seek to engage key channel stakeholders, obtain market intel, and evaluate the other measures best suited for this delivery channel with the goal of increasing installations.

Alternate HVAC Rebate Delivery

The PAs are exploring delivery options to reduce the upfront costs for customers installing high-efficiency HVAC equipment. Currently, heating equipment incentives are available via a downstream rebate process requiring customers to front the full cost of installation while they wait for their rebate to be processed. The PAs are evaluating various pathways to provide the rebate amount upfront, therefore making it more financially feasible to move forward with more costly upgrades.

Participating Heat Pump Installer Network

With the increased focus on heat pump technologies, the PAs intend to establish a formalized network of heat pump installers trained on program offerings, heat pump technologies, and quality heat pump installations. In order to join the network, contractors must provide verification of specific applicable certifications and commit to completing a series of trainings on a range of topics including the importance of weatherization and cold-climate sizing and design. The intent of this effort is to provide customers additional support when navigating a heat pump installation. The PAs aim to foster a network of quality installers with the training, experience, and knowledge necessary to effectively talk

to customers about the benefits of heat pumps and ensure a properly sized and quality installation. This list will be made available to customers on MassSave.com and may be promoted in other customer interactions.

Enhanced Incentives for Bundled Weatherization and Heat Pumps

As referenced in the Strategic Enhancements section of the RCD Initiative description, the PAs recognize the importance of weatherization when it comes to the installation of a new heating system, more specifically cold climate heat pumps. Having a properly weatherized home prior to the installation of heat pumps will help to ensure the heat pump system is properly sized, which permits the technology to operate more efficiently, resulting in increased customer comfort and satisfaction. Therefore, the PAs plan to offer an enhanced incentive to customers who weatherize their home prior to installing heat pumps to displace fossil fuel or electric resistance heating. The enhanced incentives are intended not only to help encourage customers achieve greater savings, comfort, and environmental impacts, but also foster contractor development through business expansion or strategic partnerships with other contractors.

Guided Customer HVAC Support

Not all customers who are pre-screened for a virtual HEA or who complete the online assessment need weatherization, but they could be good candidates for heat pumps. The PAs plan to offer a pathway for customers specifically interested in cold climate heat pumps to have a targeted discussion with an HVAC specialist to discuss opportunities for their home. These technical specialists will be able to answer general customer questions about all heat pump technologies, available rebates, integrated controls, potential cost savings when fuel switching, system types and design, and the capabilities and efficiencies of different equipment.

Increased Education and Awareness of Heat Pump Technology

The PAs will continue to expand upon the educational resources that are currently available to customers. This includes adding guides that will be available on the Mass Save website about the types of systems, operating principles and best practices, proper system sizing and selection, FAQs, and the importance of properly insulating a home prior to installing a heat pump. Case studies and testimonials will be utilized to communicate the past and current success of heat pump applications in Massachusetts. Pieces of these materials will also be leveraged in marketing campaigns to help expand the reach of these educational materials. As installation costs are often at the top of mind for consumers, the PAs are creating a public facing heating comparison calculator to help customers and contractors estimate install costs and lifecycle savings resulting from switching to heat pumps. These materials will play a critical role and address the three pillars of heat pump adoption mentioned in the strategic enhancement section (Section 2.9.4).

RESIDENTIAL BEHAVIOR INITIATIVE

OVERVIEW

The primary goal of the Residential Behavior Initiative is to encourage customers to engage in behavior that will result in energy conservation and/or demand reduction. This is distinct from other Initiatives that seek to encourage purchases of efficient equipment or other investments in changes to their home. Offerings within this Initiative are divided into two main categories: (1) those that use information, social cues, and other prompts to motivate

customers to reduce or shift their consumption (behavioral savings offerings) and (2) those that provide incentives for enrolling devices in offerings that reduce their consumption during periods of high demand (ADR offerings).

ELIGIBILITY

Participation in behavioral savings offerings varies by PA. For those PAs who have a behavioral savings offering, participants are often divided into control and treatment groups, to enable the measurement of savings attributable to behavioral interventions. Participation in ADR offerings is based on a customer owning an eligible communicating device connected to an active PA electric account. This eligibility is based on whether the technology is included in the offering (e.g., thermostats connected to central air conditioning) and whether the manufacturer of the device has enrolled in the offering.

OFFERINGS

As noted above, there are two main offerings within the Residential Behavior Initiative: (1) a Behavioral Savings offering and (2) an ADR offering.

Behavioral Savings Offering

Historically, behavioral savings offerings have been tied to the delivery of Home Energy Reports (HERs). Most HERs consisted of a few common elements—visuals showing changes in consumption, comparisons to the consumption of neighbors or other similar buildings, and tips identifying behaviors the customer could engage in to reduce their consumption. By comparing the usage of customers receiving these reports (in the treatment group) to those not receiving the HERs (in the control group), savings attributable to the reports themselves could be calculated. These HERs also often include targeted messaging and promotions of energy efficiency offerings outside of the Residential Behavior Initiative.

During the 2019-2021 Plan term, all the PAs offered HERs to their customers (or for at least a portion of the term). The feasibility and cost effectiveness of behavioral offerings is contingent upon scale. There are large, fixed, upfront costs associated with creating the data integrations that have created cost-effectiveness challenges for the PAs serving fewer customers which cannot be addressed through a statewide contract. For this reason, not all PAs will enroll customers in behavioral savings offerings in this term. It is worth noting that even without all PAs participating, most customers in the state will be served by at least one PA (either natural gas or electric) that does have a Residential Behavioral Savings offering.

The specific design and implementation of a Behavioral Savings offering will differ amongst PAs. These variations are largely driven by differences in data management practices and related customer-facing activity within the PA. Importantly, as the PAs explore different approaches to Behavioral Savings offerings, the PAs will share learnings and best practices with each other to maximize the benefit to customers.

Active Demand Reduction Offering

Residential ADR offerings use incentives to motivate customers to enroll eligible equipment in the program. Once enrolled, the PAs, through a service provider (discussed below), send signals to customer equipment to reduce or offset the customer's consumption during peak periods. Eligible technologies in the residential sector include

thermostats connected to central air conditioning, residential storage (batteries), and EVs and vehicle chargers. Generally, the PAs offer an incentive for a customer to sign up for a technology, and an additional incentive for participating during called DR events. Customers can override these signals and choose not to participate, but this may affect the level of incentive they receive or their eligibility for continued program participation.

Central air conditioning represents one of the largest controllable loads in residential homes and use of air conditioning is highly coincident with ISO-NE system peaks, making it an ideal end use for ADR. By adjusting the temperature settings on a connected thermostat during peak periods, the PAs can deliver substantial reductions in demand. Several management strategies, such as staggering when setbacks are enacted and pre-cooling, can help maximize savings delivered across a portfolio of connected thermostats. The increasing penetration of both connected thermostats and central air conditioning make this a key area of continued growth for ADR.

Battery storage is an ideal candidate for ADR, especially in residential applications. Currently, there are no demand charges on residential distribution bills, meaning there is little incentive for customers to charge and discharge their battery. This results in valuable assets that may serve to only provide backup during a power outage. By enrolling storage, the PAs can dispatch signals that cause batteries to discharge (send power back to the grid) during peak periods. Further, unlike adjusting thermostat settings, there are no direct impacts to customer comfort or convenience. While there are currently a modest number of batteries installed in the Commonwealth, each battery can deliver substantial demand reductions and the PAs expect continued growth in residential storage installations. Unitil will continue to monitor the other PAs' residential storage efforts in order to determine if an offering of this type is warranted for its unique service territory.

EV charging is similar to batteries in that the number of systems installed is currently limited, but in large quantities, EV's impact can be substantial, and their numbers are expected to grow rapidly from their current level. While the majority of EV charging occurs outside of peak periods for those EVs that are charging during event windows, the PAs will offer an incentive for the customer to reduce their rate of charge. As with other offerings, customers may choose to override this signal if it is an inconvenient time for their vehicle's charging to be slowed. Please see Section 1.3.1 for a discussion of the types of benefits that the PAs achieve by engaging in these activities and how the PAs consider which end uses are appropriate for ADR strategies.

During the 2019-2021 term, National Grid began demonstrating a new type of offering for inverters connected to residential PV installations. Inverters are capable of providing valuable grid services that can increase the efficiency with which the distribution grid operates. Specifically, this offering leverages the ability of inverters to provide power factor correction, helping address feeders with excessive reactive power. Excessive reactive power effectively increases the amount of energy that needs to be delivered to meet a fixed demand. By providing customers with an incentive for altering and maintaining settings on their inverter, the PAs are able to deliver value to all ratepayers by increasing the efficiency of the grid. Pending the outcome of an ongoing evaluation of this effort, National Grid intends to introduce this as a regular measure and other PAs may also offer this service to their customers. In the future, this offering could be extended to other customers and may be leveraged to provide other grid benefits besides power factor correction.

DESIGN AND DELIVERY

Behavioral Savings

As noted above, the specific design and delivery of behavioral savings offerings varies by PA. During the previous term, the PAs explored altering the delivery channel (e.g., email vs paper) and design of behavioral prompts, in an effort to optimize for cost and efficacy. For example, Eversource has moved away from providing behavioral prompts through a third-party provider, instead offering electronic messages implemented in-house. Evaluations and studies documenting attributes of behavioral savings offerings, such as the rate at which savings revert to the mean after treatments cease, help inform evolutions in the design of these offerings. The PAs with behavioral savings offerings will also continue to experiment with cross-promoting other energy efficiency and ADR offerings, drawing on the data required for an effective Behavioral Initiative in order to deliver pertinent, motivating promotions to customers.

Active Demand Reduction

Most customers learn about and enroll the PAs' demand reduction offerings through the device itself. For instance, many customers installing connected "smart" thermostats controlling central air conditioning are prompted to sign up for ADR while they are setting up their device or through an email from the thermostat manufacturer. Follow-up messaging can occur through the device itself or through communications from the manufacturer to the customer. The PAs have found this to be an effective means to enroll customers. For storage, most customers will learn about the DR program from their installer while considering installing a solar PV system. Installing solar and storage together allows the customer to access tax benefits and incremental solar incentives that would be unavailable for stand-alone battery installations. The PAs market outside of these pathways as well to drive additional demand but have found these channels to be most effective.

ADR offerings are implemented through a PA's DERMS. The DERMS provider establishes integrations with the manufacturer of the equipment, or, in the instances of some storage technologies, the system integrator, or operator. This allows the DERMS to connect directly to customer equipment to reduce demand during peak events, without the customer needing to take any action. While not all manufacturers of equipment in the included end uses are enrolled with the DERMS, in all end uses served, the vast majority of equipment being installed is eligible to participate in the PAs' demand reduction offerings. Since there is a cost associated with adding a manufacturer's devices to the offerings, projected market share of a manufacturer's device is considered in the context of the offering remaining cost effective.

An EV ADR offering, primarily targeting system peaks, can be implemented by sending a dispatch signal through connected electric vehicle supply equipment (frequently referred to as EVSE) or directly to the vehicle itself using vehicle telematics. During the previous term, Eversource implemented an EVSE-based approach while National Grid used a telematics-based approach, with the intention of comparing outcomes to design a statewide approach. Eversource and National Grid are in the process of evaluating these two approaches, with the intent of implementing a statewide EV demand reduction offering or offerings by the summer of 2022. Because of the implications of large-scale vehicle electrification, the PAs, individually or collectively, may offer customers other options for shifting EV charging through EV-specific, grid modernization, or other efforts, as well as time-varying rates or pricing. While customers may have more than one choice in EV-charging offerings at a time, customers will not receive duplicate incentives for the single action of charging during off-peak hours. Cape Light Compact and Unitil will monitor the progress of this offering in order to determine if it is a right fit for their service territories.

STRATEGIC ENHANCEMENTS

Behavioral Savings

As noted above, the PAs will continue to explore how to optimize the effectiveness and cost of Behavioral Savings offerings in the 2022-2024 Plan term. This may include the use of videos, one-click surveys to gather data and include the relevance of information provided and using different messaging for different customers who may be more receptive to different types of prompts. The PAs will continue to refine the use of behavioral channels to effectively move customers to participate in other offerings as well. Further, the PAs will look for opportunities to further integrate different sets of data and experiences, such as the online energy assessment. PAs facing cost-effectiveness challenges will explore alternative approaches, such as leveraging existing engagement platforms and new techniques for quantifying savings.

Active Demand Reduction

During the 2022-2024 term, the PAs will make several key enhancements. First, the PAs will continue to work with DERMS providers to streamline the process for enrolling new equipment manufacturers, ensuring as much of the market as possible is served. Second, the PAs will consider incremental incentives for the purchase of cost-effective, ADR-capable equipment in end uses that are not yet included in ADR efforts but may be in the future when sufficient scale is reached to support a new end use. Third, for smart thermostat purchases made through the Online Marketplace, the PAs will introduce point-of-sale ADR promotions. At a minimum this will include highlighting ADR incentives to potential customers. The PAs also plan to offer customers the option to pre-enroll their thermostat in ADR offerings, netting the DR incentive from their purchase price, and delivering a thermostat that is already enrolled in ADR when it is installed. Fourth, upon successful demonstration of the cost effectiveness of using customer-owned smart solar inverters to reduce energy use, the PAs will investigate additional system benefits available through customer-owned smart solar inverters. As described in Section 1.3.1, the PAs will continuously consider the addition of new end uses to the pool of supported ADR technologies.

2.11 INCOME ELIGIBLE SECTOR PROGRAMS

2.11.1 INCOME ELIGIBLE EXISTING BUILDINGS PROGRAM

The following figure summarizes the PAs' projected energy savings, program costs, benefits, and cost-effectiveness for the Income Eligible Existing Buildings Program, including both electric and natural gas values.

Figure 2-31: 2022-2024 Planned Performance Summary (Combined Electric and Natural Gas)

Planned Results	Projection
Total Statewide Budget	$580,998,537
Net Annual All-Fuel MMBtu Savings	1,857,464
Net Lifetime All-Fuel MMBtu Savings	30,447,780
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	86,778
Total Benefits	1,736,832,377
Projected Cost Effectiveness (BCR)	3.0

INCOME ELIGIBLE COORDINATED DELIVERY INITIATIVE

OVERVIEW

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 having at least 50 percent of units be 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 (SNAP) services.

The Initiative is administered in coordination with LEAN and implemented by local CAP agencies. The Initiative leverages other sources of funding, including the Massachusetts Department of Housing and Community Development (DHCD), Weatherization Assistance Program (WAP), and the Heating Emergency Assistance Retrofit Task Weatherization Assistance program (HEARTWAP). This approach provides a seamless, integrated experience leveraging all applicable funding sources for income-eligible participants with no co-payments required from customers.

ELIGIBILITY

1–4 Unit Buildings

The Income Eligible Coordinated Delivery Initiative serves residential customers living in 1-4 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.

5+ Unit Buildings

The Income Eligible Coordinated Delivery Initiative 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.

OFFERINGS

Cost-effective measures are provided at no cost to 1–4-unit customers. For qualifying projects with 5+ unit buildings with cost-effective opportunities, the PAs will pay 100 percent of the project cost with established dollar limits where applicable. The measures available to Income Eligible Coordinated Delivery Initiative customers include:

1. Insulation (attic, wall, pipe, and duct).
2. Air sealing.
3. Heating system repair and replacement, including both like-for-like system replacement (i.e., upgrading to a high-efficiency version of the existing equipment type) and fuel switching measures where appropriate by electric PAs.
4. Programmable and smart thermostats.
5. Domestic water heating, including low-flow showerheads, faucet aerators, pipe wrap, and HPWHs (electric).
6. Lighting, including LEDs, lighting fixtures, and torchieres.
7. Appliance upgrades, including refrigerator and freezer replacement, second refrigerator removal, advanced power strips, clothes washer replacement, dehumidifier replacement, and window air conditioner replacement.
8. 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.

9. Some repairs and pre-weatherization barrier remediation required for weatherization (electrical, roofs, etc.).

10. Health and safety testing and improvements (combustion safety testing, ventilation, etc.).

In coordination with LEAN, the PAs will work with MTAC to include new measures or technologies as appropriate.

DESIGN AND DELIVERY

Marketing and Customer Acquisition

Customers primarily become eligible for the Income Eligible Coordinated Delivery Initiative because they are enrolled on utility natural gas and electric discount rates or because they are referred to heating assistance programs at local CAP agency locations. The Initiative benefits from a long-standing relationship with the Commonwealth of Massachusetts Department of Transitional Assistance, with whom the PAs have a data sharing agreement that ensures residents who are enrolled in income-based public benefits programs are automatically enrolled in utility natural gas and electric discount rates. CAP agencies regularly receive lists of single-family customers who are newly enrolled on utility discount rates, and CAP agency staff proactively reach out to customers by phone, email, and mail to inform them of their eligibility for energy efficiency upgrades and to schedule energy assessments.

The PAs, together with LEAN, also leverage relationships with local housing authorities, the MA DHCD, regional Community Development Corporations (CDCs), and private and non-profit affordable housing companies to recruit multifamily customers into the Initiative. PAs also use utility account data, as well as other available data, to target, market to, and recruit additional multifamily customers into the program.

Bearing in mind the continuously changing economic situations for many customers due to the effects of the COVID-19 pandemic, the PAs will also closely monitor the numbers of new customers enrolling in utility discount rates and ensure that they continue to be promptly contacted regarding energy efficiency upgrades. The PAs will work with LEAN and CAP agencies to provide support necessary for additional capacity should it become necessary.

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 thirteen 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 PAs will work in collaboration with the Low-Income Best Practices working group, LEAN, DHCD, Lead Vendors (where applicable), and CAP agencies to coordinate statewide on all aspects of the Income Eligible Coordinated Delivery Initiative, including but not limited to planning, delivery, implementation, education, marketing, training, cost effectiveness, evaluation, and QA.

1-4 Units

The PAs will fund 100 percent of the cost of qualified installed measures. All applicable funding sources from each program are leveraged and offered jointly to income-eligible residents to enhance services. The Initiative is seamlessly offered in conjunction with the current DHCD WAP and HEARTWAP programs. Federal money will primarily be used to address heating system upgrades, health and safety issues, as well as repairs, to allow for energy-efficient measures to be installed safely and cost effectively. PA 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 by the Mass Save energy efficiency budgets.

As mandated by DHCD, all projects that receive DOE funding, must receive CAP agency post-installation QA inspections to ensure that all work is performed to the Initiative's guidelines. The CAP agencies also perform a minimum of 50 percent in-process inspection of projects. Because the PAs' 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 PA-funded projects at the same time. DHCD Technical Field Monitors perform another level of visual inspection for 20 percent of all DOE-funded projects; 10 percent of these total units also receive a full Quality Control Inspection that includes complete testing on the dwelling. During these inspections, the DHCD reviews both DOE and PA-funded work. In addition, an independent third-party vendor performs QA inspections on up to five percent of all jobs, whose services are exclusively funded by the PAs**.**

5+ Units

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 natural gas and electric end uses. Assessments and services for buildings that are going through the refinancing process are 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 PAs only), the appliance conditions. All energy assessments include a building health and safety evaluation. The CAP agency then arranges for all applicable measures and services to be installed by a qualified contractor. Savings are 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 PAs 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.

INNOVATIONS PLANNED FOR 2022-2024

Innovations Overview

The PAs, in close collaboration with LEAN, plan to build on the historical success of the income-eligible programs by taking steps to further improve and streamline the customer experience, offer more opportunities for greater energy savings for both single and multifamily income-eligible customers, and provide customers in all building types with

opportunities for electrification where it is cost effective and does not increase a customer's energy burden so that income-eligible customers are participating in the same ways as other customers in opportunities to be part of a clean energy future, all in an environment that anticipates the continued long-term impact of COVID-19. The innovations planned for the 2022-2024 term include:

1. Increased focus on installing heat pumps paired with weatherization and ADR.
2. Streamlined income-eligible customer online experience.
3. Increased opportunities for multifamily buildings:
    a. Customized "Deep Energy Retrofit" approach,
    b. Incentives for greater efficiency in multifamily common area laundry facilities,
    c. Multifamily remote monitoring and building optimization, and
    d. Targeted small multifamily engagement strategy.
4. Continued consideration of income-eligible customers in majority standard income buildings.
5. COVID-19 considerations.

Increased Focus on Installing Heat Pumps Paired with Weatherization and Active Demand Reduction

Over the last three-year term, the PAs and LEAN saw a decrease in the costs of air source heat pumps and the development of cost-effective savings in single-family applications for both partial and total displacement of oil, propane, and electric resistance with these technologies. The PAs and LEAN will develop and implement a sustained and coordinated effort to expand cost-effective heat pump adoption among income-eligible customers across building types wherever heat pump adoption will not increase the customer's energy burden. In both single-family and multifamily properties, customers with electric resistance, oil, or propane heat will be prioritized. In all cases, in line with the comprehensive approach offered through the Income Eligible program, all heat pumps will be installed in conjunction with home weatherization for homes that have not yet been insulated, so as to ensure that heat pump systems are appropriately sized. During energy assessments and as part of the suite of energy upgrades offered, including as part of heat pump upgrades, customers who have Wi-Fi connectivity in their homes will also be offered the option of smart thermostats for their home and information about enrolling in PAs ADR offerings.

As part of this electrification-forward approach, PAs and their partners in LEAN are developing several approaches to ensuring that customers have the information they need to be informed about heat pump technologies and how they work and that capacity continues to be built statewide to meet customer demand. New educational materials will be developed to help customers understand the various heat pump technologies available to them, become more comfortable with how they operate compared to existing heating systems, and help them make an informed decision about the best systems for their homes. The PAs and LEAN will closely monitor customer satisfaction with new heat pump systems, look to incorporate lessons learned, and help customers to overcome barriers as they scale this new approach. The Income Eligible program will coordinate with the Retail program to leverage opportunities for CAP agencies to partner with preferred HVAC contractors to ensure smooth statewide delivery of heat pump systems.

Furthermore, current and future CAP agency staff will continue to receive ongoing upskilling as needed to ensure they are well equipped to identify cost-effective heat pump and electrification opportunities for customers that will not increase the customer's energy burden.

Streamlined Income Eligible Online Experience

The PAs will coordinate with LEAN to improve the consistency of both the customer intake experience and the h HEA experience for income-eligible customers statewide. This will include the launch of a new centralized LEAN single-family intake website to complement the existing multifamily website.[47] To guarantee greater language access for income-eligible customers, the website will be provided in the same languages (including Spanish, Portuguese, and English), and the intake phone line will have options in the same languages as the Mass Save hotline (including Spanish, Portuguese, Mandarin, and English). These new resources will provide a centralized, comprehensive, and consistent experience for income-eligible customers statewide. The Mass Save website (www.MassSave.com) is also provided in Spanish, Portuguese, and English. This new resource will provide a centralized, comprehensive, and consistent online experience for income-eligible customers statewide.

Increased Opportunities to Multifamily Buildings

Multifamily buildings have unique savings opportunities, because of differences in technical potential and the nature in which they are managed. Because of the higher available incentives and the possibility of non-energy impacts which can enhance cost effectiveness, income-eligible initiatives are often well suited for testing new opportunities. Depending on the results associated with the efforts below, these opportunities may also be added to the market-rate initiatives.

Customized Deep Energy Retrofit Approach

An emerging submarket of income-eligible, multifamily retrofit projects are existing income-eligible building owners who may have participated in the Income Eligible Coordinated Delivery Initiative in the past; however, they may now be going through the refinancing process and/or pursuing significant capital improvement renovations more typically seen in the Residential New Buildings program. These projects are integrating a range of the latest high-performance building technologies that go beyond the programmatic scope of a typical retrofit project, such as but not limited to structurally insulated exterior cladding, continuous insulation or targeted exterior air sealing, ventilation with energy recovery ventilators, variable refrigerant flow systems, and heat recovery ventilators, and heating system conversions from delivered fuels or natural gas to high-efficiency electric heat, all with the intent to achieve deeper energy savings. The PAs will work with LEAN to develop an income-eligible multifamily offering for major renovation projects, conceptually similar to the current Additions and Renovations Program for 1-4 units, with a potential pay-for-savings incentive design. As a first step, the PAs will establish an appropriate baseline based on standard refinancing practices. The PAs and LEAN will work to implement this approach in 2022.

[47] Existing multifamily website is: www.LEANmultifamily.org.

Incentives for Greater Efficiency in Multifamily Common Area Laundry Facilities

The goal of this offering will be to increase the efficiency of common area laundry room equipment in multifamily buildings, particularly smaller buildings where there is the most opportunity for laundry rooms, an area of the building that is often neglected because ownership and leasing arrangements provide little incentive for industry actors to use more efficient commercial equipment. The PAs will research the typical specifics of contract and leasing arrangements for laundry facilities in multifamily buildings in Massachusetts to develop an offering that focuses on the business model with the greatest savings impact potential.

Multifamily Remote Monitoring and Building Optimization

Many income-eligible multifamily facilities have limited maintenance staff. Connecting these facilities with available technologies to optimize equipment and alert staff to problems can streamline operational efficiencies. There are several products on the market that install sensors in boiler rooms and other key areas of the building that connect to a web platform that allow maintenance staff to monitor and keep their equipment optimized and alerts them to problems with less time and effort, leading to greater long-term energy savings for the building owner.

For the 2022-2024 term, the PAs will explore the potential application of these monitoring and optimization products in the income-eligible multifamily market. As a component of participation in a multifamily building retrofit, and to trial this technology, the PAs will consider paying for the annual costs of monitoring systems for three years, which would give time to building staff and owners to develop comfort with their equipment, realize energy savings, and create a longer-term maintenance plan for future years.

TARGETED SMALL MULTIFAMILY ENGAGEMENT STRATEGY

The PAs plan to increase their engagement of owners of small income-eligible, multifamily properties with the goal of increased participation and therefore benefits to their tenants. Landlords of small multifamily properties have different challenges and resources than larger landlords, who are more likely to have property management staff engaged in operational planning and therefore more likely to be aware of the value proposition offered by energy efficiency program participation. Smaller landlords on the other hand, are more likely to self-manage their properties, and therefore have fewer management resources to dedicate to energy efficiency program participation. This means a targeted effort to better reach small landlords and educate them about the program and its benefits and value proposition, but also potentially offering simplified participation options and processes for small landlords and greater access to technical support.

A key element of this effort will focus on forming partnerships and new outreach avenues in specific municipalities with substantial smaller landlord multifamily building ownership. Some of this work will build on or expand prior efforts to engage with local entities and organizations, while some of it will be new and might include alignment with Community First Partnership Program, to focus on those towns entering into such partnerships in a given year. Many of these efforts will benefit both income-eligible and market-rate properties and residents.

Continued Consideration of Income-Eligible Customers in Majority Standard Income Buildings

Building on progress made during the 2019-2021 term, the PAs will work with CAP agencies and RCD vendors on the “mixed-income protocol,” which is a streamlined coordination of service to income eligible customers where the

minority of units in low rise residential buildings qualify as income eligible. PAs, LEAN, and RCD lead vendors are facilitating coordination between CAP agencies, RCD lead vendors, and home performance contractors to ensure that income-eligible customers in buildings that do not meet the 50 percent income-eligible threshold still have access to no-cost instant savings measures, eligible appliance upgrades, and other upgrades for which the income-eligible customer is the central decision maker. As many income-eligible customers are renters, the PAs will continue to provide information to landlords about additional incentives available to them and their tenants who qualify as income eligible, whether through the mixed-income protocol or full income-eligible program.

Remote Interactions

During the 2022-2024 term, the PAs plan to work with CAP agencies on developing and improving remote electric assessments (trialed by some CAP agencies during the 2020 program year) and integrate them as a permanent component of the Initiative. This component will be provided as an option for customers who prefer more remote interactions. The PAs and their lead CAP agencies will look for opportunities to further digitize the income-eligible customer journey where possible, as well as minimize in-person interaction for both single and multifamily paths when a site visit is not necessary.

2.12 RESIDENTIAL FINANCING

2.12.1 OVERVIEW

The highly successful Mass Save HEAT Loan offers zero percent interest financing to help customers pay for the 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 to invest in energy efficiency. Customers may qualify for loans up to $25,000 with terms up to seven years, depending on the PA and the loan provider.

2.12.2 RESIDENTIAL FINANCING OFFERING

ELIGIBILITY

All PA customers with an active residential account are eligible to apply for a HEAT Loan on qualified measures. HEAT Loans are available for a variety of energy efficiency purchases, including HVAC and envelope improvements. Eligibility criteria and borrowing limits are set for each type of purchase. The PAs work with a network of over one hundred participating HEAT Loan lenders. Loan agreements are between the customer and the selected HEAT Loan Lender, and therefore, receipt of a HEAT Loan is contingent upon approval by the selected lender.

OFFERINGS

In addition to HVAC, DHW, and envelope improvements, the HEAT Loan is available to help with the cost of the most prevalent pre-weatherization barriers. It is also available for the installation of residential storage solutions enrolled in the PAs' ADR offerings. The loans are offered at zero percent interest to customers, up to a total of $25,000, although there are lower limits for specific items. Previous evaluations have established that customers are particularly

motivated by the availability of no-interest loans, and that the HEAT Loan motivates many customers to install more efficient items that they would have in the absence of the loan.[48]

The PAs have paid considerable attention to ensuring reasonable access to the HEAT Loan. In order to increase the number of customers who can successfully take advantage of the HEAT Loan, some PAs are working with the Capital Good Fund, a community development financial institution that focuses on extending responsible credit to customers who may not be approved for loans by traditional lenders. At the same time, the PAs are sensitive to concerns about customers taking on debt that they may not be able to repay. The PAs will continue to look for ways to increase access to the HEAT Loan to customers without encouraging unmanageable debt.

DESIGN AND DELIVERY

As noted above, the HEAT Loan is delivered through a network of over one hundred banks, credit unions, and other lenders. This wide array of lenders allows many customers to receive their loan from a local institution or the lender with whom they already do their banking or select a lender that meets their needs for application process or approval timelines. After the eligibility of the measures to be financed has been confirmed, customers apply for a loan from one of these lenders and repay the loan directly to the lender. The process for applying for a HEAT Loan is described in detail on https://www.masssave.com/en/saving/residential-rebates/heat-loan-program/.

Customers may learn about the HEAT Loan program a number of different ways. Energy specialists promote the HEAT Loan to customers with an opportunity for an eligible measure identified during the home energy assessment. The HEAT Loan is particularly attractive to customers financing expensive installations, such as new heating and cooling equipment. For that reason, some HVAC installers promote the availability of the HEAT Loan to their customers. Many lenders promote the HEAT Loan themselves, providing another pathway for customers to enter the PAs' programs.

Any savings or costs associated with installing energy efficiency measures due to availability of the HEAT Loan are included in the initiatives under which the measure was installed, for example, in the RCD Initiative. The PAs arrange for payment to the lender to buy down the interest rate to zero percent to the customer. HEAT Loans are generally administered by the electric PAs, except for instances in which a natural gas PA serves a customer in a municipal electric utility territory, in which case the natural gas PA would offer the loan. The PAs collaborate with the Massachusetts Bankers Association to provide procedures for banks to participate in the Residential Sector programs.

STRATEGIC ENHANCEMENTS

As noted throughout the Plan, electrification of space heating is one of the main areas of focus. The PAs will therefore offer an electrification HEAT Loan of up to $25,000, including up to $5,000 for electrification barriers such as electrical panel upgrades, for customers who install heat pumps in their homes. The design, delivery, and terms of the HEAT Loan will be the same as the existing loan offering. The intent is to ensure customers who are installing heat pumps are able to get the financing they need, regardless of past HEAT Loan participation.

[48] Navigant. *HEAT Loan Assessment (RES 37),* available at: https://ma-eeac.org/wp-content/uploads/MA-RES-37-HEAT-Loan-Evaluation-Report_FINAL_01AUG2018.pdf.

The increasing prevalence of costly items such as heat pumps and energy storage in the HEAT Loan program have put upward pressure on the program budgets over time. As noted above, previous evaluations have found the HEAT Loan to be an effective tool in motivating customer action and during the 2022-2024 term, the PAs will explore ways to control interest buy-down costs. Third-party evaluations have found the HEAT Loan process to work well for most customers; however, in the interest of always improving their programs, the PAs will also identify opportunities to further simplify the process, from confirmation of eligibility to securing the loan. This could include introducing processes that differ from those described in this section.

2.13 RESIDENTIAL EDUCATION

2.13.1 OVERVIEW

Today's K-12 students are tomorrow's energy consumers, innovators, and participants in the energy efficiency workforce. The objective of the Residential Education effort is to offer educational outreach programs and enhanced consumer education that will teach Grades K-12+ students how to be efficient energy consumers. The Residential Education effort increases awareness of the benefits of energy efficiency and its impact on climate and encourage participation in Mass Save programs.

The PAs support educators, students, and families by providing curriculum and materials on energy efficiency, energy conservation, efficient technologies, and related career opportunities. This includes age-appropriate materials at each grade level to encourage learning and fostering an energy-efficient literate society.

Several PAs collaborate to offer energy efficiency curricula and training to Massachusetts educators. Educators receive ongoing support for implementing energy efficiency programming in the classroom. For the 2022-2024 term, curriculum enhancements will include career exploration and training opportunities in energy efficiency, which will be offered to both educators and students. Additional efforts directed at consumers will focus on educating customers on the benefits of investing in energy efficiency products and services available to them through Mass Save programs. Consumer education will be delivered in several languages besides English that are widely spoken across Massachusetts, such as Spanish and Portuguese, and reviewed for cultural relevance.

During the 2022-2024 term, the PAs will focus their outreach to students and families who reside within environmental justice communities. This is part of the PAs' continued commitment to serve the state's customers equitably. The PAs plan to offer several workshops to educators and students annually. The PAs will focus on recruiting environmental justice communities or underserved school districts to participate in the workshops.

2.13.2 ELIGIBILITY

Participation in the Residential Education program is available to all educators, school districts, students, and customers in participating PA territories.

2.13.3 OFFERINGS

The Residential Education program reaches students, community-based organizations, and educators through a variety of different channels. Educator resources include workshops on the science of energy, introduction to energy

efficiency, integrating energy efficiency into other subject areas, insulation and air infiltration, and energy audit tools. Educators are also provided the opportunity to choose kits with materials needed to implement the lessons in their classrooms and learning environments. There is an array of curricula on all aspects of energy that is available to educators to utilize. Educators receive professional development credits (CEUs) for their participation in the program's workshops.

Resources for students include but are not limited to, science fair project ideas, energy information and resources guides, youth award participation, and leadership opportunities. In addition to the resources, some of the PAs utilize hands-on, interactive exhibits and games at community-based events in their service areas to further conduct outreach to K-12 students.

Massachusetts residents have the opportunity to participate in community events, where they can learn about Mass Save programs, as well as ways to save energy. The PAs have also distributed Kill-a-Watt kits (devices that measure how much electricity an appliance or electronic uses) to libraries across the state. Residential customers can check out these Kill-a-Watt devices to learn more about their energy usage at home.

DESIGN AND DELIVERY

Residential energy education offerings are available to educators, students, and families and are provided through Massachusetts K-12 schools. Locations may vary depending upon the specifics of the offering and are available across the state.

Due to the COVID-19 pandemic, virtual offerings are now being offered for all professional development workshops. Typically, the PAs support six to eight professional development workshops offered in different parts of Massachusetts to effectively accommodate educators from across the state. These virtual workshops (and when possible again, in-person workshops) will continue to be offered to all educators in the 2022-2024 term. In addition to school year workshops, the PAs offer a three-day summer workshop to educators who apply to the program and are accepted. Professional development credits are earned, and graduate college credit can be received if teachers do an extra assigned project.

Figure 2-32: Professional Development Workshop Images

STRATEGIC ENHANCEMENTS

The PAs are committed to continuous improvement and building upon past success. During the 2022-2024 term, the PAs are considering the deployment of the following strategic enhancements for education offerings:

- **Increased focus on school districts with lower PA participation.** The PAs will encourage school districts to participate in workshops as a district and not on a teacher-by-teacher basis so that all educators and students receive the same opportunities and programs. Securing buy-in from a district's superintendent and requiring participation in the workshops ensures that all students will receive the same opportunities. In support of the PAs' continued focus on equitable services, outreach will be increased to schools in Environmental Justice communities, as well as those communities identified with lower-than-average historical participation in energy efficiency programs.

- **Training and career development opportunities for high school students.** The PAs will provide workshops for educators and students to promote and encourage careers in energy efficiency. These workshops will focus on introducing various career opportunities for students and highlight the career pathways and education needed to succeed in these careers.

- **Community outreach.** The PAs will continue to reach out to customers through various community events and CBOs to encourage participation in the Mass Save programs.

- **Exploring additional virtual pathways.** During the 2022-2024 term, the PAs will continue to offer virtual professional development workshops to give all educators the opportunity to attend these trainings if they cannot participate in person. Additionally, the PAs are exploring other opportunities to add virtual programming where appropriate.

- **Community partnerships.** The PAs recognize that an effective tool in advancing their proposed residential education efforts are community-based initiatives. This determination was reinforced by a variety of stakeholders during their review of the initial draft 2022-2024 Plan. To complement the Community First Partnership Program, the PAs will introduce the Mass Save Energy Efficiency Education Grant. This grant will offer community-based organizations an enhanced opportunity to participate in residential education efforts by partnering with the PAs to offer energy efficiency outreach and education geared toward renters, landlords, English-isolated customers, customers with low and moderate income, K-12 students, and young adults. The PAs have allocated $1.5 million over the 2022-2024 term for innovative, community-based residential education initiatives to increase awareness and community engagement in energy efficiency programs. This offering is intended to provide smaller financial awards and streamlined reporting. The awards will be open to all community-based organizations in each PA's service territory; however, the PAs will prioritize applicants from, and working with, environmental justice communities. The final design of this offering will be completed by the second quarter of 2022, and financial awards will be based on selected organizations meeting the final design criteria.

2.14 PA-SPECIFIC INITIATIVES

The PAs 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 PAs 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. They may also be based on the governing structure of a PA, 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 PA, with the idea that the programming could be rolled out across PAs if proven successful and cost-effective. The PA-specific initiatives are set forth in Appendix G and represent proposals of only the PA making the proposal.

3. COMMERCIAL & INDUSTRIAL SECTOR

SECTION 3: COMMERCIAL & INDUSTRIAL SECTOR

3.1 COMMERCIAL & INDUSTRIAL SECTOR VISION

3.1.1 VISION

For more than two decades, the Massachusetts PAs have been national leaders in designing and implementing award-winning C&I energy efficiency programs and have served as a model for other program administrators throughout the country to emulate. Notably, the PAs pioneered the Small Business turnkey pathway, developed a leading model for combined heat and power (CHP) programming, built one of the largest and most successful Midstream delivery pathways in the country, and most recently, launched a next generation new construction program design that will inevitably become a best-in-class model. Sustaining a similar level of thought leadership and success for the 2022-2024 term will require continued innovation in both program design and deployment.

The vision for the C&I Sector builds upon the PAs' previous accomplishments with a focus on expanding equity and customer engagement across all industry segments, building types and sizes, geographical locations, end uses, and project types. Against a backdrop of diminishing savings opportunities, especially from lighting, and a challenging and uncertain economic climate (especially for small businesses), the PAs will redouble their efforts and focus on the fundamentals that drive program success. This includes increasing the awareness and understanding of the availability and value of energy efficiency, simplifying and streamlining delivery pathways, investing in continuous improvement and portfolio development to expand the range of services available to customers, and building capacity and capability in the energy efficiency market to help customers realize the value of those services. Ensuring that all C&I customers, large or small, participate in energy efficiency programs is a strong component of the PAs' vision for the sector in the upcoming term. To implement this strategy, the PAs will explore partnerships with diverse business and commerce groups, will target Main Streets programming for environmental justice communities, incorporate direct customer feedback to inform our program design and delivery, and will engage with the market to provide innovative approaches to implementation.

As the lighting market has matured, the PAs will look toward the decarbonization of buildings to drive transformation and innovation in the marketplace. To implement this vision, the PAs will deploy a number of strategies to accelerate the pace of space and water heating electrification with the aggressive increase in budget as compared to April.. These electrification strategies will include the pairing of incentives with customer education and contractor training alongside workforce development investments.

For most business customers, energy efficiency is simply not a priority with energy costs typically representing a very small percentage of operating costs. In the face of this barrier to participation, the PAs must invest in building awareness through marketing, education, and outreach to highlight both the availability and value of energy efficiency improvements in commercial buildings and industrial facilities. While increasing awareness is an important area of focus, the PAs will also increase their efforts to help customers understand the participation options available and to simplify the pathways through which customers can avail themselves of those opportunities in a way that best suits their needs, priorities, and decision-making criteria. More generally, the PAs will strive to provide each customer with the right offer(s) at the right time to effectuate the maximum benefits in terms of GHG emissions reductions,

energy savings, cost reductions, and operational efficiencies—for that customer based on their individual circumstances and business needs.

The PAs fully recognize the ambitious nature of this vision. However, providing GHG emissions reductions and energy efficiency opportunities that benefit all customers is a fundamental guiding principle of their mission and purpose and the offerings described in this Plan detail how the PAs will deliver on this vision for all their C&I customers throughout the 2022-2024 term.

3.2 COMPARISON TO 2019-2021 PLAN

To successfully achieve the goals and outcomes described above, the PAs have identified the following six strategic interventions for the C&I Sector:

- **Reducing GHG emissions.** The PAs believe energy efficiency is and will continue to be a major contributor to the Commonwealth's efforts to achieve net zero GHG emissions by 2050. In addition to ongoing efforts to promote greater efficiency in newly constructed buildings, the PAs will also increase efforts to efficiently and cost effectively electrify existing buildings with an additional focus on increasing weatherization as an enabler of electrification.

- **Equity.** The PAs will use new techniques and enhanced targeting efforts to reach the small business community, a market segment with historically less participation on a percent basis than C&I customers as a whole. The PAs will build upon their previous efforts to increase small business participation with an increased focus on equity during the 2022-2024 term.

- **Workforce development.** With demand for energy efficiency services exceeding capacity of the existing workforce and buildings and building systems becoming increasingly complex, the PAs will expand efforts to grow, diversify and improve the workforce in Massachusetts. New efforts will include special focus on diversity, equity, and inclusion by drawing under-represented groups into the energy efficiency workforce.

- **Awareness, understanding, and accessibility.** The PAs will increase efforts to facilitate greater participation through a variety of activities intended to overcome informational and organization barriers. For the 2022-2024 term, the PAs will focus on providing more outreach and education, increasing access to information about efficiency opportunities, and simplifying and streamlining the participation process.

- **Technical assistance and tools.** For many years, the PAs have offered technical assistance through trade allies and engineering and implementation vendors and connected C&I customers with a network of independent energy advisors. For the 2022-2024 term, the PAs will expand upon these efforts by developing custom express calculator tools, providing a comprehensive savings assessment tool to identify opportunities in small businesses and providing more insight into the impact measures have on GHG emissions. Through these and similar efforts, the PAs anticipate increased energy savings and reduced program costs.

- **Continuous improvement and portfolio expansion.** As the C&I Sector programs continue to mature, the available savings opportunities are dwindling. For the 2022-2024 term, the PAs will systematically investigate and develop new savings opportunities for inclusion in the C&I Sector portfolio.

The figure below shows how these strategic interventions will be applied to help the PAs meet their C&I Sector goals for the 2022-2024 term and is a significant shift in implementation from previous Three-Year Plans.

Figure 3-1: C&I Sector Map of Goals to Intervention Strategies for 2022-2024 Plan

Goal	Equity	Workforce Development	Awareness, Understanding & Accessibility	Technical Assistance & Tools	Reducing GHG Emissions	Continuous Improvement & Portfolio Expansion
Save energy and reduce demand	X	X	X	X	X	X
Increase participation	X		X	X	X	X
Increase comprehensiveness	X			X	X	
Reduce program costs				X		X
Increase awareness and understanding	X	X	X	X	X	
Simplify and streamline	X		X	X		
Increase capacity and capability		X			X	

3.3 KEY LEARNINGS

EM&V reports and other studies commissioned by the PAs were integral in determining where to focus resources and activity for the next three-year period. The following learnings from these various studies had a particular impact in shaping the C&I Sectors' goals, objectives, and offerings for the 2022-2024 term.

- Currently, Massachusetts is experiencing a tight labor market for energy efficiency professionals as job openings exceed the supply of workers. Employers are having particular difficulty in hiring workers for the vocational trades and building operators and facility management technicians with interdisciplinary knowledge are in short supply.[49]

- In the C&I electric portfolio, medium-sized businesses had a contribution ratio below 1 suggesting these businesses are underrepresented in the C&I electric savings portfolio. In the C&I natural gas portfolio, small and microbusinesses also had contribution ratios below 1.[50]

[49] See *Workforce Development Study*.
[50] See *Customer Profile Study*.

- Greater measure comprehensiveness, or the diversity of end uses in an industry segment, leads to higher overall energy savings when participation is held constant.[51]

- From 2013-2018, participation in energy efficiency programs was not equally distributed across the state. Rural areas participated at lower levels and achieved less savings as a percentage of energy used when compared to the state's urban and suburban areas.[52]

- Manufacturing, retail trade, and professional services are the C&I market segments that use the largest amount of electricity while the healthcare, educational services, and retail trade segments have the highest account participation rates.[53]

- Manufacturing, educational services, and real estate leasing are the largest users of natural gas in Massachusetts, while educational services, accommodations/food services, and recreation have the highest account participation rates.[54]

- For the C&I electric portfolio, the Custom pathway represents 9 percent of projects but 45 percent of savings and the Prescriptive pathway accounts for 59 percent of projects but only 31 percent of savings. The Midstream pathway makes up the remaining 32 percent and 24 percent of projects and savings, respectively.[55]

- For the C&I natural gas portfolio, the Custom pathway represents 30 percent of projects but 69 percent of savings and the Prescriptive pathway accounts for 40 percent of projects but only 15 percent of savings. The Midstream pathway makes up the remaining 30 percent and 16 percent of projects and savings, respectively.[56]

During the 2022-2024 term, the PAs will increase their efforts to facilitate greater participation through a variety of activities intended to overcome informational and organizational barriers. Providing more outreach and education, increasing access to information about efficiency opportunities, and simplifying and streamlining the participation process will be key areas of emphasis.

3.4 C&I GOALS, BUDGETS, GHG EMISSIONS REDUCTIONS AND BENEFITS

3.4.1 GOALS

The PAs develop GHG emission reductions, energy savings, and electric demand savings goals, budgets, and cost-effectiveness forecasts that represent best estimates to realize their vision for the C&I Sector. This section provides

[51] See *Customer Profile Study*.
[52] See *Customer Profile Study*.
[53] See Customer Level Database.
[54] See Customer Level Database.
[55] See Customer Level Database.
[56] See Customer Level Database.

the aggregate, statewide values for the C&I Sector programs for the 2022-2024 term (information for individual PAs can be found in Appendix A). The key savings metrics for measuring success of these programs are:

- Carbon dioxide savings ($MMCCO_2e$).
- Net lifetime savings at source from all fuel sources (MMBtus).
- Demand savings (kW) for the electric PAs.
- Net lifetime electric savings (MWh) for the electric PAs (excluding fuel conversions and ADR efforts).
- Net lifetime gas savings (therms) for the natural gas PAs.

KEY METRICS

As part of their three-year planning process, the PAs must develop GHG emissions reduction goals, energy and demand savings goals, budgets, cost-effectiveness models, and cost-efficiency forecasts that represent their best estimates to realize their vision for the C&I Sector. Additionally, as set forth in the Climate Act, c. 8, § 106, the EEA Secretary set a GHG reduction goal for the 2022-2024 Plan on July 15, 2021.

The PAs will need to meet multiple objectives and outcomes for the C&I Sector, including meeting electric savings, natural gas savings, demand reduction, and GHG reduction goals. The programs also yield considerable non-energy-related benefits, such as improved health outcomes. These different types of values are all converted into dollars as a common denominator and summed as benefits. A summary of the PAs' best estimates for spending, savings, GHG reductions, and benefits for the C&I Sector is provided in the following figures.

Figure 3-2: C&I Budgets, Savings, GHG Emission Reductions, and Benefits (Combined Natural Gas & Electric)

Planned Results	2022	2023	2024	2022-2024
Total Statewide Budget	$398,966,636	$472,405,213	$629,855,021	$1,501,226,870
Net Annual All-Fuel MMBtu Savings	2,872,922	2,803,744	2,780,374	8,457,040
Net Lifetime All-Fuel MMBtu Savings	28,193,802	30,074,798	32,119,396	90,387,996
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	73,601	90,938	123,247	287,787
Total Benefits	1,557,935,050	1,602,840,599	1,862,738,336	5,023,513,986

Figure 3-3: C&I Budgets, Savings, GHG Emission Reductions, and Benefits (Electric)

Planned Results	2022	2023	2024	2022-2024
Total Statewide Budget	$316,116,024	$372,231,307	$514,724,894	$1,203,072,226
Net Annual All-Fuel MMBtu Savings	1,995,758	1,885,633	1,834,495	5,715,886
Net Lifetime All-Fuel MMBtu Savings	15,411,253	16,667,733	18,331,766	50,410,751
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	23,030	35,836	61,785	120,651
Total Benefits	1,154,918,694	1,170,526,142	1,406,526,753	3,731,971,588

Figure 3-4: C&I Budgets, Savings, GHG Emission Reductions, and Benefits (Natural Gas)

Planned Results	2022	2023	2024	2022-2024
Total Statewide Budget	$82,850,612	$100,173,906	$115,130,127	$298,154,645
Net Annual All-Fuel MMBtu Savings	877,164	918,111	945,879	2,741,154
Net Lifetime All-Fuel MMBtu Savings	12,782,549	13,407,065	13,787,631	39,977,244
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	50,571	55,102	61,463	167,136
Total Benefits	403,016,356	432,314,458	456,211,584	1,291,542,398

3.4.2 BUDGETS

BUDGET SUMMARY BY YEAR

The following figure summarizes the expected levels of spending by cost category required to achieve the PAs' savings goals and other objectives for the C&I Sector.

Figure 3-5: C&I Sector Budget Summary

Program Budgets ($M)	2022	2023	2024	2022-2024
Participant Incentives	$288,622,904	$359,717,809	$514,458,101	$1,162,798,814
Sales, Technical Assistance & Training	$76,339,199	$75,652,567	$76,101,148	$228,092,914
Program Planning & Administration	$16,059,599	$18,717,789	$20,159,518	$54,936,906
Marketing & Advertising	$8,515,532	$8,543,582	$8,589,076	$25,648,189
Evaluation & Market Research	$9,429,402	$9,773,466	$10,547,179	$29,750,047
Total Planned Spending	**$398,966,636**	**$472,405,213**	**$629,855,021**	**$1,501,226,870**

3.4.3 COST EFFECTIVENESS AND EFFICIENCY

The PAs conducted a cost-effectiveness analysis of the proposed C&I Sector portfolio using the AESC Study that determined avoided costs of energy. The PAs will strive to meet the cost effectiveness and efficiency projections for the C&I Sector; however, the PAs acknowledge that potential market changes and future evaluations could influence the final outcome. In addition to producing cost-effective energy savings and demand reductions, the C&I Sector is also projected to produce considerable environmental benefits in the form of reductions in GHG emissions, helping the Commonwealth meet its decarbonization goals.

3.5 COMMERCIAL & INDUSTRIAL SECTOR OVERVIEW

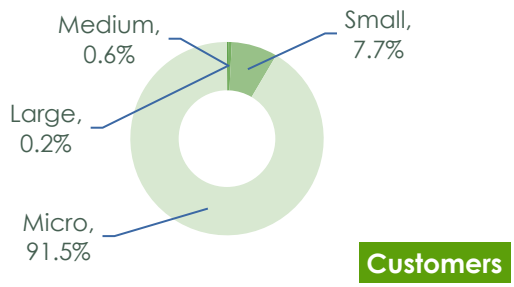
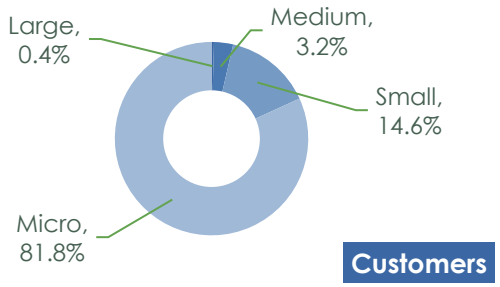
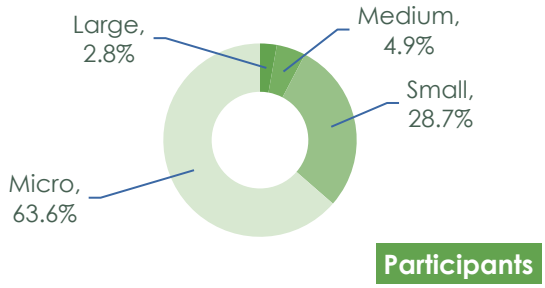
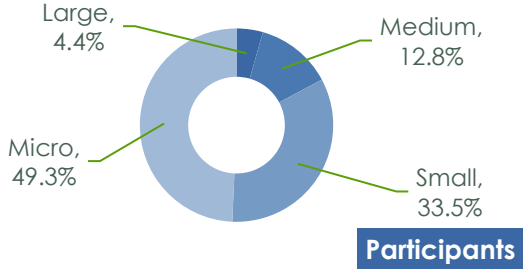
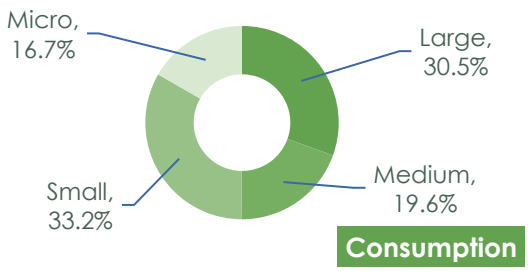
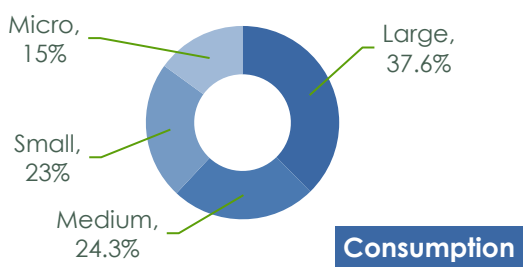
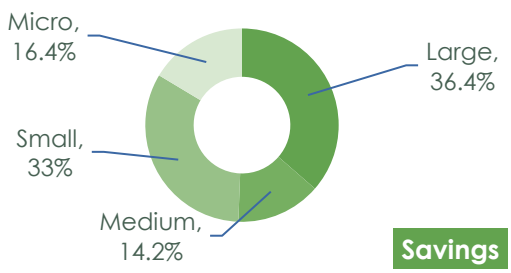
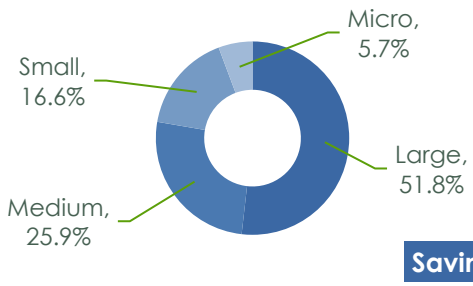
There are roughly 350,000 and 150,000 electric and natural gas C&I customers, respectively, served by the PAs in Massachusetts. These customers span a wide array of sizes and industry segments. The PAs define C&I customer size based on annual consumption levels, consistent with the *C&I Customer Profile Study*. Annual consumption is a useful basis for categorization because it is a reasonable proxy for and is indicative of savings potential. The figure below summarizes the size ranges used by the PAs to categorize C&I customers.

Figure 3-6: C&I Customer Sizes by Annual Consumption

Customer Size	Annual Electricity Usage	Annual Natural Gas Usage
Microbusiness	Less than 0.11 GWh	Less than 8,000 Therms
Small Business	0.11 – 1.5 GWh	8,000 – 40,000 Therms
Medium Business	1.5 – 4.5 GWh	40,000 – 250,000 Therms
Large Business	Greater than 4.5 GWh	Greater than 250,000 Therms

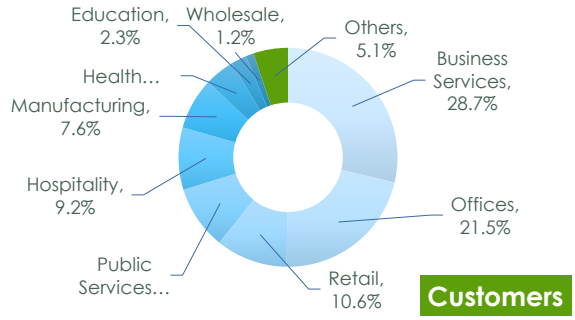
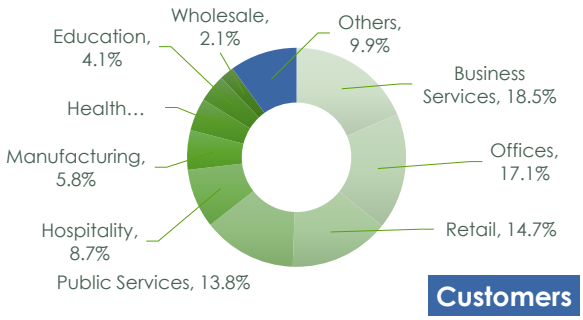
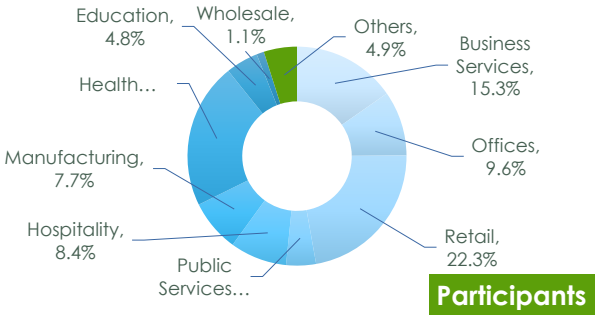
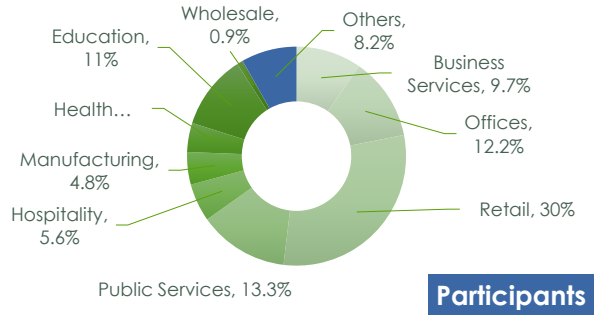
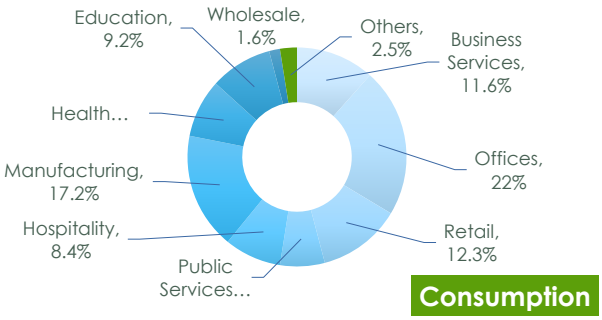
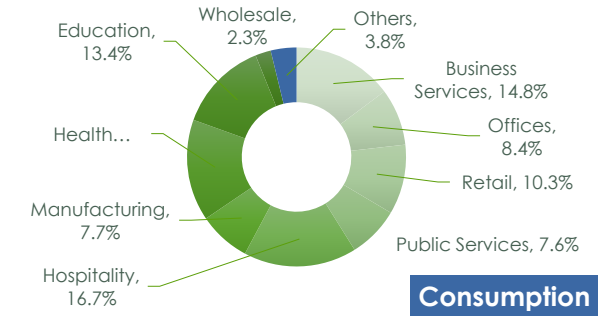
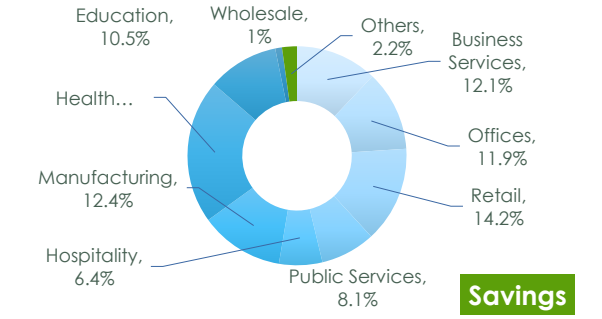
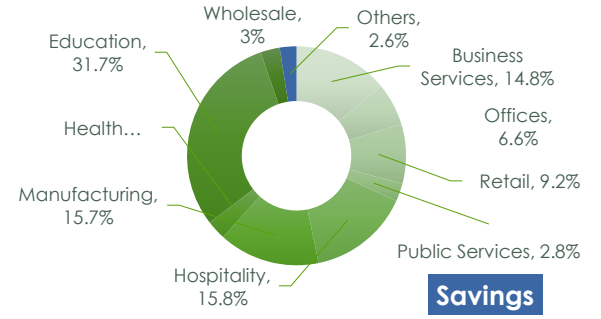
2018 C&I Customer Profile Study Findings

Figure 3-7: C&I Customers, Participants, Consumption, and Savings by Customer Size

Electric	Natural Gas
	
	
	
	

2018 C&I Customer Profile Study Findings (continued)

Figure 3-8: C&I Customers, Participants, Consumption, and Savings by Customer Size

Electric	Natural Gas
	
	
	
	

Based on these parameters, over 90 percent of the PAs' electric and natural gas C&I customers are characterized as microbusinesses or small businesses. Conversely, less than 1 percent of the PAs' electric and natural gas customers are characterized as a large business; however, they represent over 35 percent and over 50 percent of electric and natural gas savings, respectively. This is due in part to large businesses having much greater consumption and therefore savings opportunities. Additionally, larger customers typically have greater financial resources as well as staff resources and expertise to support the identification of and investment in energy efficiency opportunities. In addition to more limited opportunities and resources, smaller customers are also more sensitive to financial paybacks and more focused on avoiding investments that impinge on cash flows.

In addition to encompassing a wide variety of sizes, C&I customers also span a wide array of industry segments, each with its own typical facility design and infrastructure, business needs, budgeting processes, and decision-making criteria. The figure below provides a listing of the customers served (by market segment) through the C&I Sector's programs.

Figure 3-9: C&I Customers by Market Segment

Segment	Customer Types
Business Services	• Professional, scientific, and technical services
Education	• Colleges and universities • K-12 schools
Health Care	• Hospitals • Medical offices and clinics • Nursing and residential care facilities
Hospitality	• Arts, entertainment, and recreation • Food services and drinking places • Lodging
Manufacturing	• Manufacturing • Chemicals, minerals and petroleum • Construction • Utilities • Agriculture, forestry, fishing and hunting
Offices	• Finance and insurance • Information • Real estate and rental/leasing • Transportation and warehousing
Public Services	• Local, state, and federal government • Wastewater and water treatment
Retail	• Clothing stores • Electronics and appliance stores • Food and beverage stores • Sporting goods, hobby, books, and music stores
Wholesale	• Wholesale trade
Other	• Other services (excludes public administration)

Figure 3-10: Billing Data, 2011-2018, Number of Unique Accounts from C&I Customer Profile (Electric PAs)

Electric PA	2013	2014	2015	2016	2017	2018	2019
Cape Light Compact	25,661	25,909	26,069	25,842	25,535	26,829	26,665
Eversource	162,688	117,462	145,989	170,830	171,586	172,653	173,146
National Grid	158,306	168,548	177,996	179,742	181,765	171,575	178,654
Unitil	3,706	3,529	3,765	3,667	4,081	3,891	4,025
Statewide Total	**350,361**	**315,448**	**353,819**	**380,081**	**382,967**	**374,948**	**382,490**

Figure 3-11: Billing Data, 2011-2018, Number of Unique Accounts from C&I Customer Profile (Natural Gas PAs)

Natural Gas PA	2013	2014	2015	2016	2017	2018	2019
Berkshire	4,661	5,277	5,307	5,328	5,380	5,372	5,649
Columbia	39,397	34,137	23,917	34,332	35,502	34,736	34,993
Eversource	28,365	27,009	26,108	30,246	30,187	30,843	30,595
Liberty	4,186	3,993	4,127	3,976	4,462	4,410	4,459
National Grid	71,142	73,395	77,531	78,174	78,730	79,118	79,595
Unitil	1,333	1,668	1,663	1,687	1,749	1,744	1,974
Statewide Total	**149,084**	**145,479**	**138,653**	**153,743**	**156,010**	**156,223**	**157,265**

Figure 3-12: Annual Consumption Electric (MWh) from the C&I Customer Profile

Electric PA	2013	2014	2015	2016	2017	2018	2019
Cape Light Compact	909,163	903,607	808,110	851,558	838,320	923,446	791,034
Eversource	16,191,031	14,753,423	14,563,785	15,817,829	15,454,060	15,696,509	14,340,957
National Grid	12,314,825	12,191,982	12,260,878	11,735,509	11,362,904	11,069,174	10,442,903
Unitil	283,900	254,320	387,932	255,999	257,343	260,393	194,829
Statewide Total	**29,698,919**	**28,103,332**	**28,020,706**	**28,660,895**	**27,912,627**	**27,949,522**	**25,769,723**

Figure 3-13: Annual Consumption Natural Gas (dekatherms) from the C&I Customer Profile

Natural Gas PA	2013	2014	2015	2016	2017	2018	2019
Berkshire	39,552	40,226	42,689	37,714	42,298	46,793	40,948
Columbia	259,012	234,992	197,155	300,365	345,532	332,954	290,761
Eversource	357,648	480,146	453,889	424,923	473,171	488,870	488,235
Liberty	27,899	31,074	31,183	26,007	24,714	27,821	25,938
National Grid	533,141	678,622	687,638	643,960	632,542	700,519	696,052
Unitil	13,935	14,614	14,988	15,022	14,289	15,663	21,008
Statewide Total	**1,231,188**	**1,479,673**	**1,427,543**	**1,447,991**	**1,532,545**	**1,612,620**	**1,562,943**

Figure 3-14: Population Size and Electric Savings, from the C&I Customer Profile

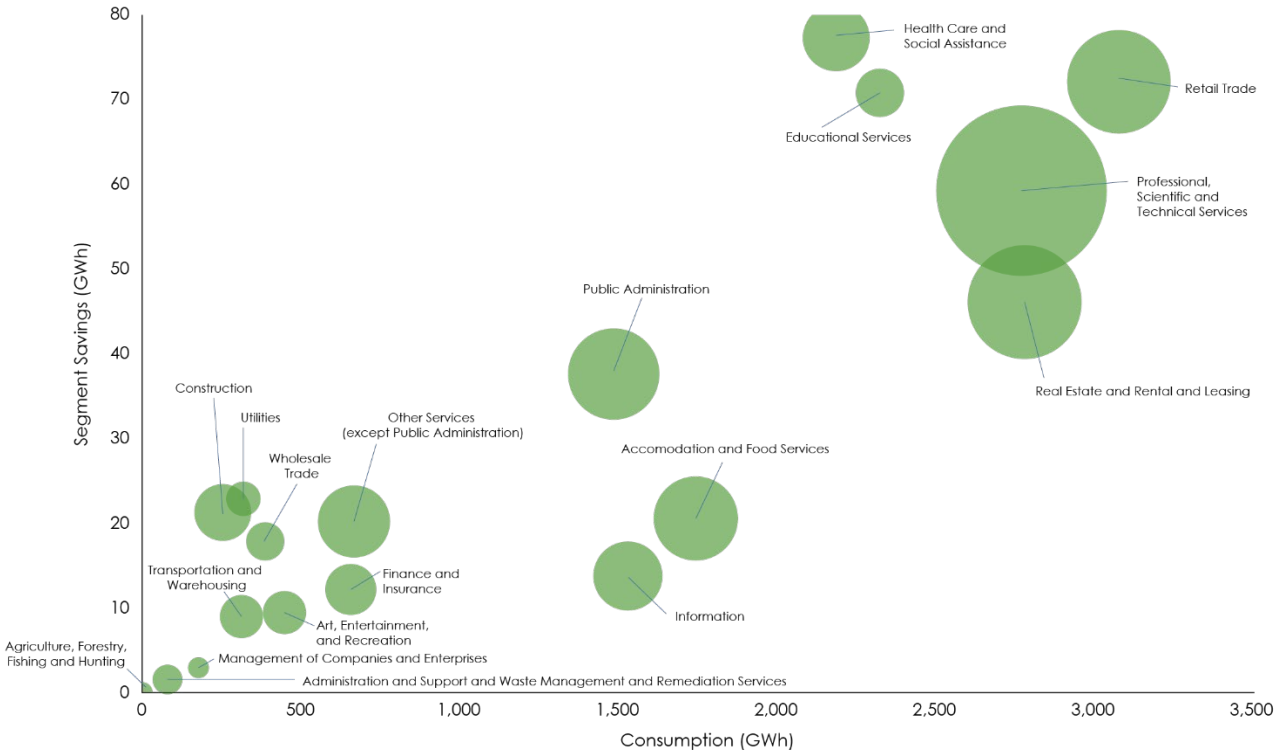
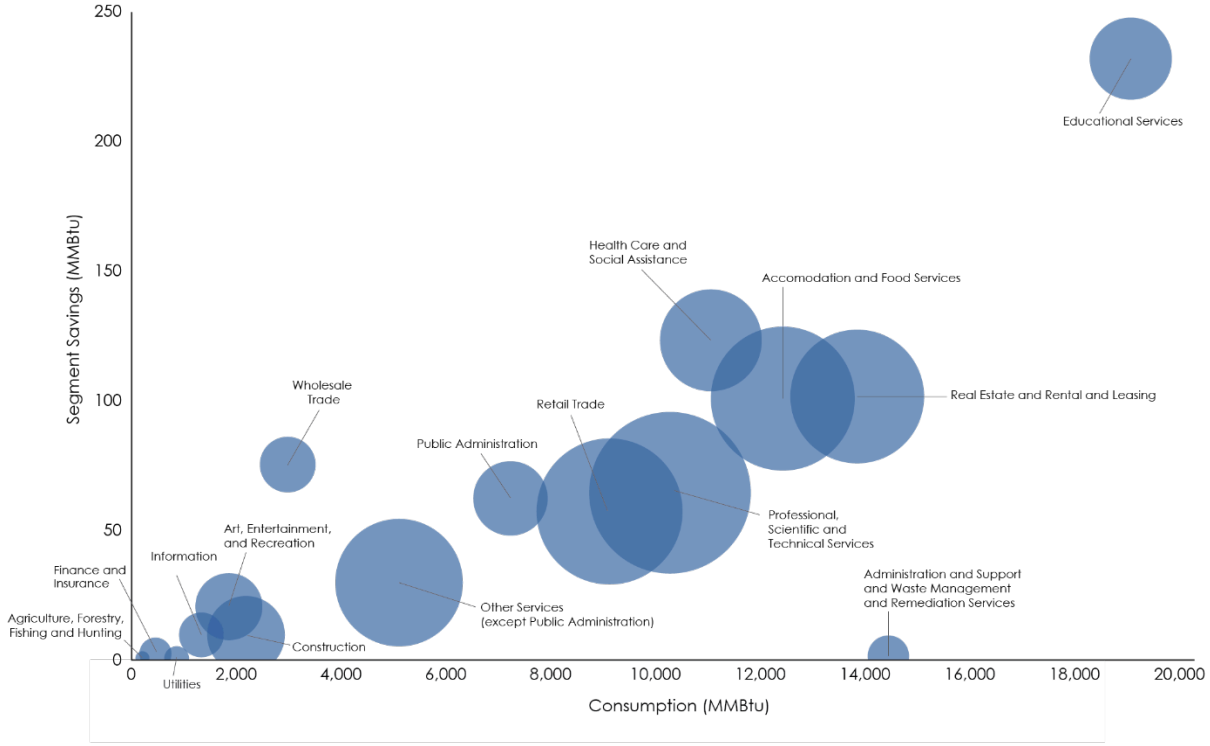


Figure 3-15: Population Size and Natural Gas Savings, from the C&I Customer Profile



3.6 COMMERCIAL & INDUSTRIAL SECTOR OFFERINGS

For the C&I Sector, the PAs have developed a diverse portfolio to effectively serve the many sizes and segments of customers. The C&I Sector has several participation pathways that enable the individual customer to be served in a manner most consistent with their needs and preferences, no matter how simple or complex the project they are undertaking.

3.6.1 MIDSTREAM PATHWAY

The Midstream pathway employs a point-of-sale approach in which the PAs collaborate directly with distributors of high-efficiency lighting, HVAC, water heating, and food service equipment. The PAs provide incentives to distributors to motivate them to stock, promote, and sell high-efficiency products and to provide retail price discounts to motivate customers or their contractors to purchase more efficient products than they would otherwise. By working with distributors at an important juncture in the supply chain, the Midstream pathway provides an incredibly scalable means by which to influence thousands of transactions cost efficiently.

3.6.2 DOWNSTREAM (PRESCRIPTIVE) PATHWAY

The Downstream pathway employs a prescriptive equipment-based approach where the PAs, or their vendors and trade ally partners, work directly with customers to identify, promote, and incentivize investments in energy-efficient

products and equipment including lighting, furnaces, boilers, heat pumps, rooftop air conditioners, water heaters, motors and drives, process equipment, building optimization and controls products, and pumps. Incentives, which are typically offered on a per unit basis (e.g., dollar per fixture, dollar per ton, etc.) are calibrated to mitigate some or most of the incremental cost of the more energy-efficient equipment relative to standard efficiency alternatives. By working directly with customers in the Downstream pathway, the PAs have the opportunity to inform the customer of the various efficient options available and guide them through the process of determining which option best meets their technical needs and financial criteria.

Figure 3-16: C&I Participation Pathways

Pathway	Midstream	Downstream (prescriptive)	Custom
Approach	Point-of-sale	Equipment based	Project based
Project Types	Retrofit, replace on failure, and new equipment	Retrofit, replace on failure	Retrofit and new equipment
Scalability	High	Medium	Low
Transaction Costs	Low	Medium	High
End Uses Available	Lighting, HVAC, gas water heating, food service, pumps	Almost All (exc. Combined Heat & Power, food service, true new construction)	All
Eligibility	Active Massachusetts C&I Account	Active Massachusetts C&I Account	Active Massachusetts C&I Account and more complex than one-for-one replacement
Target Market	Small C&I customers Large C&I customers with small retrofit projects	Medium/Large C&I customers with equipment upgrade projects	Large C&I customers and projects, including new construction and major renovation
Process Mechanics	Incentive paid directly to distributor and distributor applies customer incentive as a line item on the invoice No paperwork required of customer or customer agent	Incentive paid directly to customer or designee Incentive application (PDF, web) completed and submitted by customer or representative	Incentive paid directly to customer or designee Incentive application completed, along with engineering calculations and analysis, submitted by customer
Incentive Strategy	Incentive designed to motivate distributors to stock, promote, and sell energy-efficient products	Incentive calibrated to mitigate some or most of the incremental cost energy-efficient equipment relative to standard efficiency alternatives	Incentive calibrated to motivate customer action in consideration of customer economics (e.g., payback, Return on Investment (ROI), Net Present Value (NPV), etc.)
Incentive Structure	Incentives for each product as $ per unit (i.e., Horsepower (HP), Ton, etc.)	Incentive for each product as $ per Unit (i.e., HP, Ton, etc.)	Dollar per unit of savings incentive based on project-specific savings and economics
Savings Methodology	Deemed	Deemed formula	Project-specific based on technical/engineering analysis

3.6.3 CUSTOM PATHWAY

The Custom pathway employs a project-based approach where the PAs, or their vendors and trade ally partners, work directly with customers to identify, promote, analyze, and incentivize investments in customer and/or site-specific GHG emissions reductions and energy efficiency across all energy end uses, equipment, and system types. Incentives are project specific and calibrated based on the specific needs and criteria of the customer and the project being considered. In the Custom pathway, the PAs provide financial support for a technical or engineering analysis of the opportunity and rely heavily on the results of that analysis to understand the GHG and energy savings, economics of the project, and to calibrate the incentives. By working directly with customers in the Custom pathway, including providing both technical and financial support, the PAs are able to effectively serve the needs of customers contemplating large, complex, often system- or whole building-based projects in such a way as to maximize the energy savings achieved subject to the customers' needs and financial criteria.

In addition to the Midstream, Downstream (prescriptive), and Custom pathways the PAs also have a turnkey pathway that is exclusively for eligible small business customers (defined as having annual usage of under 1.5 million kWh and/or 40,000 therms). The Turnkey pathway involves direct-install services provided by PA-contracted lead vendors. These vendors directly engage small business customers to identify the complete array of potential electric or natural gas savings opportunities and then carry out installation of the measures chosen by the customer.

3.7 COMMERCIAL & INDUSTRIAL SECTOR CHALLENGES

In addition to considering the various policy, market, and technology trends in the development of the 2022-2024 Plan, the PAs are also aware of and considered the various barriers to energy efficiency. Because of the variety of C&I customers in Massachusetts the existence or extent of these barriers can vary greatly based on industry segment, customer size, and other factors. Examples of the barriers include informational, organizational, operational, and economic, and are further detailed below.

3.7.1 INFORMATIONAL CHALLENGES

Informational barriers result from a lack of information or expertise and can stall or even prevent projects from being identified or started. Examples of informational barriers include:

- **In-house technical expertise.** Identifying energy efficiency opportunities requires a level of specialized knowledge that often does not exist in many businesses, particularly smaller enterprises.
- **Awareness of available resources.** Many business owners are unaware of or do not sufficiently understand the variety of federal, state, and other financial or technical resources that are available to support energy efficiency investments.
- **Valuation of investments in energy efficiency.** Business customers may not understand the value of actions taken and investments made in energy efficiency and thus may perceive those investments as being more risky and less valuable.

3.7.2 ORGANIZATIONAL CHALLENGES

Organizational barriers emerge due to the structure, culture, capacity, and behavior of a business. Examples of organizational barriers include:

- **Capability and capacity.** Many businesses simply lack sufficient staff with the knowledge or time necessary to identify and act upon the energy efficiency opportunities available in business processes, systems, and buildings.

- **Split incentives.** Roughly 50 percent of commercial buildings and floorspace are occupied by someone other than the building owner; however, over 80 percent of building owners are responsible for energy-related equipment purchases and O&M of the energy systems in their buildings. When customers rent property (thus not responsible for or authorized to make capital investments), the benefits of energy efficiency investments do not accrue to the person or entity with the authority to make those investments thereby complicating the decision-making process.

- **Multiple decision makers.** Many capital investments decisions, particularly those requiring non-trivial changes to the infrastructure of a building, require the involvement and approval of multiple levels of decision makers, who each have their own perspectives and criteria for judging the efficacy of those investments. This can greatly delay or even prevent investments in energy efficiency.

3.7.3 OPERATIONAL CHALLENGES

Operational barriers refer to impediments to energy efficiency due to conflicts with the everyday operations of a business. Examples of operational barriers include:

- **Competing business priorities.** For many C&I customers, energy efficiency opportunities must compete for both attention and funding with a wide array of alternative priorities. These competing priorities can vary widely by industry type, building type, and size. Small business customers, in which the business owner is often the sole decision maker for energy efficiency investments, lack the time or expertise to understand and assess the available options and are likely to prioritize investments that improve revenue and thus cash flow. In some industries, such as health care or technology manufacturing, continuity of operations is critical and thus requires that installation of energy efficiency measures be completed with minimal, if any, disruption. In the hospitality industry, customer comfort and satisfaction are the number one priority and will always supersede investments in energy efficiency.

3.7.4 ECONOMIC CHALLENGES

Economic barriers can prevent an energy efficiency project from getting off the ground due to high upfront costs or demanding customer payback requirements. Examples of financial barriers include:

- **Internal competition for capital.** Investments required to upgrade equipment, provide energy management training to staff, or hire outside consultants to provide energy are all often subordinate to other corporate

priorities. In the healthcare industry, hospitals must make large investments to remain in compliance with strict regulatory requirements.

- **Investment and payback criteria.** Many C&I customers require investment paybacks of less than three years making many energy efficiency projects difficulty to justify. Commercial real estate customers, for example, can have a very short investment horizon because they often do not hold onto properties for long-term periods.

- **Energy prices**. Low commodity prices reduce the value of the reductions in energy usage that result from energy efficiency investments and volatile prices create uncertainty about the likely financial benefits of those investments.

3.8 COMMERCIAL & INDUSTRIAL SECTOR STRATEGIC INTERVENTIONS

The PAs have a long and successful history of providing a diverse range of energy efficiency offerings to their C&I customers. As the C&I Sector in Massachusetts evolves along with the energy efficiency technological and policy landscape, the PAs have identified the following strategic interventions as keys to successfully achieving their proposed goals.

3.8.1 STRATEGIC INTERVENTION: EQUITY

As discussed in Section 1, in planning for the 2020-2024 term, the PAs have participated in various efforts to review and address issues around equity in their offerings. Some of these tactics have been developed, while others are still being developed with an eye toward engagement with customers and trade allies to encourage them to install energy-efficient measures and participate in the C&I Sector programs. To address equity, the PAs will focus their efforts on small businesses with a particular focus on microbusinesses, which often are locally owned and operated, and many of these “Main Street” commercial enterprises have been particularly affected by the pandemic. In addition to juggling many roles within a small business, the owners and/or general managers have had to continuously adapt their businesses to new models and changing economic conditions. The PAs are dedicated to efforts that will increase energy efficiency measures within these small businesses, which will in turn help to control some costs for the business itself.

Figure 3-17: Key Findings from Non-Participant Studies (C&I Sector)

Finding	Explanation
Microbusinesses have consistent patterns of lower population savings and account participation rates than other small and non-small businesses.	Microbusiness electric accounts had considerably lower population savings achieved (PSA) metrics than small business electric accounts. Microbusiness participation continues to increase, largely due to the upstream pathways. In 2017, there was a ~70% difference in PSA between microbusinesses (1.07%) and small/non-small businesses (1.82% and 1.81%, respectively). Microbusiness participation rates have also remained 10% to 13% below small business participation rates.
While microbusiness participation rates are relatively low at the account level, viewing participation at the location level reveals that over half of natural gas microbusiness locations have been served over the analysis period.	From 2012-2017, for microbusiness gas accounts, location participation was 53% and current account participation was 6.6%. For small gas accounts, location participation was 65.3% and current account participation was 22.7%. For microbusiness electric accounts, location participation was 34% and current account participation was 8.9% between 2012-2017. For small electric accounts, location participation was 70.1% and current account participation was 44.1%.
While seasonal microbusinesses have lower participation rates than non-seasonal microbusinesses, they do have higher population savings achieved.	Electric microbusinesses have the most seasonal accounts of any size group. In 2017, seasonal accounts made up 7.74% of the microbusiness population and about 5% of total microbusiness consumption. Results show that microbusiness seasonal accounts participate least often compared to non-seasonal microbusiness accounts, small seasonal accounts, and non-small seasonal accounts. Within microbusiness, non-seasonal account participation is higher than seasonal account participation, but seasonal microbusinesses have higher PSA than non-seasonal (1.42% compared to 1.30%). This is the case for all electric PAs, including Cape Light Compact, which has the highest proportion of seasonal microbusiness accounts.
Upstream lighting initiatives have driven a substantial increase in the number of microbusiness participants over the analysis period, but other initiatives, especially turnkey, provided deeper savings for participants and the population as a whole.	From 2012-2017, turnkey microbusiness participants decreased by 34.5%, while upstream lighting microbusiness participants increased by 1,384.5%. Upstream lighting provided the second-highest GWh savings every year in the analysis period.

Small businesses have a number of constraints, including awareness, time, and capital availability. Awareness is key to increasing small business participation in energy efficiency, and the PAs are dedicated to increasing awareness through the addition of newly-translated materials, materials focused on renter-landlord efforts, and door-to-door efforts through the PAs' Main Streets deployments in environmental justice communities. Main Streets efforts often include microbusinesses that typically rent their spaces, and these are keys to addressing equity. The Main Streets offering also has the benefit of providing proactive outreach to businesses rather than relying on them to initiate the service, thereby reducing time constraints. Main Streets also generally provides a comprehensive approach with on-site instant savings measures, so that the business can see savings immediately. In addition, the PAs are exploring other avenues, such as key partnerships and tools that can enhance awareness of potential incentives and the necessary steps to implement energy efficiency measures.

Figure 3-18: Strategic Intervention (Equity)

Strategic Intervention – Equity						
Goals						
• Save energy and reduce demand. • Provide comprehensive services to all small business customers.		• Ensure that there are clear pathways for participation across diverse segments. • Increase participation in previously lesser served communities.				
Barriers	**Example Tactics**	**Tactic Status**	**Customers Impacted**	**Building Type(s)**	**Pathway(s) Involved**	**Time Horizon**
Awareness of services and incentives • Small business owners often juggle a lot of tasks. They may not be aware of offerings. **Split incentives for renters and landlords** • The renter may need to educate the landlord on the benefits of energy improvements. **Driving customers to holistic solutions** • Some customers choose only the projects with the fastest paybacks and/or measures that they have the ability to change. **Reaching new audiences** • Based upon the Non-Participant study, the PAs have begun to identify customers that have not historically participated.	Focus Main Streets efforts on targeted communities (e.g., environmental justice). These will bring the services to the customers in a proactive manner.	M	S	E	P, C	S
	Develop marketing materials focused on renter participation. These will provide an overview of the services and incentives as well as provide materials that can be shared with landlords.	N	S	E	M, P, C	M
	Investigate a small business tool to evaluate all applicable measures. This will ensure that energy engineers are reviewing all measures at once and providing a consistent output to customers statewide.	N	S	E	M, P, C	L
	Commit to offering a statewide online assessment sign-up platform with the focus on allowing customers to sign up at any time and have that effort centralized across the state. This effort builds on the success some PAs have had to date with online sign-ups on their own websites.	N	S	E	M, P	S
	Commit to translating materials in the most commonly spoken languages in MA after English, including Spanish, Portuguese, and Mandarin, while considering additional languages that are widely spoken in certain PA territories. While there have been efforts to translate materials for specific efforts such as Main Streets as well as the midstream efforts, the PAs hope that these new materials will aid in reaching English-isolated customers.	N	S	E	M, P, C	S
	Continue to explore partnerships with groups that are trusted sources. In recent years, the PAs have started to partner with key local partners on implementation of Main Streets and the Community First Partnership Program. They often offer translation services, project management support, and connections with peers on resources. These partnerships can also serve as part of the feedback loop that enhances our services. Please see Section 2.9.2 about small business integration into the Community First Partnership Program.	N	S	E	M, P, C	M, L
	Explore partnerships with renter and landlord housing organizations, real-estate agencies, and with minority business associations to increase program participation rates.	N	M	N, E	P	S, M, L

Tactic Status: Existing (E), Modified (M), and New (N)
Customers Impacted: Small (S), Medium (M), and Large (L)
Building Type(s): Existing (E) and New (N)
Pathway(s) Involved: Midstream (M), Downstream Prescriptive (P), Custom (C), and New Construction (N)
T**ime Horizon:** Short-term (S), Mid-term (M), and Long-term (L)

3.8.2 STRATEGIC INTERVENTION: WORKFORCE DEVELOPMENT

The PAs recognize that their existing workforce development efforts to date have mainly been reactive to market forces and focused on upskilling their existing business partners and have not significantly considered how to engage new market participants (employees of business partners and new business partners). The PAs' approach to overcoming these recruitment and technical proficiency barriers to participation will span an array of tactics, both existing and new, across the full array of C&I customer segments in order to create the most significant market impact as possible.

On March 26, 2021, Massachusetts Governor Baker signed Massachusetts State Senate Bill S.9, *An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy* into law.[57] In light of the enacted legislation, and its changes to workforce development funding, the PAs will partner with the MassCEC to implement workforce development solutions as identified in Section 1.1.3. The details contained in this section are minimum planned strategic interventions, and any impacts from this enacted legislation may alter the PAs' planned activities. The topics discussed here relate to those interventions which impact the C&I Sector.

To ensure the long-term success of the energy efficiency programs, the PAs need a proactive approach to develop new employees who can be placed into jobs with their business partners. The Clean Energy Pathways internship program seeks to increase the supply of qualified HVAC workers and building operators, the diversity of the workforce, and energy efficiency program participation in traditionally HTR communities by creating a career pathway for women, people of color, and low-income young adults. Over the 2022-2024 term, the PAs will strive to train and place approximately 120 individuals into energy efficiency-related careers. In addition, the PAs are also engaging with the marketplace to bring DEI trainings to their business partners, and to proactively reach out to those looking to become part of the ecosystem. In this manner, the PAs can broaden the pool of business partners they rely on to meet their goals and increase the diversity of employees.

In looking to further diversity, equity, and inclusion in the programs, the PAs have also started to create strategic partnerships with local entities. One partnership is with the Emerald Cities Collaborative, a national non-profit organization working to create sustainable and inclusive local economies, to host round tables for WBEs and MBEs. Through these partnerships, the PAs are endeavoring to expand the business partner base that currently leverage the incentive programs and to ensure those organizations have an opportunity to participate in RFPs.

Beyond helping to train and place employees with their business partners, the PAs are working to overcome a lack of customer technical proficiency by engaging with the Northwest Energy Efficiency Council (NEEC) to bring their BOC trainings to building and facility operators. As a mission-driven organization, the BOC works to elevate the profession of the building operator through training in energy efficiency and smart building technologies, continued education, and certification. This newly upskilled workforce provides energy and resource savings to building owners and organizations. By leveraging the BOC trainings, the PAs have found that facilities operators are more prepared to run facilities where incentivized energy-efficient technologies have been installed. The PAs further recognize the challenges their municipal customers are facing and are endeavoring to bring no-cost access to the BOC technical webinar library to them, beyond offering the BOC course series in the state. With over sixty webinars offering

[57] Massachusetts Senate Bill S.9., *An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy*, effective and signed into law on Mar. 26, 2021, Section 13, available online at: https://malegislature.gov/Bills/192/S9.

practical maintenance solutions taught by industry experts, municipal facilities staff can work to develop useful skills to optimize their buildings' energy use on a cadence that fits their schedules.

In looking to diversify areas of expertise of their business partners, the PAs have partnered with the University of Massachusetts at Amherst to create the MAEEP. The partnership has allowed the development of partial or all-day general awareness and technical training sessions with information that will lead to implementation of energy efficiency improvements. The primary purpose of these training sessions is to educate, inform, and equip end-users with tools to identify implementation improvements. The trainings typically include introduction to advanced technologies, tools for understanding the benefits of implementing improvements, and opportunities to make use of resources available through the PAs. In light of COVID protocols, MAEEP was able to pivot to a virtual training environment in 2020 to ensure that the business partners were able to continue to develop their skills. The partnership also allows for participants to obtain CEUs when offered.

At the beginning of each program year, the PAs host a Business Partner Open House where energy efficiency programs are discussed. In addition, the PAs review program performance during the prior program year and plans for the future. As part of these meetings, the PAs offer breakout sessions to review details on specific program offerings, how they are utilized, and the best pathways to leverage them with C&I customers. Beyond the Business Partner Open House, the PAs also work with their contracted vendors on bringing specific training opportunities to them, including sales, industry certification, and measure-specific trainings.

Figure 3-19: Strategic Intervention (Workforce Development)

Strategic Intervention – Workforce Development						
Goals						
• Save energy and reduce demand. • Create a sustainable workforce to support the local energy efficiency and DR industry.		• Attract and retain a demographically and geographically diverse workforce. • Ensure personnel are equipped with skills necessary to deliver current and future energy efficiency and DR portfolios.				
Barriers	**Example Tactics**	**Tactic Status**	**Customers Impacted**	**Building Type(s)**	**Pathway(s) Involved**	**Time Horizon**
Diversity, Equity & Inclusion (DEI) • Some customers have language barriers that may prevent or discourage participation. Additionally, some customers may be more likely to trust business partners that have a similar cultural background and understanding **Technical Proficiency** • Workforce tends to focus on specific areas of expertise. • Customer's facility staff not trained to manage new advanced technology **New Market Entrants** • Vendors report there are not enough qualified candidates • Non-participants do not know energy efficiency is a career opportunity	Offering DEI trainings to contracted vendors and Business Partner network	N	S, M, L	E, N	-	S
	Clean Energy Pathways is designed to create an internship that targets ethnic minorities and women in cohorts to develop and place new entrants into positions in the clean energy market	N	S, M, L	E, N	-	S
	PAs maintain a close relationship with business partners to gain insight on workforce needs as well as customer feedback to develop training protocols	N	S, M, L	E, N	-	M
	Continue to conduct workforce trainings such as energy-efficient technologies, building codes and standards, and building above code. Specialized contractor trainings will push for more comprehensive energy projects and to increase the adoption of new and emerging energy-efficient technologies. Workforce trainings will include but are not limited to: advanced lighting design and controls, HVAC equipment and systems, including heat pumps, and refrigeration tuning and controls	E	S, M, L	E, N	-	S, M
	PAs recognize the benefit of BOC for all facility operators and are targeting municipal facility managers specifically. PAs will continue to offer trainings regarding advanced energy-efficient technologies and controls and will explore offering tuition reimbursement to municipal representatives	E	L	E, N	-	S
	Work with Business Partners to identify transferable skills and promote opportunities to current workforce	N	S, M, L	E, N	-	S, M
	Marketing and outreach to business partners to gain new entrants to the energy efficiency programs	N	S, M, L	E, N	-	M

Tactic Status: Existing (E), Modified (M), and New (N)
Customers Impacted: Small (S), Medium (M), and Large (L)
Building Type(s): Existing (E) and New (N)
Pathway(s) Involved: Midstream (M), Downstream Prescriptive (P), Custom (C), and New Construction (N)
T**ime Horizon:** Short-term (S), Mid-term (M), and Long-term (L)

3.8.3 STRATEGIC INTERVENTION: IMPROVING PARTICIPATION THROUGH GREATER AWARENESS, UNDERSTANDING, AND ACCESSIBILITY

Limited awareness, understanding and accessibility of energy efficiency opportunities is an impediment to greater program participation. Additionally, given the tremendous diversity of the C&I customer base in the state, there is great variation in the extent and type of organizational and informational barriers that must be addressed to overcome these impediments to participation.

Some, primarily smaller C&I customers simply lack the staffing capacity to investigate efficiency opportunities while others may have sufficient staffing capacity but lack the technical knowledge to understand or evaluate available opportunities. Still others may have both the capacity and knowledge to be aware of and understand the technical opportunities but are not able to translate that into a sufficiently compelling business case in order to obtain or authorize funding, particularly in light of competing priorities.

For the 2022-2024 term, the PAs' approach to overcoming these organizational and informational barriers to participation will span an array of tactics, both existing and new, across the full array of customer segments and sizes as well as participation pathways in order to positively impact as many customers as possible. The PAs are committed to making additions to and improvements in the information that is provided to customers as well simplifying the materials needed to participate in the programs. In addition to redesigning and simplifying all the incentive application materials, the PAs have begun, and will continue, to develop additional information about the various participation pathways (Midstream, Downstream, Prescriptive, and Custom) and the benefits and applicability of each. This provides customers greater flexibility in choosing the pathway that works best for them given the particular nature of their project, their preferences, and decision-making criteria.

Similarly, the PAs have begun and will continue to reorganize and update information on the statewide website, MassSave.com. Information will be provided regarding the complete array of financial and technical resources the PAs provide, the pathways through which those resources are available, and the types of products and projects the PAs support across all end-use categories. In addition, the PAs will be providing segment-specific information to build awareness and understanding of the options available to specific kinds of customers. The goal is to minimize the effort required for a customer to find relevant and useful information. An assessment of the structure and navigation of MassSave.com will be completed and the results of that assessment will be key in guiding the website's redesign.

In addition, the PAs and DOER will finalize direction for and convene a C&I working group, which shall meet four times a year during the 2022-2024 term and will be co-led by the PAs and the DOER. The key focus of this group will be direct engagement with customers and contractors who have experience with the programs. The charter of the C&I working group will be developed jointly by DOER and the PAs, with input from the working group. The charter will contemplate conducting detailed surveys and the sharing of survey results providing independent feedback and input from a sufficiently sized and diverse spectrum of C&I stakeholders, especially contractors and customers. Information to be gathered should be representative of the diversity (e.g., customer size and industry segment, contractor end-use/focus, etc.) of the stakeholder population. The working group will share and discuss how the PAs have considered and incorporated that input into their program design and implementation activities. Additional stakeholders will be EEAC councilors with C&I expertise and other expert stakeholders who will identify the C&I customers and contractors they are authorized to represent. The size of the working group will be sufficiently limited in order to facilitate candid exchange and to foster administrative efficiency.

Figure 3-20: Strategic Intervention (Improving Participation with Greater Awareness, Understanding, and Accessibility)

Strategic Intervention – Improving Participation With Greater Awareness, Understanding, and Accessibility						
GOALS						
• Save energy and reduce demand. • Increase C&I participation rates.		• Expand awareness of energy efficiency opportunities. • Simplify and streamline offerings.				
Barriers	**Example Tactics**	**Tactic Status**	**Customers Impacted**	**Building Type(s)**	**Pathway(s) Involved**	**Time Horizon**
• **Organizational** ○ Limited technical expertise to understand, identify and act upon energy efficiency opportunities ○ Insufficient awareness of available technical and financial resources available to support efficiency investments ○ Difficulty determining and conveying the value of efficiency investments to internal financial decision makers	Redesign and simplify incentive application materials and processes by reorganizing and consolidating along major end use categories	M, N	S, M, L	E, N	P, C	S
	Simplify, streamline, and calibrate C&I Sector portfolio and pathways	E, M	S, M, L	E, N	M, P, C, N	S
	Reorganize, update and expand portfolio content for C&I customers on MassSave.com including information organized both according to end-use category and business or building type	E, M	S, M, L	E, N	M, P, C, N	S
	Increase use of native language marketing and outreach materials using the languages most commonly spoken in MA beyond English (Spanish, Portuguese, Mandarin), particularly in communities and segments showing historically lower participation	N	S	E	P, C	M, L
	Develop and deploy segment-specific content for target markets that speaks to customers using relevant peer-to-peer comparisons	E, M, N	S, M, L	E, N	M, P, C, N	S, M, L
• **Informational** ○ Low level of awareness of benefits of energy efficiency ○ Lack of confidence in realizing energy savings resulting from energy efficiency projects	Provide web-based registration for small businesses to request facility assessments	M, N	S	E	P	S
	Conduct brand awareness study to gain deeper understanding and identify opportunities to increase engagement among groups with historically lower participation.	N	S, M, L	E, N	M, P, C, N	S
	Research and provide publicly available tools for assessing project analysis for small business customers	N	S, M	E	M, P, C	S

Tactic Status: Existing (E), Modified (M), and New (N)
Customers Impacted: Small (S), Medium (M), and Large (L)
Building Type(s): Existing (E) and New (N)
Pathway(s) Involved: Midstream (M), Downstream Prescriptive (P), Custom (C), and New Construction (N)
Time Horizon: Short-term (S), Mid-term (M), and Long-term (L)

For the 2022-2024 term, the PAs will focus additional attention on small businesses to overcome both informational and organization barriers which are often more acute with this large population of customers. In order to improve accessibility for small business customers, the PAs will provide a web-based tool so these customers can request facility assessments to identify savings opportunities. While some PAs already provide this capability on their own internal websites, this new tool will be made available on the MassSave.com website thus allowing any small business in the state to take advantage of this capability. Also, the PAs will provide additional outreach and communications using native language materials, particularly in areas of the state that have experienced historically lower participation rates, perhaps in part due to language barriers.

To address the challenges some customers may have in valuing investments in energy efficiency, the PAs are exploring available tools that will enable customers to conduct a simple techno-economic analysis of their project. Designed primarily for simple, relatively small projects, these tools will enable customers to evaluate their energy use and demand reductions, as well as the financial impacts from their energy efficiency investments.

3.8.4 STRATEGIC INTERVENTION: TECHNICAL ASSISTANCE & TOOLS

Technical assistance and tools are critical in making C&I energy efficiency a strategic value proposition. Organizational and operational barriers that may impede the energy efficiency program participation are as diverse as the C&I marketplace itself, resulting in a variety of energy efficiency program offerings. Customers may need understanding on the value of energy efficiency, or they may struggle with competing priorities and often overlook energy efficiency quantification as it may not be their top priority. For example, customers who have unique or specialized equipment, like laundromats, may be focused on the number of shirts/clothes cleaned per hour, while a restaurant owner may be more occupied with maintaining the aesthetics and quality of their cuisine and customer satisfaction. Additionally, C&I customers often struggle with techno-economic analysis required to substantiate their incentive applications and are overwhelmed with program requirements. For example, small business customers do not have the time, staffing, or skillset to consider performance data prior to installing insulation or lighting controls. The purpose of continuing to innovate and develop technical assistance tools and training is to help customers understand the cost-value proposition, streamline the requirements, and increase program participation.

For the 2022-2024 term, the PAs will continue to communicate with customers through trade allies and engineering and implementation vendors who are specialized by customer segment and size and are well equipped to deliver targeted pathways to energy savings and GHG emission reductions. Further, the PAs will continue to provide access to unbiased technical assistance provided by a network of independent energy advisors (TA vendors) drawn from a pool of private sector engineering consultants that meet the PAs' criteria for expertise and experience. The PAs will also improve and expand their technical trainings offered to facility personnel so energy efficiency best practices can be shared and heightened recognition for efficiency opportunity can be developed. PAs will educate customers and business partners about electrification through trainings and targeted technical assistance. PA internal resources and independent outside technical experts will continue to be leveraged for technology or industry-specific trainings. Creating unique savings opportunities requires technical expertise and knowledge of energy efficiency program guidelines, therefore, the PAs will continue to support workforce development efforts in technologies such as heat pumps, integrated controls, weatherization and building controls. Additionally, the PAs will offer trainings to diverse customers, vendors, and trade allies through organizations such as MAEEP to help nurture and grow expertise in the field of energy efficiency and decarbonization.

Custom express calculators allow for readily quantifying the savings and GHG emission reductions associated with projects being considered for implementation. These tools are designed or in development to target sectors (small business), initiatives (ESPO) and end uses (lighting). For the 2022-2024 term, the PAs will continue to update and revise existing tools for industry standard practices or energy efficiency code and associated existing building conditions. For example, the PAs intend to develop weatherization and heat pump tools for vendors and customers to identify cost-effective weatherization and electrification projects. The PAs envision that this easy-to-use tool will increase program participation and foster faster adoption of comprehensive measures such as weatherization and small business commercial sector electrification efforts. In the short term, the PAs will continue to serve all customers by promoting scoping studies and energy assessments that identify savings opportunities and determine electrification readiness through independent engineering firms who can quantify savings and support project development to facilitate implementation. While every customer has different needs, the PAs will continue to expand the delivery model for fast-track review of semi-complex projects with automated underlying savings and cost-benefit calculations. The relative rigor of the review is expected to align with the scope of potential implementation (e.g., energy savings and GHG emission reductions potential and proposed incentive amounts).

Figure 3-21: Strategic Intervention (Technical Assistance & Tools)

Strategic Intervention – Technical Assistance & Tools	
GOALS • Reduce GHG emissions, save energy and reduce demand. • Streamline statewide program delivery. • Increase consistency. • Increase the capability and capacity of vendors to design and implement electrification projects.	• Support customer and vendor engagement through education and outreach. • Reduce cost of program delivery. • Maintain high program realization rates. • Identify and quantify savings and GHG emissions reductions most relevant to customers.

Barriers	Example Tactics	Tactic Status	Customers Impacted	Building Type(s)	Pathway(s) Involved	Time Horizon
Consistency in decision making processes • Businesses require calculations to support applications for incentives • Customer of all types and sizes need assistance with existing conditions, standard practice, and code requirements to assess savings • New technologies require understanding prior to adoption • Programmatic ease of use and participation • Multiple pathways for similar projects necessitates deeper understanding of program delivery options • Proliferating energy efficiency requires knowledgeable and agile staff capable of identifying customers' unique savings opportunities	Provide sector based (small business tool), initiative-based (ESPO LCTM, grocery) industry based, end use based (HVAC, lighting) and technology based (kitchen hood, transformer, heat pumps) approaches to customers.	N	S, M	E	C	M
	Develop a weatherization tool for vendors and customers to easily identify cost effective weatherization projects for small business customers.	M	S	E	C	S
	Develop a tool for vendors and customers to easily identify energy savings, GHG emissions reductions, and costs impacts of electrification.	N	S, M	E	M, P, C	S
	Review support services for customers that have invested in the expansion of automated systems (MBCx, EMIS, EMS, fault detection), as the implementation of measures can help offset the initial capital investment.	E, M, N	S, M, L	E, N	M, P, C, N	S, M, L
	Improve and expand upon technical trainings offered to facility personnel at customer or vendor sites. Recruit technical experts to deliver technology or industry-specific trainings (i.e., compressed air, labs, RCx) on energy efficiency and GHG emissions reductions best practices .	M, N	S, M, L	E, N	M, P, C, N	S, M, L
	Increase equitable access to the MAEEP trainings by continuing to offer these trainings virtually (as well as in person). Also, continue to use MAEEP to help train the market on new developments in energy efficiency while targeting specific areas of growth needed in industry.	M, N	S, M, L	E, N	M, P, C, N	S, M, L
	Conduct techno-economic analysis of emerging technologies prior to consideration for implementation and incentivizing to drive market decisions (MTAC, etc.).	E, M	S, M, L	E, N	M, P, C	M, L
	Continue to simplify the delivery model for fast-track review of semi-complex projects with automated underlying savings and cost-benefit calculations. The relative rigor of the review should align with the project scope (e.g., savings potential, GHG emissions reductions, and proposed incentive amounts).	E, M	M, L	E	P, C	S, M

Figure 3-21: Strategic Intervention (Technical Assistance & Tools)(continued)

Strategic Intervention – Technical Assistance & Tools						
Barriers	**Example Tactics**	**Tactic Status**	**Customers Impacted**	**Building Type(s)**	**Pathway(s) Involved**	**Time Horizon**
	Continue to develop prescriptive offerings and Custom Express tools based on technology and rigor of savings in alignment with program regulations and guidelines.	E, M	M, L	E	P, C	S, M
	Improve existing technical and project-management support to enable project identification and completion.	M	M, L	E	P, C	S, M
	Continue to offer on-site consultative engineering assistance through both statewide and targeted (third-party) offerings to guide customers toward efficient options, evaluate vendor proposals, and facilitate savings submissions.	E, M	M, L	E	P, C	S, M
	Expand ways to connect customers with engineering firms for energy audits and pay for scoping studies.	E, M	M, L	E	C, N	S, M
	Develop new approaches to leverage and complement existing building energy compliance needs (example: BERDO, PACE).	N	L	E	C	S, M
	Continue to work with regulatory agencies to drive synergies in approaches resulting in effective utilization of resources (e.g., Working together with DOER to standardize energy audit guidelines and templates for auditing municipal sector buildings).	M	M, L	E	M, P, C, N	S, M
	Develop comprehensive, strategic offering and tool to ease participation, streamline program delivery and ensuring the smallest businesses can benefit to stretch beyond turnkey measures.	N	S	E	C, P	M, L
	Continue to grow Zero Net Energy pathways through the new construction efforts.	M	S, M, L	N	N	S, M, L
	Develop case studies and other marketing materials to help risk-averse customers overcome their concerns. Use printed materials, publications, testimonial videos (of efficient manufacturing plants), and site tours.	N	S, M, L	E	M, P, C, N	S, M
	In addition to energy and cost savings, inform customers of the GHG emissions reductions associated with measures being considered so they have the information necessary to act on their internal GHG reduction goals.	N	S, M, L	E, N	M, P, C, N	S

Tactic Status: Existing (E), Modified (M), and New (N)
Customers Impacted: Small (S), Medium (M), and Large (L)
Building Type(s): Existing (E) and New (N)
Pathway(s) Involved: Midstream (M), Downstream Prescriptive (P), Custom (C), and New Construction (N)
Time Horizon: Short-term (S), Mid-term (M), and Long-term (L)

The PAs are committed to providing streamlined and comprehensive C&I Sector program delivery that keeps pace with the existing and forthcoming compliance demands and advancements in technology and innovative approaches to program implementation. This process begins with techno-economic analysis of emerging technologies in groups such as MTAC that reviews the energy savings appropriateness of technology, codes, and standards prior to consideration for implementation and incentivizing to drive market decisions.

For example, the New Construction Team aligned the program delivery to incorporate pathways supporting Zero Net Energy (ZNE) and is considering adopting building Energy Use Intensities (EUI) for incentive determination. Further, to acknowledge that all customers may not achieve ZNE but desired maximum efficiency, the PAs will offer additional New Construction pathways to support these efforts. Similarly, the PAs are committed to continue their work with regulatory agencies to drive synergies in approaches resulting in effective use of resources. For instance, the PAs have worked with DOER to standardize energy audit guidelines and templates for auditing municipal sector buildings. As new technologies emerge in the market, the PAs will continue to develop case studies and other targeted marketing materials to help risk-averse customers overcome their concerns for implementation, productivity loss, and more.

While every customer has different needs, the PAs will continue to deploy and partner with independent technical energy advisors to maximize savings from end uses such as lighting, HVAC equipment, building envelope, and process and refrigeration based on need and applicable program/initiative. The PAs will strive to provide bundled solutions and develop technical assistance tools that facilitate comprehensiveness. Additionally, the PAs will also continue to advance innovative approaches to empower customers to review their energy usage data once projects are implemented for greater savings persistence. For example, the PAs use an EUI-based approach and incentivize post-install commissioning on new construction projects. This post-install feedback loop is critical in moving customers through their energy journey.

Ultimately, this strategic intervention plays a critical role in spurring customers to take action and initiate implementation of energy efficiency projects. The PAs will continue to develop a more comprehensive measure mix with the flexibility to support unique approaches of energy savings despite market or policy changes. As the programs expand from widget-based energy efficiency options to systems-based energy efficiency strategies, the PAs will continue to develop and prioritize comprehensive technical assistance solutions and training that drive efficiency and support market innovation for their C&I customers.

3.8.5 STRATEGIC INTERVENTION: REDUCING GHG EMISSIONS

The Commonwealth's goal of electrifying the built environment dovetails with the PAs' efforts to advance energy efficiency and demand response. In the 2022-2024 term, the PAs will pursue low EUI through the electrification of new buildings, emphasize weatherization as a valuable energy efficiency investment and enabling measure, and provide increased support for the electrification of existing and failed HVAC systems in existing buildings.

NEW BUILDINGS

In Massachusetts, building heating and cooling are one of the leading sources of GHG emissions. Fossil-fueled heating equipment (furnaces and boilers) are the primary heating technologies used during the winter months and air conditioning loads are the main contributor to peak electric consumption in the summer months. The electrification of heating systems in new buildings is a logical first step in addressing the equipment and design savings that can help bring a building from baseline efficiency to these greater EUI reduction tiers while presenting an option for

developers and design engineers to potentially reduce the onsite carbon footprint of a building. For the 2022-2024 term, the PA's incentive structure is designed to provide increasing incentive rates to customers who achieve higher levels of savings relative to baseline. The PAs will continue to support buildings that push for the greatest reductions in GHG emissions. In the 2019-2021 term, the PAs launched a re-structured set of pathways or tiers for customers constructing new buildings. Paths 1 and 2 capture an important segment of the commercial building stock (those looking to be leaders in the efficient building sector), and the impact of these design-level decisions will have lasting impacts over the life of the buildings.

For the 2022-2024 term, the PAs will work to increase confidence and experience in the design and building industry regarding high-performance building design that lower GHG emissions per square foot compared to current new construction practices. While it may seem counterintuitive, given the "showcase" nature of many high-efficiency buildings, the reality is that many design and construction industry practitioners tend to be conservative, especially when it comes to building comfort. Buildings can be complicated not just to design, but to operate, and many systems interact in ways that can be unexpected. Modeling can help reduce the uncertainty associated with the performance but ultimately, architects and engineers are legally liable for their designs, and even progressive firms are likely to seek to minimize risk. The tendency to rely on traditional HVAC systems that are tested can be a difficult barrier to overcome. The PAs hope that by developing case studies of successful projects, and by convening customers and industry practitioners, they can help facilitate the "normalization" of non-traditional approaches to building and system design and the increased acceptance of high-performance building designs.

EXISTING BUILDINGS

During the 2022-2024 Plan term, the electrification of existing heating systems in commercial buildings is something that the PAs will continue to emphasize in order to reduce GHG emissions and overall energy usage. The vast majority of the building stock that will exist in 20 years has already been constructed. While new construction represents an obvious opportunity to design a building with efficiency in mind, most buildings are likely to experience incremental improvements in efficiency incrementally, via equipment replacement or renovation. Large-scale "gut renovations" represent an opportunity to make significant overhauls in HVAC system design, but these projects are the exception, rather than the rule.

When assessing HVAC electrification opportunities in existing buildings, the PAs will be working with customers that have a diverse array of heating, cooling, and distribution systems. While the PAs will work with vendors and customers to promote heat electrification, they expect these projects to be most practical for customers when existing heating systems are in already need of replacement and there is an underlying need to modify or replace the distribution system. While high-efficiency heat pumps may be capable of serving the entire heating load of a building, the PAs expect the partial displacement of fossil-fuel systems to be the predominant use-case for customers considering electrification due to both technical and economic reasons. More so than for other many other technologies, the economic rationale for heat electrification often depends not just on the age, distribution layout, and fuel type of the heating system, but also on the cooling system.

Commercial buildings, especially larger ones, are more likely to be sited in locations that have access to natural gas. While this has resulted in reduced heating costs for many customers for years, the continued low cost of natural gas relative to electricity means that heat electrification is often not an economical investment. Even in situations for which heat electrification may be cost effective from a programmatic standpoint, it may not always be economical from a customer standpoint (heat electrification may cost more in terms of project and operational expense than a

natural gas option). There are certainly situations in which a customer may opt to pay more for heat electrification—such as corporate sustainability goals—but the non-economic nature of that decision raises questions of the role of ratepayer funds, program attribution, and free-ridership.

Customers who do not have air conditioning may be interested in installing a heat pump to provide cooling in the summer and as a supplemental heating source for shoulder seasons. While installation would be sized for cooling load, not heating, the system would still be able to partially displace heating during the cooler months. Such a scenario is one which the PAs expect to be fairly common, as it does not require a major retrofit of the existing heating system and can easily replace window air conditioner units if they exist.

While commercial heat electrification retrofits, especially large ones, are likely to be complicated, the PAs acknowledge that a large proportion of commercial customers with small heating and cooling loads will have more standard installations. In response to feedback from distributors, manufacturers, and installers, the PAs developed an offering for C&I customers installing small heat pumps in 2020. For these small systems, the PAs found that the equipment being installed in residential and small commercial facilities was often identical and was often being installed by the same base of installation contractors. Because the Residential Sector represented the most installations of this equipment and had established minimum efficiencies and qualified products lists, the PAs designed the C&I Sector offering to mirror the residential effort as much as possible.

While this offering specifically pertains to small split and central heat pump systems, this represents the equipment most suitable for the majority of C&I customers. For the 2022-2024 term, the PAs will explore ways of expediting GHG and energy savings estimation and incentive determination for larger and more complicated systems. As an ongoing effort, the PAs seek to leverage the scale and market reach of distribution channels, while enabling installation contractors with greater ability to leverage more generous incentives, especially in situations where there are fuel-switching opportunities. While this may not eliminate the need for "custom" estimates of savings and incentives based on project specifics, it will provide greater clarity to customers and installation contractors as to the best pathway for participating in GHG emissions reductions efforts and energy efficiency and the level of support that the PAs can provide. The PAs will also continue to stay engaged with internal and external evaluation staff to better understand how heat pumps are operated in customer facilities. To the extent that customers are successfully using heat pumps to displace fossil fuels, the PAs will seek to ensure that the programmatic funds expended result in demonstrable value for ratepayers.

HVAC systems in commercial buildings are often much larger and more complicated than those typically found in homes and are subject to more stringent ventilation and comfort requirements. The PAs work with manufacturers, distributors, and installers to better understand the specific circumstances under which heat pumps are being installed to either displace or replace fossil fuel-fired systems as well as the customer economics of such systems. At the same time, the PAs will develop tools to expedite savings estimation and create pathways that standardize offerings for heat pumps where feasible.

The PAs expect that customer HVAC decisions and controls optimization by installers will continue to be a challenge to the successful deployment of heat electrification at scale. Heat pumps have different O&M considerations than fossil fuel-fired systems and customers will need some time to become accustomed to this technology. Additionally, the optimization of heat pumps when installed alongside fossil fuel-fired systems adds complexity and an additional control point that can lead to less-than-optimal system performance. The PAs have found HVAC controls settings, whether in the form of relatively simple thermostats or more extensive building automation systems, to be a thorn in

the side of facilities managers and program evaluators alike; this is likely to continue to be a challenge as heat electrification grows.

As part of their efforts to advance electrification, the PAs intend to develop specific offerings for commercial building types that support a cost-effective, standardized, statewide approach to weatherization services. To the extent better insulated buildings have reduced heating and cooling loads, weatherization may be an important enabling measure for some building owners who are interested in electrifying their heating system, especially if energy costs remain at their current levels.

As part of a more comprehensive approach to helping customers manage energy investments and usage, the PAs plan to design and implement a Deep Energy Retrofit offering which will further support commercial building electrification and GHG emissions reductions. The PAs have already been discussing Deep Energy Retrofit with external experts and practitioners to understand what has and hasn't proved successful and will be incorporating that feedback into their eventual offering. Finalizing the details of the offering will take place over the remainder of the year enabling a launch in 2022. It is important to understand that DER projects are not simply a combination of individual investments or decisions; instead, Deep Energy Retrofits involve more systematic forethought and intentionality that leads to investments and decisions over time that result in highly impactful energy savings and GHG emissions reductions. A key focus of the PAs' development effort will be on designing and implementing the Deep Energy Retrofit offering in a manner which will eventually lead to adoption at scale.

More than with typical measure- or system-based projects, successful Deep Energy Retrofit deployment requires a deep combination of both technical and financial assistance. Engineering support is crucial to identify opportunities and technical solutions and, critically, to identify the proper sequence of improvements (e.g., right-sizing loads in advance of upgrading equipment) -- by implication, the interdependencies between equipment or systems must be explicitly considered rather than focusing simply on finding the most energy efficient option for any one piece of equipment or system -- i.e., there is a "path dependency" that must be consciously considered. Additionally, given the magnitude of the commitment, investment and technical complexity associated with Deep Energy Retrofit projects, it is critically important to be able to engage fluently with customers in not only technical terms, but also in investment and financial terms in order to guide and influence their decisions.

The PAs propose to track customer progress separately that will establish a baseline using existing conditions, identify the measures that contribute to the reductions, and measure the GHG emissions reductions in the building. In tracking progress, the PAs also plan to remove any extraneous factors (i.e., building use change) to directly measure reductions against the set baseline. The PAs will look at retrospective baselines prior to the pandemic and seek to claim savings in the 2022-2024 plan for any installed measures as well as the overall net reductions that are not currently claimed at a measure level.

The PAs believe customers themselves can be a great source of creative energy efficiency project ideas and solutions. To further encourage customers to invest in electrification and GHG reductions while also inspiring and leveraging the creativity of those same customers, the PAs plan to develop a GHG reduction competition(s). Competitions will be developed for specific customer and/or building types such as micro-businesses, landlord owned buildings, large C&I buildings, small businesses in environmental justice communities, etc. Customers whose retrofit projects are selected, based on predefined criteria, will be provided with specially designed financial supports and technical assistance. Ultimately, the PAs hope to motivate customers to submit projects which substantially reduce energy consumption and GHG emissions.

Figure 3-22: Strategic Intervention (Reducing GHG Emissions)

Strategic Intervention – Reducing GHG Emissions						
GOALS						
• Lower GHG emissions, save energy and reduce demand. • Provide customers with options that meet their economic, technical, and environmental needs, and GHG reduction goals.		• Motivate customers to think comprehensively about building design, construction, and operation.				
Barriers	**Example Tactics**	**Tactic Status**	**Customers Impacted**	**Building Type(s)**	**Pathway(s) Involved**	**Time Horizon**
• HVAC retrofit electrification could result in higher capital and operational costs. • Many existing commercial building systems have technical barriers to full electrification. • The market does not have extensive experience with heat pump technologies and design elements. • Building commissioning is more focused on functionality as opposed to the performance and optimization of systems. • Market perception is that low EUI/highly efficient buildings come with significant added costs. • Commercial weatherization remains challenging to deliver cost-effectively at scale but can be an enabler of the electrification of heating.	Provide the market with more transparent information for evaluating electrification options and pathways, including incentives and total system costs.	E, M, N	S, M, L	E, N	M, P, C, N	S
	Design and implement a Deep Energy Retrofit offering to enable as part of a more comprehensive approach to helping customers managing energy investments and usage.	N	S, M, L	E	C	M
	Promote electrification where appropriate and work with customers to develop HVAC solutions that best suit their needs.	M, N	S, M, L	E, N	M, P, C, N	M, S
	Offer financial assistance intended to promote the role of energy efficient design and technical assistance in the development process for new buildings.	M	S, M, L	N	N	S
	Engage the Commonwealth as the state's largest property holder to set a leadership example in GHG emissions reductions by making specific commitments to electrify state buildings.	N	L	E	C	S
	Develop various methods of publicly recognizing and celebrating those customers who are exhibiting significant leadership in and commitment to electrification and GHG emissions reductions.	N	S, M, L	E		S
	Increase emphasis on post-occupancy building consumption to encourage customers to support energy performance commissioning.	M	M, L	N	N	S
	Facilitate information sharing regarding best practices in design and construction, as well as per square foot cost metrics.	M	M, L	N	N	M
	Address gaps in the skills and experience through workforce development efforts to train on operations and maintenance of electric heating systems.	N	S, M, L	E, N	C, N	M

Tactic Status: Existing (E), Modified (M), and New (N)
Customers Impacted: Small (S), Medium (M), and Large (L)
Building Type(s): Existing (E) and New (N)
Pathway(s) Involved: Midstream (M), Downstream Prescriptive (P), Custom (C), and New Construction (N)
Time Horizon: Short-term (S), Mid-term (M), and Long-term (L)

3.8.6 STRATEGIC INTERVENTION: CONTINUOUS IMPROVEMENT & PORTFOLIO EXPANSION

Massachusetts has been offering energy efficiency programs for decades, and these programs have led the country for several years. The Commonwealth has one of the most mature programs in the country. For any program to stay relevant for that long, it needs to adapt and improve to meet the market conditions. As the PAs have been able to move the market to adopt high-efficiency equipment over the years, the PAs continue to expand the C&I Sector portfolio to include asset optimization measures as well as equipment-based measures. These types of energy savings require more engagement with the customers or facility operators and provide less predictable savings, which often means that achieving deeper energy savings at a facility is more expensive. Facing these challenges, the PAs will need this strategic intervention to achieve energy and GHG emissions savings in a cost-efficient manner across all customer segments.

The PAs continuously engage with other efficiency programs across the country to find new approaches and enhancements that can be adapted to fit within the Massachusetts regulatory framework. They typically go through iterations and follow a deliberate process of research, test, design, and then delivery through existing or new C&I Sector program delivery pathways. Through groups like MTAC and internal resources, the PAs will continue to move new measures through this process to bring them to the market. A recent example of this includes the Equipment and System Performance Optimization (ESPO) low-cost tuning measures. Market research showed customer equipment could be better maintained and operated, so the PAs created a pathway to motivate customers to optimize their existing equipment and controls. For the low-cost repeatable measures, the PAs created a series of custom express tools to make participating as easy as possible while capturing energy savings and reducing GHG emissions. In addition to these improvements and expansions the PAs plan to add a statewide weatherization offering to the C&I Sector portfolio to achieve additional energy savings and increase customer participation. They will also investigate the potential to achieve a more comprehensive measure mix in the small business segment with a new online audit tool for small business vendors.

With increasingly challenging goals, the PAs will need to attract customers who have not participated frequently in the past and increase the size of the energy efficiency workforce in the Commonwealth. Moreover, with the increasing complexity of systems-based measures and comprehensive energy retrofits, the energy efficiency workforce will need to grow and improve. Workforce development in this context can be seen as an enabling tactic that ensures the marketplace has enough qualified professionals to deliver energy efficiency. Therefore, the PAs are dedicated to building on their existing workforce development efforts by expanding the BOC initiative by offering more classes and attempt to expand access to the MAEEP trainings by offering them remotely and in person. With investments in the communities and workforce of Massachusetts, the PAs are ensuring the continued long-term success of the energy efficiency programs.

Figure 3-23: Strategic Intervention (Continuous Improvement and Portfolio Expansion)

Strategic Intervention – Continuous Improvement and Portfolio Expansion						
Goals • Lower GHG emissions, save energy, and reduce demand. • Increase average savings per participant. • Increase customer participation. • Increase operational efficiency.						
Barriers	**Example Tactics**	**Tactic Status**	**Customers Impacted**	**Building Type(s)**	**Pathway(s) Involved**	**Time Horizon**
• Past success means the low hanging fruit is largely gone. • Expanding beyond widget-based measures adds complexity and less predictable savings. • Comprehensive energy retrofits are more expensive to achieve. • The market lacks enough knowledgeable building operators.	Go beyond installing efficient equipment for deeper energy savings by helping customers optimize the operation of their assets.	E, M	S, M, L	E	P, C	S
	Develop a comprehensive assessment tool for small businesses to achieve energy savings beyond lighting measures.	N	S	E	M, P, C	L
	Continue to use MTAC to assess new technologies as they become commercially available and increase the portfolio of offerings.	E	S, M, L	E, N	All	S
	Bundle measures and measure categories and offer greater incentives to achieve deeper energy savings.	N	S, M, L	E	C	L
	Develop prescriptive weatherization and air sealing offerings.	N	S, M, L	E	P	L
	Adopt more custom express tools to streamline custom calculations and provide consistency across the state.	M	S, M, L	E, N	P, C	L
	Facilitate successful implementation of energy efficiency projects by expanding on current workforce development efforts and offering more training courses each year.	M	M, L	E	C	M
	Increase ease of participation by developing new C&I applications that are easier to understand and access.	E	S, M, L	E, N	P, C, N	S
Tactic Status: Existing (E), Modified (M), and New (N) **Customers Impacted:** Small (S), Medium (M), and Large (L) **Building Type(s):** Existing (E) and New (N) **Pathway(s) Involved:** Midstream (M), Downstream Prescriptive (P), Custom (C), and New Construction (N) T**ime Horizon:** Short-term (S), Mid-term (M), and Long-term (L)						

As the PAs pursue more comprehensive energy savings at customer facilities, they must find ways to improve internal operations Recently the PAs launched a redesign of their application forms. The new forms will be easier for customers to understand and access and will also reduce the time spent by the PAs in processing applications. Another area where the PAs have and will continue to streamline their processes is with the development and use of custom express calculators. With the use of custom express calculators for frequently implemented measures, PA engineers can reduce the time spent reviewing measures and help to streamline the evaluation process. Additionally, to help control costs, the PAs intend to prioritize the bundling of measures. By packaging high-cost savings measures with low-cost savings measures, the PAs will be able to achieve deeper energy savings for customers without significantly inflating their budgets. This strategic intervention will be integral in helping the PAs reach their goals while staying within their budgets.

3.9 COMMERCIAL & INDUSTRIAL SECTOR PROGRAM DESCRIPTIONS

The PAs provide their C&I customers with a wide array of technical and financial supports and services support investments in cost-effective GHG emissions reductions strategies and energy efficiency. These supports and services are provided to customers considering the construction of a new building, planning a major renovation of an existing building, upgrading existing systems or equipment, or replacing systems or equipment that have or soon will fail, and are intended to educate customers about and motivate them to choose the most efficient, cost-effective options across all end uses regardless of industry or building type.

The PAs have developed participation, energy and demand reduction goals, budgets, and cost-effectiveness and cost-efficiency projections that represent best estimates to realize their C&I Sector vision and have assessed the cost effectiveness of the proposed portfolio. The PAs will strive to meet the cost-effectiveness and performance projections for the C&I Sector while acknowledging that potential market changes will influence the final outcome.

The figure below summarizes the PAs' projected energy savings and demand reduction, budget, benefit, cost-effectiveness. and GHG emission reduction projections for the C&I Portfolio of Programs and associated Core Initiatives.

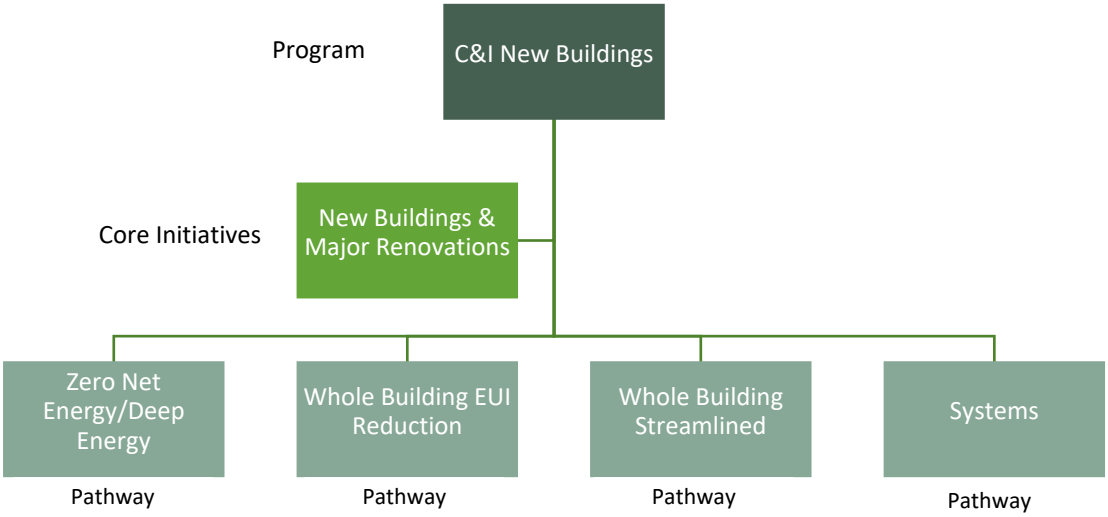
Figure 3-24: 2022-2024 Planned Performance Summary – C&I Sector Portfolio

Planned Results	Projection
Total Statewide Budget	$1,501,226,870
Net Annual All-Fuel MMBtu Savings	8,457,040
Net Lifetime All-Fuel MMBtu Savings	90,387,996
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	287,787
Total Benefits	5,023,513,986
Projected Cost Effectiveness (BCR)	2.5
Net Annual Electric MWh Savings	850,193
Net Annual Natural Gas Therms Savings	22,706,170
Active Demand Reductions (Net MW)	154.6

3.9.1 C&I NEW BUILDINGS PROGRAM

The PAs work with customers planning new buildings or major renovations to help them achieve the lowest GHG emissions, lowest EUI and greatest energy efficiency possible. The PAs have developed multiple participation pathways to provide options that meet customers' needs whether they are contemplating a ZNE building, minimizing EUI across an entire building, or simply replacing individual systems or equipment that have or are soon to fail. The New Buildings & Major Renovations Core Initiative is discussed in further detail in the sections below.

Figure 3-25: C&I New Buildings Program – Core Initiative and Pathways



The figure below summarizes the PAs' projected energy savings, budget, benefit, cost-effectiveness and GHG reduction projections for the New Buildings Program.

Figure 3-26: 2022-2024 Planned Performance Summary – C&I New Buildings Program

Planned Results	Projection
Total Statewide Budget	$93,779,089
Net Annual All-Fuel MMBtu Savings	758,977
Net Lifetime All-Fuel MMBtu Savings	11,479,295
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	34,668
Total Benefits	511,464,508
Projected Cost Effectiveness (BCR)	4.2
Net Annual Electric MWh Savings	62,589
Net Annual Natural Gas Therms Savings	3,367,416

C&I NEW BUILDINGS & MAJOR RENOVATIONS - CORE INITIATIVE

OVERVIEW

The PAs work with all customers and on all building types, regardless of project size, complexity or function, to help achieve the lowest EUI and greatest energy efficiency possible in new buildings or major renovations. For the 2022-2024 term, the PAs plan to offer four participation paths to drive customers to the most progressive solutions for new construction and major renovation projects:

- Paths 1, 2 and 3 (see figure below) are comprehensive whole building pathways that consider all energy systems and the entire building design in an integrated fashion, where the two EUI-based participation pathways (1 and 2) offer the highest available incentives.
- Path 3 is available for customers who may not be ready or able to focus on EUI targets and whose projects, due to size and scope, are more cost effectively served without the need for an energy model.
- Path 4 is available for customers who engage late in the design/construction timeline but may yet be influenced in decisions regarding certain equipment for partial building new construction projects (e.g., tenant fit-outs), small projects (i.e., below 20,000 sq. ft.) and projects that may not be conditioned whole buildings, such as parking garages.

Multifamily projects are handled collaboratively between the Residential, Income Eligible, and C&I Sectors depending upon the measures and metering with the largest projects participating in one of the pathways below. For details on smaller multifamily projects (under 4 stories), please see Section 2.10.2 and 2.11.1. The figure below summarizes the PAs' projected energy savings, budget, benefit, cost-effectiveness and GHG reduction projections for the New Buildings & Major Renovations Core Initiative.

Figure 3-27: 2022-2024 Planned Performance Summary – C&I New Buildings & Major Renovations (Core Initiative)

Planned Results	Projection
Total Statewide Budget	$93,779,089
Net Annual All-Fuel MMBtu Savings	758,977
Net Lifetime All-Fuel MMBtu Savings	11,479,295
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	34,668
Total Benefits	511,464,508
Projected Cost Effectiveness (BCR)	4.2
Net Annual Electric MWh Savings	62,589
Net Annual Natural Gas Therms Savings	3,367,416

By engaging customers early in their project timeline, the goal is to unlock maximum opportunities for cost savings, technical support, and optimal energy efficiency and energy use reduction. Both building owner and design team incentives are available to help cover the incremental construction and design service costs associated with the inclusion of energy-efficient equipment and systems. By working together from the project's feasibility or conceptual design phase, customers can achieve deep energy savings, and even ZNE status, to minimize future energy use and operating costs while reducing their building's carbon footprint.

ELIGIBILITY

Participation in the C&I New Buildings and Major Renovations Core Initiative is available to all active, or soon to be active, non-residential electric and/or natural gas customers who contribute to the energy efficiency funds.

OFFERINGS

The PAs offer two main sources of support and value: (1) technical assistance and (2) financial assistance. Technical assistance can take a variety of forms including design charrettes, technical guidance on energy efficiency and EUI reduction strategies, whole building energy modeling, and mid-design feedback. All technical support is intended to identify and assess GHG emissions reductions and energy efficiency and usage reduction opportunities and inform customers' project development and decision making.

Financial assistance consists of a range of options including prescriptive and custom incentives, as well as cost sharing for engineering services, post-occupancy verification support, or other energy and energy efficiency-related activities. The goal of this support is to help customers identify, evaluate, and fund GHG emission reductions and energy efficiency opportunities in a manner which motivates and enables them to undertake projects that result in greater levels of energy usage, cost, and GHG emissions reductions than they would otherwise have achieved.

DESIGN AND DELIVERY

Due to the large variation in new construction projects and the wide range of customer priorities, aspirations and constraints, there is a range of pathways tailored to meet customers' expectations. These pathways are shown in the figure below.

STRATEGIC ENHANCEMENTS

For the 2022-2024 term, the PAs will drive improvements by setting EUI targets with customers early in the design phase and by focusing on post-occupancy performance along with ZNE and Passive House designs. For the first time, the PAs have tied the New Construction & Major Renovation Initiative's incentives and savings to operational performance with the new Path 1 ZNE/Low EUI approach. In this approach, customers must commit to commissioning their project to the equivalent of Leadership in Energy and Environmental Design's (LEED) Enhanced level, including envelope commissioning. Design teams will be required in this path to use energy models to predict operational EUIs, while project teams will look at performance relative to predictions. This is a feedback loop that is sorely lacking in the field but is necessary to bend the EUI curve downward in Massachusetts and the Northeast region.

As part of this effort, the PAs have restructured incentives, hoping to influence more customers to strive for the maximum possible efficiency for their new buildings. For Paths 1 and 2, incentives are now paid on a dollar per square

foot basis, allowing the customer to easily estimate achievable incentive amounts in advance. To motivate customers to go deeper with energy savings, Path 2 will offer incentives on a progressive scale where the incentive rate increases in reverse proportion to the EUI achieved. For the 2022-2024 term, the PAs will introduce a verification incentive designed to motivate customers to compile energy use trend data following occupancy (post occupancy) to determine whether buildings are operating as intended as early as possible. This verification incentive also requires a review of controls to ensure they are operating optimally. Additionally, the Path 3 Whole Building Streamlined approach now utilizes a simplified spreadsheet tool to estimate energy savings for small and mid-size buildings that are less energy intensive. This tool replaces more costly and time-intensive building modeling and allows for faster energy savings and incentive calculations to inform and influence the customer during the design process.

Figure 3-28: New Buildings & Major Renovations Pathways

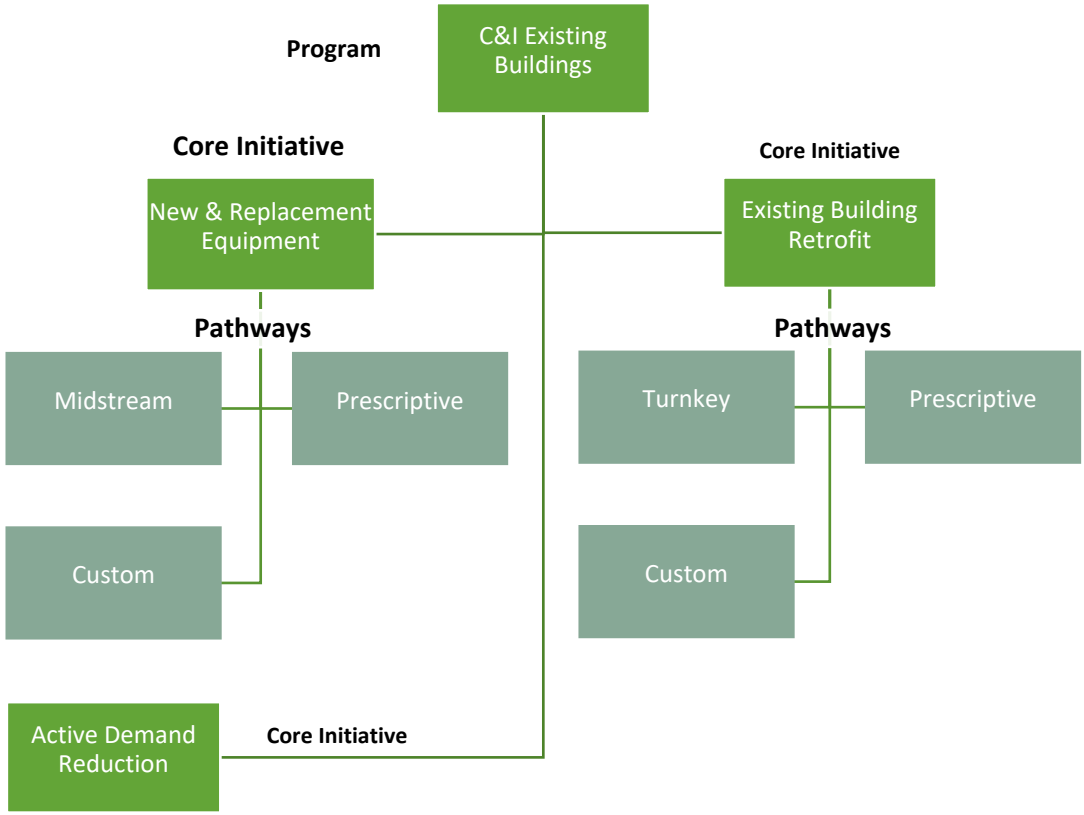
Pathway	Path 1 Zero-Net Energy / Deep Energy Savings	Path 2 Whole Building EUI Reduction	Path 3 Whole Building Streamlined	Path 4 Systems
Project Types	ZNE, ZNE ready, Passive House & Low EUI	Large building, EUI focused	Small to medium-sized, non-energy intensive	Very small or partial building and late engaging customers
Eligibility/ Target Building Sizes	20,000 SF or greater heated & cooled space	50,000 SF or greater heated & cooled space	20,000-100,000 SF heated & cooled space	Any size, as applicable
Objective	Drive projects toward ZNE and a 25 EUI (or negotiated target) in operation; focus on outcomes	Drive projects toward low EUIs	Support for smaller, fast moving projects providing flexibility when spreadsheet analysis could take place of modeling	Support tenant fit-outs, late engagers, and projects not involving entire building to optimize energy efficiency of equipment and systems
Incentive Design	Performance based – both customer and design team incentives with additional certification and optional verification incentives	Customer and design team incentives w/optional verification incentive	Customer and design team incentives	Prescriptive and custom
Incentives*	Customer • Construction - $1.25/SF • Post-occupancy - $1.00 /SF • ZNE or Passive House certification - $3,000 • Design-based technical assistance for ZNE Services – 50% of fee up to $10,000 • Verification – 50% of fee up to $10,000 Design Team • Up to $15,000, not less than $8,000	Customer • 25%+ EUI reduction - $1.25 / SF • 10-24.9% EUI Reduction - $0.35 - $0.75/SF • Design-based technical assistance – 75% cost share up to $20,000 per PA • Verification – 50% of fee up to $10,000 Design Team • Up to $15,000	Customer • Custom – envelope, HVAC, energy recovery, water heating, other - $0.35 / kWh and $2.00/therms • Prescriptive – lighting, VFDs, boilers, etc.– Standard program incentives • Design-based technical assistance – 100% covered by PAs Design Team • Up to $10,000	Customer • Custom and prescriptive incentives for a variety of energy using equipment • Equipment-based technical assistance – up to 50% cost share
Other Costs to PAs	PAs pay 100% of cost of energy modeling and post occupancy model true-up to determine claimable savings			

** Incentives are subject to change.*

3.9.2 C&I EXISTING BUILDINGS

The PAs work with building owners to help them upgrade existing systems and equipment with more efficient options. To meet the wide variety of customer types and sizes, building types, and end uses, the PAs have developed a portfolio of technical and financial support and participation pathways to assist customers regardless of whether they are in need of a one-for-one equipment replacement, upgrading an entire system, or contemplating a custom, multi-end use project. For additional details, please refer to the New & Replacement Equipment Initiative, Existing Building Retrofit Initiative, or C&I ADR Initiative sections.

Figure 3-29: C&I Existing Buildings Program – Core Initiatives and Pathways



The figure below summarizes the PAs' projected participation, energy and demand reduction, budget, and cost-effectiveness and cost-efficiency projections for the Existing Buildings Program.

Figure 3-30: 2022-2024 Planned Performance Summary – C&I Existing Buildings Program

Planned Results	Projection
Total Statewide Budget	$1,333,101,982
Net Annual All-Fuel MMBtu Savings	7,698,063
Net Lifetime All-Fuel MMBtu Savings	78,908,701
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	253,119
Total Benefits	4,512,049,478
Projected Cost Effectiveness (BCR)	2.5
Net Annual Electric MWh Savings	787,604
Net Annual Natural Gas Therms Savings	19,338,754

C&I EXISTING BUILDING RETROFIT - CORE INITIATIVE

OVERVIEW

The Existing Buildings Retrofit Initiative is available to all non-residential customers and supports efficiency and associated DR opportunities for all types of commercial, industrial, institutional, and municipal buildings and operations. The Initiative works with customers to pursue energy and DR 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, equipment reliability and performance to justify investments, and then to support the upgrades as simply and seamlessly as possible.

The figure below summarizes the PAs' projected energy savings, budget, benefit, cost-effectiveness and GHG reduction projections for the Existing Building Retrofit Core Initiative.

Figure 3-31: 2022-2024 Planned Performance Summary – C&I Existing Building Retrofit Core Initiative

Planned Results	Projection
Total Statewide Budget	$1,069,856,314
Net Annual All-Fuel MMBtu Savings	5,977,785
Net Lifetime All-Fuel MMBtu Savings	59,494,840
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	181,926
Total Benefits	3,342,927,871
Projected Cost Effectiveness (BCR)	2.2
Net Annual Electric MWh Savings	615,453
Net Annual Natural Gas Therms Savings	14,329,238

ELIGIBILITY

Participation in the C&I Existing Building Retrofit Core Initiative is available to all active non-residential electric and/or natural gas customers who contribute to the energy efficiency funds. Additionally, eligibility for the small business turnkey pathway within this Core Initiative is restricted to customers using less than 1.5 million kWh and/or 40,000 therms annually.[58]

OFFERINGS

For the 2022-2024 term, the PAs will offer two main sources of support and value: (1) technical assistance and (2) financial assistance. Technical assistance can take a variety of forms including buildings assessments, engineering assessments, and advanced building or equipment/system modeling to identify and assess potential energy efficiency opportunities and inform customers' project development and decision making. Financial assistance consists of a range of options including prescriptive and custom incentives for energy efficiency projects that deliver energy savings. The goal of providing financial support is to help customers identify, evaluate, and fund energy efficiency opportunities in a manner which motivates and enables them to undertake projects that result in a greater reduction of energy usage, costs, and GHG emissions reductions than they would otherwise have undertaken.

DESIGN AND DELIVERY

The PAs understand that there is a large variation in C&I customer size and type, and that each customer segment requires a range of approaches tailored to meet customers' needs and expectations. The figure below details the PAs' customer segment engagement approaches for the 2022-2024 term.

[58] For Unitil customers, eligibility is restricted to those using less than 1.0 million kWh annually.

Figure 3-32: Customer Segment Engagement Approaches

Segments	Medium & Large	Small Businesses	Multifamily
Description	Medium & large C&I customers have a small number of accounts; however, they represent a significant portion of energy consumption in the C&I Sector.	Small businesses can participate in all C&I offerings. However, the PAs have developed pathways specifically to provide turnkey services.	Multi-unit residential use buildings have unique characteristics that require a cross-functional offering. Multi-unit buildings may contain building-level systems more traditionally found in commercial facilities while also consisting of in-unit residential measures.
Objective	The PAs engage in market segmentation to classify and serve these large customers with their unique needs.	Remove barriers and increase participation within the small business category. PAs define small businesses by energy consumption.	Integrated offering of residential and commercial implementation teams to support delivery of services to multi-unit buildings with both residential and commercial meters.
Engagement Strategy	The PAs generally engage with these larger customers through a managed account approach that connects customers directly to resources and offerings best suited to their circumstances.	Small businesses can utilize the Turnkey offering and work with one of the PAs' contracted vendors. There is also a Customer Directed Option if a small business works with a vendor of its choice.	This pathway is supported mainly within the Residential Coordinated Delivery Initiative.
Financial Support	Custom and prescriptive incentives as well as cost-share for technical assistance services.	Custom and prescriptive incentives	Custom and prescriptive incentives.
Technical Assistance and Consultation Services	Customers may receive technical assistance from an independent firm that is contracted with the PAs or from a vendor contracted with the customer. The outcome of technical support is to help customers understand their energy savings opportunities and to act on them.	The PAs provide a Turnkey vendor to provide technical assistance and consultation on Turnkey measures.	The PAs work with contracted vendors to offer the assessment, which provides a path for implementation based upon cost-effective measures.

STRATEGIC ENHANCEMENTS

Due to their wide-ranging customer base, the PAs work to offer multiple pathways in order to best meet the customer's needs. The key areas of focus in this area are: (1) awareness of the offerings, and (2) access to incentives and services that motivate the customer to adopt energy-efficient measures and services in their building. To this end, the PAs are working on some enhancements to support this work during the 2022-2024 term.

The PAs rely on dedicated account managers, contracted vendors, and trade allies to engage customers; however, some customers are still not aware of the full suite of C&I Sector offerings. To increase customer awareness, the PAs are working on updating the statewide website to provide the best possible information about the C&I Sector's energy efficiency offerings. Additionally, the PAs are developing a statewide online platform that will gather information about a customer's building and provide the most applicable information regarding efficiency options.

Outside of the Turnkey offering approach and incentives, customers and trade allies must complete applications to receive incentives. These forms have evolved over the years and the PAs have recently initiated an effort to streamline and consolidate the forms. In addition to the above-referenced efforts, the PAs are committed to reviewing the Mass Save Application Portal (MAP), the online platform to submit applications, for possible improvements.

C&I NEW & REPLACEMENT EQUIPMENT - CORE INITIATIVE

OVERVIEW

The PAs work with customers who are purchasing new equipment or replacing equipment that has failed or is at risk of failing, by encouraging them to opt for the lowest GHG emissions and the most energy-efficient equipment available in the market. Most major commercial equipment continues to be used until the end of its useful life, and the goal of the New & Replacement Equipment Core Initiative is to help motivate customers to purchase high-efficiency equipment, ultimately saving on their energy consumption and costs.

The figure below summarizes the PAs' projected energy savings, budget, benefit, cost-effectiveness and GHG reduction projections for the New & Replacement Equipment Core Initiative.

Figure 3-33: 2022-2024 Planned Performance Summary – C&I New & Replacement Equipment Core Initiative

Planned Results	Projection
Total Statewide Budget	$211,061,380
Net Annual All-Fuel MMBtu Savings	1,709,005
Net Lifetime All-Fuel MMBtu Savings	19,402,588
2030 Annual GHG Emissions Reductions (Metric Tons CO_2e)	71,193
Total Benefits	1,032,868,538
Projected Cost Effectiveness (BCR)	4.3
Net Annual Electric MWh Savings	170,481
Net Annual Natural Gas Therms Savings	5,009,516

ELIGIBILITY

Participation in the C&I New & Replacement Equipment Core Initiative is available to all active non-residential electric and/or natural gas customers.

OFFERINGS

The PAs offer financial support in the form of incentives for a range of measures across a variety of end uses based on incremental cost, which is the price difference between industry standard practice (ISP) or code-compliant equipment, and the higher-efficiency equipment. This is balanced against the incremental savings difference between

the operation of the standard or code-compliant equipment and the high-efficiency equipment over the expected life of the equipment. The PAs guide and influence customers' decision making through energy consulting, qualified product lists, and setting efficiency thresholds. There are multiple measures available through Downstream Prescriptive pathway applications (prescriptive and custom) and the Midstream point-of-sale pathway (formerly known as Upstream) to customers who are installing new equipment or replacing failed equipment.

The PAs plan to continue supporting customers switching from oil, propane, or electric resistance heat to a high-efficiency electric HVAC system and will begin supporting cost-effective natural gas conversions to electric high-efficiency heat pumps. The PAs currently offer a prescriptive heat pump offering for small-sized equipment (<5.4 tons) and will be expanding the availability of all sized heat pumps to customers by offering them through all pathways (Midstream, Downstream, Prescriptive, and Custom). This expansion is to help drive the adoption of heat pumps and reach every customer.

Figure 3-34: Downstream Prescriptive and Custom Offerings

HVAC	Lighting	Process
Natural gas	Interior lighting	New compressors
Furnaces	Interior lighting with controls	Refrigerated dryers
Condensing boilers	Exterior lighting	Additional storage
Wireless enabled and programmable thermostats	Exterior lighting with controls	Zero-loss condensate drains
Infrared heaters	Lighting controls	Enhanced controls
Steam traps		Piping improvements
Faucet aerators		Leak repairs
Showerheads		Motors with VSDs
Electric		VSDs
Heat Pumps		
Room air purifiers		
Motors and VSDs		
VSDs		
Chillers		

The PAs also offer a Custom pathway for any project regardless of end use.

The PAs continually review energy-efficient measures to determine whether they can effectively be provided to C&I customers through a Midstream pathway versus, or in addition to, other pathways such as Custom. For example, the PAs recently added Ultra-Low Temperature (ULT) Freezers to the Midstream pathway given that the customers purchasing these are generally researchers who are working from grants. Submitting applications through a Downstream (prescriptive) or Custom pathway proved to be challenging for them given their grants and inability to apply an incentive check to the purchase. Having the equipment incentivized at the point of purchase through the Midstream pathway allows customers to purchase high-efficiency equipment without conflicting with grant requirements. This addition of ULT freezers (and other cold-storage equipment) to the Midstream pathway also helped proactively mitigate the storage needs required for the COVID-19 vaccines to help support Massachusetts communities during the pandemic.

Another example of the PAs working to serve C&I customers more comprehensively and streamlining the process is the shift to having all commercial foodservice equipment being solely incentivized at the point of purchase through the Midstream pathway. This allows customers to receive incentives instantly for eligible equipment without the need to complete application forms.

Figure 3-35: Midstream Offerings

HVAC	Lighting	Foodservice	Natural Gas Water Heaters
Unitary air conditioners	LED controllable linear lamps and linear lamps with controls	Ovens – combination, convection, conveyor, rack, deck	Storage
Air-source, water source, and geothermal heat pumps	LED linear fixtures and fixtures with controls	Broilers - conveyor and underfired	Tankless (on-demand)
Pump Energy Index (PEI)-rated pumps	High/low bay and high/low bay with controls	Griddle, steamer, fryer	Volume (DHW boiler)
Dual enthalpy economizers	LED exterior and LED exterior with controls	Dishwashers	Indirect
ECM circulator pumps		Refrigerators, freezers, and ice machines	
Variable refrigerant flow heat pumps		Hot food holding cabinets and refrigerated chef bases	
Cold-storage equipment		On-demand commercial electric hand wrap machine	

The PAs periodically review equipment and technology that can be included in the Midstream pathway. For the 2022-2024 term, the PAs are considering the inclusion of commercial electric heat pump water heaters and induction cooktops into the Midstream pathway.

DESIGN AND DELIVERY

When customers are faced with having to purchase a new, or replace a failed piece of equipment, they have a choice between standard-efficiency equipment and high-efficiency equipment. The PAs have multiple pathways available for customers under the New & Replacement Equipment Core Initiative, the Midstream pathway, Prescriptive Downstream pathway, and the Custom pathway. Each pathway is clearly defined with a set of guidelines and requirements allowing customers to participate based on the individual customer's business needs. These pathways provide customers with choices when faced with the need to add new equipment or replace failed equipment. The PAs have worked to align offerings across the Midstream and Downstream pathways to simplify the experience for customers while expanding the portfolio of energy efficiency measures.

Midstream Pathway

The Midstream pathway leverages existing distributor networks and infrastructure to influence thousands of equipment-purchasing decisions that customers and contractors make every day. This provides customers a streamlined participation channel where incentives are provided at the point of purchase on eligible equipment purchased from participating distributors or dealers. This eliminates the need for applications to be filled out and reviewed in advance of the installation. The success of the PAs' Midstream pathway has made high-efficiency equipment more readily available to customers, especially in the instance of emergency replacements, where previously distributors may have only stocked standard efficiency equipment. The PAs require a mandatory pass through of a portion of the incentive to the contractor or purchaser, who is encouraged to pass through the incentive to the customer in their pricing. This allows the PAs to directly promote these offerings to customers and contractors for increased engagement in the pathway.

The PAs have various program requirements in place such as pre-approval requirements, which allows them to engage customers and discuss their potential project allowing upselling of more energy efficiency projects to customers. PAs are also engaged in training distributors to promote upselling and pivoting toward a systems-based approach based on type, size, and quantity of equipment being purchased at distributors' or dealers' locations. Some examples of distributor trainings include lighting controls trainings and presentations, which has led to increased adoption of controls and cross-promotion education regarding other energy efficiency offerings. Additionally, the PAs send follow-up mailings to customers who have purchased equipment through the Midstream pathway promoting other available offerings. This also has helped cross-promote and upsell other opportunities that customers can take advantage of to make their buildings more energy efficient.

Prescriptive Downstream Pathway

Prescriptive incentives are most effective when the customer or the trade ally serving the customer can be actively engaged before the installation of new equipment or replacement of failed replacement. PAs exert influence over the customer and/or the trade ally purchasing equipment directly through involvement of account managers, training of trade allies, and building awareness across customers and industry regarding more efficient options. The prescriptive application process involves reviewing the proposed equipment in advance of the installation which gives the PAs an opportunity to potentially influence (cross promote and upsell) additional energy efficiency measures at the facility.

Custom Pathway

While the Downstream and Midstream pathways offer customers opportunities to access common energy efficiency measures, the Custom pathway provides customers with an opportunity to put forth more complex and/or site-specific energy efficiency measures for consideration within the programs. Typically, these more complex measures require detailed energy efficiency savings analysis, review (or calculation) of measure-specific implementation costs, and, in some instances, inputs from energy modelling programs. This information is required by the PAs to determine if the energy efficiency measures are cost effective and are consistent with other pertinent program guidelines. The Custom pathway allows the customer and PAs the flexibility to consider new technology and advance other cost-effective energy efficiency measures and strategies not offered through the Downstream Prescriptive or Midstream pathways. As increasingly stringent code adoption, rising standard practice, customer awareness, and the success of our energy efficiency programs continues to put pressure on PAs' ability to claim savings for simple equipment replacement, the Custom pathway is a key to creating integrated solutions that create new energy efficiency savings.

Figure 3-36: New & Replacement Equipment Pathways

Pathway	Midstream	Downstream Prescriptive	Custom
Project types	Adding new equipment or replacing failed equipment	Adding new equipment or replacing failed equipment	Adding new equipment or replacing failed equipment
Eligible/target building sizes	Any facility	Any facility	Any facility
Objective	Provide easy access to high-efficiency equipment and lower upfront costs	Widget based or high-efficiency equipment replacement with predefined set of qualification guidelines and active PA participation in decision making process	Widget or systems-based replacement with consultative style engagement and influence of customer decision. Significant PA participation through techno-economic analysis via in-house staff or contracted vendors
Incentive design	Incentives provided at point of purchase on eligible equipment from participating distributors or dealers	Per unit incentives provided for installation of eligible equipment	Incentives provided based on project specific energy savings and economics

STRATEGIC ENHANCEMENTS

During the 2022-2024 term, the PAs' main focus for this Core Initiative will be to support and drive the adoption and installation of heat pumps in non-residential locations, identify opportunities to expand the range of measures offered and work closely with business partners to increase upsell and cross-sell opportunities in the Midstream pathway. The PAs also plan to increase direct-to-customer marketing in order to drive greater awareness of the available opportunities. In addition, the PAs will continue to translate Midstream pathway materials, consider additional native language materials, and will work with environmental justice communities to provide appropriate materials based on the needs of their community.

C&I ACTIVE DEMAND REDUCTION - CORE INITIATIVE

OVERVIEW

The PAs work with C&I customers to target peak system demand reductions. This Core Initiative provides system benefits by reducing the long-term capacity, transmission, and distribution costs that are borne by all ratepayers. Additionally, customers with third-party supply rates subject to ICAP fees may realize additional value through the reduction of coincident demand. During the 2022-2024 term, the PAs will provide ADR offerings for the summer seasons, corresponding to peak system loads.

To a large extent, this Core Initiative's offerings are outcome based and technology neutral; they do not limit how or what technology customers could use when responding to events. Customers can participate in ADR offerings with a wide range of strategies. While not exhaustive, the PAs expect customers to respond with changes to HVAC and chiller system sequences and controls, production and shift scheduling, lighting switching and dimming, refrigeration and process equipment scheduling, and battery storage. Some customers may prefer to develop automated response sequences while others will prefer to engage in manual adjustments to facility systems on equipment during events.

The figure below summarizes the PAs' projected energy savings and demand reduction, budget, benefit, cost-effectiveness and GHG reduction projections for the Active Demand Reduction Core Initiative.

Figure 3-37: 2022-2024 Planned Performance Summary - Active Demand Reduction Core Initiative

Planned Results	Projection
Total Statewide Budget	$52,184,289
Active Demand Reductions (Net MW)	154.6
Total Program Benefits	136,253,068
Cost-Effectiveness (BCR) - Electric-Only	2.6

ELIGIBILITY

This Core Initiative has two primary DR elements: (1) Targeted Dispatch and (2) Daily Dispatch. Participation in the Targeted Dispatch offering is available to any customer with electric interval metering. If the customer does not have an interval meter installed by their utility as part of their electric service or rate class, they or their CSP may install one, provided the data is shared with the appropriate PA at the end of the performance period. Individual PAs may have restrictions with respect to the equipment or technologies used to curtail load.

Participation in the Daily Dispatch offering is open to any customer with an eligible asset that can achieve a reduction in facility demand for up to 60 two- or three-hour events per summer. The PAs may have differing eligibility requirements and will evaluate performance based on the output of the device used or based on the whole building load reduction measured at the utility meter, depending on technology and metering capabilities. To be eligible for this offering, any battery storage systems must be considered a behind-the-meter (BTM) asset. BTM means a facility that serves an on-site load other than parasitic load or station load utilized to operate the facility. In some cases, the PA's DERMS providers can send dispatch signals directly to the customers' CSP, who then sends dispatch signals

directly to customer-owned devices, such as batteries and other participating equipment. This machine-to-machine communication makes it easier for customers to participate.

The 2022-2024 Plan phases out support for fossil fuel generators. Starting in 2022, fossil fuel generators will not be eligible to participate in Active Demand Reduction offerings, including Daily Dispatch or Targeted Dispatch, in 2022-2024. The PAs may provide a transition period of up to one year for existing Targeted Dispatch participants.

OFFERINGS

The Targeted Dispatch offering pays large C&I customers with interval metering capability for actual, measured curtailment of load during events called during ISO-NE system peaks. The PAs work with customer facility staff and CSPs to identify peak load curtailment opportunities that can be curtailed during up to eight targeted events lasting three hours each. Customer performance during each event is assessed using a site-specific baseline and at the end of the season, incentives are paid on a per-kW basis based on average overall performance.

The Daily Dispatch offering pays customers a higher incentive rate for responding to an increased number of events (up to 60 events per summer). This offering gives customers and vendors the flexibility to curtail or discharge electricity in a way that works best for the customer. As with the Targeted Dispatch offering, Daily Dispatch incentives are paid based on average performance at the end of the season.

DESIGN AND DELIVERY

The success of the C&I ADR Core Initiative relies heavily on existing energy efficiency sales teams who regularly conduct outreach to customers to develop efficiency projects. While customers can participate directly, experience to date suggests that most customers prefer to work with a CSP to assess curtailment potential, advise on control strategies, and help implement potential upgrades or equipment that may facilitate greater performance during events.

It should be noted that equipment installed to facilitate load reduction during peak events is fully eligible for incentives through “traditional” equipment-based pathways. Similarly, the PAs’ staff can work with customers and installation contractors to leverage energy efficiency projects for additional value through the ADR offerings where appropriate. Energy efficiency and DR efforts offer two distinct incentives for differing, but complementary, purposes.

Many smaller commercial customers may have HVAC systems which are controlled by the same smart thermostats most commonly found in residences. To the extent that these customers have connected air conditioning loads, they will be targeted by the same marketing efforts that the device manufacturers apply to their residential customers. As with residential customers, the PAs will work to increase the number of smart thermostats installed in commercial buildings with compatible systems and to encourage enrollment.

STRATEGIC ENHANCEMENTS

At present, the PAs’ efforts around EV participation in ADR offerings have been focused on residential EV charging. Both National Grid and Eversource are exploring the efficacy of delivering cost-effective benefits though the curtailment of EV charging during events. Eversource is implementing a demonstration using direct load control of vehicle chargers (frequently referred to as EVSEs). National Grid has been working with manufacturers in an effort to

use vehicle on-board charge controllers. Eversource and National Grid are in the process of evaluating the relative merits of these two approaches, with the goal of implementing a statewide EV demand reduction offering by the summer of 2022.

As outlined in Section 2, National Grid has piloted the control of PV inverters to improve power factor on selected feeders in order to assess whether the improved power factor results in energy savings for all customers on the feeder and provides system benefits for customers. The evaluation of this effort is ongoing as of the filing of this Plan, and if it yields positive results, National Grid plans to include this effort as an offering for customers with eligible residential and commercial PV inverters during the 2022-2024 term. The other PAs have been monitoring National Grid's results and may provide a similar offering at their discretion.

FIVE YEAR INCENTIVE LOCK

As part of the Department's approval of the Daily Dispatch offering in July 2020, the PAs were authorized to offer a five-year incentive lock for participants. The purpose of requesting the lock was to provide prospective developers and customers interested in investing in a battery with a degree of certainty with respect to the incentive rate that the customer could expect to receive by performing in response to daily dispatch events.

In response to stakeholder feedback requesting additional details on how the lock will be applied and administered, the PAs make the following clarifications:

- The "five-year lock" represents a lock on the *rate* at which the PAs will compensate participants for performance in the Daily Dispatch offering. It is not intended to offer a revenue guarantee that a customer who enrolls will receive in any given year or over the duration of their participation.

- To the extent that what constitutes "performance" may change in response to both changing market conditions and other incentive programs, the PAs need to maintain the ability to modify their programs to ensure that ratepayer funds are used to maximize additional or incremental reductions in capacity, beyond what would have occurred in the absence.

- The PAs recognize that there may be other sources of value available to owners and operators of battery assets including SMART adders, Clean Peak Energy Certificate (CPEC) generation, demand charge management, reliability concerns, and that may influence how they choose to charge and discharge their batteries.

- While the PAs did not initially propose a baseline for assessing performance in the first year of the C&I Daily Dispatch offering or for the residential battery offer, the application of a baseline at some point in the future remains a distinct possibility that prospective participants in battery systems should consider when assessing potential incentives from participating assets.

- The PAs are waiting on the outcome of an evaluation study to determine whether a baseline should be applied to their daily dispatch offering.

In response to developer feedback regarding the time required to propose, finance, construct, and interconnect a commercial battery system, which can take several years, the PAs are responding to the concern that this lead time

can substantially cut into the five years of participation from initial enrollment at a known, fixed rate. In order to address this, the PAs propose that for eligible commercial batteries (BTM assets greater than 50 kW), the customer or developer can, upon submission of a completed application for interconnection from their EDC, request a commitment letter from their PA that grants the customer or developer two years from the date of issue to enroll in the Connected Solutions Daily Dispatch offer for a further five years of participation in Daily Dispatch at the incentive rate in effect at the time the offer letter was issued. Any time in excess of two years until the customer enrolls will be counted as part of the five years of participation. In this proposal, the PAs seek to balance future risk of recovering ratepayer funds for program costs many years into the future, with a desire from developers to have increased certainty in their project proposals.

NATURAL GAS DEMAND RESPONSE

As described in Section 1, both National Grid and Eversource have proposed natural gas demand response demonstrations through their gas rate cases and Eversource has an approved gas demand response demonstrations as part of the settlement agreement pursuant to their acquisition of NiSource's Columbia Gas of Massachusetts assets. While the PAs are not proposing additional demonstrations or pilots at this time. The PAs (and National Grid in particular) commit to working with DOER on exploring options for differentiated demonstrations, specifically localized benefits or price response, in the first year of the plan.

3.10 PA-SPECIFIC INITIATIVES

The PAs 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 PAs 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. They may also be based on the governing structure of a PA, 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 PA, with the idea that the programming could be rolled out across PAs if proven successful and cost-effective. The PA-specific initiatives are set forth in Appendix G and represent proposals of only the PA making the proposal.

4. Evaluation, Measurement & Verification

SECTION 4: EVALUATION, MEASUREMENT & VERIFICATION

4.1 INTRODUCTION

EM&V has been an integral component of the efficiency programs in Massachusetts since their inception. The robust EM&V framework supports the development and continuous improvement of cost-effective demand side management (DSM) programs as the programs adapt to changing markets. Evaluation plays an essential role throughout the program lifecycle, from conducting research in support of new program designs and key priorities such as equity and electrification, to developing program theory, assessing demonstration projects for new offerings, and ultimately evaluating verified savings and benefits from mature programs. Evaluation can also track progress toward market transformation and can assess PA contributions to shifting markets toward more efficient standard practices. Massachusetts has invested heavily in EM&V research, and leads the country in terms of comprehensive, in-depth evaluations.

The key purposes of EM&V are to support continuous program improvement and program innovation, ensure accurate and credible impacts, determine cost effectiveness, and support timely regulatory reporting to the Department and ISO-NE. These purposes are interactive and are all equally important.

4.2 EM&V FRAMEWORK

Consistent with previous Three-Year Plans and Department precedent, the PAs propose to continue the evaluation framework that has been successfully used to promote high-quality, third-party EM&V efforts in Massachusetts. It is critical that the state's energy efficiency 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 PAs 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 EEAC will continue to have an oversight role over the EM&V activities of the PAs, which will help ensure consistency, timeliness, and credibility of the results. The EEAC's oversight role will be accomplished through the EEAC's EM&V consultant (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.

The PAs and the EM&V Consultant will continue to work diligently to reach a consensus on evaluation issues throughout the 2022-2024 term. 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 EEAC.

To enable the PAs to fulfill their responsibility to report program savings to the Department with full confidence, an appeals process has been established, through which the PAs may bring decisions made by the EM&V Consultant to the EEAC for review and resolution. This process is implemented through the formation of an evaluation appeals committee (Appeals Committee) of the EEAC, whose responsibility in this area 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 consists of three voting members of the EEAC, including DOER. Consistent with general EEAC proceedings, the Appeals Committee will include and consult with, in both deliberations and decision making, a representative of both the PAs and the EEAC'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 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 Department. The PAs 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 areas of differences specific to evaluation without proceeding to the Appeals Committee. This is a testament to the professionalism, hard work, and collaborative engagement of the PAs and the EM&V Consultant. The PAs are continuously looking for opportunities to improve evaluation processes and address new issues that arise and may suggest updates to the EM&V framework in the future if needed.

The PAs will maintain a statewide focus to the maximum extent possible and review EM&V budgets with the EM&V Consultant. In addition, the PAs will integrate electric and natural gas evaluation efforts to the maximum extent possible. In addition, where possible, the PAs and EM&V Consultant will collaborate on evaluation studies conducted in conjunction with nearby jurisdictions in order to reduce costs. For example, during the 2019-2021 term, Massachusetts participated in regional studies related to residential lighting sales and C&I ADR.

The PAs are responsible for contracting with independent evaluation contractors and ensuring that they meet all required terms and conditions in order to protect customers' safety, property, and privacy and security of customer data. Each PA signs contracts with each independent evaluation contractor in order to ensure their contractual requirements to protect customers are satisfied.

4.3 EVALUATION MANAGEMENT COMMITTEE

The PAs and the EM&V Consultant established the Evaluation Management Committee (EMC) 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 EMC meets monthly and serves as a forum to coordinate evaluation studies and related tasks, resolve issues, and set strategic direction.

The PAs 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. For example, the EMC currently has working groups related to EM&V for ADR, and the EMC is also co-chairing a broader working group on the topic of offering ventilation measures during the COVID-19 pandemic that includes

representatives from PA evaluation staff, implementation staff, engineering staff, and the EEAC Consultants. The EMC will continue to develop working groups, as needed, in order to keep the EM&V process running transparently, efficiently, and effectively.

4.4 DESCRIPTIONS OF RESEARCH AREAS

Consistent with the experience since the establishment of the GCA, the EMC worked collaboratively to develop and refine four market research areas for the 2022-2024 Plan term. These research areas are organized as follows: (1) Residential Energy Efficiency, (2) C&I Energy Efficiency, and (3) Demand (both Residential, Income Eligible, and C&I Sectors), and (4) Special and Cross Cutting. The Special and Cross Cutting research area covers topics that do not fit cleanly into the other areas, and also includes additional specialized topics in which it is particularly important to ensure consistency across research areas and markets. Examples of Special and Cross-Cutting topics include codes and standards, education and training, market effects, marketing, customer profile report, and data management.

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

4.5 TYPES OF EVALUATION FUNCTIONS

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 program populations. Impact evaluations may also include the study of key impact factors to estimate savings and benefits, such as in-service rates and other resource savings, including water and non-utility fuels (propane and oil).

- **Net-to-gross (NTG) studies** refer to specific research that quantifies program influence by estimating free-ridership and the various components of spillover (participant and/or non-participant).

- **Baseline studies** refer to specific research to determine baselines, such as industry-standard practice baselines. Baseline research is sometimes conducted concurrently with impact evaluation research.

- **Measure life studies** research equipment life and the effects of measure persistence. Equipment life is the number of years that a measure is installed and will operate until failure. Measure persistence takes into account business turnover, early retirement of installed equipment, and other reasons measures might be removed or discontinued.

- **Non-energy impact (NEI) studies** refer to research that estimates NEIs of DSM measures, including participant and utility benefits. These impacts include changes such as O&M, comfort, productivity, and avoided arrearages.

- **Cost studies** include research to determine the total and incremental costs of DSM measures.

- **Market effects evaluation** refers to the measurement of the long-term effects that programs or measures have on the structure and functioning of their target markets (e.g., changing product availability and pricing).

- **Market characterization** refers to the systematic assessment of product and service markets for the purpose of improving the design and 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.

4.6 EVALUATION PLANNING AND STRATEGIC EVALUATION PLAN

The EMC has sought to establish a long-term strategic view of EM&V for the 2022-2024 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, input from the EEAC planning workshops held in late 2020, and discussion during a series of eight EMC workshops held in January and February 2021. The EMC workshops included PA evaluation and implementation staff, EEAC consultants, and evaluation vendors, and focused on lessons learned from past studies and priorities for future research. The Strategic Evaluation Plan (Appendix H) summarizes the findings from the workshops and lays out planned topics of evaluation research in the 2022-2024 term.

4.7 EVALUATION BUDGETS

In the 2022-2024 term, the EMC expects to dedicate $47.2 million to EM&V studies. This budget includes funding for independent third-party evaluators to conduct research managed by the EMC and reflects an intention to focus EM&V research on plan priorities, with less research on measures and initiative that are not a key focus of the plan, have been evaluated recently and are not expected to meaningfully change, or are not expected to make a material difference to overall program savings. The budget is a 10 percent reduction from the planned EM&V study budget for the 2019-2021 term of $52 million, which was in turn based on spending in the 2017 program year. For more details on the Evaluation budget, see Appendix H: Strategic Evaluation Plan.

The EM&V study 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, maintenance of the Technical Reference Manual (TRM or eTRM), internal PA staff labor and expenses related to EM&V, non-study consultant costs, and market research undertaken by the PAs. See Section 6 for more information on the Hard-to-Measure Initiative.

4.8 EVALUATION & IMPLEMENTATION FEEDBACK LOOP

One of the purposes of EM&V is to provide information to enhance the energy efficiency programs. Evaluation can contribute to program improvements at all stages of the program lifecycle, from initial program design and formulation to small scale testing, full scale implementation, and refinements of mature programs. The EMC strives to engage program implementers at the earliest stages of program development or redesign. For example, in the 2019-2021 term, EM&V was actively engaged in the redesign of the Non-Residential New Construction program, the refinement of the Municipal & Community Partnership Strategy (now Community First Partnership Program), and the

initiation of a comprehensive Workforce Development program. EM&V provides essential information for program design by providing data on baseline efficiencies, market conditions, and program participation levels. In addition, EM&V performs an important function to check program effectiveness and verify savings.

The PAs 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. The implementation team is often interviewed as part of an evaluation study, particularly for process and market studies. Implementation and engineering staff may also be consulted about detailed project information and customer contacts for projects selected for evaluation.

Once a draft report is available, the draft findings and recommendations 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 findings and recommendations are shared with the Residential Management Committee (RMC) and Commercial and Industrial Management Committee (C&IMC) and their respective working groups, which determine whether it is appropriate to adopt and implement a recommendation. If the PAs 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 into the TRM by PA evaluation staff and into the BCR model by the Common Assumptions Working Group.

Information on EM&V continuously flows in both directions between implementation and evaluation, allowing the implementation teams to seek guidance from EM&V, and the EMC to ensure that they are researching 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 three management committees meet quarterly in Tri-MC meetings to discuss various topics, including evaluations. Finally, PA evaluation staff stay in consistent communication with program implementation staff to stay current on program offerings and suggest relevant data and findings from program evaluation that can inform program strategy.

4.9 COMPLETE EVALUATION STUDIES

In advance of the November 1, 2021 version of the 2022-2024 Plan, the PAs completed over 30 new studies, in addition to other studies previously filed. These new studies include a wide range of evaluation topics in the Residential, Income Eligible, and C&I Sectors, as well as cross-sector evaluation areas. A summary of each of these studies is included in Appendix I and the full set of studies are provided in Appendix J. All currently completed studies are also available on the EEAC's website at: http://maeeac.org/studies/.

5. Statewide Marketing

SECTION 5: STATEWIDE MARKETING

The Statewide Marketing Hard-to-Measure initiative is used to support general statewide marketing efforts and the statewide Mass Save® brand. By creating powerful, engaging and motivating education and marketing strategies, the PAs can increase awareness of the benefits of energy efficiency and drive increased participation in programs and services. Proposed marketing strategies put the customer at the center and consider the unique motivational differences among residential and non-residential customers. This means being aware of, empathetic to, and reflective of the needs of the community. COVID-19 has been a game changer, with many customers facing unprecedented hardship. The PAs recognize these challenges and the need to innovate in order to support the customers' needs. With people spending more time at home, marketing strategies quickly pivoted to engage customers in their homes through streaming video, connected TV, streaming radio, and social media platforms.

Building on the success of digital and social marketing platforms will continue to be a key focus in the 2022-2024 term. Mass Save marketing efforts play a key role as informational sources for customers, connecting them to the energy-saving opportunities best suited to improve their homes and businesses regardless of objective or where they are in their energy efficiency journey. The Mass Save website has become a critical focal point in the state's comprehensive marketing strategy, providing a consolidated one-stop-shop for residents and businesses to learn about energy efficiency, program offerings, and partner opportunities. In 2020, MassSave.com received over 1.2 million unique visitors.

Social media platforms have become an inseparable part of daily life for Massachusetts residents and businesses, with users turning to social media platforms for entertainment, news, and inspiration. Statewide marketing will continue to leverage the strong social media presence built over past terms. With over 130K Facebook followers (www.facebook.com/MassSavers) and nearly 21.8K Twitter followers (www.twitter.com/MassSave), PA marketing and education reach an ever-broadening audience to promote energy efficiency. The social media platforms allow the PAs to tell a unique story that engages and entertains by tapping into cultural moments and trending topics, and to support effective peer-to-peer marketing, allowing customers to become brand ambassadors.

Reaching customers who have not yet participated in Mass Save branded programs remains a fundamental commitment of the PAs. Engaging customers traditionally considered HTR continues to be a core focus of marketing efforts with greater emphasis on diversity and inclusion in the 2022-2024 term.

5.1 MARKETING PLAN OVERVIEW

The ultimate goal of all educational, community outreach, and marketing efforts is to build a culture of energy efficiency in the Commonwealth. 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 PAs' comprehensive energy efficiency programs. For the 2022-2024 term, the core objectives of the PAs' education, awareness, and promotion campaign will 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.
- Ensuring marketing and services are inclusive and representative of the diverse communities served.
- Exploring and deploying targeted marketing to communities where English is not the primary language.
- Utilizing diverse media (e.g., internet, radio, public transit, social media, etc.) to disseminate consistent and clear messages.
- Ensuring that the various strategies work together to ultimately achieve deeper and broader savings.
- Creating awareness and understanding of Mass Save as a trusted statewide resource for all customers' energy efficiency needs.
- Ensuring that customers understand who their Mass Save sponsor is and increasing the awareness of PAs' commitment to their customers.

Through an extensive array of effective messages and an all-inclusive media strategy, the PAs 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 the 2022-2024 Plan. During the 2022-2024 term, the PAs will:

- 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 PA 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 the PAs can better and more consistently target customers.
- 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 platforms, driving customers from Facebook and Twitter to MassSave.com blog articles or program-specific web pages.

As stated above, reaching customers who have not yet participated in Mass Save branded programs, often referred to as HTR customers, remains a fundamental commitment of the PAs. The Mass Save website is currently accessible in English, Spanish and Portuguese, the most common languages spoken across the state, and may include other language tools in the future to ensure accessibility for diverse linguistic populations. The statewide Mass Save phone line offers five different language options (English, Spanish, Portuguese, Russian, and Mandarin). During the 2019-2021 term, the PAs 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 them in the 2022-2024 term.

5.1.1 MASS SAVE®

In 2010, the PAs 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 PAs was to complement their individual PA brands when communicating with residential and business customers about energy efficiency programs.

The PAs 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 PAs have rights to the word mark Mass Save, having obtained federal registration of it on August 29, 2006. Under trademark law, the PAs 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 four three-year plan periods, the PAs 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.

5.1.2 2022-2024 MARKETING

The PAs 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 PAs an opportunity to offer streamlined information, including the online home energy assessment, online rebate processing, access to an online retail marketplace, and online HVAC Facilitation tool, which offer substantial customer experience benefits. The centrality of this website to the PAs' marketing efforts demonstrates the commitment of the PAs to working together for the benefit of customers throughout the state. In 2020, the PAs continued to implement strategic and creative updates on MassSave.com.

The PAs' focus on total customer experience recognizes the entry of the customer through the website as a critical component of that experience. The PAs 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 information regarding Mass Save. The PAs will utilize multiple marketing and branding strategies to facilitate customer perception of individual PAs as trusted energy advisors, leveraging the strong awareness and trust held by existing utility brands. These efforts will support the expansion of messaging and branding strategies into the broader context of energy and environment as a whole, supporting the Commonwealth's expanded policy objectives around electrification, renewable energy, and clean peak strategies.

The marketing efforts include: (1) updating and optimizing the MassSave.com website, (2) posting customer-success stories 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, Instagram, LinkedIn 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. The PAs have also proposed enhanced marketing partnerships with communities (Community First Partnership Program), as discussed above. Because this work will cross sectors and programs, it will be funded through statewide marketing, although the partnerships will be managed primarily by the PA staff responsible for implementing the promoted programs.

The PAs receive monthly status updates on campaign successes and results, allowing them to benchmark and evaluate the effectiveness of their messaging and media planning and adapt the marketing strategies to take into account the results.

5.1.3 MAINTENANCE OF COMPLEMENTARY EFFORTS

While working diligently on the statewide education efforts, the PAs will also continue individually to maintain customer awareness, satisfaction, and participation goals. Accordingly, the PAs will continue their outreach efforts using 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.

6. Hard-to-Measure Initiatives

SECTION 6: HARD-TO-MEASURE INITIATIVES

The PAs classify some of their undertakings as "Hard-to-Measure" initiatives. This set of work describes activities that contribute to or facilitate the PAs' achievement of their goals, but do not, by themselves, directly produce savings. Each sector has Hard-to-Measure Initiatives which are listed below.

- **Statewide Marketing – All Sectors.** The budget in the Statewide Marketing's Hard-to-Measure Initiative is used to support general statewide marketing efforts and the statewide brands, including Mass Save. Program marketing is included in each of the program's budgets.

- **Statewide Database – Residential, Income Eligible, and 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 PAs' statewide energy efficiency database. Statewide database efforts will affect all sectors, with funds budgeted for each sector. Please refer to Appendix A for more information on Mass Save Data and the PAs' statewide energy efficiency database.

- **DOER Assessment – Residential, Income Eligible, and C&I.** The DOER Assessment represents an annual budget for DOER that is assessed.[59]

- **Sponsorships & Subscriptions – Residential, Income Eligible, and C&I.** 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 Department's Order regarding the 2019-2021 Plan and general accepted practice, each sponsorship and subscription expense must be reasonable, prudently incurred, and provide a direct benefit to Massachusetts customers. For additional information on Sponsorships & Subscriptions, please see Appendix K.

- **Workforce Development – Residential, Income Eligible, and C&I.** The PAs 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. The Workforce Development budgets will support the Clean Energy Pathways internship and other PA trainings and workforce activities. Additionally, this budget includes $12 million annually allocated across sectors to be distributed to the MassCEC in accordance with the Climate Act. The PAs charge only external (non-employee) general training to this hard-to-measure category. In addition to the cross-program workforce development costs booked in this hard-to-measure cost category, additional workforce development spending is included in the initiative-level budgets within Sales, Training, and Technical Assistance (STAT). For example, the Residential New Homes Initiative budget for STAT includes continued support for training industry professionals on advanced building practices. For more information on Workforce Development efforts, refer to Sections 1.13 (All Sector efforts), 2.9.3 (Residential and Income Eligible Sector efforts), and 3.9.2 (C&I Sector efforts).

[59] Per G.L. c. 25A, § 11H.

- **Evaluation & Market Research – Residential, Income Eligible, and C&I.** This budget category includes costs associated with the EM&V budget, potential studies, the AESC Study, the eTRM, acquisition of data sets, related labor costs, and other evaluation and market research costs. As the results of this research provides value across programs, these costs are allocated to the Hard-to-Measure Initiative category, consistent with the 2019-2021 Plan. Evaluation and market research costs will be allocated to one or more sectors as appropriate for each activity.

- **EEAC Consultants – Residential, Income Eligible, and C&I.** The EEAC Consultants' budget is managed by DOER and used to support the retention of expert consultants by the EEAC and reasonable administrative costs, in accordance with G.L. c. 25, § 22(c). The EEAC must annually submit to the Department a proposed budget for the "retention of expert consultants and reasonable administrative costs."[60]

- **Research, Development & Demonstrations – Residential, Income Eligible, and C&I.** In their continued efforts to explore new technologies, measures, and solutions available for customers, the PAs set forth this budget to pursue research and development for new technologies, measures, and solutions that may or may not immediately lead to savings. This allows the PAs to be proactive and leaders in innovation. Costs associated with research and development into areas of interest, are charged to this category. Demonstration projects, meeting the definition and intent of recent updates to the Department's Energy Efficiency Guidelines (Guidelines),[61] may be considered, where applicable. Proposed demonstration projects must meet the following criteria:

    - Reasonableness of the size, scope, and scale of the proposed project in relation to the likely benefits to be achieved.
    - Adequacy of the evaluation plan.
    - Extent to which there is appropriate coordination among the PAs.
    - Bill impacts to customers.

    The PAs will seek to identify demonstration project candidates during plan development or propose them within a plan term through a mid-term modification.

- **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. For more information on the Residential HEAT Loan, please see Section 2.12.

- **Residential Education – Residential.** The budget in the Residential Education Hard-to-Measure initiative is used to support public energy efficiency education efforts. For more information on Residential Education efforts, please see Section 2.13.

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[60] G.L. c. 25, § 22(c).

[61] 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. 20-150-A (2021).

- **Low-Income Energy Affordability Network – Income Eligible.** LEAN and the PAs work together to comprehensively serve income-eligible households across the state. LEAN delivers energy programs to income-eligible customers and also represents them in legislative discussions and regulatory proceedings in the state. The LEAN budget is used to pay for their administrative and personnel costs related to program implementation. For more information on LEAN, please see the Income Eligible Sector description in Section 2.11.

7. Closing

SECTION 7: CLOSING

The 2022-2024 Plan sets an ambitious vision and aggressive goals for the PAs over its three-year term. Achieving the Plan's objectives will contribute toward achieving the Commonwealth's climate and net zero emissions goals, improving the equity of energy efficiency programs, and delivering benefits to consumers and businesses throughout the state. The PAs are proud to offer a bold set of programs that prioritize electrification, equity, and workforce development.

As noted earlier in this Plan, the Program Administrators have used the three-year planning process as a time of reflection and to strategically determine what resources are needed to achieve their program goals and what solutions are needed. The Program Administrators are proud of the work and partnerships that have informed the Plan's priorities, strategic interventions, goals, and new and enhanced program offerings over the past year. The Program Administrators provide the Commonwealth with one of the most comprehensive energy efficiency and demand response portfolios in the nation and their programs are regularly emulated by other utilities and administrators. This Plan ensures the Commonwealth maintains its leading-edge status over the next three years.

The Program Administrators are proud to submit this 2022-2024 Plan and to continue the important work of reducing energy consumption, decarbonizing the state's economy, and saving electric and natural gas customers money. The planning process is done, the time to blaze a new trail is here, and the Program Administrators are ready to begin.

Appendices

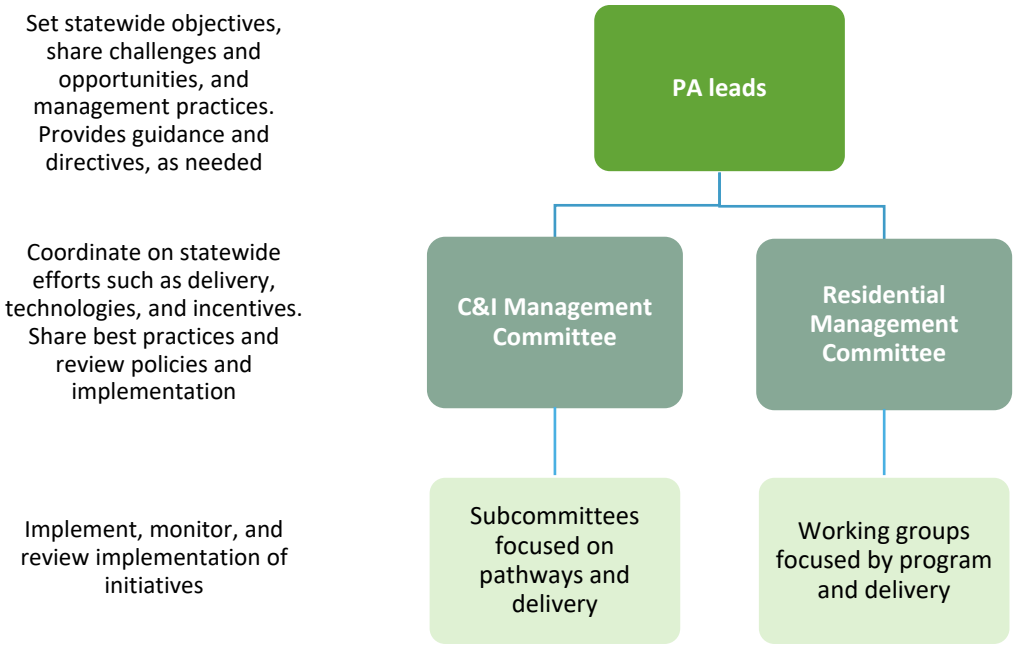
APPENDIX A: STATUTORY AND REGULATORY REQUIREMENTS

A.1 STATUTORY AND REGULATORY REQUIREMENTS

A.1.1 OVERVIEW

Consistent with the GCA, the PAs work together to jointly develop and implement the Three-Year Plans. The PAs 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 PAs continuously develop and share best practices and seek to improve the energy efficiency and programs to provide the best possible service to their customers.

Figure A-1: Management Structure for Program Delivery



In addition to the management groups above, the PAs serve on a number of essential committees and working groups that ensure statewide collaboration among stakeholders and consistency within and across the programs. These committees and groups are detailed in the figure below.

Figure A-2: Committees and Working Groups

Group/Committee	Members and Responsibilities
Low Income Best Practices Group	• Representatives from PAs, CAP agencies, and LEAN. • Discuss program implementation, new measures, innovative strategies, and other matters related to income-eligible offerings.
Evaluation Management Committee	• Steering committee for statewide evaluation activities and issues, program guidance, and direction to each of the evaluation research areas. • Plan, prioritize, and delineate the research studies to be undertaken. See Section 4 for more details.
Massachusetts Technology Assessment Committee	• Proactive and a reactive body. The committee addresses residential and C&I technologies, drawing on the subject matter experts from the committee, PA staff, or outside expertise as necessary. • Authority for consistent program interpretation of technical matters relating to emerging technologies and provides information, documented technical interpretations, and technology assessments.
Statewide Marketing Group	• 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.
Common Assumptions Group	• Maintain consistent application, calculation, and presentation of savings, benefits, and costs.
Demand Working Group	• Works on initiatives related to reducing customer demand, including pilot programs, cost-effectiveness review, and statewide strategies.

A.1.2 STATEWIDE BUDGETS, SAVINGS, AND BENEFITS

SUMMARY OF BUDGETS, LIFETIME SAVINGS, AND BENEFITS

The program budgets, savings, and benefits set forth in the 2022-2024 Plan are presented on an aggregate, statewide basis. As detailed in the Energy Efficiency Data tables, each PA provides its individual recommended savings and budget levels for the three-year term commencing January 1, 2022, consistent with the statewide program designs and Energy Efficiency Guidelines. Please see Appendix C: Statewide Energy Efficiency Data Tables for budgets, savings, benefits, and cost-effectiveness calculations. As described above, the PAs have established key savings metrics in the 2022-2024 Plan that are designed to measure success and support their overall comprehensive approach to reducing energy use for customers. The key savings metrics are:

1. Net lifetime all fuel savings, which is determined by converting all fuel savings to MMBtu savings. The conversion factor takes into account, when converting electric savings, the embedded energy with heat values from a mix of fuels that generate the electricity.

2. 2030 cumulative annual emissions reductions (metric tons of CO_2e).

3. Demand savings (kW) for the electric PAs.

4. Net lifetime electric savings (MWh), excluding fuel conversions and ADR efforts for the electric PAs.

5. Net lifetime natural gas savings (therms) for the natural gas PAs.

Please see Appendix C for more details regarding the use of these core savings metrics for measuring success in the 2022-2024 term. 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 PA's service area, the specific needs of each PA's customers, and the Commonwealth's policy goals related to energy and GHG emissions reductions. The PAs' energy efficiency and ADR programs provide benefits for customers related to avoided costs, NEIs, GHG emissions reductions, and job growth and retention.

A.1.3 STATEWIDE COMBINED, ELECTRIC, AND NATURAL GAS DATA

STATEWIDE COMBINED DATA

Figure A-3: Statewide Adjusted Net Lifetime Savings All Fuels (MMBtu), excluding ADR

	2022	2023	2024	2022-2024
Residential	35,292,442	39,787,436	44,736,060	119,815,938
Income Eligible	9,654,484	10,141,573	10,651,997	30,448,054
Commercial & Industrial	28,190,212	30,070,986	32,115,524	90,376,723
Total	**73,137,138**	**79,999,995**	**87,503,582**	**240,640,715**

Figure A-4: Statewide Benefits ($)

	2022	2023	2024	2022-2024
Residential	1,705,837,783	2,033,876,548	2,446,459,603	6,186,173,933
Income Eligible	554,696,917	576,279,051	605,856,409	1,736,832,377
Commercial & Industrial	1,557,935,050	1,602,840,599	1,862,738,336	5,023,513,986
Total	**3,818,469,749**	**4,212,996,198**	**4,915,054,349**	**12,946,520,296**

Figure A-5: Statewide Budgets ($)

	2022	2023	2024	2022-2024
Residential	$521,996,633	$603,530,790	$723,244,558	$1,848,771,981
Income Eligible	$187,593,394	$198,698,980	$213,028,616	$599,320,990
Commercial & Industrial	$398,966,636	$472,405,213	$629,855,021	$1,501,226,870
Total	**$1,108,556,663**	**$1,274,634,983**	**$1,566,128,195**	**$3,949,319,841**

STATEWIDE ELECTRIC DATA

Statewide tables reflect aggregated proposals of the individual electric PAs.

Figure A-6: Electric PA Net Adjusted Lifetime Savings All Fuels (MMBtu), excluding ADR

	2022	2023	2024	2022-2024
Residential	18,090,428	21,580,049	25,861,741	65,532,217
Income Eligible	3,977,410	4,110,519	4,286,014	12,373,943
Commercial & Industrial	15,407,663	16,663,922	18,327,894	50,399,478
Total	**37,475,500**	**42,354,489**	**48,475,649**	**128,305,638**

Figure A-7: Electric PA Lifetime Electric Energy Savings (MWh), excluding fuel conversions and ADR

	2022	2023	2024	2022-2024
Residential	1,020,684	1,166,450	1,262,741	3,449,876
Income Eligible	282,758	277,791	268,403	828,952
Commercial & Industrial	3,752,246	2,758,804	2,501,759	9,012,809
Total	**5,055,689**	**4,203,045**	**4,032,903**	**13,291,637**

Figure A-8: Electric PA Summer Peak Demand Reductions (MW)

	2022	2023	2024	2022-2024
Residential	93.2	120.1	148.8	193.2
Income Eligible	5.6	5.9	5.8	14.4
Commercial & Industrial	165.3	174.7	192.7	275.5
Total	**264.1**	**300.6**	**347.3**	**483.1**

Figure A-9: Electric PA Budgets ($)

	2022	2023	2024	2022-2024
Residential	$316,794,948	$383,669,528	$484,154,090	$1,184,618,566
Income Eligible	$111,829,638	$115,589,025	$121,447,823	$348,866,487
Commercial & Industrial	$316,116,024	$372,231,307	$514,724,894	$1,203,072,226
Total	**$744,740,610**	**$871,489,861**	**$1,120,326,808**	**$2,736,557,278**

STATEWIDE NATURAL GAS DATA

Statewide tables reflect aggregated proposals of the individual natural gas PAs.

Figure A-10: Natural Gas PA Net Lifetime Savings (MMBtu), All Fuels

	2022	2023	2024	2022-2024
Residential	17,202,014	18,207,388	18,874,319	54,283,721
Income Eligible	5,677,075	6,031,054	6,365,983	18,074,111
Commercial & Industrial	12,782,549	13,407,065	13,787,631	39,977,244
Total	**35,661,638**	**37,645,506**	**39,027,933**	**112,335,077**

Figure A-11: Natural Gas PA Lifetime Gas Savings (therms)

	2022	2023	2024	2022-2024
Residential	171,321,527	182,135,022	189,954,766	543,411,315
Income Eligible	55,244,359	58,709,990	61,948,780	175,903,129
Commercial & Industrial	135,484,629	147,306,158	155,976,147	438,766,934
Total	**362,050,515**	**388,151,170**	**407,879,693**	**1,158,081,378**

Figure A-12: Natural Gas PA Budgets ($)

	2022	2023	2024	2022-2024
Residential	$205,201,685	$219,861,261	$239,090,468	$664,153,415
Income Eligible	$75,763,756	$83,109,955	$91,580,792	$250,454,503
Commercial & Industrial	$82,850,612	$100,173,906	$115,130,127	$298,154,645
Total	**363,816,053**	**$403,145,122**	**$445,801,387**	**$1,212,762,563**

A.1.4 COMMON ASSUMPTIONS AND TECHNICAL REFERENCE MANUAL

The PAs 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 PAs to collectively provide the best available data in a consistent manner. The PAs work together to standardize assumptions and approaches to various costs, savings, and benefits data. The PAs coordinate the application of the avoided costs from the AESC studies and evaluation results. In addition, the PAs collaborate to maintain similar data definitions, measure identifications, naming conventions in the screening models, reporting tables, and the TRM.

Specific program assumptions are accounted for uniformly, and algorithms are applied in the same manner across the PAs, as set forth in the TRM. The TRM documents how the PAs consistently, reliably, and transparently calculate savings resulting from the installation of prescriptive energy efficiency measures. The TRM provides methods, formulas, and default assumptions for estimating energy, peak demand, and other resource impacts from energy efficiency measures. The TRM is an excellent example of how the PAs work together, share data and best practices, and work to develop common assumptions that reflect EM&V results. The PAs have transitioned the paper TRM manual into an electronic version, which is available publicly, provides additional search functions to aid users, and is user friendly. The TRM is available at http://www.masssavedata.com/Public/TechnicalReferenceLibrary. A paper version is attached at Appendix O.

Starting in 2022, new evaluation results will be applied on a prospective only basis instead of being applied both retrospectively and prospectively. The PAs will update gross savings assumptions and net and gross impact factors each year based on the latest evaluation studies and apply them on a prospective basis to calculate savings in subsequent years. At the beginning of each year, the latest TRM will be posted on the electronic TRM at https://www.masssavedata.com/Public/TechnicalReferenceLibrary.

The PAs also apply common assumptions to define participants consistently for statewide programs. In order to be able to review participants in a consistent manner, the PAs develop a set of common definitions to guide each PA's participant calculation. These definitions are designed to reflect unique participants in each program and initiative. Please see Appendix P for participant definitions used in the 2022-2024 Plan.

A.1.5 DEVELOPMENT OF GOALS

INTRODUCTION

The PAs engage in a highly collaborative and detailed planning process for setting savings goals and budgets. This process includes reviewing many conditions that affect savings goals and costs, such as regulatory requirements, the Commonwealth's goals, stakeholder input, program designs, including changes and related opportunities and costs, equitable opportunities and barrier mitigation, market conditions, workforce availability, bill impacts, training, education, and marketing needs to support the programs, PA-specific potential studies, and the energy efficiency needs and objectives of customers within each sector and service territory. The PAs also consider evaluation results including the findings from impact evaluations on claimable savings, and process evaluations to inform programs and goals. 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 PAs. Ultimately the results associated with development of a PA's plan are PA-specific and the planning process for savings varies for each program and initiative; however, certain common processes apply to inform the development of savings goals and to facilitate regulatory review.

PROCESS TO DETERMINE GOALS

PLAN GOALS

GHG Goals

While there were many conditions that affected the savings goals in this Plan, as a primary mandate, this 2022-2024 Plan was constructed to meet or exceed the GHG goal set by the EEA Secretary in accordance with the Climate Act. The Climate Act does not provide a precise method for determining the amount of GHG emissions that are reduced from the Three-Year Plan. Indeed, it contemplates that updates and revisions to the method of calculating GHG emissions will be needed.[62] The 2030 Interim CECP and 2050 Roadmap, however, provide a method for calculating GHG emissions, which the Secretary of EEA adopts in prescribing the GHG Goal.

The July 15, 2021 letter from the Secretary establishing the GHG goals, attached at Appendix D (GHG Goal Letter) calculates the amount of GHG emissions savings based on the amount of energy savings tied to a given measure. Energy efficiency measures within the Plan generally have some amount of energy savings. The GHG Goal Letter multiplies the energy savings for each measure by an emissions factor based on the type of energy being saved, such as electricity or natural gas. The emissions factors for the fossil fuels remain constant, but for electricity, EEA's electric emissions factors assume significant electric grid decarbonization by 2030. This assumption reduces the GHG emission reduction expectations for electric energy savings measures, and leads to relatively higher GHG savings for measures that replace some other fuel with electric consumption.

The GHG Goal Letter also considers the life of the measure when calculating GHG emissions. The GHG Goal Letter provides that the GHG goal is designed "with a view toward [the Plan's] necessary contribution to meeting the limits and sub-limits that will be adopted under the GWSA."[63] The EEA Secretary decided that "an emissions reduction measure must be sufficiently permanent to contribute to meeting, at a minimum, the next two statewide goals adopted pursuant to [the GWSA.]"[64] Thus, the EEA Secretary's expectation is that if a measure's evaluated lifetime ends before 2030, then the GHG emissions savings from that measure are not considered to contribute to the GHG reduction goal. Based on this articulated expectation, and the Climate Act's requirement that the Plan must be constructed to meet or exceed the GHG goal, the Program Administrators designed their measure mixes in a manner that prioritizes contributions to the GHG goal.

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62 See G.L. c. 25, §21(d)(5) (requiring Department to use updated methodology to calculate whether the Plan attains the GHG Goal).
63 See Appendix D, GHG Goal Letter at 2.
64 See Appendix D, GHG Goal Letter at 2.

All Available Cost-Effective Energy Efficiency

At the same time, the PAs' 2022-2024 Plan balances the GHG goal with the GCA's continuing requirement for the Plan to seek 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. There is no simple, algebraic method to evaluate whether the mandate of all available cost-effective energy efficiency has been met. The PAs' 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 the GHG and energy savings goals and 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 markets in which the programs are operating, subject to overall cost. Evaluation results, including impact, 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 PAs learn throughout the planning process related to program design, evaluation, market conditions, costs and other factors.

CONSIDERATIONS

In setting goals, the PAs took into account the requirement to reach the GHG goals, as well as (1) the need to plan for a sustainable effort in the continued delivery of energy efficiency; (2) consideration of new technologies and enhancements; (3) the results of avoided costs, and potential and evaluation studies; and (4) the need to design programs to address identified barriers. The PAs also heavily weighed the Commonwealth's priority of equitable service and realization of benefits for environmental justice communities. In addition to all other items, the PAs took into account many interacting considerations, including, but not limited to, economic and environmental benefits, bill impacts, cost efficiency, integrated program delivery, contractor and market infrastructure, efforts focused on innovation, customer experience, changing market conditions and transformation efforts, and the need to establish an integrated effort that can be sustained over time. In assessing the level of energy efficiency savings that is possible and sustainable for this Plan, the PAs 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) avoided costs; (6) market barriers; (7) commitment to equity; (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; (11) the need to accommodate new technologies over time; and (12) input and consideration of priorities articulated by the EEA, DOER, the AGO, the Council, stakeholders, and public commenters. Ensuring sustainability requires the PAs to examine all of these considerations when developing their energy efficiency goals.

The planning process for the 2022-2024 term included a focus on customers' experiences with the suite of energy efficiency programs, and in particular how to improve the experiences of moderate income residential customers, tenants and owners of residential rental units, English-isolated customers, small businesses, as well as those

customers living in mixed-income multifamily buildings. Significant effort and expertise were dedicated to updating the Residential and Income Eligible programs and initiatives to better serve customers who qualify as low or moderate income. In addition, across all sectors, the PAs updated the design of programs and initiatives in order to enhance delivery of electrification measures. These updates, including a significant investment in workforce training and development, as well as more comprehensive weatherization efforts, will help maximize the achievement of energy efficiency savings and benefits through electrification.

BOTTOM-UP PLANNING

As a foundation for each three-year planning process, the PAs examine historical data to gain insight into participation trends, savings achieved, and the costs to achieve annual and lifetime savings. The PAs also consider recent or pending changes in federal efficiency standards, as well as other third-party research on consumer adoption of new technologies. In parallel, each PA assesses what it individually can achieve over the next three years, while collectively collaborating to decide what changes, if any, need to be made to program offerings. For example, the PAs 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 the 2021 AESC Study, which also guides the PAs as they strive to achieve all cost-effective energy efficiency opportunity.

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

TOP-DOWN PLANNING

While bottom-up planning focuses on individual measures within each PA'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 PA, its participating and non-participating customers. PAs use potential studies for top-down planning, which helps them to better understand the potential opportunity to achieve energy efficiency savings within their service territory. Potential studies typically provide the PAs with insight into three types of energy efficiency potential:

- **Technical potential** is defined as the *complete* adoption 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 estimated 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 customer barriers, market barriers, or other limitations.[65]

The PAs use the results of potential studies to gain valuable insight into the achievable, cost-effective energy efficiency potential for the residential/income eligible and C&I sectors over a period of years. Each of the PAs has performed a territory-specific potential study in advance of the 2022-2024 Plan filing in accordance with the Department's directives.[66] The PAs have diligently worked to coordinate studies to use a consistent set of measures and measure characteristics, and to present findings using common definitions for the various levels of achievable potential, common benefit-cost inputs, and common savings assumptions for high-impact measures, such that study results are comparable. In addition, with input from the EEAC, the PAs established a common study deadline to submit final potential study results.[67] The overall consistency across the PAs' potential studies in terms of timing, formatting, and definitions enhances their value to the Department and stakeholders.[68]

The potential studies consider a wide range of factors to estimate potential savings over time including, but not limited to, the size of the market, economic trends, modeled market penetration and saturation of specific equipment, adoption rates for efficient equipment, costs and benefits associated with efficiency upgrades, and market barriers. In general, the potential studies relied on the TRM - 2019 Report Version (the most recent TRM available at the time of the studies) and net-to-gross assumptions for the current term. The potential studies are intended to provide a top-down estimate and are useful to inform high-level planning but are not intended to provide detailed assessments of potential at the measure level. Potential studies are also not intended to suggest specific program changes, model alternative program designs, or consider GHG emissions reductions. In conjunction with other data sources and experience implementing programs, the PAs use the results of potential studies to approximate the remaining achievable, cost-effective potential opportunity for energy savings over the next three-year period. The potential studies provide one key source to inform overall goals, as well as expected energy savings trends and areas of opportunity for investment.

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 using current incentive levels, up to a "max achievable" scenario, which is the highest achievable level of potential, typically where the PA pays 100 percent of incremental costs of energy efficiency improvements. The PAs 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 PAs also take into account any changes in market conditions, potential program design enhancements, policy directives, and other information that may impact the estimates of available energy savings provided by the potential studies. The PAs share technical potential studies results with each other and are able to benefit from comparing and

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[65] Potential definitions are based on American Council for an Energy Efficient Economy (ACEEE) definitions available at http://aceee.org/topics/efficiency-potential-and-market-analysis.

[66] 2016-2018 Three-Year Plans Order at 24-25; 2019-2021 Three-Year Plans Order at 38.

[67] 2019-2021 Three-Year Plans Order at 38.

[68] 2019-2021 Three-Year Plans Order at 38.

contrasting the work of the different study experts to ensure they are consistently informed on industry best practices and different ways of looking at complex issues. The diversity of perspectives ultimately increases confidence in results. The PA-specific potential study materials are available at Appendix F.

EVALUATION RESULTS

As noted above, the PAs also utilize the results of independent third-party evaluations to inform proposed goals. As part of the statewide EM&V framework, the PAs collectively conduct many different types of evaluation studies, including impact evaluations, baseline studies, NTG studies, market effects evaluation, NEI studies, cost and measure life studies, market characterization, and process evaluations. For more information on each type of study please see Plan Section 4.5 and the Strategic Evaluation Plan at Appendix H.

COST DRIVER CONSIDERATIONS

A final step in energy efficiency goal setting for the three-year term is to develop the budgets required to deliver the energy efficiency programs to the marketplace. This involves assessing the cost impact of the programs on participating and non-participating customers in support of "right sizing" proposed budgets. In the 2022-2024 term, the PAs face new challenges in pursuing all cost-effective energy efficiency, including: (1) reduced savings from lighting as a result of the widespread adoption of energy-efficient lighting technologies such as LED lighting, driven by past PA-led efforts, (2) the achievement of aggressive GHG emissions reduction goals set pursuant to statute, and (3) a continued emphasis on serving low and moderate income residents, especially those residents living in environmental justice communities. The cost of marketing, delivering, and evaluating ever more sophisticated programs is expected to increase in order to capture more complex and deeper opportunities, such as controls, weatherization in the C&I sector, electrification, and demand reduction. Increased efforts and incentives designed to serve customers who have not historically participated in the PAs' programs at a proportional rate will also contribute to increased costs.

To address these challenges and deliver cost-effective energy efficiency programs to their customers, the PAs have developed a thorough understanding of current and future cost drivers for their proposed energy efficiency programs. Because each PA 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 state and impact each PAs' service territory differently. Each PA sets its goals based on its own unique service territory.

Additional details on key cost and savings driver considerations include the following:

- **Measure mix.** As claimable lighting savings decline, the electric PAs will increase investment in other measures that tend to be more expensive per kWh. Therefore, as lighting savings decrease in the portfolio, the average program cost per unit of electric savings will increase. In addition, given the focus on GHG reductions and electrification, the PAs will invest more in incentivizing adoption of heat pumps, which are relatively expensive measures. Moreover, as the PAs strive to meet aggressive goals, they may raise incentives to drive participation, which increases the cost not just for newly acquired savings but also for savings that would have been obtained with lower incentive levels as well. Increased incentives will also tend to drive greater adoption of measures with higher unit savings costs.

- **Increased baselines.** As federal and state building codes and appliance standards become increasingly rigorous, the amount of claimable incremental savings from program-qualifying energy efficiency measures decreases (unless the efficiency of the program measures rise as well). This decrease in savings attributable to the programs results in a higher cost per unit of savings. The Energy Independence and Security Act (EISA) lighting standards continue to increase baseline efficiency levels and therefore decrease program savings, as do federal water heater and other appliance standards. New construction practices in the Commonwealth are increasingly energy efficient due to the GCA requirement that Green Communities adopt stretch codes, aggressive outreach to new construction market actors by the PAs and increasing federal standards for various kinds of equipment and appliances. In addition to increasing efficiency required from updated codes and standards, markets are adopting more efficient practices due to innovation, enhanced technology, and evolution of industry standard practice. This naturally occurring market adoption of efficient equipment and practices is accounted for through evaluation studies, and savings attributable to PAs are adjusted accordingly. While these trends result in real savings for customers in the state, they reduce the incremental energy savings the PAs can capture and claim through their programs. Consistent with the Term Sheet, the Plan specifies how certain baselines will be determined in several scenarios when evaluating and calculating program savings. The agreements in the Plan help bring more certainty to the program implementers as they pursue savings opportunities with customers.

- **Strategies to foster greater participation and deeper savings.** As the PAs seek to increase participation in their programs across all customer groups, they will invest more resources in reaching customer groups that have historically participated at lower levels. This will require financial investments in partnerships, enhanced marketing, more resources in additional languages, and more robust incentives, among other strategies. In addition, the PAs are committed to significant workforce development, which will require investment in recruitment, training, establishing career pathways, and supporting the contractor network as they expand, diversify, and upskill the workforce. These investments are essential to the long-term success of the programs, but do not produce directly claimable savings, and therefore lead to increases in the cost to achieve in the short term.

- **Cost-effectiveness limitations**. The 2021 AESC Study projected lower wholesale natural gas prices, as well as electricity prices, and summer demand prices than the previous iteration (2018 AESC Study). As a result, energy savings are assigned less-per-unit economic value than in prior terms, challenging the PAs to minimize costs and maximize benefits to maintain cost-effective program delivery. The PAs 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.

- **Unique service area drivers.** Despite consistent program offerings, variations among PAs in savings goals and costs to achieve naturally result due to each PA's unique service territory. Each PA'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 PA has unique commercial and residential demographics, which may result in differences in how each PA approaches program delivery.

For example, the service territory of one PA 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 PA 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 the PAs' plans are therefore appropriate, consistent with sound regulatory policy, the GCA, and previous Department recognition of PA differences. In setting their goals, each PA has used its knowledge of its unique service territory, as well as inputs and insights from independent energy efficiency potential studies to design programs that best meet the needs of its customers. All PAs are committed to achieving all available cost-effective energy efficiency in accordance with the GCA.

- **PA collaboration with stakeholders.** As part of the process of developing goals and budgets, the PAs engaged in discussions with the EEAC's consultants on the assumptions that were used for bottom-up planning. The PAs also considered the multiple (and sometimes conflicting) priorities of the EEAC members and other stakeholders in planning for cost-effective savings opportunities in the 2022-2024 Plan. For example, the PAs have included a strong commitment to promoting equity in service as well as a robust workforce development initiative in the 2022-2024 Plan, both of which offer important opportunities that are supported by the PAs as well as the Commonwealth but come with additional costs. Finally, the PAs worked with the DOER and the AGO to review all aspects of the 2022-2024 Plan, including savings and cost assumptions.

SUMMARY

In developing the proposed savings goals, the PAs undertook, individually and collectively, a detailed review of the GHG goals set by the Secretary of EEA and energy efficiency opportunities and costs, with a particular emphasis on meeting GHG reductions, addressing customer barriers, and examining opportunities. This analysis included a bottom-up approach to assess savings opportunities by measure and initiative, a top-down look at GHG reduction goals, overall savings potential, and cost to achieve savings, and careful consideration of evaluation study findings, potential studies, and market changes. Development of the 2022-2024 Plan was influenced by collaborative discussions with the EEAC and stakeholders to better understand key savings and cost drivers across the Commonwealth, considering market development efforts, sustainability of delivery efforts, and bill impacts.

A.1.6 COST-EFFECTIVENESS AND BENEFITS

Cost Effectiveness

The PAs have projected the expected benefits and costs associated with this statewide 2022-2024 Plan to be consistent with the requirements of the Guidelines and D.P.U. 0850-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."[69] A program is cost effective under the TRC test if the cumulative present value of its benefits is

[69] D.P.U. 08-50-A at 14.

equal to or greater than the cumulative present value of its costs.[70] Under the GCA, for the purposes of cost-effectiveness screening, programs are aggregated by sector.[71] As set forth in the Guidelines, an energy efficiency program and core initiative also should be projected to be cost-effective over the term.[72] To conduct the TRC test, the PAs 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 PAs 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 PA costs and program participant costs. PA 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 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 PAs calculate the benefits associated with positive or negative electric, natural gas, oil, propane, water savings, and capacity savings, and energy DRIPE.[73] 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 O&M, longer equipment replacement cycles and productivity improvements, reductions in costs associated with reduced customer arrearages, service terminations, and reconnections, and other measurable benefits due to the installation of the energy efficiency.

In accordance with the Guidelines and the Climate Act, the calculation of program benefits includes calculations of the social value of greenhouse gas emissions reductions, except in the cases of conversions from fossil fuel heating and cooling to fossil fuel heating and cooling. The PAs engaged the 2021 AESC Study vendor to perform additional research in order to determine an appropriate value in advance of the final Plan filing. The resulting study is available at Appendix Q.

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.

Benefit Analysis Components

Overview

The PAs 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 demand reduction initiatives, each of which are described further below.

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70 Guidelines § 3.4.3.1.
71 G.L. c. 25, § 21(b)(3), as revised by Acts of 2018, c. 227.
72 Guidelines § 3.4.3.1.
73 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.

Avoided Energy Supply Cost Study

To develop avoided supply costs, the PAs 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 PAs, state agencies, and other interested parties throughout New England. In order to inform the initial draft of the 2022-2024 Plan (must be submitted to EEAC by April 30, 2021), the *2021 AESC Study* was completed on March 15, 2021. The 2021 AESC Study is available at Appendix Q.

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 *2021 AESC Study* provides an updated assessment of avoided electricity, natural gas, and delivered fuel costs using a model that simulates the operation of the New England wholesale energy and capacity markets in an iterative, integrated manner. The *2021 AESC Study* projected lower wholesale natural gas prices, electricity, and summer demand prices than the previous iteration (2018 AESC Study). The *2021 AESC Study* also provides a literature review of social cost of carbon methodologies, including a recommended value. The recommended value is applied in the initial draft of the 2022-2024 Plan, pursuant Senate Bill 9 - *An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy.*

Pursuant to *An Act Creating a Next Generation Roadmap for Climate Policy*, St. 2021, c. 8, which requires the calculation of program benefits to include the social value of GHG reductions, the PAs have applied a value for the Social Cost of Carbon value to all measures except fossil fuel heating and cooling measures. The PAs engaged with the 2021 AESC study vendor to perform an updated review of the Social Cost of Carbon, which is attached at Appendix Q.

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 O&M 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 PAs" and found that the benefits of the NEIs are quantifiable and flow to Massachusetts ratepayers.[74] The Department has specifically stated that non-resource benefits should be included in cost-effectiveness.[75] Consistent with Department precedent, the PAs have included the benefits associated with NEIs established in evaluation studies in the program cost-effectiveness calculations.

[74] 2013-2015 Order at 61.
[75] Guidelines at §§ 3.4.4.1, 3.4.4.2.

For the 2022-2024 term, the PAs will include NEIs not filed in previous Three-Year Plans and will apply pre-existing NEIs to other programs as set forth below:

- **Income Eligible Multifamily NEIs for Health and Safety.** Producing annual NEI benefit recommendation due to weatherization programs in income eligible, multi-family housing. The study will be finalized by July 1, 2021 to inform the final draft plan.

- **C&I Update Scoping Study, April 2020.** Provided a gap analysis to prioritize areas of needed C&I NEI research. This study will provide recommendations for research but not NEI values.

Demand Reduction

The 2022-2024 Plan includes ADR initiatives. Unlike passive demand reduction measures, active demand savings and benefits accrue during specified and limited time periods. Under the proposed initiatives, ADR measures will be called on to perform during specified dispatch events and the claimed savings will be based on customer performance during those called events. Due to these unique characteristics of ADR measures, the PAs developed a methodology for appropriately accounting for costs and benefits in the TRC test. The methodology was first utilized in the 2019-2021 Plan and will continue to be utilized in the 2022-2024 term.

Economic Development and Job Growth and Retention

Another positive effect of the energy efficiency programs in Massachusetts has been green job growth and retention. As further explained in the Workforce Development Section, the PAs 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.

A.1.7 COST CATEGORIZATION AND BUDGET REQUIREMENTS

OVERVIEW

The PAs have developed consistent definitions and methods of assigning and allocating budget costs across all five program implementation cost categories. With respect to salaries and overhead, each PA has developed their own methods to allocate these costs to appropriate cost categories. For vendor costs, the PAs utilize uniform practices to assign these costs based on cost-causation principles.

PROGRAM IMPLEMENTATION BUDGET COST CATEGORY DEFINITIONS

The PAs developed and refined the program implementation cost category definitions over several years. The cost categories listed below are consistent with the implementation of the 2019-2021 Plan. For the 2022-2024 Plan, the statewide cost category definitions used by all the PAs will be:

- **Program planning and administration.** This includes costs associated with developing program plans, including:

    - Market transformation plans.

- Research & Development (R&D), excluding R&D assigned to Evaluation and Market Research.
- Day-to-day program administration, including labor, benefits, expenses, materials, and supplies.
- Overhead costs.
- Any regulatory costs associated with energy efficiency activities.
- Database/data repository development and maintenance.
- 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.** This includes costs for the development and implementation of marketing strategies and costs to advertise energy efficiency programs, such as television, radio, billboards, brochures, telemarketing, websites, and mailings. These marketing strategies are designed to educate customers and trade allies regarding the existence and availability of energy efficiency programs and/or technologies, and to induce them to participate. These costs include internal salaries for employee functions related to marketing and advertising.

- **Participant incentives.** This includes funds paid by the reporting PA 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-downs.

- **Sales, technical assistance, and training.** These costs include 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) manufacturers 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.** These are costs associated with:
  - Cost-effectiveness evaluation.
  - Market research, such as baseline studies, market assessments and surveys, and technical potential studies.
  - Impact and process evaluation reports.
  - Cost-effectiveness testing.

- AESC Study.
- TRM maintenance and updates.
- Other costs related to evaluations and market research, including tracking and reporting program inputs and outputs, funding studies, and other costs clearly associated with evaluating the program. This category also includes internal salaries for employee functions related to evaluating the programs.

At this time of this filing, the PAs have not encountered any costs that are difficult to assign to one of the five cost categories. Costs are assigned to the appropriate category within the relevant program, core initiative, or hard-to-measure program. Costs that are not 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.

BREAKDOWN OF PROGRAM IMPLEMENTATION BUDGET BY COST CATEGORY

Historically, the majority of program implementation budgets are delivered directly to customers in the form of incentives; intended to help customers overcome financial barriers to investment in energy efficiency. For the 2022-2024 term, the PAs have allocated the majority of the electric and natural gas budgets to be delivered directly to customers (i.e., participant incentives). Participant incentives help customers adopt high-efficiency measures and is a primary driver of historic and continuing energy savings.

The second largest budget allocation is for the Sales, Technical Assistance & Training cost category, supporting the activities of vendors, contractors and other industry professionals. These investments are major contributors to the green economy in the Commonwealth. The remaining program implementation budgets are allocated across the three cost categories of Evaluation and Market Research, Marketing and Advertising, and Program Planning and Administration (PP&A). These percentages are in line with historical averages, demonstrating that the PAs 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.

SALARIES

Consistent with Department precedent, all the PAs 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. The PAs 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 across several programs and 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.

ALLOCATION OF OVERHEAD COSTS

Consistent with historical practice, the PAs allocate certain non-program specific costs to each relevant core initiative or sector. In particular, many of the costs in the PP&A budget category are allocated across core initiatives. This includes costs such as overhead services and fees related to building maintenance, technology and software, finances, telephones, legal counsel, and other vendors. These costs are allocated to all core initiatives in all relevant sectors. The PAs allocate these costs to non-hard-to-measure programs based on the core initiative's percent of total planned costs. The PAs develop the allocation percentages based on planning assumptions and maintain those percentages for reporting purposes.

VENDOR COST CATEGORIES

The PAs also collaborate to use consistent vendor cost categories. The PAs consistently review new costs to determine the appropriate category. The PAs maintain a chart, attached at Appendix R, showing vendor cost types and the related cost category to support consistency and serve as a guide. This list has remained consistent since the last three-year plan.

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 PAs 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 K for more information.

EVALUATION AND MARKET RESEARCH COSTS

During the 2019-2021 term, the PAs began to charge all EM&V costs to a hard-to-measure line item called Evaluation and Market Research. No EM&V costs are allocated to individual programs. This budget category includes costs associated with the EM&V budget, potential studies, the AESC Study, the TRM, acquisition of data sets, and other evaluation and market research costs. Evaluation and Market Research costs are allocated to one or more sectors as appropriate to the cost.

STATUTORY BUDGET REQUIREMENTS

MINIMIZING ADMINISTRATIVE COSTS

In accordance with the GCA, the PAs seek to minimize administrative costs to the fullest extent practicable. Administrative costs, also commonly referred to as PP&A costs, are 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 2022-2024 term, 5 percent of the statewide electric and natural gas PAs' costs are assigned to PP&A. These percentages are in line with the budget allocations approved by the Department historically, demonstrating that the PAs have been able to provide direct benefits to customers and contractors and grow the energy efficiency portfolios while minimizing costs. Most 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 PAs' approach to minimizing administrative costs is the statewide collaborative process. This process is used by the PAs 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 PA individually, results in economies of scale that reduce the cost for each PA. For example, joint releases of RFPs lead to minimization of administrative costs (i.e., cost for preparation and release of the RFP are shared by the PAs). The PAs 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.

The PAs also seek to minimize administrative costs in reporting by collaborating on reporting templates, utilizing joint vendor services where appropriate, and seeking to balance requests for additional data with the benefits to customers of collecting and reporting such data and the costs. The PAs continue to receive requests regularly from many parties, including at the Residential and C&I Management Committees and EEAC meetings, which can increase administrative costs. The PAs continue to look to find ways to balance what is essential and valuable from processes that do not provide sufficient benefit for the cost. The PAs are working to raise awareness with all parties that every data request, meeting, committee, and point of contact results in additional administrative costs and the diversion of resources from activities that more directly translate into benefits. In the 2022-2204 term, the PAs will continue to work with stakeholders on finding the right balance of providing information, utilizing existing information, and understanding the purpose of a data request in order to seek to minimize administrative costs where possible. In accordance with the Department's Order in D.P.U. 21-50-A on the Energy Efficiency Guidelines, the PAs are working with the Council to develop a formal process for how data requests from the Council will be made and satisfied. The process is intended to ensure an appropriate balance of the value and usefulness of the data requested with the cost to provide the data.

Notwithstanding any appropriate coordination with other customer service departments, it is necessary and appropriate for all PAs 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 EEAC, Department, and DOER, and documentation and achievement of substantial savings. The PAs 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 minimize costs are effective, and administrative costs incurred by the PAs 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 PAs seek to minimize costs at all available opportunities, and not just from one point in time to another. By collaborating, creating consistent programming, optimizing staffing needs, and providing beneficial reporting, the PAs can minimize administrative costs to the extent practicable while providing quality energy efficiency services for customers.

The PAs have continued to apply lessons from an administrative cost study conducted in advance of the 2019-2021 term. This study, *The Best Practices for Minimizing Program Planning and Administrative Costs for the Massachusetts Utilities and Energy Efficiency Services Providers*, was finalized on October 25, 2018 (PP&A Report) and was filed with the 2019-2021 Plan. The PP&A Report:

1. Identified best practices, both in Massachusetts and nationwide, for tracking and assessing administrative costs.

2. Identified potential benchmarks, metrics, and/or indicators for measuring administrative costs.

3. Provided specific recommendations, as appropriate, for reducing administrative costs.

Consistent with the PP&A Report, the PAs continue to seek to minimize administrative costs using the following overall recommendations:

1. Continue to focus on ways to improve consistency in accounting practices.

2. Formalize and seek to streamline further the reporting and data request process.

3. Follow cost accounting best practices in allocation, tracking, and control.

4. Seek new ways to minimize the regulatory/collaboration/facilitation/reporting and ad hoc requests burden without compromising goal obtainment.

5. Implement an annual process to stress test status quo processes and spending.

The PAs will continue to use these recommendations during the 2022-2024 term to assist in efforts to continuously minimize administrative costs to the greatest extent practicable without negatively affecting program delivery. The PAs will continue to regularly review costs and allocation procedures internally and through statewide Cost Review Working Group meetings and other discussions and will examine whether there are ways to streamline reporting and updates to interested parties. Additionally, at the time of each plan-year and term report filing, the PAs will review administrative costs and cost allocation procedures.

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 natural gas energy efficiency programs shall be spent on comprehensive low-income residential demand side management and education programs."[76] The electric and gas PAs have allocated sufficient budgets to Income Eligible programs to meet or exceed this mandate.

COMPETITIVE PROCUREMENT

The PAs use 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 PAs are committed to continuing to utilize competitive procurement practices to the fullest extent practicable throughout the implementation of the 2022-2024 Plan. Therefore, consistent with past practice, the PAs 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 PAs will continue to seek to expand the pool of qualified program vendors, promote the entry of new market actors into contractor and subcontractor roles, encourage diversity and inclusion through procurement, and ensure the transparency of the contractor bidding process and selection criteria used to evaluate proposals.

A.1.8 PERFORMANCE INCENTIVES

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.[77] The Department has established Guidelines outlining the principles and requirements for the design of a performance incentive mechanism.[78] Pursuant to the Guidelines, an incentive mechanism must be:

1. Designed to encourage PAs to pursue all available cost-effective energy efficiency.

[76] G.L. c. 25, § 19(c).
[77] G.L. c. 25 § B.2.v. The Compact, as a municipal aggregator, does not receive a performance incentive. See D.P.U. 08-50-A at 51.
[78] Guidelines § 3.6.2.

2. Designed to encourage energy efficiency programs that will best achieve the Commonwealth's energy goals.

3. Based on clearly defined goals and activities that can be sufficiently monitored, quantified, and verified after the fact.

4. Available only for activities in which the PA plays a distinct and clear role in bringing about the desired outcome.

5. As consistent as possible across all electric and natural gas PAs.

6. Avoid any perverse incentives.[79]

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 electric and natural gas customers, while still providing appropriate incentives for the PAs.[80] All PAs must calculate design level incentive payments based on projections of performance for the entire three-year term, not based on annual projections.[81] Both electric and natural gas PAs collect performance incentives through the Energy Efficiency Surcharge (EES) at the design level during the three-year term.[82] The Department reviews each PA's performance based on the entire term of the three-year plan and approves final performance incentives through the term report proceeding.[83] Each PA reconciles actual and design performance incentive payments at the end of each term as part of their respective EES filings.[84]

The Department has approved performance incentive mechanisms that include savings and value components based on benefits and net benefits.[85] 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 the PAs to achieve savings where they exist to reach portfolio goals.[86] 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 the PAs to seek all available cost-effective savings opportunities wherever they exist, but rather would encourage the PAs to focus on only the sector in which performance incentives remain available.[87]

The Department has approved performance incentive mechanisms that are designed to provide additional incentives where the PAs successfully deliver benefits to customers by overcoming barriers associated with a nascent market,

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79 Guidelines § 3.6.2.
80 Guidelines §§ 3.6.2, 3.6.3.
81 Guidelines § 3.6.4; D.P.U. 11-120-A, Phase II at 7-8. Design level performance is defined as 100 percent of the PA's projected benefits and net benefits multiplied by the appropriate payout rate.
82 D.P.U. 11-120-A, Phase II at 13 n.16.
83 See D.P.U. 11-120-A, Phase II at 13.
84 Guidelines § 3.6.4.2.
85 See 2016-2018 Three-Year Plans Order at 67.
86 2016-2018 Three-Year Plans Order at 69.
87 2016-2018 Three-Year Plans Order at 69.

such as ADR.[88] To avoid double counting of benefits in this type of performance incentive model, the PAs must appropriately track and consistently allocate all savings associated with the market-specific measures to ensure they are not also counted as traditional energy efficiency savings.[89]

Also, in D.P.U. 13-67, the Department determined that performance metrics, an incentive model designed to encourage PAs to undertake specific actions or meet specific goals, were no longer appropriate under the GCA. This is because the PAs are obligated to undertake activities targeted by performance metrics to satisfy the mandates of the GCA.[90] Further, the Department found that preparing and verifying performance of these metrics would divert PA 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.[91]

The Department affirmed these findings from D.P.U. 13-67 in the *2019-2021 Three-Year Plans Order*.[92] In that Order, the Department rejected a proposed renter component designed to incentivize services to renters by awarding the PAs with $20 for each renter served, in addition to any performance incentive earned in connection with the savings and benefits attributed to the measures installed for each renter.[93] The Department found that the renter component incentivized the PAs to undertake activities (i.e., serving renters) that they were already obligated to undertake under the GCA.[94] The Department also rejected the renter component because it would lead to the PAs achieving an incentive in multiple incentive components for a single action.[95] Finally, the Department rejected the renter component because it would allow the PAs to potentially collect performance incentives for activities that failed to achieve the special renter component threshold, as the PAs would still be eligible to collect performance incentives based on the measures installed for each renter regardless of whether they succeeded in serving a specified number of renters, thus "rendering the renter component threshold superfluous."[96]

PROPOSED PERFORMANCE INCENTIVE MECHANISM

Overview

In the 2019-2021 term, the Department approved an incentive mechanism with a value component and a two-part savings component with (1) an energy efficiency and passive demand component and (2) an ADR component. The value component was based on net benefits and the savings components were based on total benefits. A benefits-based performance incentive mechanism appropriately aligns the PAs' performance with the pursuit of all available cost-effective energy efficiency. Benefits are directly associated with the cost effectiveness that is required by the GCA, and align with other state goals, including energy savings and GHG reductions.

For the 2022-2024 term, the PAs plan to use a similar benefits-based construct for their performance incentive mechanism. The PAs, however, plan to move away from the ADR component of the performance incentive

88 2019-2021 Three-Year Plans Order at 96.
89 2019-2021 Three-Year Plans Order at 96.
90 D.P.U. 13-67, at 14-15.
91 D.P.U. 13-67, at 13.
92 D.P.U. 13-67, at 93-95.
93 2019-2021 Three-Year Plans Order, at 92-93.
94 Id. at 94, citing G.L. c. 25, § 21(a); D.P.U. 13-67, at 12.
95 Id. at 93.
96 Id. at 94.

mechanism. The market for ADR offerings is no longer nascent, and as described in the 2022-2024 Plan, the PAs have made significant progress in this area and forecast continued growth in ADR in this new three-year term.

The PAs propose the use of a three-component structure, with a focus on electrification, equity, and energy efficiency benefits in a manner designed to address Department precedent and design principles articulated in the Department's Energy Efficiency Guidelines. Development of this three-component approach has required flexibility, innovation, and collaboration, and seeks to address essential priorities while honoring regulatory guidelines. The proposed mechanism has three components and is based on benefits achieved in each component: (1) Equity Component, (2) Electrification Component, and (3) the Remaining Portfolio "Standard" Component. PAs had to make some determinations about measures that could qualify for multiple components (i.e., electrification measures in an EJ community) to ensure that there is no double counting of benefits. The makeup of each component is described in more detail in the sections below. Based upon the well-developed principles and precedent described above, the performance incentive mechanism provides for 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. Each PA's total performance incentive will be the sum of the incentives for each component of the mechanism based on performance over the full term. The specifics of each component of the mechanism, including calculation of payout rates and requirements for earning performance incentives are set forth below and in Appendix S.

To avoid conflicting incentives, the PAs have discontinued the value component in recognition of the fact that the achievement of benefits in the equity and electrification components may be more expensive than those in the standard component. If the value component remained, it could disincentivize the PAs from targeting equity and electrification measures. Further, the 2022-2024 Plan reflects a significant increase in the scope and scale of the programs, inclusive of a steep ramp up in electrification measures, particularly in the large C&I sectors. These electrification goals represent a large degree of uncertainty compared to past plans, both in scale and estimated costs, such that a value component may either reward PAs for having initially over-estimated costs for planning purposes, or unduly penalizing PAs should initial estimates of costs for large C&I electrification prove insufficient to achieve targeted reductions. Finally, the AGO and DOER, along with the Council, were all supportive of removing the value component in order to encourage the Program Administrators' pursuit of equitable access to programs and electrification measures. The PAs remain mindful of minimizing administrative costs and short-term customer bill impacts and note that there are other mechanisms in place to manage costs (e.g., Mid-Term Modification Guidelines).

Additionally, in order to support the Commonwealth's goals as stated in the Climate Act, the PAs have not applied the Marginal Abatement Cost benefits to fossil fuel measures for the purposes of performance incentives. While these environmental compliance cost benefits continue to be included for the purposes of cost-effectiveness screening, as required by the Guidelines, they have been removed solely for performance incentives as a manner of continuing emphasis on Commonwealth and Plan priorities.

The specifics of each component of the mechanism, including calculation of payout rates and requirements for earning performance incentives are set forth in the performance incentive models attached as Appendix S.

STATEWIDE INCENTIVE POOL FOR 2022-2024

Statewide, the design level incentive pool is set at $131.8 million for electric efforts and $38.2 million for gas efforts.

Electric Incentive Pool

The electric incentive pool is divided among the performance incentive components as follows:

Figure A-14: Electric Performance Incentive Totals

Electric Performance Incentive Totals			
Component	**Threshold**	**Design Level**	**Cap**
Equity Component	85% of planned portfolio equity benefits	$23.8 million	N/A, subject to portfolio cap
Electrification Component	50% of planned portfolio electrification benefits	$37.6 million	N/A, subject to portfolio cap
Standard Component	75% of planned portfolio benefits OR weighted average portfolio threshold	$70.4 million	Capped at 125% of Standard Component design level until Equity & Electrification thresholds are met
Total Portfolio		**$131.8 million**	**125% of portfolio design level**

Natural Gas Incentive Pool

The natural gas incentive pool is divided among the performance incentive components as follows:

Figure A-15: Natural Gas Performance Incentive Totals

Natural Gas Performance Incentive Totals			
Component	**Threshold**	**Design Level**	**Cap**
Equity Component	85% of planned portfolio equity benefits	$15.0 million	N/A, subject to portfolio cap
Electrification Component	50% of planned portfolio electrification benefits	$2.8 million	N/A, subject to portfolio cap
Standard Component	75% of planned portfolio benefits **OR** weighted average portfolio threshold	$20.3 million	Capped at 125% of Standard Component design level until Equity & Electrification thresholds are met
Total Portfolio		**$38.2 million**	**125% of portfolio design level**

The amounts reflected in the above tables reflect the challenge of continuing to adopt aggressive savings goals in 2022-2024 in light of achievements to date, the remaining savings opportunities identified in each service territory, and the success the PAs are cultivating as markets are transformed. In addition, the 2022-2024 Plan incorporates new technologies and less tested strategies that create increased risk, and the proposed incentive pool provides an appropriate level of incentives to undertake the additional risk. As discussed more below, the specific amounts allocated to the Equity and Electrification components are designed to recognize the unique challenges and costs associated with delivering electrification measures and serving equity.

These electric and gas incentive pools are 4.7 percent and 3.1 percent of the total Plan budget, respectively. These amounts are lower as a percentage of the total Plan budget as compared to prior plans and are supported by DOER, the Attorney General, the Council, and the PAs. The statewide incentive pool will not change as a result of newly identified benefits or changes to avoided costs that may occur during the term of this Plan. Further, as required by the Guidelines, these percentage levels are as low as possible to minimize the costs to electric and natural gas customers, while still providing appropriate incentives for the PAs.

EQUITY COMPONENT

The 2022-2024 Plan will address equity matters aggressively. The PAs are committed to increasing awareness, education, and participation for certain customer segments that have historically participated at lower rates compared to overall participation. These customers include renters, English-isolated customers, and moderate-income customers and are correlated to environmental justice communities. In alignment with achieving this outcome, the PAs propose an equity component as part of their 2022-2024 performance incentive mechanism.

The equity component incentivizes PAs for achieving benefits (not including large C&I) in designated environmental justice communities and select Boston zip codes (as identified and listed in Section 1.1.2) and for moderate-income customers statewide, including benefits achieved from electrification measures. The selected environmental justice communities were determined using a methodology developed by the PAs and DOER in order to target municipalities that are a priority for investment in energy efficiency because they meet certain criteria related to income, minority or English isolation, and lower past participation in energy efficiency programs. There is one common payout rate for the electric PAs that is 20 percent higher than the electric standard component payout rate and one common payout rate for the natural gas PAs that is 55 percent higher than the gas standard component payout rate. These payout rates are determined by dividing the portion of the performance incentive pool allocated to the equity component by the planned statewide benefits from eligible equity measures.

The threshold for the equity component for both natural gas and electric PAs is based on achieving 85 percent of planned equity benefits. This threshold was set at a level to ensure growth in achievement of equity benefits over PA performance in 2017-2019 when normalized for measures being offered in 2022-2024 (e.g., residential upstream lighting measures were not considered as part of the baseline exercise). Upon meeting the threshold, the PAs may begin to earn a performance incentive. Performance incentives for the equity component are not capped, so long as the total performance incentive for a PA has not exceeded 125 percent of the total portfolio design level.

ELECTRIFICATION COMPONENT

The 2022-2024 Plan is designed to carry out the applicable goals of the GCA and the Climate Act, including the achievement of 845,000 metric tons of CO_2e in 2030. The 2022-2024 Plan prioritizes measures that support the 2030

GHG emission reduction goal, inclusive of the support of converting customers from fossil fuel heat to electrification. Similar to ADR in 2019-2021, electrification at scale is a nascent effort for the PAs in 2022-2024 and the electrification component is designed to incentivize the accelerated adoption of eligible measures. The electrification component incentivizes the PAs for achieving benefits from electrification measures that are not in environmental justice communities or not for moderate-income customers statewide.

There is one common payout rate for the electric PAs that is 20 percent higher than the electric standard component payout rate and one common payout rate for the natural gas PAs that is 55 percent higher than the gas standard component payout rate. These payout rates are determined by dividing the portion of the performance incentive pool allocated to the electrification component by the planned statewide benefits from eligible electrification measures.

The threshold for the electrification component for both natural gas and electric PAs is based on achieving 60 percent of planned electrification benefits. This threshold level was designed to ensure that the PAs achieve a minimum level of electrification benefits for customers prior to receiving any performance incentives for this component, but also recognize the large uncertainty and scale of the electrification goals. Performance incentives for the electrification component are not capped, so long as the total Performance Incentive for a PA has not exceeded 125 percent of the total portfolio design level.

STANDARD COMPONENT

The standard component incentivizes PAs for benefits achieved in the rest of the service territories that are not counted in the two benefits components described above.

The threshold for the standard component can be achieved in one of two ways. PAs must achieve either 75 percent of planned standard component benefits or the statewide weighted portfolio threshold in order to begin earning an incentive for this component. There is one common payout rate for the electric PAs and one common payout rate for the natural gas PAs. These payout rates are determined by dividing the portion of the performance incentive pool allocated to the standard component by the planned statewide benefits from eligible standard component measures.

The weighted portfolio threshold is established statewide by first calculating the threshold value of benefits for each component and summing them. The weighted portfolio threshold is then calculated by dividing the total threshold benefits by the total planned benefits. The weighted portfolio threshold is 73 percent for the electric PAs and 77 percent for the natural gas PAs. Thus, an electric PA can begin earning the standard component incentive by either achieving 75 percent of the standard benefits (i.e., $1.32 billion on electric) or 73 percent of a combination of benefits from any of the three components. The weighted portfolio threshold ensures that the PAs are not incentivized to discontinue achieving benefits in any one component in order to meet the threshold in another component and provides flexibility to pursue and achieve all cost-effective savings opportunities wherever they may exist. This flexibility is especially important for PAs who have larger proportions of environmental justice communities within their service territories. See the tables below for the calculations of the electric and natural gas weighted thresholds and an example of how a PA would earn performance incentives under the weighted portfolio threshold.

Electric:

Figure A-16: Electric Weighted Portfolio Threshold

Component	Planned Benefits	Threshold	Threshold Benefits
Equity	$1,375,191,475	85%	$3,664,737,785
Electrification	$2,175,367,856	60%	$1,168,912,753
Standard	$4,886,317,047	75%	$1,323,711,340
Total	**$8,436,876,378**	**73%**	**$6,157,361,879**

Natural Gas:

Figure A-17: Natural Gas Weighted Portfolio Threshold

Component	Planned Benefits	Threshold	Threshold Benefits
Equity	$1,109,063,653	85%	$942,704,105
Electrification	$205,604,704	60%	$123,362,822
Standard	$2,328,762,405	75%	$1,746,571,804
Total	**$3,643,430,762**	**77%**	**$2,812,638,731**

Example Using the Statewide Electric PI Pool:

Figure A-18: Examples of Statewide Electric PI Pool

Component	Achievement of Benefits	PI Earned Without Weighted Threshold	PI Earned With Weighted Threshold
Equity	125.0%	$29.7 million	$29.7 million
Electrification	80.0%	$30.1 million	$30.1 million
Standard	70.0%	$0	$49.3 million
Total	**81.5%**	**$59.8 million**	**$109.1 million**

In this example, the PA has, in aggregate, delivered 81.5 percent of its total planned benefits and exceeded planned benefits in the equity component. However, without the flexible weighted portfolio threshold, the PA would earn $0 in the standard component and only achieve 45 percent of its total planned performance incentive. Instead, use of the weighted threshold is much more aligned overall with seeking all cost-effective opportunities and eliminates the incentive to discontinue pursuing equity benefits in pursuit of meeting the standard component threshold.

PAs are capped at earning 125 percent of the standard component until meeting the thresholds in both equity and electrification. Once those thresholds are met, PAs can earn performance incentives in excess of 125 percent of the standard component so long as the total performance incentive for a PA has not exceeded 125 percent of the total portfolio design level.

A.1.9 STATEWIDE DATA/DATA AVAILABILITY

OVERVIEW

The PAs provide transparent reporting on their energy efficiency activities in multiple presentations, reports, and electronic data platforms. Providing regular communications allows the public and stakeholders to receive up-to-date information regarding energy efficiency investments and savings directly from the PAs. The PAs provide formal reporting required by the GCA and the Department, including the three-year plan, plan-year reports, term reports, annual EES filings, and quarterly reports to the EEAC. Additionally, the PAs provide monthly data dashboards to the EEAC, present regularly on various topics of interest to the EEAC, maintain a detailed energy efficiency database, Mass Save Data, (http://www.masssavedata.com), and make detailed residential and C&I customer profile data available on a web-based platform with dashboard functionality (https://www.masssavedata.com/Public/CustomerProfileDashboard).

REPORT TYPES

Quarterly Report

At the end of each quarter, the PAs provide a detailed report on the implementation, expenditures, savings, and benefits regarding activities during that quarter. These 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 an individual PA and aggregated statewide reflecting costs, participants, savings, benefits, and GHG emissions reductions. In accordance with the Climate Act, the quarterly reports will include a quantification of the degree to which the activities undertaken pursuant to each plan contribute to meeting any and all GHG emission limits and sub-limits imposed by statute or regulation. This data is reported on a cumulative basis throughout the 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.

Plan-Year Report

As discussed above, the PAs annually file a plan-year report in order for the Department to fulfill its obligation to review the effectiveness of the programs.[97] The plan-year report documents fully evaluated implementation results for each program year that are later incorporated as part of each PA's term report. The plan-year reports include updated data tables comparing planned, preliminary, and evaluated results. Each PA 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 or initiative, a PA must provide a detailed explanation of the reasons why the program is not cost effective, and how the PA 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 three-year plan.

Term Report

At the conclusion of a three-year plan term, the PAs 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 PA'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 lost base revenue (LBR), if any.

Data Sources

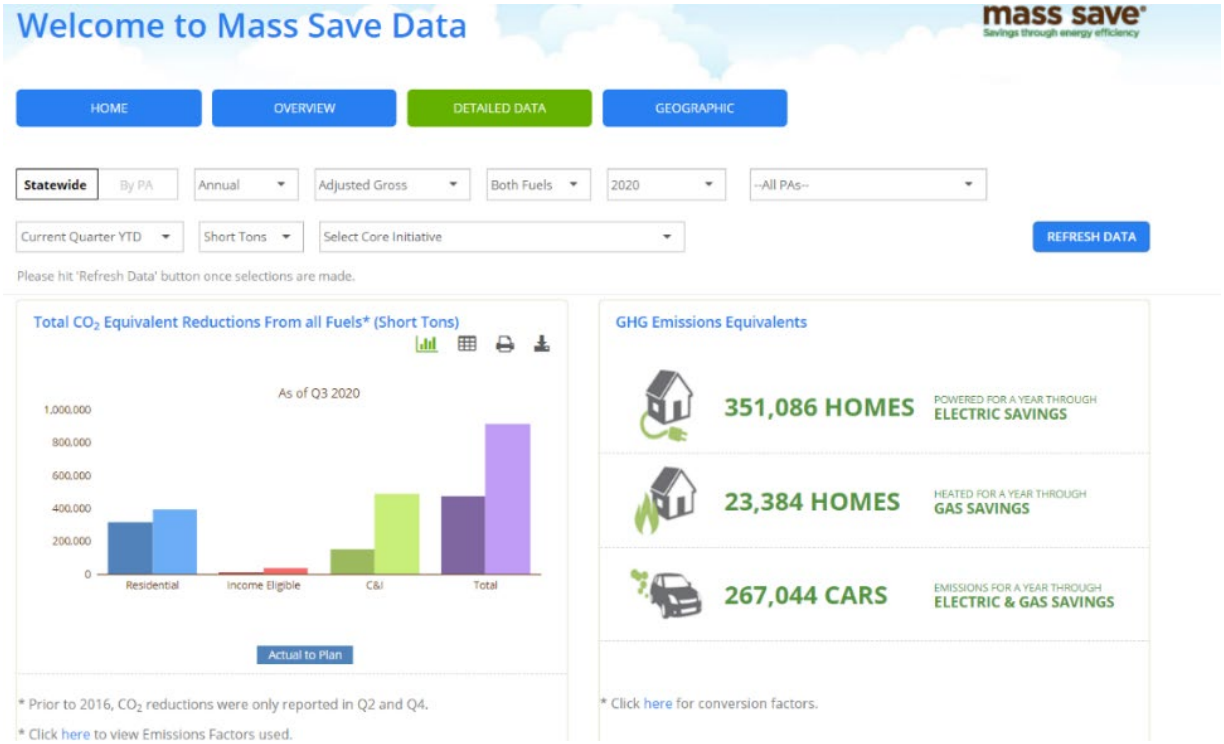
Mass Save Data

The PAs develop 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 the PAs, as well as additional information and

[97] Pursuant to G.L. c. 25, § 21(d)(2).

presentations of data. The database provides a single, reliable and timely data source for currently reported data on an individual PA 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 PAs designed Mass Save Data to export data easily for those stakeholders like the EEAC 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 provides accessible, meaningful information to customers, municipalities, and stakeholders over time.

Figure A-19: Mass Save Data

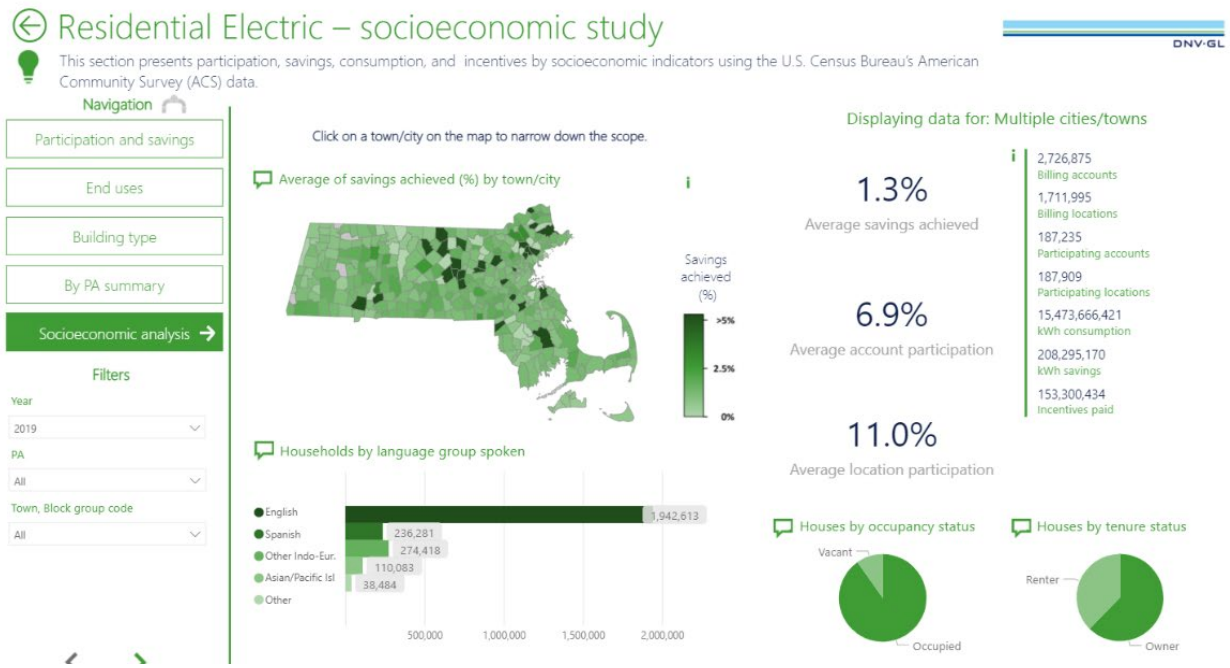


Mass Save Data provides quantitative data similar to that provided in the PAs' public reports, including information related to participants, expenditures, annual and lifetime savings, electric capacity savings, and benefits. The database includes data at the sector, program, initiative, and measure levels. In addition to the PAs' 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 PAs are now providing usage data by town by individual month on an annual basis. The PAs have updated Mass Save Data and provided new information and views based on input from members of the EEAC 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, HEAT Loan, GHG emissions reductions, 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 eTRM. The PAs update Mass Save Data with various data sets monthly, quarterly, and annually.

Customer Profile Studies and Data Dashboards

Accessible through Mass Save Data, the Residential and C&I customer profile dashboard (https://www.masssavedata.com/Public/CICustomerProfileDashboard) is a web-based platform with dashboard functionality. The platform was developed using customer usage and energy savings data and the dashboard presents data visualizations and extracts data previously available via the paper-based Customer Profile reports in a transparent and easy-to-use web-based format while maintaining existing customer confidentiality rules. The annual profiles studies offer diverse views of participation, savings, and geographic dynamics within the PAs' energy efficiency programs.

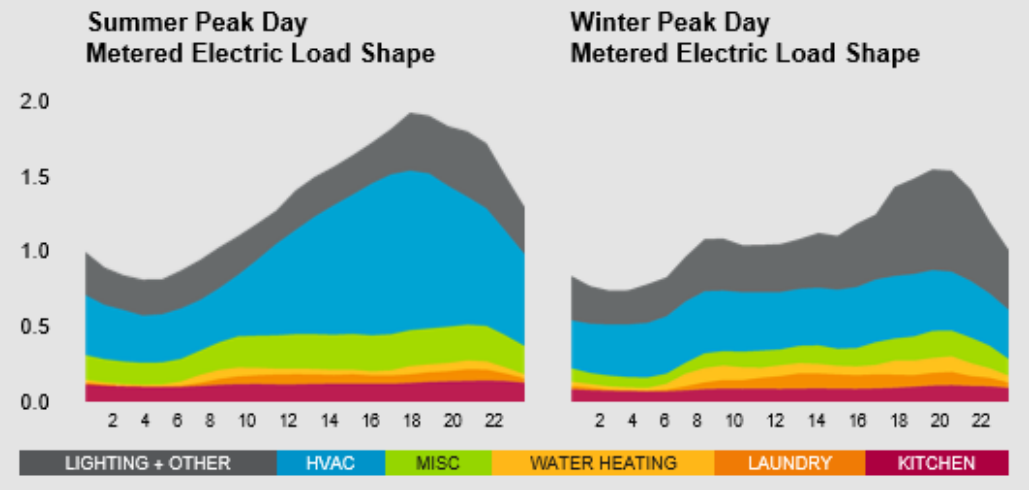
Figure A-20: Customer Profile Dashboard



Baseline Studies

The baseline studies posted to the MA EEAC website (https://ma-eeac.org/studies/) collect saturation, characterization, and usage behavior data for all major electric and natural gas appliances, HVAC equipment, and electronics in Massachusetts homes and businesses. These are useful in understanding: (1) how and when people use the electric and natural gas equipment in their homes and businesses, (2) how habits and use change over time, and (3) how quickly new technologies are being adopted statewide.

Figure A-21: Baseline Studies

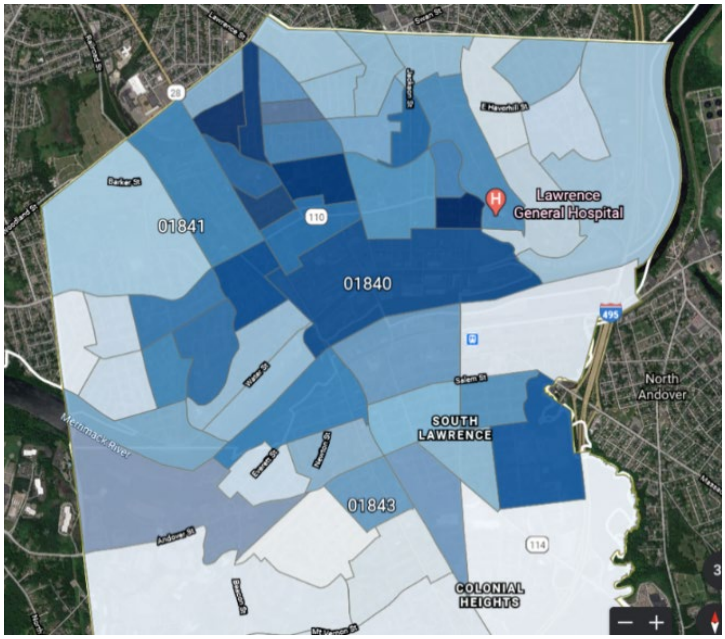


Municipal Mapping Tool

A new municipal mapping tool is currently under development and will leverage the Google Earth platform and combine data on historical participation in energy efficiency programs with statistics and HTR populations such as renters, income level, English-isolated, and small business counts. Currently, the first round of maps is being developed for those municipalities participating in partnerships with the PAs.

These maps, which can be viewed at a street level, can be used as a tool to geographically target the PAs' energy efficiency offerings.

Figure A-22: Municipal Mapping Tool



Data Availability

While the PAs have made an extensive quantity of data available, stakeholders have shown particular interest in town/municipal and zip code level data. The figure below is an easy reference guide to what data is available at two levels: (1) from which data source (sources described in more detail in section above), and (2) at what frequency.

Figure A-23: Data Availability

Reporting source and how often it is reported	Municipal Level			Zip Code Level		
	Mass Save Data Annual[1]	PA Reports to EEAC Bi-Annual[2]	DNV GL Veracity Customer Data Dashboards Annual[3]	Mass Save Data Annual	PA Reports to EEAC Bi-Annual	DNV GL Veracity Customer Data Dashboards Annual
Residential and Income Eligible Sectors	Annual usage, savings, and incentives, Usage by month	N/A	Under development	Annual usage, savings, and incentives	Number of participants, including income eligible and moderate income[4]	Under development
C&I Sector	Annual usage, savings, and incentives Usage by month	N/A	Number of participants Savings, including upstream and non-upstream savings	Annual usage, savings, and incentives (Boston only)[5]	N/A	N/A

[1] Annual geographic data for Mass Save Data, the PAs' energy efficiency database, is updated 6-12 months after calendar year-end (https://www.masssavedata.com/Public/GeographicSavings?view=C).

[2] Biannual geographic data is provided as part of the Q2 and Q4 EEAC Quarterly reports submitted by the PAs (http://ma-eeac.org/august-19-eeac-meeting/). For the most recent Bi-Annual Reporting, see file titled: 2020 Q2 Bi-Annual Data Reporting Statewide; see tab Bi-Annual No. 6.

[3] Annual geographic data on the DNV GL Veracity Platform is updated 6-12 months after calendar year-end (available online at: https://www.masssavedata.com/Public/CICustomerProfileDashboard).While the data is open to the public, account set-up is required to access this database. The Residential Dashboard is still in development.

[4] This spreadsheet (see footnote 2) includes the number of participants (excluding upstream and behavior) by zip code broken out by: (a) total income-eligible participants, (b) total non- income-eligible participants, (c) single-family/attached low-rise participants (not moderate income), and (d) single-family/attached low-rise participants (moderate income).

[5] For the C&I Sector, zip code data is shown for neighborhoods of the city of Boston but is not available in other municipalities due to customer privacy protections.

Data Privacy

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.[98] Protecting customer data is a core database concern of the Department, PAs, and stakeholders. Safeguarding the confidentiality of sensitive customer-specific account data is both a legal obligation and an important corporate responsibility for the PAs. As Energy Efficiency PAs, customers trust us with their data, and we take seriously customer privacy and security.[99] In order to protect customer privacy, and pursuant to standards articulated by the Department in D.P.U. 14-141, data has been aggregated according to the following guidelines:

- C&I data is displayed only when there is a minimum of 15 customers, with no single customer accounting for more than 15 percent of electric or natural gas usage.
- Residential and Income Eligible data is displayed only when there is a minimum of 100 customers.

A.1.10 COST RECOVERY, FUNDING SOURCES, AND BILL IMPACTS

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.[100] For the PAs to pursue the aggressive goals set forth in this Plan, it is essential that the Department provide a full and fair opportunity for the PAs 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, and performance incentives, if applicable, the details related to individual PA cost-recovery mechanisms will be addressed in separate Department proceedings.

Pursuant to the GCA, after reviewing a PA's proposed three-year plan, the Department must approve fully reconciling funding mechanisms, in addition to other statutorily-specified sources. If the Department determines that the three-year plan ensures that the PAs have identified and will capture all energy efficiency and demand reduction resources that are cost effective or less expensive than supply.[101]

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[98] In Massachusetts, the PAs 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 PA business. Disclosure of customer information to a third party without customer authorization would violate corporate privacy policies and expose a PA to liability under the Massachusetts Right to Privacy Act, M.G.L. c. 214, § 1B or Chapter 93A, and potentially other statutes.

[99] The PAs 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 PA business purpose.

[100] For a discussion of performance incentives, please see supra Section IV.F.

[101] G.L. c. 25, §§ 19, 21(d)(2).

FUNDING SOURCES

Introduction

The PAs seek to leverage available funding sources and financing initiatives to increase the benefits of Three-Year Plans and minimize customer bill impacts. For electric PAs, 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 PAs' participation in the 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., an EES).[102]

Consistent with the Department's Guidelines, the PAs allocate SBC, FCM, and RGGI revenues to each customer sector in proportion to the kWh consumption of each class.[103] In approving other funding for electric PAs, 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.[104] 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.[105]

For natural gas PAs, the GCA does not identify multiple funding sources for energy efficiency programs and instead requires them to include a fully reconciling funding mechanism to collect energy efficiency program costs from customers (i.e., EES).[106] In approving funding for the natural gas PAs, the Department must consider the effect of any rate increases on customers.[107]

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

NON-EES REVENUES

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 PA calculates projected SBC revenues as the product of the statutorily mandated SBC of $0.0025 per kWh and projected sales for the applicable year.

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102 G.L. c. 25, §§ 19(a); 21(b)(2)(vii).
103 The Income Eligible Sector is allocated at least 10 percent of the funds for electric energy efficiency programs and 20 percent of the funds for natural gas energy efficiency programs pursuant to G.L. c. 25, § 19(c).
104 G.L. c. 25, § 19(a).
105 2013-2015 Three-Year Plans Order at 122; D.P.U. 08-50-D at 11-12.
106 G.L. c. 25, § 21(b)(2)(vii); see also G.L. c. 25, § 21(d)(2).
107 Guidelines § 3.2.2.2.

Forward Capacity Market Proceeds (electric only)

Pursuant to G.L. c. 25, § 19(a), the Three-Year Plans of the electric PAs shall be funded in part by "amounts generated by the distribution companies and municipal aggregators under the FCM program administered by ISO-NE."[108] Specifically, each PA 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 PAs propose to apply all net proceeds from the FCM to energy efficiency programs.

To minimize ratepayer funding for energy efficiency efforts, each electric PA seeks to maximize FCM revenues for its customers. FCM bidding strategies are 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 PA employs its own individual strategy in bidding future capacity into the FCM.

The Department has recognized the challenges PAs 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.[109] 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.[110] Another is that there are financial penalties for failing to deliver on FCM supply obligations. However, each PA takes all reasonable steps to maximize FCM revenues during the term.

In developing a bid, each PA uses the best information available at the time and 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, PAs 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 PAs avoid overpromising and thereby compromising future system reliability. In addition, the reconciling nature of the EES ensures that customers are made whole if PA FCM revenue projections are overly conservative and the PA ultimately collect additional FCM revenues.

Regional Greenhouse Gas Initiative Proceeds (electric only)

Pursuant to G.L. c. 25, § 19(a), the Three-Year Plans of the electric PAs shall be funded in part by "not less than 80 percent of amounts generated by the CO_2 allowance trading mechanism established under the RGGI Memorandum of Understanding, as defined in subsection (a) of section 22 of chapter 21A, and the NOx Allowance Trading Program."

As stated in the PAs' June 28, 2019 report to the Department on RGGI funding, DOER is responsible for allocating the proceeds from the RGGI auctions in a proportion determined by DOER for the purposes set forth in G.L. c. 21A, §

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108 G.L. c. 25, § 19(a) as defined in section 1 of chapter 164.
109 2013-2015 Order, at 119.
110 The next forward capacity auction, in February 2022, will be for capacity delivery in July 2025.

22(c)(1). Accordingly, the electric PA work with DOER to develop the most accurate projection of RGGI revenues that will be allocated by DOER for the programs.

In December 2019, as part of the state's supplemental budget, the Massachusetts Legislature adjusted how DOER allocates RGGI revenue.[111] The Legislature prioritized the spending of RGGI revenue on state programs other than energy efficiency, such as the Green Communities program and EV incentive programs, among others. As a result, the PAs should not expect any RGGI revenue for the 2022-2024 term.

EES REVENUES

The EES is a fully reconciling funding mechanism[112] that the Department approves for funding the Three-Year Plans.[113] On an annual basis, each PA submits an updated EES for Department review, based on: (1) the PAs' most recent projections of budgets, revenues for non-EES funding sources (for electric PAs), and sales for the current year, and (2) a reconciliation of any under- or over-recovery of costs from the previous year.[114] Electric PAs collect the EES through EERF tariffs.[115] For natural gas PAs, the EES is collected through the LDAC tariff in accordance with established Department practice.[116] The EERF and LDAC filings of the PAs are separate proceedings from the three-year plan proceeding and are implemented on schedules that vary among the PAs.[117]

Carryover Information

In determining its EES, an electric PA takes into account carryover funds. Pursuant to the Guidelines, if the funding for a customer sector from SBC, FCM, RGGI, and other non-EES sources exceeds the customer sector's budget, the electric PA must carry over any excess funding to the customer sector's budget for the subsequent year in order.[118] For the 2022-2024 term, the electric PAs do not have any carryover funds. Each PA may have an over- or under-collection from their respective EES, and these are reflected in the electric PA-specific funding tables in each PA-specific Exhibit.

OUTSIDE FUNDING LEVELS

The 2022-2024 Plan does not contain outside funding assumptions at this time given current absence of material viable funding sources. Given the very high GHG goals and related costs and bill impacts, the PAs are actively working

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111 See Section 95 of Chapter 142 of the Acts of 2019, available at https://malegislature.gov/Laws/SessionLaws/Acts/2019/Chapter142.

112 The PAs collect funds related to RCS through their EES. 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 natural gas PAs and in the Energy Efficiency Reconciliation Factor (EERF) tariff filings for the electric PAs.

113 G.L. c. 25, § 21(d)(2).

114 2016-2018 Three-Year Plans Order at 114.

115 Guidelines §§ 2(9), 3.2.1.6.

116 Guidelines §§ 2(9), 3.2.2.

117 With the exception of Compact, EERF filings are made coincident with each electric PAs' 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 natural gas PAs' LDAC filings are approved for effect November 1 each year. Due to the timing of these filings, the budget and revenue projections are based on the 12-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 2022-2024 Plan.

118 See § 3.2.1.6.1.

to identify outside funding opportunities and seeking assistance from government agencies with locating and allocating funding to the PAs for these efforts. PAs expect that additional and significant outside funding will be required to achieve the Plan's electrification goals, including to pay for costs such as structural reinforcement to handle heavy equipment, required customer electrical upgrades, and other costs associated with large building electrification efforts.

As part of their holistic and integrated approach, the PAs will seek to educate customers about funding offered through other government programs. An example of this is DOER's Green Communities program, which provides grants to qualified municipalities to reduce energy usage as compared to a set baseline. While the objectives of these programs may differ from the goals of the PAs' 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 reducing GHG emissions. Additionally, for low-income projects, LEAN will leverage outside third-party funding from all available sources, including but not limited to government (federal, state and municipal) tax credits, investor funding, and grants from governments (federal, state and municipal) and 501c3 entities.

BILL IMPACTS

Consistent with directives of the GCA and the goal of the 2022-2024 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 PAs have sought to develop a statewide energy efficiency plan that acquires these resources with the lowest reasonable customer contribution.[119] For the 2022-2024 Plan, the PAs assessed potential bill impacts with a heightened sensitivity, as many customers' bills remain in arrears due to the economic downturn associated with the ongoing COVID-19 pandemic. 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.[120]

The Department requires the PAs to submit traditional bill impacts for non-participants under the following scenarios:

- The current (i.e., 2021) EES to the proposed EES for the first year of the three-year plan (i.e., 2022).
- The EES from the first year of the three-year plan (i.e., 2022) to the proposed EES for the second year of the three-year plan (i.e., 2023).
- The EES from the second year of the three-year plan (i.e., 2023) to the proposed EES for the third year of the three-year plan (i.e., 2024).
- The current EES (i.e., 2021) to the proposed EES for the third year of the three-year plan (i.e., 2024).[121]

119 See G.L. c. 25, § 21(b).
120 2013-2015 Three-Year Plans Order at 122; D.P.U. 08-50D, at 11-12.
121 D.P.U. 08-50-D, at 12.

The Department also directed the PAs 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."[122] The Department later clarified the bill impact requirements for non-participants by providing a spreadsheet to the PAs, directing them to use average monthly usage levels under the first and fourth scenarios listed above.

Accordingly, to calculate bill impacts for participants, the PAs 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 figure below. To best approximate low, medium, and high annual savings consistent with the Department's directive in D.P.U. 08-50-D, the PAs collaborated on appropriate assumptions for the Residential, Income Eligible, and C&I Sector programs to develop statewide percentages that best approximate savings for those types of participants. The PAs determined that the percentages in the figure below will provide directional information on the bill impacts that a residential, income-eligible, or C&I participant may experience.

The PAs determined that there is no low, medium, and/or 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 completed). Similarly, the PAs determined that there is no low, medium, and/or high savings scenario for residential and income-eligible natural gas non-heating participants and street lighting. Accordingly, the PAs determined that the percentages in the table below best approximate savings for those types of participants.

Figure A-24 Proposed Budgets

	Low	Medium	High
Residential (electric)	2%	10%	30%
Residential (natural gas)	2%	15%	30%
Residential (natural gas non-heating)	2%		
Income Eligible (natural gas non-heating)	2%		
Income Eligible	25%		
Street Lighting	10%		
C&I (electric)	1%	10%	20%
C&I (natural gas)	1%	10%	20%

[122] Id.

Each PA has provided traditional bill impacts for all rate classes in its individual filing. Please see Exhibit [PA]-6 for this analysis.

The PAs are sensitive to the resulting bill impacts and costs that these will place on customers, which underscores the importance of identifying alternative funding sources as a means to achieving these outcomes with reduced customer rate increases. In addition, it is important to emphasize that actual rate and bill impacts for customers associated with the 2022-2024 Plan will vary based upon a multiplicity of factors, such as the cost of service in a particular PA'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 toward energy efficiency expenditures, such as proceeds realized from the FCM or from cap-and-trade programs (i.e., RGGI). Finally, bill and rate impacts will vary from the bill and rate impacts included in each PA's EES filings, which are done on a different time schedule from this filing and include up-to-date over- and under-collections.

PA-SPECIFIC INITIATIVES

The PAs 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 PAs 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. They may also be based on the governing structure of a PA, 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 PAs if proven successful and cost-effective. The PA-specific initiatives are set forth in Appendix G and represent proposals of only the PA making the proposal.

A.2 STATUTORY AND REGULATORY PROCESS

A.2.1 OVERVIEW

The PAs are responsible for administering energy efficiency programs within the Commonwealth. G.L. c. 25, §§ 19, 21. The Green Communities Act (GCA) requires the PAs 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). Additionally, *An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy* (Climate Act) requires the PAs to construct the plans to meet or exceed the GHG goal set by the secretary of EEA. G.L. c. 25, § 21(d)(4). The GCA sets up a multi-level framework in which the PAs work with a diverse Energy Efficiency Advisory Council (EEAC) on program development and implementation, and also appear before the Department for Plan approval, reporting, and cost recovery.

A.2.2 REGULATORY BACKGROUND

The GCA is the founding legislation for the creation of the modern three-year energy efficiency plans administered by the PAs. *An Act Relative to Green Communities*, Acts of 2008, c. 169. Passed in 2008, it mandated plans from electric and gas distribution companies to capture all-available cost-effective energy efficiency and demand resources. Review of these plans was given by the legislature to the Department.

The Global Warming Solutions Act (GWSA), passed the same year, established GHG emissions limits for the Commonwealth. *An Act Establishing the Global Warming Solutions Act,* Acts of 2008, c. 298. It directed the Commonwealth to meet the GHG limits through the Massachusetts 2050 Decarbonization Roadmap (2050 Roadmap), which outlines eight pathways by which the Commonwealth can equitably and cost-effectively achieve net-zero GHG emissions by 2050. Each pathway analyzes potential annual energy supplies that will be needed to serve projected demand in all sectors of the economy.

The GWSA also created the Interim 2030 Clean Energy and Climate Plan (2030 CECP). The 2030 CECP builds upon the strategies in the 2050 Roadmap and outlines an approach for hitting the 2030 GHG goal with new initiatives advancing decarbonization of the Commonwealth's buildings, transportation, and electricity sectors. The 2030 CECP includes specific strategies for the Three-Year Plans and how they fit into the larger GHG emissions reduction effort. The 2030 CECP also provides a GHG emissions reductions amount that the Three-Year Plans should accomplish for the Commonwealth to reach its 2030 GHG limit. However, the 2030 CECP did not mandate any GHG emissions reductions for the plan. The Three-Year Plans were reviewed within the context of the GCA and focused on energy savings. While the plans reported on their reduction of GHG emissions, it did not come under the purview of the 2030 CECP, 2050 Roadmap, or the GWSA. This changed with the passing of the Climate Act and the GHG Goal requirement.

An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy, Acts of 2021, c. 8, (Climate Act), established a legal requirement to reduce GHG emissions by 50 percent below the 1990 baseline level by 2030 and to achieve net zero GHG emissions by 2050. The Climate Act also established a GHG reduction goal for the three-year plan (GHG Goal), as established by the Secretary of the Executive Office of Energy and Environmental Affairs (EEA). The EEA Secretary set the GHG Goal in her letter dated July 15, 2021 (GHG Goal Letter).

A.2.3 ROLES AND RESPONSIBILITIES

DEPARTMENT OF PUBLIC UTILITIES

The Department is a quasi-judicial regulatory agency with extensive statutory authority over the PAs.[123] The Department is responsible for ensuring that the electric and gas utilities provide safe, reliable, and least-cost service to Massachusetts customers. In addition to prioritizing safety, security, reliability of service, affordability, the Department must also prioritize equity and reductions in GHG emissions to meet statewide GHG emission limits and sub-limits. G.L. c. 25, § 1A. 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. The Department also evaluates the plan to ensure that it is constructed to achieve the GHG Goal.

Under the GCA, the Department has oversight authority over the PAs and the EEAC and is responsible for final administrative review of energy efficiency determinations. G.L. c. 25, §§ 19, 21, 22. The Department has ultimate

[123] 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.

jurisdiction with respect to the final plan approval, cost effectiveness, rates, and cost-recovery.[124] The Department 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 PA 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.[125] Funding for the programs is also approved by the Department and reconciled annually through separate proceedings.

The Department is responsible for determining the effectiveness of the Three-Year Plan annually consistent with G.L. c. 25, § 21(d)(2). PAs annually 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 PA has not reasonably complied with its Three-Year Plan, the Department may open an investigation into the PA's performance. G.L. c. 25, § 21(e). At the conclusion of the program term, each PA 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.

At the conclusion of the three-year plan, the Department submits to the Massachusetts legislature, a report "indicating the degree to which the activities undertaken pursuant to the performance of each Plan met the [GHG Goal]." G.L. c. 25, §21(d)(5). This report is to use the most recent and complete data and measurements then available.

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[124] 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 administrative costs to the fullest extent practicable and utilizing competitive procurement processes to the fullest extent practicable, provided, however, that when determining cost-effectiveness, the calculation of program benefits shall include calculations of the social value of greenhouse gas emissions reductions except in the cases of conversions from fossil fuel heating and cooling to fossil fuel heating and cooling." 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, provided, however, that when determining cost-effectiveness, the calculation of program benefits shall include calculations of the social value of greenhouse gas emissions reductions." G.L. c. 25, § 21(a).

[125] See G.L. c. 30A, §§ 5, 10-12, 14 (outlining adjudicatory proceedings and availability of judicial review). Additionally, to comply with G.L. 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 G.L. c. 30A adjudicatory proceeding. G.L. c. 30A, § 5.

ENERGY EFFICIENCY ADVISORY COUNCIL

The EEAC consists of 15 voting members of diverse backgrounds and expertise, composing of governmental and non-governmental members, who are appointed by the Department.[126] G.L. c. 25, § 22(a). The EEAC also includes one "non-voting, ex-officio member"[127] from each of the PAs (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 EEAC ensures that the PAs 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 EEAC's diverse membership and consultants allows it to provide strategic, objective advice to the PAs. The EEAC also provides a forum for coordinating stakeholder feedback on a statewide basis. The EEAC is tasked with coordinating with the PAs in developing a three-year plan, periodically reviewing program cost effectiveness, and providing a report to the Legislature regarding the implementation of the PAs' Three-Year Plan. G.L. c. 25, § 22(b), (c). The EEAC may retain energy efficiency experts. G.L. c. 25. § 22(c). To conduct its business, the EEAC holds meetings, which are subject to the open meeting law, typically on a monthly basis. They EEAC may also create subcommittees to assist with its business (e.g., the Executive Committee and the EWG). The EEAC is designed to engage the expertise of its diverse members and consultants to provide strategic advice to the PAs and the EEAC.

A.2.4 THREE-YEAR PLAN PROCESS

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 PAs engage with the EEAC on the development of each new Plan, including through regular meetings, topic-specific EEAC workshops, and through regular communications with the EEAC's consultants. In 2020 and 2021, the PAs actively participated in six sector-specific workshops convened by the EEAC. Following the workshops in 2021, the EEAC issued a resolution on March 24, 2021 memorializing certain strategic and tactical recommendations to the PAs from the EEAC workshops. The PAs also participated in six public comment listening sessions organized by the EEAC in 2020 and three in Spring 2021, as well as listened to and reviewed oral and written public comments at regular EEAC meetings. The PAs closely reviewed the Council's recommendations from workshops in the March Resolution, as well as comments from the

[126] 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.

[127] 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.

listening sessions, and incorporated many of the themes and comments into the program designs for the April and Final Plan.

The submission of the Plan to the EEAC 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 EEAC. G.L. c. 25, § 21(c). The EEAC'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 EEAC offers its approval or comments to the PAs. G.L. c. 25, § 21(c). In this role, the Council "shall review and approve demand resource program plans and budgets, work with PAs 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 30, 2021, the EEAC passed a resolution with comments on the April 30, 2021 draft Three-Year Plan (July Resolution), attached at Appendix L. Since the passage of the July Resolution, the PAs have worked collaboratively with the EEAC to refine the Plan to address the GHG Goal Letter and the recommendations and priorities of the EEAC and enhance opportunities to provide energy efficiency services to customers. On September 22, 2021, the PAs submitted draft set of benefit-cost screening models and energy efficiency data tables to the EEAC, and on October 6, the PAs submitted an additional draft narrative Plan. Through EEAC meetings and one-on-one meetings, Councilors and their consultants provided additional feedback and suggestions to the PAs.

In addition to the formal and collaborative process with the EEAC, the PAs also engaged myriad stakeholders, including customers, past participants, contractors, energy experts, trade allies, manufacturers, and distributors. The PAs value and appreciate the input and strong interest in energy efficiency from Councilors, stakeholders, and customers. The PAs weigh the diverse input of the EEAC against the PAs' responsibility to administer the Programs in accordance with the statutory framework of the GCA, including an assessment of customer bill impacts. Pragmatically this has resulted in the PAs adopting some, but not all, individual Councilor requests and Council recommendations.

The PAs also worked closely with the Attorney General, DOER, and the Council's consultants to closely review aspects of the Plan, savings, and cost assumptions in order to come to agree on major elements of the Plan. On October 25, 2021, the PAs, DOER, and the Attorney General's Office reached an agreement on 2021-2024 goals, budgets, and performance incentives, and other key terms for the Plan, which are incorporated herein (see Appendix M). On October 27, 2021, the Council unanimously passed a resolution supporting the 2022-2024 Three-Year Plan (see Appendix N).

Throughout this process, the PAs refined their program designs and goals, based on EEAC and stakeholder input, and prepared this final Plan for review and approval by the Department—the next phase of the Three-Year Plan process.

DEPARTMENT REVIEW AND APPROVAL OF THE PLAN

Every three years, the PAs file their joint energy efficiency plan on or before October 31,[128] 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). The Department reviews the plan to ensure that it is constructed to meet or exceed the GHG goal set by the EEA Secretary, and that each PA acquires all cost-effective energy efficiency and demand reduction resources, delivers energy efficiency programs while minimizing administrative costs, and complies with the requirements of G. L. c. § 21 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).[129] In reviewing the PAs' Three-Year Plans, the Department reviews savings, cost effectiveness, budgets, bill impacts, and funding to determine whether the PAs have met their obligations under the GCA and other Department precedent.

[128] The Program Administrators are filing the 2022-2024 Plan on November 1, 2021 in accordance with the Memorandum of the Department of Public Utilities dated October 5, 2021 on procedural items for this filing.

[129] 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 (Dec. 30, 2009).

APPENDIX B: GLOSSARY

GLOSSARY OF TERMS AND ABBREVIATIONS	
2019-2021 Order	Order issued by the Department on January 29, 2019 for the 2016-2018 Plans in dockets D.P.U. 18-110 through D.P.U. 18-119
2019-2021 Plan	2019-2021 Three-Year Energy Efficiency Plan
2021 AESC Study	Avoided Energy Supply Components in New England: 2021 Report (March 15, 2021, amended May 14, 2021)
2022-2024 Plan	2022-2024 Three-Year Energy Efficiency Plan
2030 Interim CECP	Interim Clean Energy and Climate Plan Report for 2030
2050 Roadmap	Massachusetts 2050 Decarbonization Roadmap
ACEEE	American Council for an Energy-Efficient Economy
ADR	Active Demand Reduction
AESC	Avoided Energy Supply Costs
AFUE	Annual Fuel Utilization Efficiency
AGO	Office of the Attorney General of Massachusetts
Appeals Committee	Evaluation appeals committee of the Council
Attorney General	Office of the Attorney General
BCR	Benefit/Cost Ratio
BERDO	Boston Building Energy Reporting and Disclosure Ordinance
BOC	Building Operator Certification
C&I	Commercial and Industrial
C&IMC	Commercial and Industrial Management Committee
CAP	Community Action Program
CDO	Customer Directed Option
CHP	Combined Heat and Power
Climate Act	An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy, Chapter 8 of the Acts of 2021. Signed into law on March 26, 2021.
CO2e	Carbon Dioxide Equivalent
Consultants	Consultants employed by the Energy Efficiency Advisory Council
Council	Energy Efficiency Advisory Council
CPHC	Certified Passive House Consultant
CPHT-E, CPHT-MBS	Certified Passive House Tradesperson
CSCS	Codes & Standards Compliance and Technical Support Initiative
CSP	Curtailment Service Provider
DBE	Diverse Business Enterprise
DEI	Diversity, Equity & Inclusion
Department	Massachusetts Department of Public Utilities
DEP	Massachusetts Department of Environmental Protection

DHCD	Massachusetts Department of Housing and Community Development
DOE	U.S. Department of Energy
DOER	Massachusetts Department of Energy Resources
DPU	Massachusetts Department of Public Utilities
D.P.U. 08-50	Energy Efficiency Guidelines, 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.P.U. 11-120 Guidelines	Energy efficiency guidelines established in D.P.U. 11-120-A, Phase II (2013)
D.T.E. 98-100 Guidelines	Energy efficiency guidelines established in Investigation to Establish Methods and Procedures to Evaluate and Approve Energy Efficiency Programs, D.T.E. 98-100 (2000)
DRIPE	Demand Reduction Induced Price Effect
DSM	Demand-Side Management
ECM	Electronically Commutated Motor
EEA	Executive Office of Energy and Environmental Affairs
EEAC	Energy Efficiency Advisory Council
EERF	Energy Efficiency Reconciliation Factor
EES	Energy Efficiency Surcharge
EISA	Energy Independence and Security Act
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
Equity	The process of establishing more equal access to and participation in energy efficiency, particularly among those groups who have historically participated at lower rates, including renters/landlords, moderate-income customers, English-isolated families, and microbusinesses
ESCO	Energy Services Company
eTRM	Electronic Technical Reference Manual
EUI	Energy use intensity
EWG	Equity Working Group
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. 20-150 Guidelines
GWSA	Global Warming Solutions Act, St. 2008, c. 298
HEARTWAP	Heating Emergency Assistance Retrofit Task Weatherization Assistance program
HER	Home Energy Report
HERS	Home Energy Rating System
HPC	Home Performance Contractor
HRV	Heat-Recovery Ventilator Equipment
HVAC	Heating, Ventilation, and Air Conditioning
ICAP	Installed Capacity
IIC	Independent Installation Contractor
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
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	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.
LIHEAP	Low-Income Home Energy Assistance
M&V	Measurement and Verification
MAEEP	Massachusetts Energy Efficiency Partnership
MAP	Mass Save Application Portal
MassCEC	Massachusetts Clean Energy Center

Mass Save Data	The PAs' energy efficiency database: https://www.masssavedata.com/public/home
MBCx	Monitoring Based Commissioning
MBE	Minority Business Enterprise
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
MMTCO2e	Million Metric Tons of Carbon Dioxide Equivalent
MOU	Memorandum of Understanding
MSBA	Massachusetts School Building Authority
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
PACE	Property Assessed Clean Energy
Participant Cost	The total cost of a project or measure less the customer incentive.
Community First Partnership Program	Statewide municipal and community partnership program (formerly called the Municipal & Community Partnership Strategy)
Performance Incentive	Compensation for a utility's successful execution of the energy efficiency programs during the program year as determined by Massachusetts Department of Public Utilities.
PHI	Passive House Institute
PHIUS	Passive House Institute US
PI	Performance Incentive
Plan	Three-Year Energy Efficiency Plan
PP&A	Program Planning and Administration
PP&A Report	Best Practices for Minimizing Program Planning and Administrative Costs (PP&A) for the Massachusetts Utilities and Energy Efficiency Services Providers dated October 24, 2018

Program Administrators	Utilities and municipal aggregators that are certified to offer energy efficiency programs.
PTF	Pooled Transmission Facilities
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
QPL	Qualifying Products List
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
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
TRM	Technical Reference Manual
WAP	Weatherization Assistance Program
WBE	Women-Owned Business Enterprise

APPENDIX C: STATEWIDE ENERGY EFFICIENCY DATA TABLES

Energy Efficiency Data Tables

Overview

Statewide Electric
November 1, 2021

DATA OVERVIEW

The following data tables provide a summary of the Program Administrator's benefits, costs, savings, and cost-effectiveness for 2019 through 2024. The 2019 through 2021 planned values are consistent with each Program Administrator's 2019-2021 Three-Year Plan. The 2019 and 2020 evaluated values are consistent with each Program Administrator's 2019 and 2020 Plan-Year Reports. The 2021 year-to-date data represents the most up-to-date estimated actual values available through through June 30, 2021 (Q2). The 2022-2024 planned values are consistent with each Program Administrator's 2022-2024 Three-Year Plan.

SUPPORTING INFORMATION

The data included in these tables is based on other supporting models. The primary supporting models used by the Program Administrators are the Benefit-Cost Screening model, each Program Administrator's EES calculation support documents, and the Performance Incentive model. These exhibits should be referenced when looking for more detailed analyses, such as measure level detail and EES calculations. High-level summaries for each of these models are provided below, along with information on plan details that are not summarized in the following plan tables.

Benefit-Cost Screening Models

The Benefit-Cost Screening model provides measure level savings and benefits. This model uses the avoided cost values from the 2021 Avoided Energy Supply Cost study prepared by Synapse Energy Economics. The models also provide Program Administrator-specific information, including avoided T&D costs.

GHG

The avoided CO2e (metric tons) in the savings table (table IV.D.3.2.i) are calculated consistent with the methodology stipulated by the Massachusetts Executive Office of Energy and Environmental Affairs in Letter from Sec. Theoharides, "Greenhouse Gas Emissions Reduction Goal for Mass Save," July 15, 2021. See: https://www.mass.gov/doc/greenhouse-gas-emissions-reduction-goal-for-mass-save/download

EM&V Activities

The Evaluation, Monitoring & Verification Section of the Joint Statewide Three-Year Plan describes in detail the EM&V activities planned for 2022-2024.

Performance Incentive Model

The Performance Incentive model filed as part of the Joint Statewide Three-Year Plan provides support for the performance incentive dollars proposed for collection by the Program Administrator. Note that performance incentives are not applicable to the Cape Light Compact.

EES Calculations

Each Program Administrator's Energy Efficiency Surcharge analysis provides supporting information on the EES rates proposed for effect in 2022-2024, including how the rates are calculated for each customer sector, and how revenue is collected from each customer sector.

2022-2024 Plan Data Tables

Template Version: October 28, 2021

PA-Specific Information

FILING INFORMATION

Distribution Company	Electric	
Program Administrator	Statewide Electric	*PA-specific*
Date of Filing/Draft	November 1, 2021	

FILING DATES AND DOCKETS

Reporting Period	Filing Date	DPU Docket Number
2019 Planned	February 2, 2019	Statewide Electric
2020 Planned	February 2, 2019	Statewide Electric
2021 Planned	February 2, 2019	Statewide Electric
2019 Evaluated	May 29, 2020	D.P.U. 20-50
2020 Evaluated	June 4, 2021	D.P.U. 21-70
2021 YTD	through June 30, 2021 (Q2)	n/a
2022 Planned	November 1, 2021	Statewide Electric
2023 Planned	November 1, 2021	Statewide Electric
2024 Planned	November 1, 2021	Statewide Electric

RATES FOR ADJUSTMENTS

2020 Nominal Discount Rate	2.33%	
2021 Nominal Discount Rate	2.33%	
2023 Nominal Discount Rate	1.98%	
2024 Nominal Discount Rate	1.98%	
2022 Electric LI Rate Subsidy, Resi	n/a	*PA-specific*
2022 Electric LI Rate Subsidy, C&I	n/a	*PA-specific*
2023 Electric LI Rate Subsidy, Resi	n/a	*PA-specific*
2023 Electric LI Rate Subsidy, C&I	n/a	*PA-specific*
2024 Electric LI Rate Subsidy, Resi	n/a	*PA-specific*
2024 Electric LI Rate Subsidy, C&I	n/a	*PA-specific*
Effective Tax Rate	27.32%	*PA-specific*

Energy Efficiency Guidelines 3.4.6 requires that "Benefits and costs that are projected to occur over the term of each Energy Efficiency Program shall be stated in present value terms, using a discount rate that is equal to a twelve-month average of the historic yields from the ten-year United States Treasury note, using the previous calendar year to determine the twelve-month average." The Program Administrators calculated the discount rate used in the 2022-2024 Plan consistently with this methodology, but averaged interest rates over the previous three years (instead of the previous one year) to account for the anomalous impact of the COVID-19 pandemic on interest rates.

Slicers for Pivot Tables

Tables with Master Data source

Electric	Cape Light Compact
Gas	Eversource Electric
(blank)	National Grid Electric
	Statewide Electric
	Unitil Electric
	Berkshire
	Eversource Gas (EGMA)
	Eversource Gas (NSTAR)
	Liberty
	National Grid Gas
	Statewide Gas
	Unitil Gas
	(blank)

Tables with Master Sector source

Electric	Cape Light Compact
Gas	Eversource Electric
(blank)	National Grid Electric
	Statewide Electric
	Unitil Electric
	Berkshire
	Eversource Gas (EGMA)
	Eversource Gas (NSTAR)
	Liberty
	National Grid Gas
	Statewide Gas
	Unitil Gas
	(blank)

IV.B. Program Administrator Funding Sources

1. Summary Table

Statewide Electric
November 1, 2021

2022 Total Electric Funding Sources							2022 Funding as a Percent of Total Electric Funding Sources					
Sector	**SBC**	**FCM**	**Other Funding**	**Carryover**	**EERF**	**Total**	**SBC**	**FCM**	**Other Funding**	**Carryover**	**EERF**	**Total**
A - Residential	21,645,631	28,595,694	-	28,945,555	256,931,400	336,118,280	6%	9%	0%	9%	76%	100%
B - Income Eligible	2,676,923	3,452,865	-	32,273,574	75,868,349	114,271,710	2%	3%	0%	28%	66%	100%
C - Commercial & Industrial	30,330,428	49,272,497	-	32,687,341	213,688,201	325,978,468	9%	15%	0%	10%	66%	100%
Grand Total	**54,652,982**	**81,321,056**	**-**	**93,906,469**	**546,487,950**	**776,368,458**	**7%**	**10%**	**0%**	**12%**	**70%**	**100%**

2023 Total Electric Funding Sources							2023 Funding as a Percent of Total Electric Funding Sources					
Sector	**SBC**	**FCM**	**Other Funding**	**Carryover**	**EERF**	**Total**	**SBC**	**FCM**	**Other Funding**	**Carryover**	**EERF**	**Total**
A - Residential	22,031,353	19,549,757	-	-	362,758,240	404,339,349	5%	5%	0%	0%	90%	100%
B - Income Eligible	2,727,567	2,379,484	-	-	115,312,137	120,419,188	2%	2%	0%	0%	96%	100%
C - Commercial & Industrial	30,221,728	33,608,104	-	-	326,045,850	389,875,683	8%	9%	0%	0%	84%	100%
Grand Total	**54,980,648**	**55,537,345**	**-**	**-**	**804,116,227**	**914,634,220**	**6%**	**6%**	**0%**	**0%**	**88%**	**100%**

2024 Total Electric Funding Sources							2024 Funding as a Percent of Total Electric Funding Sources					
Sector	**SBC**	**FCM**	**Other Funding**	**Carryover**	**EERF**	**Total**	**SBC**	**FCM**	**Other Funding**	**Carryover**	**EERF**	**Total**
A - Residential	22,440,693	19,230,873	-	-	470,148,895	511,820,462	4%	4%	0%	0%	92%	100%
B - Income Eligible	2,780,475	2,364,331	-	-	121,673,881	126,818,687	2%	2%	0%	0%	96%	100%
C - Commercial & Industrial	30,185,574	33,129,755	-	-	473,656,678	536,972,007	6%	6%	0%	0%	88%	100%
Grand Total	**55,406,742**	**54,724,960**	**-**	**-**	**1,065,479,454**	**1,175,611,156**	**5%**	**5%**	**0%**	**0%**	**91%**	**100%**

2022-2024 Total Electric Funding Sources							2022-2024 Funding as a Percent of Total Electric Funding Sources					
Sector	**SBC**	**FCM**	**Other Funding**	**Carryover**	**EERF**	**Total**	**SBC**	**FCM**	**Other Funding**	**Carryover**	**EERF**	**Total**
A - Residential	66,117,677	67,376,324	-	28,945,555	1,089,838,535	1,252,278,091	5%	5%	0%	2%	87%	100%
B - Income Eligible	8,184,965	8,196,680	-	32,273,574	312,854,366	361,509,585	2%	2%	0%	9%	87%	100%
C - Commercial & Industrial	90,737,730	116,010,357	-	32,687,341	1,013,390,729	1,252,826,157	7%	9%	0%	3%	81%	100%
Grand Total	**165,040,372**	**191,583,362**	**-**	**93,906,469**	**2,416,083,631**	**2,866,613,834**	**6%**	**7%**	**0%**	**3%**	**84%**	**100%**

Notes:
For supporting information on SBC collections, see Table IV.B.3.1.
For supporting information on FCM revenue, see Table IV.B.3.2.
For supporting information on other funding see, Additional Sources of Information.
For supporting information on estimated carryover, see Table IV.B.3.5.
For supporting information on the EERF, see Table IV.B.3.6.
Funding sources for each year are represented in nominal dollars (2022$, 2023$, 2024$).

IV.B. Program Administrator Funding Sources

3.1. System Benefit Charge Funds

Statewide Electric

November 1, 2021

2022 System Benefit Charge Collections				
Sector	Sales (kWh)	SBC Charge ($/kWh)	Collections	
			($)	(% of Total)
A - Residential	8,658,252,292	0.0025	21,645,631	39.6%
B - Income Eligible	1,070,769,170	0.0025	2,676,923	4.9%
C - Commercial & Industrial	12,132,171,223	0.0025	30,330,428	55.5%
Grand Total	**21,861,192,686**		**54,652,982**	**100%**

2023 System Benefit Charge Collections				
Sector	Sales (kWh)	SBC Charge ($/kWh)	Collections	
			($)	(% of Total)
A - Residential	8,812,541,215	0.0025	22,031,353	40.1%
B - Income Eligible	1,091,026,735	0.0025	2,727,567	5.0%
C - Commercial & Industrial	12,088,691,215	0.0025	30,221,728	55.0%
Grand Total	**21,992,259,165**		**54,980,648**	**100%**

2024 System Benefit Charge Collections				
Sector	Sales (kWh)	SBC Charge ($/kWh)	Collections	
			($)	(% of Total)
A - Residential	8,976,277,215	0.0025	22,440,693	40.5%
B - Income Eligible	1,112,190,070	0.0025	2,780,475	5.0%
C - Commercial & Industrial	12,074,229,503	0.0025	30,185,574	54.5%
Grand Total	**22,162,696,788**		**55,406,742**	**100%**

2022-2024 System Benefit Charge Collections				
Sector	Sales (kWh)	SBC Charge ($/kWh)	Collections	
			($)	(% of Total)
A - Residential	26,447,070,722	0.0025	66,117,677	40.1%
B - Income Eligible	3,273,985,976	0.0025	8,184,965	5.0%
C - Commercial & Industrial	36,295,091,941	0.0025	90,737,730	55.0%
Grand Total	**66,016,148,639**		**165,040,372**	**100%**

Notes:

Collections are the sales multiplied by the SBC charge.

Consistent with the Department's Energy Efficiency Guidelines § 3.2.1.2, electric Program Administrators allocate revenue from the System Benefits Charge to the residential, low-income, and commercial and industrial customer sectors in proportion to the sector's kilowatt-hour consumption.

IV.B. Program Administrator Funding Sources

3.2. Forward Capacity Market Proceeds

Statewide Electric

November 1, 2021

2022 Forward Capacity Market Revenue							
Program Administrator	Jan 2022 - May 2022			June 2022 - Dec 2022			Total Revenue ($)
	Savings (kW)	Price ($)	Revenue ($)	Savings (kW)	Price ($)	Revenue ($)	
National Grid	821,874	n/a	17,317,245	811,942	n/a	21,597,657	38,914,902
Eversource	678,138	n/a	15,923,021	749,682	n/a	20,302,767	36,225,788
Unitil	12,763	n/a	267,288	10,893	n/a	273,353	540,642
CLC	50,257	n/a	2,387,971	54,406	n/a	3,251,754	5,639,725
			-			-	-
Grand Total	**1,563,032**	**n/a**	**35,895,525**	**811,942**	**n/a**	**21,597,657**	**81,321,056**

2023 Forward Capacity Market Revenue							
Program Administrator	Jan 2023 - May 2023			June 2023 - Dec 2023			Total Revenue ($)
	Savings (kW)	Price ($)	Revenue ($)	Savings (kW)	Price ($)	Revenue ($)	
National Grid	811,942	n/a	15,426,898	838,577	n/a	11,745,948	27,172,846
Eversource	749,682	n/a	14,501,977	705,058	n/a	10,349,970	24,851,947
Unitil	9,830	n/a	181,304	9,854	n/a	134,558	315,862
CLC	54,406	n/a	2,322,681	62,398	n/a	874,009	3,196,690
			-			-	-
Grand Total	**1,625,860**	**n/a**	**32,432,860**	**1,615,887**	**n/a**	**23,104,485**	**55,537,345**

2024 Forward Capacity Market Revenue							
Program Administrator	Jan 2024 - May 2024			June 2024 - Dec 2024			Total Revenue ($)
	Savings (kW)	Price ($)	Revenue ($)	Savings (kW)	Price ($)	Revenue ($)	
National Grid	838,577	n/a	8,389,963	781,283	n/a	18,630,009	27,019,972
Eversource	705,058	n/a	7,392,836	627,352	n/a	17,827,947	25,220,783
Unitil	8,872	n/a	88,768	10,481	n/a	181,732	270,500
CLC	62,398	n/a	624,292	57,050	n/a	1,589,413	2,213,705
			-			-	-
Grand Total	**1,614,905**	**n/a**	**16,495,859**	**1,476,166**	**n/a**	**38,229,101**	**54,724,960**

2022-2024 Forward Capacity Market Revenue								
Sector	2022		2023		2024		2022-2024	
	FCM Revenue ($)	% of FCM Revenue	FCM Revenue ($)	% of FCM Revenue	FCM Revenue ($)	% of FCM Revenue	FCM Revenue ($)	% of FCM Revenue
A - Residential	28,595,694	35.2%	19,549,757	35.2%	19,230,873	35.1%	67,376,324	35.2%
B - Income Eligible	3,452,865	4.2%	2,379,484	4.3%	2,364,331	4.3%	8,196,680	4.3%
C - Commercial & Industrial	49,272,497	60.6%	33,608,104	60.5%	33,129,755	60.5%	116,010,357	60.6%
Grand Total	**81,321,056**	**100%**	**55,537,345**	**100%**	**54,724,960**	**100%**	**191,583,362**	**100%**

Notes:

Revenue is allocated across customer sector based on percentage allocation of kWh sales. See Table IV.B.3.1.

Each Program Administrator completes this table according to how their FCM resources have cleared in each auction.

IV.B. Program Administrator Funding Sources

3.5. Carryover

Statewide Electric

November 1, 2021

Estimated 2021 Carryover into 2022								
Sector	2019-2021 Planned		2019-2021 Actual		2019-2021 Beginning Balance (Carryover from 2018)	2021 Ending Balance w/o Interest (Carryover from 2021)	Interest on Carryover	Total 2021 Carryover into 2022
	Funding	Budget	Revenue	Expenditures				
A - Residential	787,780,511	786,114,962	886,326,540	865,323,584	3,536,188	(17,466,768)	1,271,198	16,195,570
B - Income Eligible	215,182,864	218,674,390	201,803,247	188,130,944	(25,169,547)	(38,841,850)	879,013	37,962,837
C - Commercial & Industrial	1,046,587,533	1,052,850,283	940,410,616	949,061,908	66,956,717	75,608,009	(328,360)	(75,279,649)
Grand Total	**2,049,550,908**	**2,057,639,635**	**2,028,540,402**	**2,002,516,436**	**45,323,357**	**19,299,391**	**1,821,851**	**(21,121,242)**

Notes:

The above table provides an estimate of the over- or under-collection for the EERF from the 2019-2021 Three-Year Plan. The Program Administrator's actual 2019-2021 carryover for collection in 2022 will be presented in its Energy Efficiency Reconciliation Factor filing.

A positive carryover value indicates an over-collection while a negative carryover value indicates an under-collection.

IV.B. Program Administrator Funding Sources

3.4 Other Funding

Statewide Electric

November 1, 2021

Other Funding Sources, 2022-2024				
Sector	**2022**	**2023**	**2024**	**2022-2024**
A - Residential	-	-	-	-
B - Income Eligible	-	-	-	-
C - Commercial & Industrial	-	-	-	-
Grand Total	**-**	**-**	**-**	**-**

Notes:

"Other" Funding are those funds, private or public utility administered or otherwise, that may be available for energy efficiency or demand resources and do not include SBC Funds, FCM Revenue, or RGGI Proceeds. The Program Administrators assume no other funding sources for this plan.

IV.B. Program Administrator Funding Sources

3.6. EERF

Statewide Electric

November 1, 2021

2022 Energy Efficiency Reconciliation Factor Funds							
Sector	**Total Budget**	**Sales (kWh)**	**SBC + FCM + Other Funding + Carryover**	**Interest**	**EERF Funding Required**	**Low-Income Subsidization**	**EERF Funding Collected**
A - Residential	332,059,091	8,658,252,292	79,186,880	154,279	253,026,491	34,187,415	287,213,906
B - Income Eligible	116,214,052	1,070,769,170	38,403,361	13,087	77,823,778	4,092,403	4,092,403
C - Commercial & Industrial	333,013,378	12,132,171,223	112,290,266	7,150	220,730,262	37,588,531	258,318,793
Grand Total	**781,286,521**	**21,861,192,686**	**229,880,507**	**174,517**	**551,580,530**	**75,868,348**	**549,625,101**

2023 Energy Efficiency Reconciliation Factor Funds							
Sector	**Total Budget**	**Sales (kWh)**	**SBC + FCM + Other Funding**	**Interest**	**EERF Funding Required**	**Low-Income Subsidization**	**EERF Funding Collected**
A - Residential	404,221,035	8,812,541,215	41,581,110	118,314	362,758,240	52,291,338	415,049,578
B - Income Eligible	120,390,542	1,091,026,735	5,107,051	28,646	115,312,137	6,367,209	6,367,209
C - Commercial & Industrial	389,822,442	12,088,691,215	63,829,833	53,241	326,045,850	56,653,591	382,699,441
Grand Total	**914,434,019**	**21,992,259,165**	**110,517,993**	**200,201**	**804,116,227**	**115,312,138**	**804,116,228**

2024 Energy Efficiency Reconciliation Factor Funds							
Sector	**Total Budget**	**Sales (kWh)**	**SBC + FCM + Other Funding**	**Interest**	**EERF Funding Required**	**Low-Income Subsidization**	**EERF Funding Collected**
A - Residential	511,685,689	8,976,277,215	41,671,566	134,773	470,148,895	55,620,708	525,769,604
B - Income Eligible	126,794,960	1,112,190,070	5,144,806	23,727	121,673,881	6,835,205	6,835,205
C - Commercial & Industrial	536,918,580	12,074,229,503	63,315,329	53,427	473,656,678	59,217,968	532,874,646
Grand Total	**1,175,399,229**	**22,162,696,788**	**110,131,702**	**211,927**	**1,065,479,454**	**121,673,880**	**1,065,479,454**

2022-2024 Energy Efficiency Reconciliation Factor Funds							
Sector	**Total Budget**	**Sales (kWh)**	**SBC + FCM + Other Funding + Carryover**	**Interest**	**EERF Funding Required**	**Low-Income Subsidization**	**EERF Funding Collected**
A - Residential	1,247,965,816	26,447,070,722	162,439,556	407,366	1,085,933,626	142,099,462	1,228,033,088
B - Income Eligible	363,399,554	3,273,985,976	48,655,219	65,460	314,809,795	17,294,817	17,294,817
C - Commercial & Industrial	1,259,754,399	36,295,091,941	239,435,428	113,819	1,020,432,790	153,460,088	1,173,892,878
Grand Total	**2,871,119,768**	**66,016,148,639**	**450,530,202**	**586,645**	**2,421,176,211**	**312,854,367**	**2,419,220,783**

Notes:

For supporting information on the Total Program Administrator Budget, which includes Performance Incentives, see Table IV.C.1.3.

For supporting information on the EERF calculation, including low income subsidization, refer to the Program Administrator's EERF exhibit.

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Electric
November 1, 2021

2022 Program Administrator Budget ($)										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**14,690,204**	**14,538,971**	**217,139,497**	**65,110,858**	**5,309,419**	**316,788,948**	**15,270,143**	**332,059,091**	**268.18**	**3.47**
A1 - Residential New Buildings	1,861,396	329,193	17,558,407	1,641,926	-	21,390,922	1,201,397	22,592,320	1,850.11	4.08
A1a - Residential New Homes & Renovations	1,861,396	329,193	17,558,407	1,641,926	-	21,390,922	1,201,397	22,592,320	1,850.11	4.08
A2 - Residential Existing Buildings	10,361,653	11,560,607	165,908,085	51,060,848	-	238,891,193	14,068,746	252,959,939	204.23	4.24
A2a - Residential Coordinated Delivery	5,066,983	2,292,304	90,948,434	14,700,257	-	113,007,978	6,380,820	119,388,798	1,845.08	4.27
A2b - Residential Conservation Services (RCS)	1,000,055	3,699,839	-	21,409,939	-	26,109,832	-	26,109,832		-
A2c - Residential Retail	3,694,836	5,358,530	66,737,119	4,851,077	-	80,641,563	6,979,297	87,620,860	539.34	5.95
A2d - Residential Behavior	208,321	-	61,938	5,762,259	-	6,032,518	317,140	6,349,658	6.92	3.65
A2e - Residential Active Demand Reduction	391,458	209,933	8,160,594	4,337,317	-	13,099,302	391,489	13,490,791	149.99	2.12
A3 - Residential Hard-to-Measure	2,467,155	2,649,170	33,673,005	12,408,084	5,309,419	56,506,833	-	56,506,833		-
A3a - Residential Statewide Marketing	3,336	1,692,040	-	-	-	1,695,376	-	1,695,376		-
A3b - Residential Statewide Database	29,961	-	-	-	-	29,961	-	29,961		-
A3c - Residential DOER Assessment	1,660,014	-	-	-	-	1,660,014	-	1,660,014		-
A3d - Residential Sponsorships & Subscriptions	81,033	15,464	-	8,126	10,075	114,698	-	114,698		-
A3e - Residential Workforce Development	-	-	-	5,069,081	-	5,069,081	-	5,069,081		-
A3f - Residential Evaluation and Market Research	-	-	-	-	5,299,344	5,299,344	-	5,299,344		-
A3g - Residential EEAC Consultants	250,016	-	-	-	-	250,016	-	250,016		-
A3h - Residential R&D and Demonstration	115,000	15,400	95,000	3,822,285	-	4,047,685	-	4,047,685		-
A3i - Residential HEAT Loan	162,795	183,370	33,578,005	2,350,043	-	36,274,213	-	36,274,213		-
A3j - Residential Education	165,000	742,896	-	1,158,550	-	2,066,446	-	2,066,446		-
B - Income Eligible	**4,454,334**	**1,487,287**	**87,583,592**	**16,895,025**	**1,415,400**	**111,835,638**	**4,378,414**	**116,214,052**	**3,876.40**	**1.97**
B1 - Income Eligible Existing Buildings	3,546,645	1,251,650	87,583,592	15,731,029	-	108,112,916	4,378,414	112,491,331	3,747.36	2.04
B1a - Income Eligible Coordinated Delivery	3,546,535	1,251,641	87,436,757	15,729,269	-	107,964,202	4,374,438	112,338,639	3,758.74	2.04
B1b - Income Eligible Active Demand Reduction	110	9	146,835	1,760	-	148,715	3,976	152,691	1,171.69	3.01
B2 - Income Eligible Hard-to-Measure	907,689	235,637	-	1,163,996	1,415,400	3,722,722	-	3,722,722		-
B2a - Income Eligible Statewide Marketing	-	235,521	-	-	-	235,521	-	235,521		-
B2b - Income Eligible Statewide Database	10,032	-	-	-	-	10,032	-	10,032		-
B2c - Income Eligible DOER Assessment	504,152	-	-	-	-	504,152	-	504,152		-
B2d - Income Eligible Sponsorships & Subscriptions	16,505	116	-	2,025	1,265	19,910	-	19,910		-
B2e - Income Eligible Workforce Development	-	-	-	1,161,972	-	1,161,972	-	1,161,972		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	1,414,135	1,414,135	-	1,414,135		-
B2g - Low-Income Energy Affordability Network (LEAN)	**377,000**	-	-	-	-	**377,000**	-	**377,000**		-
C - Commercial & Industrial	**12,743,985**	**5,502,973**	**233,733,324**	**56,867,448**	**7,275,294**	**316,123,024**	**16,890,353**	**333,013,378**	**50,195.92**	**2.99**
C1 - C&I New Buildings	1,063,180	802,865	13,246,428	8,846,649	-	23,959,123	1,422,687	25,381,809	117,745.53	3.22
C1a - C&I New Buildings & Major Renovations	1,063,180	802,865	13,246,428	8,846,649	-	23,959,123	1,422,687	25,381,809	117,745.53	3.22
C2 - C&I Existing Buildings	9,385,402	4,304,850	220,424,271	40,179,795	-	274,294,319	15,467,667	289,761,985	45,008.33	3.16
C2a - C&I Existing Building Retrofit	7,193,632	3,543,689	167,729,788	32,975,155	-	211,442,263	11,290,325	222,732,589	125,592.16	2.95
C2b - C&I New & Replacement Equipment	1,701,334	588,256	42,120,769	5,191,104	-	49,601,463	3,637,915	53,239,378	14,594.08	4.17
C2c - C&I Active Demand Reduction	490,436	172,905	10,573,715	2,013,536	-	13,250,592	539,426	13,790,019	13,093.47	2.84
C3 - C&I Hard-to-Measure	2,295,403	395,257	62,625	7,841,004	7,275,294	17,869,583	-	17,869,583		-
C3a - C&I Statewide Marketing	-	373,397	-	-	-	373,397	-	373,397		-
C3b - C&I Statewide Database	30,361	-	-	-	-	30,361	-	30,361		-
C3c - C&I DOER Assessment	1,839,718	-	-	-	-	1,839,718	-	1,839,718		-
C3d - C&I Sponsorships & Subscriptions	142,002	20,686	-	11,995	12,491	187,175	-	187,175		-
C3e - C&I Workforce Development	-	-	-	5,330,724	-	5,330,724	-	5,330,724		-
C3f - C&I Evaluation and Market Research	-	-	-	-	7,262,803	7,262,803	-	7,262,803		-
C3g - C&I EEAC Consultants	208,322	-	-	-	-	208,322	-	208,322		-
C3h - C&I R&D and Demonstration	75,000	1,175	62,625	2,498,284	-	2,637,084	-	2,637,084		-
Grand Total	**31,888,524**	**21,529,230**	**538,456,413**	**138,873,331**	**14,000,113**	**744,747,610**	**36,538,911**	**781,286,521**	**612.25**	**3.04**

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Electric
November 1, 2021

2023 Program Administrator Budget ($)										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**15,538,875**	**15,246,490**	**279,493,473**	**67,911,402**	**5,479,288**	**383,669,528**	**20,551,507**	**404,221,035**	**303.39**	**3.63**
A1 - Residential New Buildings	1,980,455	319,906	21,423,783	1,484,091	-	25,208,236	2,325,736	27,533,972	1,979.91	6.06
A1a - Residential New Homes & Renovations	1,980,455	319,906	21,423,783	1,484,091	-	25,208,236	2,325,736	27,533,972	1,979.91	6.06
A2 - Residential Existing Buildings	11,060,352	12,254,609	213,476,922	53,788,726	-	290,580,609	18,225,771	308,806,380	232.12	4.26
A2a - Residential Coordinated Delivery	5,302,759	2,435,323	107,355,047	15,024,669	-	130,117,799	7,050,866	137,168,665	2,025.82	3.90
A2b - Residential Conservation Services (RCS)	918,372	3,946,883	-	22,111,760	-	26,977,015	-	26,977,015		-
A2c - Residential Retail	4,277,185	5,661,375	94,657,745	4,886,018	-	109,482,322	10,303,139	119,785,461	688.18	6.13
A2d - Residential Behavior	200,992	-	55,944	5,877,119	-	6,134,055	333,053	6,467,108	6.72	3.69
A2e - Residential Active Demand Reduction	361,045	211,029	11,408,186	5,889,159	-	17,869,419	538,712	18,408,131	154.24	2.10
A3 - Residential Hard-to-Measure	2,498,068	2,671,974	44,592,767	12,638,586	5,479,288	67,880,683	-	67,880,683		-
A3a - Residential Statewide Marketing	3,469	1,692,709	-	-	-	1,696,178	-	1,696,178		-
A3b - Residential Statewide Database	29,397	-	-	-	-	29,397	-	29,397		-
A3c - Residential DOER Assessment	1,672,900	-	-	-	-	1,672,900	-	1,672,900		-
A3d - Residential Sponsorships & Subscriptions	83,034	15,478	-	8,370	10,227	117,109	-	117,109		-
A3e - Residential Workforce Development	-	-	-	5,161,920	-	5,161,920	-	5,161,920		-
A3f - Residential Evaluation and Market Research	-	-	-	-	5,469,061	5,469,061	-	5,469,061		-
A3g - Residential EEAC Consultants	256,216	-	-	-	-	256,216	-	256,216		-
A3h - Residential R&D and Demonstration	120,000	2,800	82,500	3,680,909	-	3,886,209	-	3,886,209		-
A3i - Residential HEAT Loan	163,051	184,788	44,510,267	2,532,712	-	47,390,819	-	47,390,819		-
A3j - Residential Education	170,000	776,198	-	1,254,675	-	2,200,873	-	2,200,873		-
B - Income Eligible	**4,239,258**	**1,543,012**	**90,213,040**	**18,670,302**	**931,413**	**115,597,025**	**4,793,516**	**120,390,542**	**3,888.80**	**1.99**
B1 - Income Eligible Existing Buildings	3,343,122	1,306,756	90,213,040	17,502,090	-	112,365,008	4,793,516	117,158,525	3,780.07	2.05
B1a - Income Eligible Coordinated Delivery	3,343,006	1,306,748	89,902,425	17,497,704	-	112,049,883	4,787,455	116,837,338	3,792.53	2.05
B1b - Income Eligible Active Demand Reduction	116	9	310,615	4,386	-	315,126	6,061	321,187	1,743.25	2.55
B2 - Income Eligible Hard-to-Measure	896,136	236,255	-	1,168,213	931,413	3,232,017	-	3,232,017		-
B2a - Income Eligible Statewide Marketing	-	236,136	-	-	-	236,136	-	236,136		-
B2b - Income Eligible Statewide Database	9,538	-	-	-	-	9,538	-	9,538		-
B2c - Income Eligible DOER Assessment	486,341	-	-	-	-	486,341	-	486,341		-
B2d - Income Eligible Sponsorships & Subscriptions	17,006	119	-	2,086	1,302	20,514	-	20,514		-
B2e - Income Eligible Workforce Development	-	-	-	1,166,127	-	1,166,127	-	1,166,127		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	930,111	930,111	-	930,111		-
B2g - Low-Income Energy Affordability Network (LEAN)	**383,250**	-	-	-	-	**383,250**	-	**383,250**		-
C - Commercial & Industrial	**12,782,767**	**5,441,011**	**288,247,573**	**58,264,313**	**7,492,644**	**372,228,307**	**17,594,134**	**389,822,442**	**57,297.49**	**2.57**
C1 - C&I New Buildings	964,853	807,570	12,859,712	8,915,422	-	23,547,557	1,540,931	25,088,489	111,685.49	3.54
C1a - C&I New Buildings & Major Renovations	964,853	807,570	12,859,712	8,915,422	-	23,547,557	1,540,931	25,088,489	111,685.49	3.54
C2 - C&I Existing Buildings	9,390,439	4,236,073	275,122,610	41,397,086	-	330,146,208	16,053,203	346,199,411	52,524.40	2.65
C2a - C&I Existing Building Retrofit	7,245,064	3,479,662	216,080,999	34,157,813	-	260,963,538	11,510,485	272,474,023	154,393.82	2.36
C2b - C&I New & Replacement Equipment	1,563,747	582,856	44,687,715	4,944,630	-	51,778,947	3,885,769	55,664,716	14,834.96	4.15
C2c - C&I Active Demand Reduction	581,627	173,556	14,353,897	2,294,643	-	17,403,722	656,950	18,060,672	15,749.97	2.59
C3 - C&I Hard-to-Measure	2,427,475	397,368	265,250	7,951,805	7,492,644	18,534,542	-	18,534,542		-
C3a - C&I Statewide Marketing	-	374,312	-	-	-	374,312	-	374,312		-
C3b - C&I Statewide Database	31,418	-	-	-	-	31,418	-	31,418		-
C3c - C&I DOER Assessment	1,956,802	-	-	-	-	1,956,802	-	1,956,802		-
C3d - C&I Sponsorships & Subscriptions	144,932	20,706	-	12,355	12,716	190,710	-	190,710		-
C3e - C&I Workforce Development	-	-	-	5,421,301	-	5,421,301	-	5,421,301		-
C3f - C&I Evaluation and Market Research	-	-	-	-	7,479,928	7,479,928	-	7,479,928		-
C3g - C&I EEAC Consultants	214,322	-	-	-	-	214,322	-	214,322		-
C3h - C&I R&D and Demonstration	80,000	2,350	265,250	2,518,149	-	2,865,749	-	2,865,749		-
Grand Total	**32,560,900**	**22,230,512**	**657,954,086**	**144,846,017**	**13,903,345**	**871,494,861**	**42,939,158**	**914,434,019**	**669.95**	**2.96**

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Electric
November 1, 2021

2024 Program Administrator Budget ($)										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**15,975,688**	**15,916,280**	**374,507,276**	**71,564,231**	**5,969,615**	**483,933,090**	**27,752,599**	**511,685,689**	**355.12**	**3.66**
A1 - Residential New Buildings	1,937,296	348,451	23,639,956	1,511,333	-	27,437,036	2,528,438	29,965,474	2,432.25	5.77
A1a - Residential New Homes & Renovations	1,937,296	348,451	23,639,956	1,511,333	-	27,437,036	2,528,438	29,965,474	2,432.25	5.77
A2 - Residential Existing Buildings	11,490,931	12,865,397	293,898,740	57,214,053	-	375,469,121	25,224,161	400,693,283	277.83	4.29
A2a - Residential Coordinated Delivery	5,261,087	2,602,109	134,595,339	15,731,504	-	158,190,039	8,118,273	166,308,312	2,328.66	3.47
A2b - Residential Conservation Services (RCS)	782,555	4,217,100	-	23,111,838	-	28,111,493	-	28,111,493		-
A2c - Residential Retail	4,909,390	5,833,703	144,513,051	4,832,740	-	160,088,884	16,022,737	176,111,621	922.29	6.18
A2d - Residential Behavior	208,184	-	50,616	5,994,155	-	6,252,955	367,946	6,620,901	6.50	3.92
A2e - Residential Active Demand Reduction	329,715	212,484	14,739,734	7,543,816	-	22,825,749	715,205	23,540,954	154.63	2.12
A3 - Residential Hard-to-Measure	2,547,460	2,702,432	56,968,581	12,838,845	5,969,615	81,026,933	-	81,026,933		-
A3a - Residential Statewide Marketing	3,608	1,693,403	-	-	-	1,697,012	-	1,697,012		-
A3b - Residential Statewide Database	29,091	-	-	-	-	29,091	-	29,091		-
A3c - Residential DOER Assessment	1,696,144	-	-	-	-	1,696,144	-	1,696,144		-
A3d - Residential Sponsorships & Subscriptions	85,096	15,493	-	8,621	10,384	119,593	-	119,593		-
A3e - Residential Workforce Development	-	-	-	5,016,859	-	5,016,859	-	5,016,859		-
A3f - Residential Evaluation and Market Research	-	-	-	-	5,959,231	5,959,231	-	5,959,231		-
A3g - Residential EEAC Consultants	267,452	-	-	-	-	267,452	-	267,452		-
A3h - Residential R&D and Demonstration	125,000	500	102,500	3,667,229	-	3,895,229	-	3,895,229		-
A3i - Residential HEAT Loan	161,068	183,408	56,866,081	2,785,330	-	59,995,887	-	59,995,887		-
A3j - Residential Education	180,000	809,628	-	1,360,806	-	2,350,434	-	2,350,434		-
B - Income Eligible	**3,699,455**	**2,344,249**	**93,440,430**	**20,369,889**	**1,599,800**	**121,453,823**	**5,341,136**	**126,794,960**	**3,922.93**	**2.00**
B1 - Income Eligible Existing Buildings	2,796,615	2,107,347	93,440,430	19,213,276	-	117,557,668	5,341,136	122,898,804	3,797.09	2.07
B1a - Income Eligible Coordinated Delivery	2,796,495	2,107,338	93,056,785	19,208,015	-	117,168,632	5,332,884	122,501,516	3,807.23	2.07
B1b - Income Eligible Active Demand Reduction	120	9	383,645	5,261	-	389,036	8,253	397,288	2,107.28	2.64
B2 - Income Eligible Hard-to-Measure	902,841	236,902	-	1,156,612	1,599,800	3,896,155	-	3,896,155		-
B2a - Income Eligible Statewide Marketing	-	236,780	-	-	-	236,780	-	236,780		-
B2b - Income Eligible Statewide Database	9,345	-	-	-	-	9,345	-	9,345		-
B2c - Income Eligible DOER Assessment	486,460	-	-	-	-	486,460	-	486,460		-
B2d - Income Eligible Sponsorships & Subscriptions	17,523	123	-	2,148	1,342	21,135	-	21,135		-
B2e - Income Eligible Workforce Development	-	-	-	1,154,464	-	1,154,464	-	1,154,464		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	1,598,459	1,598,459	-	1,598,459		-
B2g - Low-Income Energy Affordability Network (LEAN)	**389,513**	-	-	-	-	**389,513**	-	**389,513**		-
C - Commercial & Industrial	**13,937,204**	**5,409,627**	**428,850,245**	**58,458,239**	**8,075,578**	**514,730,894**	**22,187,686**	**536,918,580**	**72,969.01**	**2.24**
C1 - C&I New Buildings	837,817	807,946	11,905,551	9,038,477	-	22,589,791	1,631,609	24,221,400	104,749.08	3.87
C1a - C&I New Buildings & Major Renovations	837,817	807,946	11,905,551	9,038,477	-	22,589,791	1,631,609	24,221,400	104,749.08	3.87
C2 - C&I Existing Buildings	10,571,813	4,204,510	416,762,069	41,618,929	-	473,157,322	20,556,076	493,713,399	69,190.76	2.25
C2a - C&I Existing Building Retrofit	8,697,216	3,441,006	350,646,986	34,183,222	-	396,968,430	15,634,681	412,603,111	193,560.82	1.99
C2b - C&I New & Replacement Equipment	1,347,067	588,894	47,878,806	4,839,151	-	54,653,918	4,128,722	58,782,640	15,285.35	4.03
C2c - C&I Active Demand Reduction	527,530	174,611	18,236,278	2,596,556	-	21,534,974	792,674	22,327,648	17,768.13	2.48
C3 - C&I Hard-to-Measure	2,527,574	397,171	182,625	7,800,833	8,075,578	18,983,781	-	18,983,781		-
C3a - C&I Statewide Marketing	-	375,268	-	-	-	375,268	-	375,268		-
C3b - C&I Statewide Database	31,917	-	-	-	-	31,917	-	31,917		-
C3c - C&I DOER Assessment	2,047,354	-	-	-	-	2,047,354	-	2,047,354		-
C3d - C&I Sponsorships & Subscriptions	147,951	20,727	-	12,726	12,948	194,352	-	194,352		-
C3e - C&I Workforce Development	-	-	-	5,279,899	-	5,279,899	-	5,279,899		-
C3f - C&I Evaluation and Market Research	-	-	-	-	8,062,631	8,062,631	-	8,062,631		-
C3g - C&I EEAC Consultants	220,351	-	-	-	-	220,351	-	220,351		-
C3h - C&I R&D and Demonstration	80,000	1,175	182,625	2,508,208	-	2,772,008	-	2,772,008		-
Grand Total	**33,612,348**	**23,670,156**	**896,797,951**	**150,392,359**	**15,644,994**	**1,120,117,808**	**55,281,421**	**1,175,399,229**	**799.67**	**2.83**

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Electric
November 1, 2021

2022-2024 Program Administrator Budget ($)										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**46,204,767**	**45,701,740**	**871,140,246**	**204,586,491**	**16,758,323**	**1,184,391,566**	**63,574,250**	**1,247,965,816**	**310.98**	**3.60**
A1 - Residential New Buildings	5,779,148	997,550	62,622,146	4,637,349	-	74,036,194	6,055,572	80,091,765	2,081.16	5.38
A1a - Residential New Homes & Renovations	5,779,148	997,550	62,622,146	4,637,349	-	74,036,194	6,055,572	80,091,765	2,081.16	5.38
A2 - Residential Existing Buildings	32,912,936	36,680,613	673,283,747	162,063,626	-	904,940,923	57,518,678	962,459,601	239.85	4.27
A2a - Residential Coordinated Delivery	15,630,830	7,329,737	332,898,820	45,456,430	-	401,315,816	21,549,960	422,865,776	2,074.95	3.84
A2b - Residential Conservation Services (RCS)	2,700,981	11,863,822	-	66,633,537	-	81,198,340	-	81,198,340		-
A2c - Residential Retail	12,881,411	16,853,608	305,907,915	14,569,835	-	350,212,769	33,305,172	383,517,941	726.30	6.11
A2d - Residential Behavior	617,497	-	168,498	17,633,533	-	18,419,528	1,018,139	19,437,667	6.71	3.76
A2e - Residential Active Demand Reduction	1,082,217	633,446	34,308,514	17,770,292	-	53,794,470	1,645,407	55,439,876	153.35	2.12
A3 - Residential Hard-to-Measure	7,512,683	8,023,576	135,234,352	37,885,515	16,758,323	205,414,449	-	205,414,449		-
A3a - Residential Statewide Marketing	10,413	5,078,152	-	-	-	5,088,566	-	5,088,566		-
A3b - Residential Statewide Database	88,449	-	-	-	-	88,449	-	88,449		-
A3c - Residential DOER Assessment	5,029,058	-	-	-	-	5,029,058	-	5,029,058		-
A3d - Residential Sponsorships & Subscriptions	249,164	46,435	-	25,116	30,686	351,401	-	351,401		-
A3e - Residential Workforce Development	-	-	-	15,247,859	-	15,247,859	-	15,247,859		-
A3f - Residential Evaluation and Market Research	-	-	-	-	16,727,637	16,727,637	-	16,727,637		-
A3g - Residential EEAC Consultants	773,684	-	-	-	-	773,684	-	773,684		-
A3h - Residential R&D and Demonstration	360,000	18,700	280,000	11,170,423	-	11,829,123	-	11,829,123		-
A3i - Residential HEAT Loan	486,915	551,566	134,954,352	7,668,085	-	143,660,918	-	143,660,918		-
A3j - Residential Education	515,000	2,328,722	-	3,774,031	-	6,617,753	-	6,617,753		-
B - Income Eligible	**12,393,047**	**5,374,548**	**271,237,062**	**55,935,216**	**3,946,613**	**348,886,487**	**14,513,067**	**363,399,554**	**3,896.61**	**1.99**
B1 - Income Eligible Existing Buildings	9,686,382	4,665,754	271,237,062	52,446,395	-	338,035,593	14,513,067	352,548,660	3,775.42	2.05
B1a - Income Eligible Coordinated Delivery	9,686,035	4,665,726	270,395,967	52,434,987	-	337,182,716	14,494,777	351,677,493	3,786.71	2.05
B1b - Income Eligible Active Demand Reduction	347	28	841,095	11,407	-	852,877	18,290	871,167	1,732.41	2.67
B2 - Income Eligible Hard-to-Measure	2,706,665	708,794	-	3,488,821	3,946,613	10,850,894	-	10,850,894		-
B2a - Income Eligible Statewide Marketing	-	708,437	-	-	-	708,437	-	708,437		-
B2b - Income Eligible Statewide Database	28,914	-	-	-	-	28,914	-	28,914		-
B2c - Income Eligible DOER Assessment	1,476,954	-	-	-	-	1,476,954	-	1,476,954		-
B2d - Income Eligible Sponsorships & Subscriptions	51,034	358	-	6,258	3,909	61,559	-	61,559		-
B2e - Income Eligible Workforce Development	-	-	-	3,482,563	-	3,482,563	-	3,482,563		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	3,942,704	3,942,704	-	3,942,704		-
B2g - Low-Income Energy Affordability Network (LEAN)	**1,149,763**	-	-	-	-	**1,149,763**	-	**1,149,763**		-
C - Commercial & Industrial	**39,463,956**	**16,353,611**	**950,831,142**	**173,590,001**	**22,843,516**	**1,203,082,226**	**56,672,173**	**1,259,754,399**	**60,613.86**	**2.54**
C1 - C&I New Buildings	2,865,850	2,418,382	38,011,691	26,800,548	-	70,096,471	4,595,227	74,691,698	111,268.38	3.54
C1a - C&I New Buildings & Major Renovations	2,865,850	2,418,382	38,011,691	26,800,548	-	70,096,471	4,595,227	74,691,698	111,268.38	3.54
C2 - C&I Existing Buildings	29,347,654	12,745,433	912,308,951	123,195,811	-	1,077,597,849	52,076,947	1,129,674,795	56,071.37	2.60
C2a - C&I Existing Building Retrofit	23,135,912	10,464,357	734,457,773	101,316,190	-	869,374,232	38,435,491	907,809,723	160,262.76	2.33
C2b - C&I New & Replacement Equipment	4,612,148	1,760,006	134,687,289	14,974,885	-	156,034,328	11,652,406	167,686,734	14,910.62	4.11
C2c - C&I Active Demand Reduction	1,599,594	521,071	43,163,889	6,904,735	-	52,189,289	1,989,050	54,178,339	15,677.17	2.61
C3 - C&I Hard-to-Measure	7,250,452	1,189,796	510,500	23,593,642	22,843,516	55,387,906	-	55,387,906		-
C3a - C&I Statewide Marketing	-	1,122,977	-	-	-	1,122,977	-	1,122,977		-
C3b - C&I Statewide Database	93,697	-	-	-	-	93,697	-	93,697		-
C3c - C&I DOER Assessment	5,843,874	-	-	-	-	5,843,874	-	5,843,874		-
C3d - C&I Sponsorships & Subscriptions	434,886	62,119	-	37,076	38,155	572,236	-	572,236		-
C3e - C&I Workforce Development	-	-	-	16,031,924	-	16,031,924	-	16,031,924		-
C3f - C&I Evaluation and Market Research	-	-	-	-	22,805,361	22,805,361	-	22,805,361		-
C3g - C&I EEAC Consultants	642,995	-	-	-	-	642,995	-	642,995		-
C3h - C&I R&D and Demonstration	235,000	4,700	510,500	7,524,642	-	8,274,842	-	8,274,842		-
Grand Total	**98,061,771**	**67,429,898**	**2,093,208,450**	**434,111,707**	**43,548,452**	**2,736,360,278**	**134,759,490**	**2,871,119,768**	**698.41**	**2.93**

Notes:

Budgets for each year are represented in nominal dollars (2022$, 2023$, 2024$).

Refer to common definitions for allocation of costs.

IV.C. Program Administrator Budgets

3. Program Planning and Administration

Statewide Electric

November 1, 2021

Program Planning and Administration Expenditures						
Year	Internal Costs	External Costs				Total Program Planning and Administration
	Labor, benefits, employee expenses, materials, and overhead	Legal Services	Assessments	Other Vendor Services	Hard to Measure Sponsorships & Subscriptions	Total External Costs	
2022	$ 13,885,934	$ 1,799,640	$ 4,836,351	$ 11,143,264	$ 223,335	$ 18,002,590	$ 31,888,524
2023	$ 14,448,406	$ 1,788,397	$ 4,976,209	$ 11,102,612	$ 244,973	$ 18,112,191	$ 32,560,597
2024	$ 15,132,587	$ 1,826,024	$ 5,118,009	$ 11,285,034	$ 250,570	$ 18,479,637	$ 33,612,223
Grand Total	**$ 43,466,926**	**$ 5,414,061**	**$ 14,930,569**	**$ 33,530,910**	**$ 718,879**	**$ 54,594,418**	**$ 98,061,344**

Notes:

Assessments include costs associated with the Department of Energy Resource (DOER), Residential Conservation Services (RCS), Energy Efficiency Advisory Council (EEAC) Consultants, and the Low-Income Energy Affordability Network (LEAN).

Other Vendor Services include costs associated with third-party consultants that assist with program planning and administration.

The data included in the Hard to Measure Sponsorship and Subscriptions column is consistent with the hard-to-measure Sponsorships & Subscriptions lines in the Budget table.

IV.C. Program Administrator Budgets

2.2 Budget Historical Comparison

Statewide Electric
November 1, 2021

2019-2024 Residential Program Administrator Budget									
PA Budget Categories	Program Administrator Budget ($)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	11,778,249	10,334,182	11,704,331	9,666,814	11,408,306	6,115,831	14,690,204	15,538,875	15,975,688
Marketing and Advertising	14,229,961	12,463,499	14,652,679	10,104,804	12,456,747	4,258,445	14,538,971	15,246,490	15,916,280
Participant Incentive	174,636,155	193,851,769	159,351,207	219,686,936	190,687,216	94,834,028	217,139,497	279,493,473	374,507,276
Sales, Technical Assistance & Training	51,998,584	52,285,353	53,375,634	40,865,596	43,094,289	17,399,491	65,110,858	67,911,402	71,564,231
Evaluation and Market Research	7,669,239	6,098,682	8,319,598	5,970,304	7,102,880	2,688,647	5,309,419	5,479,288	5,969,615
Performance Incentive	8,538,769	9,438,254	8,432,406	11,256,849	10,801,392	-	15,270,143	20,551,507	27,752,599
Total Program Administrator Budget	**268,850,957**	**284,471,739**	**255,835,856**	**297,551,303**	**275,550,829**	**125,296,442**	**332,059,091**	**404,221,035**	**511,685,689**

2019-2024 Income Eligible Program Administrator Budget									
PA Budget Categories	Program Administrator Budget ($)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	3,519,742	3,013,464	3,501,869	2,545,412	3,248,603	1,558,119	4,454,334	4,239,258	3,699,455
Marketing and Advertising	1,017,525	928,284	1,070,973	468,269	910,563	302,820	1,487,287	1,543,012	2,344,249
Participant Incentive	51,843,030	52,900,905	51,328,031	42,587,886	35,941,461	16,548,419	87,583,592	90,213,040	93,440,430
Sales, Technical Assistance & Training	12,914,687	11,892,134	13,048,938	9,383,869	10,406,595	3,745,842	16,895,025	18,670,302	20,369,889
Evaluation and Market Research	1,929,604	1,628,494	2,142,413	1,228,440	1,592,222	632,630	1,415,400	931,413	1,599,800
Performance Incentive	2,449,352	2,395,378	2,342,145	1,608,242	1,611,906	-	4,378,414	4,793,516	5,341,136
Total Program Administrator Budget	**73,673,939**	**72,758,659**	**73,434,369**	**57,822,118**	**53,711,349**	**22,787,829**	**116,214,052**	**120,390,542**	**126,794,960**

2019-2024 Commercial & Industrial Program Administrator Budget									
PA Budget Categories	Program Administrator Budget ($)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	14,215,251	11,000,460	15,460,479	10,436,281	15,039,753	6,194,130	12,743,985	12,782,767	13,937,204
Marketing and Advertising	4,570,898	4,359,902	4,697,288	4,515,162	4,374,383	1,594,225	5,502,973	5,441,011	5,409,627
Participant Incentive	235,956,989	222,160,311	264,469,032	216,441,926	233,716,736	74,261,364	233,733,324	288,247,573	428,850,245
Sales, Technical Assistance & Training	41,907,184	32,047,188	44,953,304	31,796,358	43,729,610	14,174,203	56,867,448	58,264,313	58,458,239
Evaluation and Market Research	6,566,688	7,637,709	7,371,759	8,038,927	8,100,185	4,376,260	7,275,294	7,492,644	8,075,578
Performance Incentive	24,008,921	22,788,378	31,541,545	29,006,826	22,153,841	-	16,890,353	17,594,134	22,187,686
Total Program Administrator Budget	**327,225,931**	**299,993,947**	**368,493,406**	**300,235,480**	**327,114,507**	**100,600,182**	**333,013,378**	**389,822,442**	**536,918,580**

2019-2024 Total Program Administrator Budget									
PA Budget Categories	Program Administrator Budget ($)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	29,513,241	24,348,106	30,666,679	22,648,507	29,696,662	13,868,080	31,888,524	32,560,900	33,612,348
Marketing and Advertising	19,818,384	17,751,684	20,420,940	15,088,235	17,741,692	6,155,489	21,529,230	22,230,512	23,670,156
Participant Incentive	462,436,175	468,912,985	475,148,270	478,716,748	460,345,413	185,643,811	538,456,413	657,954,086	896,797,951
Sales, Technical Assistance & Training	106,820,455	96,224,675	111,377,876	82,045,824	97,230,493	35,319,536	138,873,331	144,846,017	150,392,359
Evaluation and Market Research	16,165,531	15,364,886	17,833,770	15,237,671	16,795,287	7,697,536	14,000,113	13,903,345	15,644,994
Performance Incentive	34,997,042	34,622,010	42,316,096	41,871,916	34,567,138	-	36,538,911	42,939,158	55,281,421
Total Program Administrator Budget	**669,750,827**	**657,224,346**	**697,763,631**	**655,608,901**	**656,376,685**	**248,684,453**	**781,286,521**	**914,434,019**	###########

Notes:
Budgets for each year are represented in nominal dollars (2019$ through 2024$).
2019-2021 planned values are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Electric.
2019 evaluated values are from the Program Administrator's 2019 Plan Year Report, D.P.U. 20-50.
2020 evaluated values are from the Program Administrator's 2020 Plan Year Report, D.P.U. 21-70.
2021 YTD values are estimated actual cost through through June 30, 2021 (Q2).
For supporting information on the 2022-2024 values, see Table IV.C.1.
The Program Administrators have better aligned cost allocations across Program Administrators for this Three-Year Plan, consistent with the Department's directives in the 2016-2018 Three-Year Plan Order (January 31, 2016). As a result, historical budget categories may not be directly comparable for each Program Administrator.

IV.C. Program Administrator Budgets

2.2 Budget Historical Comparison

Statewide Electric
November 1, 2021

PA Budget Categories	2019-2024 Residential Program Administrator Budget								
	Budget Categories as a Percent of Total Program Administrator Budget (%)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	4%	4%	5%	3%	4%	5%	4%	4%	3%
Marketing and Advertising	5%	4%	6%	3%	5%	3%	4%	4%	3%
Participant Incentive	65%	68%	62%	74%	69%	76%	65%	69%	73%
Sales, Technical Assistance & Training	19%	18%	21%	14%	16%	14%	20%	17%	14%
Evaluation and Market Research	3%	2%	3%	2%	3%	2%	2%	1%	1%
Performance Incentive	3%	3%	3%	4%	4%	0%	5%	5%	5%
Total Program Administrator Budget	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

PA Budget Categories	2019-2024 Income Eligible Program Administrator Budget								
	Budget Categories as a Percent of Total Program Administrator Budget (%)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	5%	4%	5%	4%	6%	7%	4%	4%	3%
Marketing and Advertising	1%	1%	1%	1%	2%	1%	1%	1%	2%
Participant Incentive	70%	73%	70%	74%	67%	73%	75%	75%	74%
Sales, Technical Assistance & Training	18%	16%	18%	16%	19%	16%	15%	16%	16%
Evaluation and Market Research	3%	2%	3%	2%	3%	3%	1%	1%	1%
Performance Incentive	3%	3%	3%	3%	3%	0%	4%	4%	4%
Total Program Administrator Budget	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

PA Budget Categories	2019-2024 Commercial & Industrial Program Administrator Budget								
	Budget Categories as a Percent of Total Program Administrator Budget (%)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	4%	4%	4%	3%	5%	6%	4%	3%	3%
Marketing and Advertising	1%	1%	1%	2%	1%	2%	2%	1%	1%
Participant Incentive	72%	74%	72%	72%	71%	74%	70%	74%	80%
Sales, Technical Assistance & Training	13%	11%	12%	11%	13%	14%	17%	15%	11%
Evaluation and Market Research	2%	3%	2%	3%	2%	4%	2%	2%	2%
Performance Incentive	7%	8%	9%	10%	7%	0%	5%	5%	4%
Total Program Administrator Budget	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

PA Budget Categories	2019-2024 Total Program Administrator Budget								
	Budget Categories as a Percent of Total Program Administrator Budget (%)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	4%	4%	4%	3%	5%	6%	4%	4%	3%
Marketing and Advertising	3%	3%	3%	2%	3%	2%	3%	2%	2%
Participant Incentive	69%	71%	68%	73%	70%	75%	69%	72%	76%
Sales, Technical Assistance & Training	16%	15%	16%	13%	15%	14%	18%	16%	13%
Evaluation and Market Research	2%	2%	3%	2%	3%	3%	2%	2%	1%
Performance Incentive	5%	5%	6%	6%	5%	0%	5%	5%	5%
Total Program Administrator Budget	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Notes:
Budgets for each year are represented in nominal dollars (2019$ through 2024$).
2019-2021 planned values are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Electric.
2019 evaluated values are from the Program Administrator's 2019 Plan Year Report, D.P.U. 20-50.
2020 evaluated values are from the Program Administrator's 2020 Plan Year Report, D.P.U. 21-70.
2021 YTD values are estimated actual cost through through June 30, 2021 (Q2).
For supporting information on the 2022-2024 values, see Table IV.C.1.
The Program Administrators have better aligned cost allocations across Program Administrators for this Three-Year Plan, consistent with the Department's directives in the 2016-2018 Three-Year Plan Order (January 31, 2016). As a result, historical budget categories may not be directly comparable for each Program Administrator.

IV.D. Cost-Effectiveness

1. Summary Table

Statewide Electric

November 1, 2021

2022 Total Resource Cost Test (2022$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**2.74**	**725,772,661**	**1,143,976,430**	**316,788,948**	**15,270,143**	**86,144,678**	**418,203,769**
A1 - Residential New Buildings	4.18	67,957,485	89,298,956	21,390,922	1,201,397	(1,250,849)	21,341,471
A1a - Residential New Homes & Renovations	4.18	67,957,485	89,298,956	21,390,922	1,201,397	(1,250,849)	21,341,471
A2 - Residential Existing Buildings	3.10	714,322,009	1,054,677,474	238,891,193	14,068,746	87,395,526	340,355,465
A2a - Residential Coordinated Delivery	3.79	383,368,474	520,546,775	113,007,978	6,380,820	17,789,503	137,178,301
A2b - Residential Conservation Services (RCS)	0.00	(26,109,832)	-	26,109,832	-	-	26,109,832
A2c - Residential Retail	3.08	327,110,191	484,337,074	80,641,563	6,979,297	69,606,023	157,226,883
A2d - Residential Behavior	3.46	15,642,771	21,992,428	6,032,518	317,140	-	6,349,658
A2e - Residential Active Demand Reduction	2.06	14,310,406	27,801,197	13,099,302	391,489	-	13,490,791
A3 - Residential Hard-to-Measure	0.00	(56,506,833)	-	56,506,833	-	-	56,506,833
B - Income Eligible	**2.64**	**191,405,612**	**308,387,864**	**111,835,638**	**4,378,414**	**768,200**	**116,982,252**
B1 - Income Eligible Existing Buildings	2.72	195,128,334	308,387,864	108,112,916	4,378,414	768,200	113,259,531
B1a - Income Eligible Coordinated Delivery	2.72	194,833,081	307,939,920	107,964,202	4,374,438	768,200	113,106,839
B1b - Income Eligible Active Demand Reduction	2.93	295,253	447,944	148,715	3,976	-	152,691
B2 - Income Eligible Hard-to-Measure	0.00	(3,722,722)	-	3,722,722	-	-	3,722,722
C - Commercial & Industrial	**2.69**	**724,942,833**	**1,154,918,694**	**316,123,024**	**16,890,353**	**96,962,483**	**429,975,861**
C1 - C&I New Buildings	3.96	75,801,099	101,437,547	23,959,123	1,422,687	254,639	25,636,449
C1a - C&I New Buildings & Major Renovations	3.96	75,801,099	101,437,547	23,959,123	1,422,687	254,639	25,636,449
C2 - C&I Existing Buildings	2.73	667,011,317	1,053,481,146	274,294,319	15,467,667	96,707,844	386,469,830
C2a - C&I Existing Building Retrofit	2.43	450,386,213	765,010,807	211,442,263	11,290,325	91,892,005	314,624,594
C2b - C&I New & Replacement Equipment	4.32	192,739,294	250,794,511	49,601,463	3,637,915	4,815,839	58,055,217
C2c - C&I Active Demand Reduction	2.73	23,885,810	37,675,829	13,250,592	539,426	-	13,790,019
C3 - C&I Hard-to-Measure	0.00	(17,869,583)	-	17,869,583	-	-	17,869,583
Grand Total	**2.70**	**1,642,121,106**	**2,607,282,988**	**744,747,610**	**36,538,911**	**183,875,361**	**965,161,882**

IV.D. Cost-Effectiveness

1. Summary Table

Statewide Electric

November 1, 2021

2023 Total Resource Cost Test (2022$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**2.82**	**928,202,229**	**1,437,998,175**	**376,220,365**	**20,152,488**	**113,423,093**	**509,795,946**
A1 - Residential New Buildings	6.23	130,393,496	155,313,277	24,718,803	2,280,581	(2,079,604)	24,919,780
A1a - Residential New Homes & Renovations	6.23	130,393,496	155,313,277	24,718,803	2,280,581	(2,079,604)	24,919,780
A2 - Residential Existing Buildings	3.07	864,371,474	1,282,684,899	284,938,821	17,871,907	115,502,697	418,313,425
A2a - Residential Coordinated Delivery	3.62	395,470,445	546,509,599	127,591,487	6,913,970	16,533,697	151,039,154
A2b - Residential Conservation Services (RCS)	0.00	(26,453,241)	-	26,453,241	-	-	26,453,241
A2c - Residential Retail	3.12	459,606,958	676,035,715	107,356,660	10,103,097	98,969,000	216,428,758
A2d - Residential Behavior	3.57	16,308,137	22,649,683	6,014,959	326,587	-	6,341,546
A2e - Residential Active Demand Reduction	2.08	19,439,175	37,489,901	17,522,474	528,253	-	18,050,726
A3 - Residential Hard-to-Measure	0.00	(66,562,741)	-	66,562,741	-	-	66,562,741
B - Income Eligible	**2.69**	**200,292,540**	**318,912,408**	**113,352,643**	**4,700,447**	**566,778**	**118,619,868**
B1 - Income Eligible Existing Buildings	2.76	203,461,805	318,912,408	110,183,377	4,700,447	566,778	115,450,603
B1a - Income Eligible Coordinated Delivery	2.76	202,972,280	318,107,932	109,874,370	4,694,504	566,778	115,135,652
B1b - Income Eligible Active Demand Reduction	2.55	489,526	804,476	309,007	5,943	-	314,951
B2 - Income Eligible Hard-to-Measure	0.00	(3,169,265)	-	3,169,265	-	-	3,169,265
C - Commercial & Industrial	**2.41**	**684,374,926**	**1,170,526,142**	**365,001,282**	**17,252,534**	**103,897,400**	**486,151,216**
C1 - C&I New Buildings	4.42	84,639,418	109,368,621	23,090,368	1,511,013	127,822	24,729,203
C1a - C&I New Buildings & Major Renovations	4.42	84,639,418	109,368,621	23,090,368	1,511,013	127,822	24,729,203
C2 - C&I Existing Buildings	2.39	617,910,191	1,061,157,521	323,736,231	15,741,521	103,769,578	443,247,330
C2a - C&I Existing Building Retrofit	2.06	388,331,188	756,049,781	255,896,782	11,287,002	100,534,809	367,718,593
C2b - C&I New & Replacement Equipment	4.50	202,178,622	259,997,345	50,773,630	3,810,325	3,234,769	57,818,723
C2c - C&I Active Demand Reduction	2.55	27,400,381	45,110,395	17,065,819	644,195	-	17,710,014
C3 - C&I Hard-to-Measure	0.00	(18,174,683)	-	18,174,683	-	-	18,174,683
Grand Total	**2.63**	**1,812,869,695**	**2,927,436,725**	**854,574,290**	**42,105,470**	**217,887,271**	**1,114,567,030**

IV.D. Cost-Effectiveness

1. Summary Table

Statewide Electric

November 1, 2021

2024 Total Resource Cost Test (2022$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**2.80**	**1,169,028,396**	**1,819,939,567**	**465,323,840**	**26,685,396**	**158,901,934**	**650,911,170**
A1 - Residential New Buildings	5.90	132,958,313	160,099,062	26,381,967	2,431,209	(1,672,427)	27,140,749
A1a - Residential New Homes & Renovations	5.90	132,958,313	160,099,062	26,381,967	2,431,209	(1,672,427)	27,140,749
A2 - Residential Existing Buildings	3.04	1,113,981,192	1,659,840,505	361,030,764	24,254,187	160,574,362	545,859,313
A2a - Residential Coordinated Delivery	3.39	416,293,456	590,315,338	152,106,971	7,806,092	14,108,820	174,021,882
A2b - Residential Conservation Services (RCS)	0.00	(27,030,489)	-	27,030,489	-	-	27,030,489
A2c - Residential Retail	3.16	680,683,978	996,488,914	153,932,798	15,406,596	146,465,542	315,804,935
A2d - Residential Behavior	3.85	18,173,986	24,540,286	6,012,503	353,797	-	6,366,300
A2e - Residential Active Demand Reduction	2.14	25,860,260	48,495,967	21,948,004	687,702	-	22,635,706
A3 - Residential Hard-to-Measure	0.00	(77,911,109)	-	77,911,109	-	-	77,911,109
B - Income Eligible	**2.74**	**212,012,929**	**333,654,686**	**116,783,416**	**5,135,747**	**(277,406)**	**121,641,758**
B1 - Income Eligible Existing Buildings	2.83	215,759,261	333,654,686	113,037,084	5,135,747	(277,406)	117,895,426
B1a - Income Eligible Coordinated Delivery	2.83	215,114,443	332,627,858	112,663,009	5,127,812	(277,406)	117,513,415
B1b - Income Eligible Active Demand Reduction	2.69	644,817	1,026,828	374,076	7,935	-	382,011
B2 - Income Eligible Hard-to-Measure	0.00	(3,746,332)	-	3,746,332	-	-	3,746,332
C - Commercial & Industrial	**2.15**	**751,353,761**	**1,406,526,753**	**494,937,340**	**21,334,476**	**138,901,175**	**655,172,992**
C1 - C&I New Buildings	4.88	91,042,680	114,507,027	21,721,119	1,568,867	174,362	23,464,348
C1a - C&I New Buildings & Major Renovations	4.88	91,042,680	114,507,027	21,721,119	1,568,867	174,362	23,464,348
C2 - C&I Existing Buildings	2.11	678,564,857	1,292,019,725	454,962,446	19,765,609	138,726,813	613,454,868
C2a - C&I Existing Building Retrofit	1.82	436,828,606	970,619,566	381,703,335	15,033,462	137,054,163	533,790,960
C2b - C&I New & Replacement Equipment	4.60	209,738,462	267,933,315	52,552,246	3,969,955	1,672,651	58,194,852
C2c - C&I Active Demand Reduction	2.49	31,997,789	53,466,845	20,706,864	762,192	-	21,469,056
C3 - C&I Hard-to-Measure	0.00	(18,253,776)	-	18,253,776	-	-	18,253,776
Grand Total	**2.49**	**2,132,395,086**	**3,560,121,006**	**1,077,044,597**	**53,155,620**	**297,525,703**	**1,427,725,920**

IV.D. Cost-Effectiveness

1. Summary Table

Statewide Electric

November 1, 2021

2022-2024 Total Resource Cost Test (2022$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**2.79**	**2,823,003,287**	**4,401,914,172**	**1,158,333,153**	**62,108,027**	**358,469,705**	**1,578,910,885**
A1 - Residential New Buildings	5.51	331,309,294	404,711,294	72,491,693	5,913,187	(5,002,880)	73,402,000
A1a - Residential New Homes & Renovations	5.51	331,309,294	404,711,294	72,491,693	5,913,187	(5,002,880)	73,402,000
A2 - Residential Existing Buildings	3.06	2,692,674,675	3,997,202,878	884,860,778	56,194,840	363,472,585	1,304,528,203
A2a - Residential Coordinated Delivery	3.59	1,195,132,375	1,657,371,713	392,706,436	21,100,882	48,432,019	462,239,338
A2b - Residential Conservation Services (RCS)	0.00	(79,593,562)	-	79,593,562	-	-	79,593,562
A2c - Residential Retail	3.13	1,467,401,127	2,156,861,703	341,931,021	32,488,990	315,040,565	689,460,576
A2d - Residential Behavior	3.63	50,124,894	69,182,397	18,059,980	997,524	-	19,057,503
A2e - Residential Active Demand Reduction	2.10	59,609,841	113,787,065	52,569,779	1,607,445	-	54,177,224
A3 - Residential Hard-to-Measure	0.00	(200,980,682)	-	200,980,682	-	-	200,980,682
B - Income Eligible	**2.69**	**603,711,080**	**960,954,958**	**341,971,698**	**14,214,609**	**1,057,572**	**357,243,878**
B1 - Income Eligible Existing Buildings	2.77	614,349,399	960,954,958	331,333,378	14,214,609	1,057,572	346,605,559
B1a - Income Eligible Coordinated Delivery	2.77	612,919,804	958,675,710	330,501,580	14,196,754	1,057,572	345,755,906
B1b - Income Eligible Active Demand Reduction	2.68	1,429,595	2,279,249	831,798	17,855	-	849,653
B2 - Income Eligible Hard-to-Measure	0.00	(10,638,319)	-	10,638,319	-	-	10,638,319
C - Commercial & Industrial	**2.38**	**2,160,671,519**	**3,731,971,588**	**1,176,061,646**	**55,477,364**	**339,761,058**	**1,571,300,069**
C1 - C&I New Buildings	4.41	251,483,196	325,313,195	68,770,610	4,502,567	556,823	73,829,999
C1a - C&I New Buildings & Major Renovations	4.41	251,483,196	325,313,195	68,770,610	4,502,567	556,823	73,829,999
C2 - C&I Existing Buildings	2.36	1,963,486,365	3,406,658,393	1,052,992,995	50,974,797	339,204,236	1,443,172,028
C2a - C&I Existing Building Retrofit	2.05	1,275,546,007	2,491,680,154	849,042,381	37,610,789	329,480,977	1,216,134,147
C2b - C&I New & Replacement Equipment	4.47	604,656,378	778,725,171	152,927,339	11,418,195	9,723,259	174,068,792
C2c - C&I Active Demand Reduction	2.57	83,283,980	136,253,068	51,023,276	1,945,813	-	52,969,089
C3 - C&I Hard-to-Measure	0.00	(54,298,042)	-	54,298,042	-	-	54,298,042
Grand Total	**2.59**	**5,587,385,886**	**9,094,840,718**	**2,676,366,497**	**131,800,000**	**699,288,335**	**3,507,454,832**

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. The calculation of program benefits includes calculations of the social value of greenhouse gas emissions reductions except in the cases of conversions from fossil fuel heating and cooling to fossil fuel heating and cooling.

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

2.3 TRC Cost Historical Comparison

Statewide Electric

November 1, 2021

2019-2024 TRC Costs (2019$ and 2022$)												
TRC Costs Categories	TRC Costs ($)						TRC Cost Categories as a Percent of Total TRC Costs (%)					
	2019 Evaluated	2020 Evaluated	2021 Planned	2022 Planned	2023 Planned	2024 Planned	2019 Evaluated	2020 Evaluated	2021 Planned	2022 Planned	2023 Planned	2024 Planned
A - Residential												
PA Budget	284,471,739	290,776,217	263,145,394	332,059,091	396,372,853	492,009,236	85%	86%	81%	79%	78%	76%
Participant Cost	48,624,376	46,891,725	61,045,992	86,144,678	113,423,093	158,901,934	15%	14%	19%	21%	22%	24%
Residential Total TRC Costs	333,096,115	337,667,941	324,191,386	418,203,769	509,795,946	650,911,170	100%	100%	100%	100%	100%	100%
B - Income Eligible												
PA Budget	72,758,659	56,505,539	51,293,238	116,214,052	118,053,090	121,919,164	100%	99%	100%	99%	100%	100%
Participant Cost	-	362,385	10,505	768,200	566,778	(277,406)	0%	1%	0%	1%	0%	0%
Low-Income Total TRC Costs	72,758,659	56,867,924	51,303,743	116,982,252	118,619,868	121,641,758	100%	100%	100%	100%	100%	100%
C - Commercial & Industrial												
PA Budget	299,993,947	293,399,277	312,387,651	333,013,378	382,253,816	516,271,817	63%	60%	65%	77%	79%	79%
Participant Cost	172,898,248	195,213,562	170,827,043	96,962,483	103,897,400	138,901,175	37%	40%	35%	23%	21%	21%
C&I Total TRC Costs	472,892,195	488,612,839	483,214,693	429,975,861	486,151,216	655,172,992	100%	100%	100%	100%	100%	100%
Grand Total												
PA Budget	657,224,346	640,681,033	626,826,283	781,286,521	896,679,759	1,130,200,217	75%	73%	73%	81%	80%	79%
Participant Cost	221,522,623	242,467,672	231,883,540	183,875,361	217,887,271	297,525,703	25%	27%	27%	19%	20%	21%
Grand Total TRC Costs	878,746,969	883,148,705	858,709,822	965,161,882	1,114,567,030	1,427,725,920	100%	100%	100%	100%	100%	100%

Notes:

2019 values are from the Program Administrator's 2019 Plan Year Report D.P.U. 20-50, in 2019$.

2020 values are from the Program Administrator's 2020 Plan Year Report D.P.U. 21-70, in 2019$.

2021 values are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Electric, in 2019$.

For supporting information on the 2022-2024 values, see Table IV.D.1. The 2022-2024 values are in 2022$.

IV.D Cost-Effectiveness

3.1.i. Benefits Summary Table

Statewide Electric
November 1, 2021

	2022 Benefits ($)							
Program	**Electric Capacity**	**Electric Energy**	**Natural Gas**	**Oil**	**Propane**	**Wood**	**Motor Gasoline**	**Motor Diesel**
A - Residential	**85,881,566**	**89,384,658**	**17,644,770**	**693,541,935**	**197,169,883**	**-**	**3,630,393**	**-**
A1 - Residential New Buildings	5,448,722	32,667,650	-	10,575,356	38,554,665	-	-	-
A1a - Residential New Homes & Renovations	5,448,722	32,667,650	-	10,575,356	38,554,665	-	-	-
A2 - Residential Existing Buildings	80,432,844	56,717,008	17,644,770	682,966,579	158,615,218	-	3,630,393	-
A2a - Residential Coordinated Delivery	16,570,498	67,629,859	17,701,525	325,234,811	44,338,731	-	-	-
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-
A2c - Residential Retail	32,492,079	(29,336,209)	(56,756)	357,731,768	114,276,487	-	3,630,393	-
A2d - Residential Behavior	3,820,240	18,172,188	-	-	-	-	-	-
A2e - Residential Active Demand Reduction	27,550,027	251,171	-	-	-	-	-	-
B - Income Eligible	**17,990,524**	**43,412,360**	**1,846,761**	**117,785,820**	**35,184,390**	**-**	**-**	**-**
B1 - Income Eligible Existing Buildings	17,990,524	43,412,360	1,846,761	117,785,820	35,184,390	-	-	-
B1a - Income Eligible Coordinated Delivery	17,539,712	43,415,228	1,846,761	117,785,820	35,184,390	-	-	-
B1b - Income Eligible Active Demand Reduction	450,812	(2,868)	-	-	-	-	-	-
C - Commercial & Industrial	**241,321,349**	**723,563,355**	**(135,945,463)**	**30,304,762**	**79,841,964**	**-**	**6,044,870**	**-**
C1 - C&I New Buildings	13,520,811	65,758,839	(800,535)	(1,319,150)	-	-	-	-
C1a - C&I New Buildings & Major Renovations	13,520,811	65,758,839	(800,535)	(1,319,150)	-	-	-	-
C2 - C&I Existing Buildings	227,800,538	657,804,515	(135,144,928)	31,623,912	79,841,964	-	6,044,870	-
C2a - C&I Existing Building Retrofit	157,518,464	519,372,933	(134,262,561)	22,772,405	58,265,296	-	-	-
C2b - C&I New & Replacement Equipment	32,713,041	138,324,786	(882,367)	8,851,507	21,576,668	-	6,044,870	-
C2c - C&I Active Demand Reduction	37,569,032	106,796	-	-	-	-	-	-
Grand Total	**345,193,439**	**856,360,372**	**(116,453,932)**	**841,632,516**	**312,196,237**	**-**	**9,675,263**	**-**

	2023 Benefits ($)							
Program	**Electric Capacity**	**Electric Energy**	**Natural Gas**	**Oil**	**Propane**	**Wood**	**Motor Gasoline**	**Motor Diesel**
A - Residential	**104,632,481**	**2,722,295**	**17,531,475**	**904,364,672**	**345,452,600**	**-**	**3,654,704**	**-**
A1 - Residential New Buildings	5,900,984	15,164,819	-	10,316,838	121,472,651	-	-	-
A1a - Residential New Homes & Renovations	5,900,984	15,164,819	-	10,316,838	121,472,651	-	-	-
A2 - Residential Existing Buildings	98,731,497	(12,442,523)	17,531,475	894,047,834	223,979,949	-	3,654,704	-
A2a - Residential Coordinated Delivery	14,538,397	64,154,426	17,762,635	351,739,189	47,491,169	-	-	-
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-
A2c - Residential Retail	43,309,998	(95,853,431)	(231,159)	542,308,646	176,488,781	-	3,654,704	-
A2d - Residential Behavior	3,746,623	18,903,060	-	-	-	-	-	-
A2e - Residential Active Demand Reduction	37,136,479	353,422	-	-	-	-	-	-
B - Income Eligible	**15,071,121**	**39,707,828**	**1,988,927**	**129,503,507**	**39,551,181**	**-**	**-**	**-**
B1 - Income Eligible Existing Buildings	15,071,121	39,707,828	1,988,927	129,503,507	39,551,181	-	-	-
B1a - Income Eligible Coordinated Delivery	14,248,002	39,726,471	1,988,927	129,503,507	39,551,181	-	-	-
B1b - Income Eligible Active Demand Reduction	823,119	(18,642)	-	-	-	-	-	-
C - Commercial & Industrial	**197,089,051**	**541,639,777**	**(45,387,001)**	**98,846,747**	**159,505,566**	**-**	**6,078,057**	**-**
C1 - C&I New Buildings	15,253,353	70,408,958	(1,161,749)	(1,121,333)	-	-	-	-
C1a - C&I New Buildings & Major Renovations	15,253,353	70,408,958	(1,161,749)	(1,121,333)	-	-	-	-
C2 - C&I Existing Buildings	181,835,698	471,230,819	(44,225,252)	99,968,079	159,505,566	-	6,078,057	-
C2a - C&I Existing Building Retrofit	106,439,761	352,568,165	(43,636,672)	78,960,014	120,183,129	-	-	-
C2b - C&I New & Replacement Equipment	30,381,566	118,566,631	(588,580)	21,008,065	39,322,437	-	6,078,057	-
C2c - C&I Active Demand Reduction	45,014,372	96,023	-	-	-	-	-	-
Grand Total	**316,792,654**	**584,069,901**	**(25,866,598)**	**1,132,714,926**	**544,509,346**	**-**	**9,732,761**	**-**

IV.D Cost-Effectiveness

3.1.i. Benefits Summary Table

Statewide Electric
November 1, 2021

	2024 Benefits ($)							
Program	**Electric Capacity**	**Electric Energy**	**Natural Gas**	**Oil**	**Propane**	**Wood**	**Motor Gasoline**	**Motor Diesel**
A - Residential	**129,340,705**	**(162,820,836)**	**17,390,738**	**1,272,750,321**	**497,300,946**	**-**	**3,676,892**	**-**
A1 - Residential New Buildings	4,278,807	(14,777,788)	-	10,654,548	158,124,139	-	-	-
A1a - Residential New Homes & Renovations	4,278,807	(14,777,788)	-	10,654,548	158,124,139	-	-	-
A2 - Residential Existing Buildings	125,061,898	(148,043,047)	17,390,738	1,262,095,773	339,176,807	-	3,676,892	-
A2a - Residential Coordinated Delivery	12,916,125	58,604,664	17,828,060	397,610,866	50,381,153	-	-	-
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-
A2c - Residential Retail	60,383,921	(227,922,112)	(437,322)	864,484,906	288,795,654	-	3,676,892	-
A2d - Residential Behavior	3,939,407	20,600,879	-	-	-	-	-	-
A2e - Residential Active Demand Reduction	47,822,446	673,521	-	-	-	-	-	-
B - Income Eligible	**12,336,839**	**33,478,269**	**2,179,001**	**145,995,855**	**45,062,724**	**-**	**-**	**-**
B1 - Income Eligible Existing Buildings	12,336,839	33,478,269	2,179,001	145,995,855	45,062,724	-	-	-
B1a - Income Eligible Coordinated Delivery	11,291,226	33,497,054	2,179,001	145,995,855	45,062,724	-	-	-
B1b - Income Eligible Active Demand Reduction	1,045,614	(18,785)	-	-	-	-	-	-
C - Commercial & Industrial	**221,870,938**	**400,693,808**	**(32,898,644)**	**323,071,185**	**232,228,765**	**-**	**6,106,464**	**-**
C1 - C&I New Buildings	16,543,231	73,258,789	(1,376,647)	(979,986)	-	-	-	-
C1a - C&I New Buildings & Major Renovations	16,543,231	73,258,789	(1,376,647)	(979,986)	-	-	-	-
C2 - C&I Existing Buildings	205,327,707	327,435,019	(31,521,997)	324,051,171	232,228,765	-	6,106,464	-
C2a - C&I Existing Building Retrofit	123,087,693	226,688,104	(31,145,465)	292,172,531	179,276,593	-	-	-
C2b - C&I New & Replacement Equipment	28,887,018	100,633,067	(376,532)	31,878,640	52,952,171	-	6,106,464	-
C2c - C&I Active Demand Reduction	53,352,996	113,849	-	-	-	-	-	-
Grand Total	**363,548,482**	**271,351,241**	**(13,328,905)**	**1,741,817,360**	**774,592,435**	**-**	**9,783,357**	**-**

	2022-2024 Benefits ($)							
Program	**Electric Capacity**	**Electric Energy**	**Natural Gas**	**Oil**	**Propane**	**Wood**	**Motor Gasoline**	**Motor Diesel**
A - Residential	**319,854,753**	**(70,713,883)**	**52,566,984**	**2,870,656,928**	**1,039,923,429**	**-**	**10,961,990**	**-**
A1 - Residential New Buildings	15,628,513	33,054,680	-	31,546,742	318,151,455	-	-	-
A1a - Residential New Homes & Renovations	15,628,513	33,054,680	-	31,546,742	318,151,455	-	-	-
A2 - Residential Existing Buildings	304,226,239	(103,768,563)	52,566,984	2,839,110,186	721,771,974	-	10,961,990	-
A2a - Residential Coordinated Delivery	44,025,020	190,388,948	53,292,220	1,074,584,866	142,211,053	-	-	-
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-
A2c - Residential Retail	136,185,998	(353,111,752)	(725,237)	1,764,525,320	579,560,921	-	10,961,990	-
A2d - Residential Behavior	11,506,270	57,676,127	-	-	-	-	-	-
A2e - Residential Active Demand Reduction	112,508,951	1,278,114	-	-	-	-	-	-
B - Income Eligible	**45,398,484**	**116,598,457**	**6,014,689**	**393,285,181**	**119,798,295**	**-**	**-**	**-**
B1 - Income Eligible Existing Buildings	45,398,484	116,598,457	6,014,689	393,285,181	119,798,295	-	-	-
B1a - Income Eligible Coordinated Delivery	43,078,940	116,638,752	6,014,689	393,285,181	119,798,295	-	-	-
B1b - Income Eligible Active Demand Reduction	2,319,544	(40,295)	-	-	-	-	-	-
C - Commercial & Industrial	**660,281,339**	**1,665,896,940**	**(214,231,108)**	**452,222,693**	**471,576,294**	**-**	**18,229,391**	**-**
C1 - C&I New Buildings	45,317,395	209,426,586	(3,338,931)	(3,420,469)	-	-	-	-
C1a - C&I New Buildings & Major Renovations	45,317,395	209,426,586	(3,338,931)	(3,420,469)	-	-	-	-
C2 - C&I Existing Buildings	614,963,943	1,456,470,354	(210,892,177)	455,643,162	471,576,294	-	18,229,391	-
C2a - C&I Existing Building Retrofit	387,045,918	1,098,629,202	(209,044,697)	393,904,950	357,725,019	-	-	-
C2b - C&I New & Replacement Equipment	91,981,625	357,524,484	(1,847,480)	61,738,212	113,851,276	-	18,229,391	-
C2c - C&I Active Demand Reduction	135,936,400	316,668	-	-	-	-	-	-
Grand Total	**1,025,534,575**	**1,711,781,515**	**(155,649,435)**	**3,716,164,802**	**1,631,298,019**	**-**	**29,191,381**	**-**

IV.D Cost-Effectiveness

3.1.i. Benefits Summary Table

Statewide Electric
November 1, 2021

2022 Benefits ($)						
Program	**Water**	**Total Resource Benefits**	**Non-Resource Benefits**	**Total TRC Test Benefits**	**Resource Benefits per Participant**	**Total Environmental Compliance Benefits (Social Cost of Carbon)**
A - Residential	**12,332,145**	**1,099,585,349**	**44,391,080**	**1,143,976,430**	**931**	**545,181,676**
A1 - Residential New Buildings	-	87,246,393	2,052,563	89,298,956	7,546	44,093,688
A1a - Residential New Homes & Renovations	-	87,246,393	2,052,563	89,298,956	7,546	44,093,688
A2 - Residential Existing Buildings	12,332,145	1,012,338,957	42,338,518	1,054,677,474	865	501,087,988
A2a - Residential Coordinated Delivery	11,255,060	482,730,484	37,816,291	520,546,775	7,882	259,150,583
A2b - Residential Conservation Services (RCS)	-	-	-	-		-
A2c - Residential Retail	1,077,085	479,814,848	4,522,226	484,337,074	3,209	229,579,023
A2d - Residential Behavior	-	21,992,428	-	21,992,428	25	12,234,337
A2e - Residential Active Demand Reduction	-	27,801,197	-	27,801,197	318	124,045
B - Income Eligible	**4,159,628**	**220,379,483**	**88,008,381**	**308,387,864**	**7,639**	**107,016,784**
B1 - Income Eligible Existing Buildings	4,159,628	220,379,483	88,008,381	308,387,864	7,639	107,016,784
B1a - Income Eligible Coordinated Delivery	4,159,628	219,931,539	88,008,381	307,939,920	7,657	107,019,986
B1b - Income Eligible Active Demand Reduction	-	447,944	-	447,944	3,529	(3,201)
C - Commercial & Industrial	**90,938**	**945,221,774**	**209,696,920**	**1,154,918,694**	**150,088**	**458,042,956**
C1 - C&I New Buildings	-	77,159,965	24,277,582	101,437,547	379,198	44,318,100
C1a - C&I New Buildings & Major Renovations	-	77,159,965	24,277,582	101,437,547	379,198	44,318,100
C2 - C&I Existing Buildings	90,938	868,061,809	185,419,337	1,053,481,146	142,438	413,724,857
C2a - C&I Existing Building Retrofit	79,279	623,745,816	141,264,991	765,010,807	370,492	301,201,974
C2b - C&I New & Replacement Equipment	11,659	206,640,165	44,154,346	250,794,511	60,799	112,477,847
C2c - C&I Active Demand Reduction	-	37,675,829	-	37,675,829	37,229	45,035
Grand Total	**16,582,711**	**2,265,186,606**	**342,096,381**	**2,607,282,988**	**1,862**	**1,110,241,416**

2023 Benefits ($)						
Program	**Water**	**Total Resource Benefits**	**Non-Resource Benefits**	**Total TRC Test Benefits**	**Resource Benefits per Participant**	**Total Environmental Compliance Benefits (Social Cost of Carbon)**
A - Residential	**12,667,389**	**1,391,025,618**	**46,972,557**	**1,437,998,175**	**1,100**	**665,214,269**
A1 - Residential New Buildings	-	152,855,291	2,457,985	155,313,277	12,006	66,209,465
A1a - Residential New Homes & Renovations	-	152,855,291	2,457,985	155,313,277	12,006	66,209,465
A2 - Residential Existing Buildings	12,667,389	1,238,170,327	44,514,572	1,282,684,899	989	599,004,805
A2a - Residential Coordinated Delivery	11,595,172	507,280,987	39,228,612	546,509,599	7,898	271,986,416
A2b - Residential Conservation Services (RCS)	-	-	-	-		-
A2c - Residential Retail	1,072,217	670,749,756	5,285,960	676,035,715	4,216	313,825,290
A2d - Residential Behavior	-	22,649,683	-	22,649,683	25	13,019,157
A2e - Residential Active Demand Reduction	-	37,489,901	-	37,489,901	324	173,942
B - Income Eligible	**4,273,363**	**230,095,927**	**88,816,481**	**318,912,408**	**7,741**	**112,377,755**
B1 - Income Eligible Existing Buildings	4,273,363	230,095,927	88,816,481	318,912,408	7,741	112,377,755
B1a - Income Eligible Coordinated Delivery	4,273,363	229,291,451	88,816,481	318,107,932	7,761	112,397,156
B1b - Income Eligible Active Demand Reduction	-	804,476	-	804,476	4,450	(19,401)
C - Commercial & Industrial	**96,460**	**957,868,658**	**212,657,484**	**1,170,526,142**	**147,446**	**467,168,122**
C1 - C&I New Buildings	-	83,379,229	25,989,391	109,368,621	395,466	47,465,310
C1a - C&I New Buildings & Major Renovations	-	83,379,229	25,989,391	109,368,621	395,466	47,465,310
C2 - C&I Existing Buildings	96,460	874,489,428	186,668,093	1,061,157,521	139,126	419,702,813
C2a - C&I Existing Building Retrofit	83,803	614,598,201	141,451,580	756,049,781	363,615	306,276,798
C2b - C&I New & Replacement Equipment	12,657	214,780,833	45,216,513	259,997,345	61,536	113,393,817
C2c - C&I Active Demand Reduction	-	45,110,395	-	45,110,395	40,824	32,197
Grand Total	**17,037,213**	**2,578,990,203**	**348,446,522**	**2,927,436,725**	**1,983**	**1,244,760,147**

IV.D Cost-Effectiveness

3.1.i. Benefits Summary Table

Statewide Electric
November 1, 2021

2024 Benefits ($)						
Program	**Water**	**Total Resource Benefits**	**Non-Resource Benefits**	**Total TRC Test Benefits**	**Resource Benefits per Participant**	**Total Environmental Compliance Benefits (Social Cost of Carbon)**
A - Residential	**13,012,317**	**1,770,651,084**	**49,288,482**	**1,819,939,567**	**1,299**	**821,870,259**
A1 - Residential New Buildings	-	158,279,706	1,819,356	160,099,062	14,031	61,119,557
A1a - Residential New Homes & Renovations	-	158,279,706	1,819,356	160,099,062	14,031	61,119,557
A2 - Residential Existing Buildings	13,012,317	1,612,371,378	47,469,126	1,659,840,505	1,193	760,750,702
A2a - Residential Coordinated Delivery	11,941,645	549,282,514	41,032,825	590,315,338	8,086	294,196,761
A2b - Residential Conservation Services (RCS)	-	-	-	-		-
A2c - Residential Retail	1,070,672	990,052,612	6,436,301	996,488,914	5,704	451,749,694
A2d - Residential Behavior	-	24,540,286	-	24,540,286	26	14,421,464
A2e - Residential Active Demand Reduction	-	48,495,967	-	48,495,967	329	382,783
B - Income Eligible	**4,443,048**	**243,495,735**	**90,158,951**	**333,654,686**	**7,865**	**119,230,310**
B1 - Income Eligible Existing Buildings	4,443,048	243,495,735	90,158,951	333,654,686	7,865	119,230,310
B1a - Income Eligible Coordinated Delivery	4,443,048	242,468,907	90,158,951	332,627,858	7,879	119,250,135
B1b - Income Eligible Active Demand Reduction	-	1,026,828	-	1,026,828	5,562	(19,825)
C - Commercial & Industrial	**101,127**	**1,151,173,643**	**255,353,109**	**1,406,526,753**	**163,192**	**539,443,118**
C1 - C&I New Buildings	-	87,445,388	27,061,640	114,507,027	405,485	49,377,561
C1a - C&I New Buildings & Major Renovations	-	87,445,388	27,061,640	114,507,027	405,485	49,377,561
C2 - C&I Existing Buildings	101,127	1,063,728,256	228,291,470	1,292,019,725	155,551	490,065,557
C2a - C&I Existing Building Retrofit	87,414	790,166,871	180,452,695	970,619,566	385,283	377,051,507
C2b - C&I New & Replacement Equipment	13,713	220,094,540	47,838,774	267,933,315	61,555	112,975,033
C2c - C&I Active Demand Reduction	-	53,466,845	-	53,466,845	44,115	39,017
Grand Total	**17,556,492**	**3,165,320,463**	**394,800,543**	**3,560,121,006**	**2,260**	**1,480,543,688**

2022-2024 Benefits ($)						
Program	**Water**	**Total Resource Benefits**	**Non-Resource Benefits**	**Total TRC Test Benefits**	**Resource Benefits per Participant**	**Total Environmental Compliance Benefits (Social Cost of Carbon)**
A - Residential	**38,011,851**	**4,261,262,052**	**140,652,120**	**4,401,914,172**	**1,119**	**2,032,266,204**
A1 - Residential New Buildings	-	398,381,390	6,329,904	404,711,294	11,199	171,422,709
A1a - Residential New Homes & Renovations	-	398,381,390	6,329,904	404,711,294	11,199	171,422,709
A2 - Residential Existing Buildings	38,011,851	3,862,880,662	134,322,216	3,997,202,878	1,024	1,860,843,495
A2a - Residential Coordinated Delivery	34,791,877	1,539,293,984	118,077,728	1,657,371,713	7,959	825,333,759
A2b - Residential Conservation Services (RCS)	-	-	-	-		-
A2c - Residential Retail	3,219,975	2,140,617,215	16,244,488	2,156,861,703	4,439	995,154,007
A2d - Residential Behavior	-	69,182,397	-	69,182,397	25	39,674,958
A2e - Residential Active Demand Reduction	-	113,787,065	-	113,787,065	324	680,770
B - Income Eligible	**12,876,039**	**693,971,145**	**266,983,813**	**960,954,958**	**7,751**	**338,624,850**
B1 - Income Eligible Existing Buildings	12,876,039	693,971,145	266,983,813	960,954,958	7,751	338,624,850
B1a - Income Eligible Coordinated Delivery	12,876,039	691,691,897	266,983,813	958,675,710	7,768	338,667,277
B1b - Income Eligible Active Demand Reduction	-	2,279,249	-	2,279,249	4,630	(42,426)
C - Commercial & Industrial	**288,525**	**3,054,264,075**	**677,707,513**	**3,731,971,588**	**153,880**	**1,464,654,196**
C1 - C&I New Buildings	-	247,984,582	77,328,613	325,313,195	393,641	141,160,970
C1a - C&I New Buildings & Major Renovations	-	247,984,582	77,328,613	325,313,195	393,641	141,160,970
C2 - C&I Existing Buildings	288,525	2,806,279,493	600,378,900	3,406,658,393	146,021	1,323,493,226
C2a - C&I Existing Building Retrofit	250,496	2,028,510,887	463,169,266	2,491,680,154	373,941	984,530,280
C2b - C&I New & Replacement Equipment	38,030	641,515,537	137,209,633	778,725,171	61,303	338,846,698
C2c - C&I Active Demand Reduction	-	136,253,068	-	136,253,068	40,929	116,249
Grand Total	**51,176,416**	**8,009,497,272**	**1,085,343,446**	**9,094,840,718**	**2,044**	**3,835,545,251**

IV.D Cost-Effectiveness

3.1.iii. Benefits Historical Comparison

Statewide Electric

November 1, 2021

2019-2024 Benefits ($)													
Sector	Electric		Natural Gas	Oil	Propane	Wood	Motor Gasoline	Motor Diesel	Water	Total Energy Benefits	Non-Resource Impacts	Total TRC Test Benefits	Total Environmental Compliance Benefits
	Capacity	Electric Energy											
A - Residential													
2019 Evaluated	97,402,057	204,417,983	(4,926,403)	224,532,290	57,801,715	-	-	-	7,957,654	587,185,295	34,008,684	645,620,951	59,771,109
2020 Evaluated	96,896,105	189,659,692	(2,729,665)	298,263,492	75,543,289	5,726	-	-	11,149,449	668,788,087	57,464,824	744,804,102	88,088,085
2021 Planned	81,458,647	128,258,323	1,812,883	293,395,320	127,408,363	-	-	-	8,712,507	641,046,043	39,479,468	697,768,553	70,633,844
2022 Planned	85,881,566	89,384,658	17,644,770	693,541,935	197,169,883	-	3,630,393	-	12,332,145	1,099,585,349	44,391,080	1,143,976,430	545,181,676
2023 Planned	104,632,481	2,722,295	17,531,475	904,364,672	345,452,600	-	3,654,704	-	12,667,389	1,391,025,618	46,972,557	1,437,998,175	665,214,269
2024 Planned	129,340,705	(162,820,836)	17,390,738	1,272,750,321	497,300,946	-	3,676,892	-	13,012,317	1,770,651,084	49,288,482	1,819,939,567	821,870,259
B - Income Eligible													
2019 Evaluated	17,699,965	41,730,744	795,472	35,552,026	6,686,786	-	-	-	2,559,487	105,024,481	28,827,004	160,907,811	11,770,081
2020 Evaluated	7,486,187	26,589,992	329,474	27,839,785	4,620,806	-	-	-	2,010,863	68,877,107	25,908,924	111,312,774	9,448,329
2021 Planned	6,382,494	20,566,718	592,049	31,935,680	6,065,922	-	-	-	1,388,879	66,931,743	17,400,516	111,580,184	5,436,957
2022 Planned	17,990,524	43,412,360	1,846,761	117,785,820	35,184,390	-	-	-	4,159,628	220,379,483	88,008,381	308,387,864	107,016,784
2023 Planned	15,071,121	39,707,828	1,988,927	129,503,507	39,551,181	-	-	-	4,273,363	230,095,927	88,816,481	318,912,408	112,377,755
2024 Planned	12,336,839	33,478,269	2,179,001	145,995,855	45,062,724	-	-	-	4,443,048	243,495,735	90,158,951	333,654,686	119,230,310
C - Commercial & Industrial													
2019 Evaluated	405,539,294	855,083,129	(55,684,990)	(43,520,380)	(11,164,598)	-	-	-	697,234	1,150,949,689	86,517,308	1,304,579,065	122,502,910
2020 Evaluated	814,393,831	1,486,736,543	(643,582,414)	(43,276,195)	1,875,120	-	-	-	606,085	1,616,752,973	55,479,214	1,624,805,421	113,055,233
2021 Planned	429,925,329	925,072,316	(209,847,902)	(38,257,145)	240,747	-	-	-	224,533	1,107,357,878	77,684,193	1,262,213,599	83,938,003
2022 Planned	241,321,349	723,563,355	(135,945,463)	30,304,762	79,841,964	-	6,044,870	-	90,938	945,221,774	209,696,920	1,154,918,694	458,042,956
2023 Planned	197,089,051	541,639,777	(45,387,001)	98,846,747	159,505,566	-	6,078,057	-	96,460	957,868,658	212,657,484	1,170,526,142	467,168,122
2024 Planned	221,870,938	400,693,808	(32,898,644)	323,071,185	232,228,765	-	6,106,464	-	101,127	1,151,173,643	255,353,109	1,406,526,753	539,443,118
Grand Total													
2019 Evaluated	520,641,316	1,101,231,856	(59,815,921)	216,563,936	53,323,903	-	-	-	11,214,375	1,843,159,465	149,352,997	2,111,107,827	194,044,100
2020 Evaluated	918,776,123	1,702,986,227	(645,982,605)	282,827,082	82,039,215	5,726	-	-	13,766,396	2,354,418,167	138,852,961	2,480,922,297	210,591,648
2021 Planned	517,766,470	1,073,897,357	(207,442,970)	287,073,855	133,715,033	-	-	-	10,325,919	1,815,335,663	134,564,177	2,071,562,336	160,008,803
2022 Planned	345,193,439	856,360,372	(116,453,932)	841,632,516	312,196,237	-	9,675,263	-	16,582,711	2,265,186,606	342,096,381	2,607,282,988	1,110,241,416
2023 Planned	316,792,654	584,069,901	(25,866,598)	1,132,714,926	544,509,346	-	9,732,761	-	17,037,213	2,578,990,203	348,446,522	2,927,436,725	1,244,760,147
2024 Planned	363,548,482	271,351,241	(13,328,905)	1,741,817,360	774,592,435	-	9,783,357	-	17,556,492	3,165,320,463	394,800,543	3,560,121,006	1,480,543,688

IV.D Cost-Effectiveness

3.1.iii. Benefits Historical Comparison

Statewide Electric

November 1, 2021

2019-2024 Benefits, Percent of Total TRC Test Benefits (%)													
Sector	Electric		Natural Gas	Oil	Propane	Wood	Motor Gasoline	Motor Diesel	Water	Total Energy Benefits	Non-Resource Impacts	Total TRC Test Benefits	Total Environmental Compliance Benefits
	Capacity	Electric Energy											
A - Residential													
2019 Evaluated	15%	32%	-1%	35%	9%	0%	0%	0%	1%	91%	5%	100%	9%
2020 Evaluated	13%	25%	0%	40%	10%	0%	0%	0%	1%	90%	8%	100%	12%
2021 Planned	12%	18%	0%	42%	18%	0%	0%	0%	1%	92%	6%	100%	10%
2022 Planned	8%	8%	2%	61%	17%	0%	0%	0%	1%	96%	4%	100%	48%
2023 Planned	7%	0%	1%	63%	24%	0%	0%	0%	1%	97%	3%	100%	46%
2024 Planned	7%	-9%	1%	70%	27%	0%	0%	0%	1%	97%	3%	100%	45%
B - Income Eligible													
2019 Evaluated	11%	26%	0%	22%	4%	0%	0%	0%	2%	65%	18%	100%	7%
2020 Evaluated	7%	24%	0%	25%	4%	0%	0%	0%	2%	62%	23%	100%	8%
2021 Planned	6%	18%	1%	29%	5%	0%	0%	0%	1%	60%	16%	100%	5%
2022 Planned	6%	14%	1%	38%	11%	0%	0%	0%	1%	71%	29%	100%	35%
2023 Planned	5%	12%	1%	41%	12%	0%	0%	0%	1%	72%	28%	100%	35%
2024 Planned	4%	10%	1%	44%	14%	0%	0%	0%	1%	73%	27%	100%	36%
C - Commercial & Industrial													
2019 Evaluated	31%	66%	-4%	-3%	-1%	0%	0%	0%	0%	88%	7%	100%	9%
2020 Evaluated	50%	92%	-40%	-3%	0%	0%	0%	0%	0%	100%	3%	100%	7%
2021 Planned	34%	73%	-17%	-3%	0%	0%	0%	0%	0%	88%	6%	100%	7%
2022 Planned	21%	63%	-12%	3%	7%	0%	1%	0%	0%	82%	18%	100%	40%
2023 Planned	17%	46%	-4%	8%	14%	0%	1%	0%	0%	82%	18%	100%	40%
2024 Planned	16%	28%	-2%	23%	17%	0%	0%	0%	0%	82%	18%	100%	38%
Grand Total													
2019 Evaluated	25%	52%	-3%	10%	3%	0%	0%	0%	1%	87%	7%	100%	9%
2020 Evaluated	37%	69%	-26%	11%	3%	0%	0%	0%	1%	95%	6%	100%	8%
2021 Planned	25%	52%	-10%	14%	6%	0%	0%	0%	0%	88%	6%	100%	8%
2022 Planned	13%	33%	-4%	32%	12%	0%	0%	0%	1%	87%	13%	100%	43%
2023 Planned	11%	20%	-1%	39%	19%	0%	0%	0%	1%	88%	12%	100%	43%
2024 Planned	10%	8%	0%	49%	22%	0%	0%	0%	0%	89%	11%	100%	42%

Notes:

2019 values are from the Program Administrator's 2019 Plan Year Report D.P.U. 20-50, in 2019$.

2020 values are from the Program Administrator's 2020 Plan Year Report D.P.U. 21-70, in 2019$.

2021 values are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Electric, in 2019$.

For supporting information on the 2022-2024 values, see Table IV.D.3.1.i. The 2022-2024 values are in 2022$.

IV.D. Cost-Effectiveness

3.2.i. Savings Summary Table

Statewide Electric
November 1, 2021

Program	# of Participants	2022 Net Savings											
		Electric						Natural Gas		Deliverable Fuels			
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (Source MMBTU)		(Therms)		Oil (MMBTU)		Propane (MMBTU)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**1,181,265**	**93,182**	**22,466**	**110,310**	**381,596**	**776,316**	**2,460,090**	**248,498**	**5,340,539**	**640,754**	**12,127,817**	**153,966**	**2,975,978**
A1 - Residential New Buildings	11,562	619	1,467	6,007	140,131	42,199	827,616	-	-	7,205	181,597	22,126	563,649
A1a - Residential New Homes & Renovations	11,562	619	1,467	6,007	140,131	42,199	827,616	-	-	7,205	181,597	22,126	563,649
A2 - Residential Existing Buildings	1,169,703	92,563	20,999	104,303	241,465	734,118	1,632,473	248,498	5,340,539	633,549	11,946,220	131,840	2,412,329
A2a - Residential Coordinated Delivery	61,248	2,524	3,491	19,799	286,755	139,187	1,731,738	251,551	5,366,130	264,630	5,625,066	31,032	652,008
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	149,519	7,102	628	5,041	(124,753)	36,536	(657,660)	(3,053)	(25,590)	368,919	6,321,154	100,808	1,760,321
A2d - Residential Behavior	871,604	10,922	16,879	78,388	78,388	550,884	550,884	-	-	-	-	-	-
A2e - Residential Active Demand Reduction	87,333	72,015	-	1,074	1,074	7,510	7,510	-	-	-	-	-	-
B - Income Eligible	**28,850**	**5,618**	**3,759**	**26,532**	**181,963**	**186,757**	**1,157,242**	**33,793**	**573,467**	**118,522**	**2,233,684**	**28,393**	**529,093**
B1 - Income Eligible Existing Buildings	28,850	5,618	3,759	26,532	181,963	186,757	1,157,242	33,793	573,467	118,522	2,233,684	28,393	529,093
B1a - Income Eligible Coordinated Delivery	28,724	4,615	3,759	26,537	181,968	186,801	1,157,286	33,793	573,467	118,522	2,233,684	28,393	529,093
B1b - Income Eligible Active Demand Reduction	127	1,003	-	(5)	(5)	(44)	(44)	-	-	-	-	-	-
C - Commercial & Industrial	**6,298**	**165,346**	**40,871**	**333,047**	**3,581,029**	**2,344,478**	**22,438,323**	**(4,361,119)**	**(87,630,070)**	**3,345**	**544,973**	**84,047**	**1,190,964**
C1 - C&I New Buildings	203	2,485	1,896	20,254	284,154	142,515	1,762,087	(16,271)	(247,435)	(2,008)	(24,360)	-	-
C1a - C&I New Buildings & Major Renovations	203	2,485	1,896	20,254	284,154	142,515	1,762,087	(16,271)	(247,435)	(2,008)	(24,360)	-	-
C2 - C&I Existing Buildings	6,094	162,861	38,975	312,794	3,296,876	2,201,963	20,676,235	(4,344,848)	(87,382,634)	5,353	569,333	84,047	1,190,964
C2a - C&I Existing Building Retrofit	1,684	33,669	31,561	250,456	2,711,134	1,763,123	16,961,337	(4,305,017)	(87,110,362)	769	409,089	57,872	868,054
C2b - C&I New & Replacement Equipment	3,399	8,801	7,414	61,821	585,225	435,250	3,711,309	(39,831)	(272,272)	4,584	160,244	26,175	322,911
C2c - C&I Active Demand Reduction	1,012	120,391	-	517	517	3,590	3,590	-	-	-	-	-	-
Grand Total	**1,216,414**	**264,145**	**67,096**	**469,890**	**4,144,588**	**3,307,551**	**26,055,654**	**(4,078,828)**	**(81,716,063)**	**762,621**	**14,906,473**	**266,406**	**4,696,035**

Program	# of Participants	2023 Net Savings											
		Electric						Natural Gas		Deliverable Fuels			
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (Source MMBTU)		(Therms)		Oil (MMBTU)		Propane (MMBTU)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**1,264,608**	**120,054**	**18,894**	**92,950**	**10,219**	**646,961**	**260,893**	**244,002**	**5,282,181**	**844,107**	**15,675,293**	**259,681**	**5,126,766**
A1 - Residential New Buildings	12,732	648	458	2,725	65,044	18,955	383,933	-	-	6,932	175,816	73,580	1,768,524
A1a - Residential New Homes & Renovations	12,732	648	458	2,725	65,044	18,955	383,933	-	-	6,932	175,816	73,580	1,768,524
A2 - Residential Existing Buildings	1,251,876	119,406	18,436	90,224	(54,825)	628,006	(123,039)	244,002	5,282,181	837,175	15,499,477	186,101	3,358,242
A2a - Residential Coordinated Delivery	64,230	2,313	3,595	18,679	270,683	129,342	1,608,937	251,606	5,366,935	287,728	6,037,426	33,612	694,339
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	159,089	9,091	(2,428)	(10,329)	(407,382)	(68,687)	(2,299,328)	(7,604)	(84,754)	549,446	9,462,051	152,489	2,663,903
A2d - Residential Behavior	912,704	11,174	17,269	80,264	80,264	556,229	556,229	-	-	-	-	-	-
A2e - Residential Active Demand Reduction	115,854	96,829	-	1,610	1,610	11,122	11,122	-	-	-	-	-	-
B - Income Eligible	**29,726**	**5,864**	**3,381**	**24,065**	**165,584**	**167,204**	**1,037,982**	**36,258**	**615,028**	**128,514**	**2,420,963**	**31,646**	**589,957**
B1 - Income Eligible Existing Buildings	29,726	5,864	3,381	24,065	165,584	167,204	1,037,982	36,258	615,028	128,514	2,420,963	31,646	589,957
B1a - Income Eligible Coordinated Delivery	29,545	4,038	3,381	24,078	165,597	167,319	1,038,096	36,258	615,028	128,514	2,420,963	31,646	589,957
B1b - Income Eligible Active Demand Reduction	181	1,826	-	(12)	(12)	(114)	(114)	-	-	-	-	-	-
C - Commercial & Industrial	**6,496**	**174,685**	**33,444**	**261,131**	**2,415,032**	**1,815,602**	**15,055,018**	**(1,798,306)**	**(25,401,346)**	**90,035**	**1,794,685**	**159,826**	**2,358,164**
C1 - C&I New Buildings	211	2,592	1,974	20,959	303,464	145,675	1,850,031	(21,539)	(357,586)	(1,772)	(20,584)	-	-
C1a - C&I New Buildings & Major Renovations	211	2,592	1,974	20,959	303,464	145,675	1,850,031	(21,539)	(357,586)	(1,772)	(20,584)	-	-
C2 - C&I Existing Buildings	6,286	172,093	31,470	240,171	2,111,568	1,669,928	13,204,987	(1,776,767)	(25,043,760)	91,807	1,815,269	159,826	2,358,164
C2a - C&I Existing Building Retrofit	1,690	27,682	25,364	188,312	1,610,876	1,309,286	10,089,990	(1,748,286)	(24,863,176)	73,048	1,434,621	118,441	1,776,686
C2b - C&I New & Replacement Equipment	3,490	7,563	6,106	51,301	500,133	356,830	3,111,186	(28,481)	(180,585)	18,758	380,648	41,385	581,479
C2c - C&I Active Demand Reduction	1,105	136,848	-	558	558	3,811	3,811	-	-	-	-	-	-
Grand Total	**1,300,830**	**300,602**	**55,718**	**378,145**	**2,590,835**	**2,629,767**	**16,353,893**	**(1,518,046)**	**(19,504,137)**	**1,062,655**	**19,890,941**	**451,153**	**8,074,888**

IV.D. Cost-Effectiveness

3.2.i. Savings Summary Table

Statewide Electric
November 1, 2021

2022 Net Savings

Program	Other								Total Savings MMBTU		Electric Energy, no Fuel Switching or ADR (MWh)		Avoided CO2e (Metric Tons)	
	Wood (MMBTU)		Motor Gasoline (MMBTU)		Motor Diesel (MMBTU)		Water (Gallons)							
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	2025	2030
A - Residential	-	-	8,935	69,304	-	-	53,727,528	715,260,688	1,595,885	18,097,938	146,957	1,021,759	80,601	73,125
A1 - Residential New Buildings	-	-	-	-	-	-	-	-	71,529	1,572,862	6,486	151,172	5,393	4,818
A1a - Residential New Homes & Renovations	-	-	-	-	-	-	-	-	71,529	1,572,862	6,486	151,172	5,393	4,818
A2 - Residential Existing Buildings	-	-	8,935	69,304	-	-	53,727,528	715,260,688	1,524,356	16,525,076	140,470	870,587	75,208	68,307
A2a - Residential Coordinated Delivery	-	-	-	-	-	-	47,070,768	652,959,307	460,004	8,545,426	20,520	298,601	27,194	24,363
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	-	-	8,935	69,304	-	-	6,656,760	62,301,381	505,957	7,421,256	40,488	492,523	48,015	43,944
A2d - Residential Behavior	-	-	-	-	-	-	-	-	550,884	550,884	78,388	78,388	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	7,510	7,510	1,074	1,074	-	-
B - Income Eligible	-	-	-	-	-	-	19,547,860	240,865,388	337,052	3,977,365	32,609	282,754	15,262	12,634
B1 - Income Eligible Existing Buildings	-	-	-	-	-	-	19,547,860	240,865,388	337,052	3,977,365	32,609	282,754	15,262	12,634
B1a - Income Eligible Coordinated Delivery	-	-	-	-	-	-	19,547,860	240,865,388	337,096	3,977,410	32,614	282,758	15,262	12,634
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	(44)	(44)	(5)	(5)	-	-
C - Commercial & Industrial	-	-	31,225	116,107	-	-	551,377	5,249,385	1,995,758	15,411,253	345,759	3,752,763	76,689	23,030
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	138,880	1,712,983	20,254	284,154	5,097	2,037
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	138,880	1,712,983	20,254	284,154	5,097	2,037
C2 - C&I Existing Buildings	-	-	31,225	116,107	-	-	551,377	5,249,385	1,856,878	13,698,269	325,505	3,468,609	71,592	20,993
C2a - C&I Existing Building Retrofit	-	-	-	-	-	-	467,387	4,577,462	1,391,263	9,527,443	258,439	2,830,873	44,536	14,198
C2b - C&I New & Replacement Equipment	-	-	31,225	116,107	-	-	83,990	671,924	462,026	4,167,236	66,550	637,219	27,056	6,795
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	3,590	3,590	517	517	-	-
Grand Total	-	-	40,159	185,411	-	-	73,826,765	961,375,461	3,928,696	37,486,556	525,325	5,057,275	172,553	108,790

2023 Net Savings

Program	Other								Total Savings MMBTU		Electric Energy, no Fuel Switching or ADR (MWh)		Avoided CO2e (Metric Tons)	
	Wood (MMBTU)		Motor Gasoline (MMBTU)		Motor Diesel (MMBTU)		Water (Gallons)							
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	2025	2030
A - Residential	-	-	8,935	69,304	-	-	55,235,953	736,194,418	1,775,148	21,591,171	157,898	1,168,061	104,492	99,713
A1 - Residential New Buildings	-	-	-	-	-	-	-	-	99,467	2,328,273	7,950	185,237	8,094	7,901
A1a - Residential New Homes & Renovations	-	-	-	-	-	-	-	-	99,467	2,328,273	7,950	185,237	8,094	7,901
A2 - Residential Existing Buildings	-	-	8,935	69,304	-	-	55,235,953	736,194,418	1,675,682	19,262,897	149,948	982,823	96,398	91,812
A2a - Residential Coordinated Delivery	-	-	-	-	-	-	48,589,790	674,051,986	475,843	8,877,396	20,458	297,968	29,095	26,522
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	-	-	8,935	69,304	-	-	6,646,163	62,142,432	632,488	9,818,150	47,616	602,982	67,303	65,291
A2d - Residential Behavior	-	-	-	-	-	-	-	-	556,229	556,229	80,264	80,264	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	11,122	11,122	1,610	1,610	-	-
B - Income Eligible	-	-	-	-	-	-	20,113,801	247,950,401	330,990	4,110,404	30,784	277,779	16,675	13,698
B1 - Income Eligible Existing Buildings	-	-	-	-	-	-	20,113,801	247,950,401	330,990	4,110,404	30,784	277,779	16,675	13,698
B1a - Income Eligible Coordinated Delivery	-	-	-	-	-	-	20,113,801	247,950,401	331,105	4,110,519	30,796	277,791	16,675	13,698
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	(114)	(114)	(12)	(12)	-	-
C - Commercial & Industrial	-	-	31,225	116,107	-	-	587,030	5,579,127	1,885,633	16,667,733	285,061	2,759,362	82,622	35,836
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	141,749	1,793,689	20,959	303,464	5,112	2,197
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	141,749	1,793,689	20,959	303,464	5,112	2,197
C2 - C&I Existing Buildings	-	-	31,225	116,107	-	-	587,030	5,579,127	1,743,884	14,874,044	264,102	2,455,898	77,510	33,639
C2a - C&I Existing Building Retrofit	-	-	-	-	-	-	495,671	4,848,257	1,325,947	10,814,979	205,362	1,866,615	49,021	23,175
C2b - C&I New & Replacement Equipment	-	-	31,225	116,107	-	-	91,359	730,870	414,125	4,055,254	58,182	588,724	28,489	10,464
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	3,811	3,811	558	558	-	-
Grand Total	-	-	40,159	185,411	-	-	75,936,784	989,723,946	3,991,771	42,369,308	473,743	4,205,201	203,788	149,247

IV.D. Cost-Effectiveness

3.2.i. Savings Summary Table

Statewide Electric
November 1, 2021

Program	# of Participants	2024 Net Savings											
		Electric						Natural Gas		Deliverable Fuels			
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (Source MMBTU)		(Therms)		Oil (MMBTU)		Propane (MMBTU)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**1,362,713**	**148,834**	**11,864**	**57,513**	**(699,530)**	**379,865**	**(3,876,057)**	**238,708**	**5,213,416**	**1,200,267**	**21,907,844**	**377,522**	**7,324,771**
A1 - Residential New Buildings	11,281	416	(1,093)	(2,851)	(62,692)	(18,143)	(354,695)	-	-	7,188	180,549	97,289	2,292,855
A1a - Residential New Homes & Renovations	11,281	416	(1,093)	(2,851)	(62,692)	(18,143)	(354,695)	-	-	7,188	180,549	97,289	2,292,855
A2 - Residential Existing Buildings	1,351,432	148,418	12,956	60,364	(636,837)	398,008	(3,521,362)	238,708	5,213,416	1,193,079	21,727,295	280,232	5,031,916
A2a - Residential Coordinated Delivery	67,932	2,126	3,736	16,793	246,543	108,484	1,440,606	251,642	5,367,460	330,193	6,786,340	35,225	732,877
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	173,577	11,701	(8,503)	(41,350)	(968,301)	(261,165)	(5,512,657)	(12,934)	(154,044)	862,886	14,940,955	245,007	4,299,040
A2d - Residential Behavior	962,304	11,468	17,724	82,461	82,461	534,530	534,530	-	-	-	-	-	-
A2e - Residential Active Demand Reduction	147,619	123,122	-	2,460	2,460	16,159	16,159	-	-	-	-	-	-
B - Income Eligible	**30,960**	**5,761**	**2,812**	**20,881**	**138,870**	**135,922**	**858,977**	**39,544**	**670,805**	**143,212**	**2,692,136**	**35,719**	**667,705**
B1 - Income Eligible Existing Buildings	30,960	5,761	2,812	20,881	138,870	135,922	858,977	39,544	670,805	143,212	2,692,136	35,719	667,705
B1a - Income Eligible Coordinated Delivery	30,775	3,442	2,812	20,896	138,884	136,037	859,093	39,544	670,805	143,212	2,692,136	35,719	667,705
B1b - Income Eligible Active Demand Reduction	185	2,319	-	(15)	(15)	(115)	(115)	-	-	-	-	-	-
C - Commercial & Industrial	**7,054**	**192,701**	**25,264**	**212,399**	**1,775,991**	**1,384,963**	**10,907,999**	**(1,403,248)**	**(18,478,783)**	**361,259**	**5,858,716**	**228,598**	**3,412,928**
C1 - C&I New Buildings	216	2,651	2,018	21,376	314,649	139,441	1,889,317	(24,654)	(421,990)	(1,616)	(17,895)	-	-
C1a - C&I New Buildings & Major Renovations	216	2,651	2,018	21,376	314,649	139,441	1,889,317	(24,654)	(421,990)	(1,616)	(17,895)	-	-
C2 - C&I Existing Buildings	6,838	190,050	23,246	191,022	1,461,342	1,245,522	9,018,682	(1,378,594)	(18,056,793)	362,875	5,876,611	228,598	3,412,928
C2a - C&I Existing Building Retrofit	2,051	28,984	18,328	148,590	1,036,489	968,800	6,426,845	(1,358,501)	(17,942,185)	331,731	5,300,973	175,668	2,635,185
C2b - C&I New & Replacement Equipment	3,576	6,459	4,918	41,837	424,258	272,850	2,587,965	(20,093)	(114,608)	31,144	575,638	52,930	777,743
C2c - C&I Active Demand Reduction	1,212	154,607	-	596	596	3,872	3,872	-	-	-	-	-	-
Grand Total	**1,400,727**	**347,295**	**39,939**	**290,793**	**1,215,331**	**1,900,750**	**7,890,919**	**(1,124,997)**	**(12,594,562)**	**1,704,738**	**30,458,696**	**641,839**	**11,405,405**

Program	# of Participants	2022-2024 Net Savings											
		Electric						Natural Gas		Deliverable Fuels			
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (Source MMBTU)		(Therms)		Oil (MMBTU)		Propane (MMBTU)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**3,605,400**	**193,226**	**53,223**	**258,088**	**(310,399)**	**1,784,510**	**(1,173,707)**	**731,207**	**15,836,136**	**2,685,127**	**49,710,954**	**791,168**	**15,427,516**
A1 - Residential New Buildings	35,575	1,683	832	5,881	142,482	43,011	856,854	-	-	21,325	537,962	192,995	4,625,028
A1a - Residential New Homes & Renovations	35,575	1,683	832	5,881	142,482	43,011	856,854	-	-	21,325	537,962	192,995	4,625,028
A2 - Residential Existing Buildings	3,569,826	191,543	52,391	252,207	(452,881)	1,741,499	(2,030,561)	731,207	15,836,136	2,663,802	49,172,992	598,173	10,802,487
A2a - Residential Coordinated Delivery	193,410	6,963	10,822	55,271	803,982	377,013	4,781,282	754,798	16,100,525	882,551	18,448,832	99,869	2,079,224
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	482,185	27,893	(10,303)	(46,638)	(1,500,436)	(293,316)	(8,469,645)	(23,591)	(264,389)	1,781,251	30,724,160	498,304	8,723,263
A2d - Residential Behavior	2,746,612	33,564	51,872	241,113	241,113	1,641,643	1,641,643	-	-	-	-	-	-
A2e - Residential Active Demand Reduction	147,619	123,122	-	2,460	2,460	16,159	16,159	-	-	-	-	-	-
B - Income Eligible	**89,228**	**14,414**	**9,951**	**71,506**	**486,444**	**490,113**	**3,054,430**	**109,595**	**1,859,300**	**390,248**	**7,346,782**	**95,759**	**1,786,756**
B1 - Income Eligible Existing Buildings	89,228	14,414	9,951	71,506	486,444	490,113	3,054,430	109,595	1,859,300	390,248	7,346,782	95,759	1,786,756
B1a - Income Eligible Coordinated Delivery	89,044	12,095	9,951	71,511	486,449	490,157	3,054,475	109,595	1,859,300	390,248	7,346,782	95,759	1,786,756
B1b - Income Eligible Active Demand Reduction	185	2,319	-	(5)	(5)	(44)	(44)	-	-	-	-	-	-
C - Commercial & Industrial	**17,731**	**275,492**	**99,579**	**805,501**	**7,770,977**	**5,537,642**	**48,393,939**	**(7,562,673)**	**(131,510,199)**	**454,639**	**8,198,375**	**472,471**	**6,962,057**
C1 - C&I New Buildings	630	7,727	5,888	62,589	902,267	427,631	5,501,435	(62,464)	(1,027,012)	(5,396)	(62,839)	-	-
C1a - C&I New Buildings & Major Renovations	630	7,727	5,888	62,589	902,267	427,631	5,501,435	(62,464)	(1,027,012)	(5,396)	(62,839)	-	-
C2 - C&I Existing Buildings	17,101	267,765	93,691	742,912	6,868,710	5,110,011	42,892,503	(7,500,209)	(130,483,187)	460,035	8,261,213	472,471	6,962,057
C2a - C&I Existing Building Retrofit	5,425	90,334	75,253	587,358	5,358,499	4,041,210	33,478,172	(7,411,804)	(129,915,723)	405,549	7,144,683	351,980	5,279,925
C2b - C&I New & Replacement Equipment	10,465	22,824	18,438	154,958	1,509,616	1,064,930	9,410,460	(88,405)	(567,464)	54,486	1,116,530	120,490	1,682,132
C2c - C&I Active Demand Reduction	1,212	154,607	-	596	596	3,872	3,872	-	-	-	-	-	-
Grand Total	**3,712,360**	**483,132**	**162,753**	**1,135,095**	**7,947,022**	**7,812,265**	**50,274,662**	**(6,721,871)**	**(113,814,763)**	**3,530,015**	**65,256,110**	**1,359,398**	**24,176,328**

IV.D. Cost-Effectiveness

3.2.i. Savings Summary Table

Statewide Electric
November 1, 2021

Program	2024 Net Savings													
	Other								Total Savings		Electric Energy, no Fuel Switching or ADR (MWh)		Avoided CO2e (Metric Tons)	
	Wood (MMBTU)		Motor Gasoline (MMBTU)		Motor Diesel (MMBTU)		Water (Gallons)		MMBTU					
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	2025	2030
A - Residential	-	-	8,935	69,304	-	-	56,797,118	757,834,187	1,981,525	25,877,900	167,884	1,265,202	148,332	139,950
A1 - Residential New Buildings	-	-	-	-	-	-	-	-	86,335	2,118,709	5,417	127,536	7,907	8,166
A1a - Residential New Homes & Renovations	-	-	-	-	-	-	-	-	86,335	2,118,709	5,417	127,536	7,907	8,166
A2 - Residential Existing Buildings	-	-	8,935	69,304	-	-	56,797,118	757,834,187	1,895,190	23,759,191	162,467	1,137,665	140,425	131,784
A2a - Residential Coordinated Delivery	-	-	-	-	-	-	50,148,227	695,650,837	499,066	9,496,568	20,435	301,182	32,426	30,179
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	-	-	8,935	69,304	-	-	6,648,891	62,183,350	845,435	13,711,933	57,110	751,562	100,064	101,605
A2d - Residential Behavior	-	-	-	-	-	-	-	-	534,530	534,530	82,461	82,461	7,706	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	16,159	16,159	2,460	2,460	230	-
B - Income Eligible	-	-	-	-	-	-	20,943,488	258,338,428	318,808	4,285,899	28,573	268,388	18,154	15,248
B1 - Income Eligible Existing Buildings	-	-	-	-	-	-	20,943,488	258,338,428	318,808	4,285,899	28,573	268,388	18,154	15,248
B1a - Income Eligible Coordinated Delivery	-	-	-	-	-	-	20,943,488	258,338,428	318,923	4,286,014	28,587	268,403	18,156	15,248
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	(115)	(115)	(15)	(15)	(1)	-
C - Commercial & Industrial	-	-	31,225	116,107	-	-	618,010	5,861,216	1,834,495	18,331,766	261,564	2,502,355	102,113	61,785
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	135,360	1,829,224	21,376	314,649	5,125	2,297
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	135,360	1,829,224	21,376	314,649	5,125	2,297
C2 - C&I Existing Buildings	-	-	31,225	116,107	-	-	618,010	5,861,216	1,699,135	16,502,542	240,187	2,187,706	96,989	59,488
C2a - C&I Existing Building Retrofit	-	-	-	-	-	-	518,824	5,067,728	1,340,349	12,568,785	189,112	1,644,313	68,090	46,401
C2b - C&I New & Replacement Equipment	-	-	31,225	116,107	-	-	99,186	793,488	354,914	3,929,885	50,480	542,798	28,843	13,087
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	3,872	3,872	596	596	56	-
Grand Total	-	-	40,159	185,411	-	-	78,358,615	1,022,033,831	4,134,827	48,495,564	458,020	4,035,945	268,599	216,982

Program	2022-2024 Net Savings													
	Other								Total Savings		Electric Energy, no Fuel Switching or ADR (MWh)		Avoided CO2e (Metric Tons)	
	Wood (MMBTU)		Motor Gasoline (MMBTU)		Motor Diesel (MMBTU)		Water (Gallons)		MMBTU					
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	2025	2030
A - Residential	-	-	26,804	207,911	-	-	165,760,599	2,209,289,293	5,333,926	65,548,376	470,054	3,452,336	333,425	312,788
A1 - Residential New Buildings	-	-	-	-	-	-	-	-	257,331	6,019,844	19,853	463,945	21,394	20,885
A1a - Residential New Homes & Renovations	-	-	-	-	-	-	-	-	257,331	6,019,844	19,853	463,945	21,394	20,885
A2 - Residential Existing Buildings	-	-	26,804	207,911	-	-	165,760,599	2,209,289,293	5,076,595	59,528,532	450,201	2,988,391	312,031	291,903
A2a - Residential Coordinated Delivery	-	-	-	-	-	-	145,808,785	2,022,662,130	1,434,913	26,919,390	61,413	897,751	88,714	81,064
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	-	-	26,804	207,911	-	-	19,951,814	186,627,163	1,983,880	30,951,340	145,214	1,847,067	215,381	210,840
A2d - Residential Behavior	-	-	-	-	-	-	-	-	1,641,643	1,641,643	241,113	241,113	7,706	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	16,159	16,159	2,460	2,460	230	-
B - Income Eligible	-	-	-	-	-	-	60,605,148	747,154,218	987,080	12,373,898	91,993	828,947	50,092	41,579
B1 - Income Eligible Existing Buildings	-	-	-	-	-	-	60,605,148	747,154,218	987,080	12,373,898	91,993	828,947	50,092	41,579
B1a - Income Eligible Coordinated Delivery	-	-	-	-	-	-	60,605,148	747,154,218	987,124	12,373,943	91,998	828,952	50,092	41,579
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	(44)	(44)	(5)	(5)	-	-
C - Commercial & Industrial	-	-	93,674	348,322	-	-	1,756,417	16,689,728	5,708,485	50,403,350	891,309	9,013,405	261,424	120,651
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	415,989	5,335,896	62,589	902,267	15,334	6,531
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	415,989	5,335,896	62,589	902,267	15,334	6,531
C2 - C&I Existing Buildings	-	-	93,674	348,322	-	-	1,756,417	16,689,728	5,292,496	45,067,455	828,720	8,111,138	246,091	114,119
C2a - C&I Existing Building Retrofit	-	-	-	-	-	-	1,481,882	14,493,446	4,057,559	32,911,207	652,912	6,341,801	161,647	83,773
C2b - C&I New & Replacement Equipment	-	-	93,674	348,322	-	-	274,535	2,196,282	1,231,065	12,152,375	175,212	1,768,742	84,388	30,346
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	3,872	3,872	596	596	56	-
Grand Total	-	-	120,477	556,232	-	-	228,122,165	2,973,133,239	12,029,491	128,325,625	1,453,356	13,294,688	644,942	475,018

IV.D Cost-Effectiveness

3.1.iii. Benefits Historical Comparison

Statewide Electric

November 1, 2021

2019-2024 Net Savings													
Sector	# of Participants	Electric						Natural Gas		Deliverable Fuels			
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		(Therms)		Oil (MMBTU)		Propane (MMBTU)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential													
2019 Evaluated	5,034,382	65,942	86,334	429,038	1,650,118	3,125,416	11,518,436	(1,813,279)	(2,137,720)	339,075	7,770,520	58,293	1,559,238
2020 Evaluated	7,920,615	78,507	95,078	466,320	1,545,883	3,396,735	10,825,667	(2,355,858)	(778,719)	403,988	10,338,094	66,011	2,029,540
2021 Planned	5,909,918	69,468	74,409	355,316	1,050,828	2,582,467	7,240,643	(1,300,734)	1,962,963	453,209	9,999,047	164,187	3,393,525
2022 Planned	1,181,265	93,182	22,466	110,310	381,596	776,316	2,460,090	248,498	5,340,539	640,754	12,127,817	153,966	2,975,978
2023 Planned	1,264,608	120,054	18,894	92,950	10,219	646,961	260,893	244,002	5,282,181	844,107	15,675,293	259,681	5,126,766
2024 Planned	1,362,713	148,834	11,864	57,513	(699,530)	379,865	(3,876,057)	238,708	5,213,416	1,200,267	21,907,844	377,522	7,324,771
B - Income Eligible													
2019 Evaluated	32,287	5,860	6,284	38,614	358,397	281,998	2,435,932	40,381	552,021	62,928	1,232,558	8,151	181,103
2020 Evaluated	22,123	3,378	4,640	26,908	224,901	196,269	1,534,081	13,385	235,067	48,683	969,733	6,522	125,992
2021 Planned	19,030	2,523	3,678	20,616	173,745	149,688	1,160,270	30,860	409,576	54,244	1,086,032	8,596	161,721
2022 Planned	28,850	5,618	3,759	26,532	181,963	186,757	1,157,242	33,793	573,467	118,522	2,233,684	28,393	529,093
2023 Planned	29,726	5,864	3,381	24,065	165,584	167,204	1,037,982	36,258	615,028	128,514	2,420,963	31,646	589,957
2024 Planned	30,960	5,761	2,812	20,881	138,870	135,922	858,977	39,544	670,805	143,212	2,692,136	35,719	667,705
C - Commercial & Industrial													
2019 Evaluated	22,191	90,989	80,144	616,158	7,504,365	4,519,616	51,022,617	(2,587,080)	(40,936,977)	(102,094)	(1,147,642)	(13,543)	(303,328)
2020 Evaluated	22,319	190,274	154,069	805,688	13,242,349	5,891,767	87,525,583	(22,072,150)	(490,475,422)	(173,609)	(1,832,312)	3,435	51,236
2021 Planned	24,770	133,527	101,766	651,915	8,080,418	4,771,019	54,190,016	(8,637,056)	(157,871,947)	(153,776)	(1,567,134)	419	6,538
2022 Planned	6,298	165,346	40,871	333,047	3,581,029	2,344,478	22,438,323	(4,361,119)	(87,630,070)	3,345	544,973	84,047	1,190,964
2023 Planned	6,496	174,685	33,444	261,131	2,415,032	1,815,602	15,055,018	(1,798,306)	(25,401,346)	90,035	1,794,685	159,826	2,358,164
2024 Planned	7,054	192,701	25,264	212,399	1,775,991	1,384,963	10,907,999	(1,403,248)	(18,478,783)	361,259	5,858,716	228,598	3,412,928
Grand Total													
2019 Evaluated	5,088,860	162,790	172,761	1,083,809	9,512,880	7,927,031	64,976,986	(4,359,979)	(42,522,676)	299,909	7,855,436	52,901	1,437,013
2020 Evaluated	7,965,057	272,159	253,788	1,298,915	15,013,134	9,484,772	99,885,332	(24,414,623)	(491,019,074)	279,062	9,475,515	75,969	2,206,768
2021 Planned	5,953,718	205,518	179,853	1,027,847	9,304,991	7,503,175	62,590,929	(9,906,930)	(155,499,408)	353,677	9,517,945	173,202	3,561,783
2022 Planned	1,216,414	264,145	67,096	469,890	4,144,588	3,307,551	26,055,654	(4,078,828)	(81,716,063)	762,621	14,906,473	266,406	4,696,035
2023 Planned	1,300,830	300,602	55,718	378,145	2,590,835	2,629,767	16,353,893	(1,518,046)	(19,504,137)	1,062,655	19,890,941	451,153	8,074,888
2024 Planned	1,400,727	347,295	39,939	290,793	1,215,331	1,900,750	7,890,919	(1,124,997)	(12,594,562)	1,704,738	30,458,696	641,839	11,405,405

Notes:

2019 values are from the Program Administrator's 2019 Plan Year Report D.P.U. 20-50.

2020 values are from the Program Administrator's 2020 Plan Year Report D.P.U. 21-70.

2021 values are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Electric.

For supporting information on the 2022-2024 values, see Table IV.D.3.2.i.

The Program Administrators have developed new participant definitions through the common assumptions working group for this Three-Year Plan. Historical participant numbers may not be comparable.

IV.D Cost-Effectiveness

3.1.iii. Benefits Historical Comparison

Statewide Electric

November 1, 2021

Sector	2019-2024 Net Savings									
	Other								Total Savings	
	Wood (MMBTU)		Motor Gasoline (MMBTU)		Motor Diesel (MMBTU)		Water (Gallons)		MMBTU	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential										
2019 Evaluated	-	-	-	-	-	-	68,673,886	487,394,278	1,799,700	11,556,497
2020 Evaluated	16	393	-	-	-	-	73,728,307	688,345,260	2,544,207	17,088,198
2021 Planned	-	-	-	-	-	-	50,790,426	539,607,380	2,072,276	13,713,579
2022 Planned	-	-	8,935	69,304	-	-	53,727,528	715,260,688	1,595,885	18,097,938
2023 Planned	-	-	8,935	69,304	-	-	55,235,953	736,194,418	1,775,148	21,591,171
2024 Planned	-	-	8,935	69,304	-	-	56,797,118	757,834,187	1,981,525	25,877,900
B - Income Eligible										
2019 Evaluated	-	-	-	-	-	-	14,862,245	158,135,240	185,102	2,235,056
2020 Evaluated	-	-	-	-	-	-	11,031,784	124,412,027	163,991	1,810,452
2021 Planned	-	-	-	-	-	-	7,824,462	85,919,927	96,795	1,037,946
2022 Planned	-	-	-	-	-	-	19,547,860	240,865,388	337,052	3,977,365
2023 Planned	-	-	-	-	-	-	20,113,801	247,950,401	330,990	4,110,404
2024 Planned	-	-	-	-	-	-	20,943,488	258,338,428	318,808	4,285,899
C - Commercial & Industrial										
2019 Evaluated	-	-	-	-	-	-	4,324,057	43,011,012	2,190,113	23,926,392
2020 Evaluated	-	-	-	-	-	-	3,236,759	37,670,174	1,781,114	19,634,213
2021 Planned	-	-	-	-	-	-	1,182,312	13,930,250	1,579,039	14,819,297
2022 Planned	-	-	31,225	116,107	-	-	551,377	5,249,385	1,995,758	15,411,253
2023 Planned	-	-	31,225	116,107	-	-	587,030	5,579,127	1,885,633	16,667,733
2024 Planned	-	-	31,225	116,107	-	-	618,010	5,861,216	1,834,495	18,331,766
Grand Total										
2019 Evaluated	-	-	-	-	-	-	87,860,188	688,540,530	4,174,916	37,717,945
2020 Evaluated	16	393	-	-	-	-	87,996,851	850,427,460	4,489,312	38,532,863
2021 Planned	-	-	-	-	-	-	59,797,200	639,457,558	3,748,109	29,570,822
2022 Planned	-	-	40,159	185,411	-	-	73,826,765	961,375,461	3,928,696	37,486,556
2023 Planned	-	-	40,159	185,411	-	-	75,936,784	989,723,946	3,991,771	42,369,308
2024 Planned	-	-	40,159	185,411	-	-	78,358,615	1,022,033,831	4,134,827	48,495,564

Notes:

2019 values are from the Program Administrator's 2019 Plan Year Report D.P.U. 20-50.

2020 values are from the Program Administrator's 2020 Plan Year Report D.P.U. 21-70.

2021 values are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Electric.

For supporting information on the 2022-2024 values, see Table IV.D.3.2.i.

The Program Administrators have developed new participant definitions through the common assumptions working group for this Three-Year Plan. Historical participant numbers may not be comparable.

IV.H. Performance Incentive

1. Summary Table

Statewide Electric

November 1, 2021

2022 Performance Incentives					
Sector	Total Program Costs	Pre-Tax		After-Tax	
		Performance Incentives	% of Program Costs	Performance Incentives	% of Program Costs
A - Residential	316,788,948	15,270,143	5%	11,098,340	4%
B - Income Eligible	111,835,638	4,378,414	4%	3,182,231	3%
C - Commercial & Industrial	316,123,024	16,890,353	5%	12,275,909	4%
Grand Total	**744,747,610**	**36,538,911**	**5%**	**26,556,480**	**4%**

2023 Performance Incentives					
Sector	Total Program Costs	Pre-Tax		After-Tax	
		Performance Incentives	% of Program Costs	Performance Incentives	% of Program Costs
A - Residential	383,669,528	20,551,507	5%	14,936,835	4%
B - Income Eligible	115,597,025	4,793,516	4%	3,483,928	3%
C - Commercial & Industrial	372,228,307	17,594,134	5%	12,787,417	3%
Grand Total	**871,494,861**	**42,939,158**	**5%**	**31,208,180**	**4%**

2024 Performance Incentives					
Sector	Total Program Costs	Pre-Tax		After-Tax	
		Performance Incentives	% of Program Costs	Performance Incentives	% of Program Costs
A - Residential	483,933,090	27,752,599	6%	20,170,589	4%
B - Income Eligible	121,453,823	5,341,136	4%	3,881,938	3%
C - Commercial & Industrial	514,730,894	22,187,686	4%	16,126,010	3%
Grand Total	**1,120,117,808**	**55,281,421**	**5%**	**40,178,537**	**4%**

2022-2024 Performance Incentives					
Sector	Total Program Costs	Pre-Tax		After-Tax	
		Performance Incentives	% of Program Costs	Performance Incentives	% of Program Costs
A - Residential	1,184,391,566	63,574,250	5%	46,205,765	4%
B - Income Eligible	348,886,487	14,513,067	4%	10,548,097	3%
C - Commercial & Industrial	1,203,082,226	56,672,173	5%	41,189,336	3%
Grand Total	**2,736,360,278**	**134,759,490**	**5%**	**97,943,197**	**4%**

Notes:

Performance Incentives for each year are represented in nominal dollars (2022$, 2023$, 2024$).

For supporting information on the Performance Incentive, refer to the Performance Incentive Model.

Performance Incentives are not applicable to the Cape Light Compact.

V.B. Allocation of Funds

1. Low-Income Minimum

Statewide Electric

November 1, 2021

2022 Sector Cost Allocation		
Sector	**Program Budget**	
	($)	**(% of Total)**
A - Residential	316,788,948	42.5%
B - Income Eligible	111,835,638	15.0%
C - Commercial & Industrial	316,123,024	42.4%
Grand Total	**744,747,610**	**100%**

2023 Sector Cost Allocation		
Sector	**Program Budget**	
	($)	**(% of Total)**
A - Residential	383,669,528	44.0%
B - Income Eligible	115,597,025	13.3%
C - Commercial & Industrial	372,228,307	42.7%
Grand Total	**871,494,861**	**100%**

2024 Sector Cost Allocation		
Sector	**Program Budget**	
	($)	**(% of Total)**
A - Residential	483,933,090	43.2%
B - Income Eligible	121,453,823	10.8%
C - Commercial & Industrial	514,730,894	46.0%
Grand Total	**1,120,117,808**	**100%**

2022-2024 Sector Cost Allocation		
Sector	**Program Budget**	
	($)	**(% of Total)**
A - Residential	1,184,391,566	43.3%
B - Income Eligible	348,886,487	12.8%
C - Commercial & Industrial	1,203,082,226	44.0%
Grand Total	**2,736,360,278**	**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.

V.D. Outsourced/Competitively Procured Services

1. Summary Table

Statewide Electric
November 1, 2021

2022-2024 Competitively Procured Services										
Sector	Competitively Procured Services Costs ($)					Competitively Procured Services Costs as a Percent of Total Sector Costs (%)				
			Outsourced Activities					Outsourced Activities		
	Total Cost of Services	In-House Activities	Total Outsourced	Competitively Procured	Non-Competitively Procured	Total Cost of Services	In-House Activities	Total Outsourced	Competitively Procured	Non-Competitively Procured
2022	**196,656,757**	**42,839,075**	**153,817,682**	**125,336,228**	**28,481,454**	**100%**	**22%**	**78%**	**64%**	**14%**
A - Residential	95,659,266	12,585,281	83,073,985	73,919,689	9,154,296	100%	13%	87%	77%	10%
B - Income Eligible	22,803,968	2,952,893	19,851,075	6,325,935	13,525,140	100%	13%	87%	28%	59%
C - Commercial & Industrial	78,193,523	27,300,901	50,892,622	45,090,604	5,802,018	100%	35%	65%	58%	7%
2023	**203,766,194**	**44,806,623**	**158,959,571**	**129,050,007**	**29,909,563**	**100%**	**22%**	**78%**	**63%**	**15%**
A - Residential	100,145,629	13,388,914	86,756,714	77,210,949	9,545,765	100%	13%	87%	77%	10%
B - Income Eligible	23,948,822	2,922,493	21,026,329	6,567,479	14,458,850	100%	12%	88%	27%	60%
C - Commercial & Industrial	79,671,744	28,495,217	51,176,527	45,271,580	5,904,948	100%	36%	64%	57%	7%
2024	**213,388,346**	**47,396,457**	**165,991,889**	**133,112,247**	**32,879,642**	**100%**	**22%**	**78%**	**62%**	**15%**
A - Residential	105,357,932	13,968,463	91,389,469	81,341,921	10,047,548	100%	13%	87%	77%	10%
B - Income Eligible	26,565,940	3,482,673	23,083,267	6,411,053	16,672,214	100%	13%	87%	24%	63%
C - Commercial & Industrial	81,464,474	29,945,321	51,519,153	45,359,272	6,159,880	100%	37%	63%	56%	8%
Grand Total	**613,811,297**	**135,042,156**	**478,769,141**	**387,498,482**	**91,270,659**	**100%**	**22%**	**78%**	**63%**	**15%**
A - Residential	301,162,827	39,942,658	261,220,168	232,472,559	28,747,609	100%	13%	87%	77%	10%
B - Income Eligible	73,318,730	9,358,058	63,960,671	19,304,467	44,656,204	100%	13%	87%	26%	61%
C - Commercial & Industrial	239,329,741	85,741,439	153,588,302	135,721,456	17,866,846	100%	36%	64%	57%	7%

Notes:
General Laws c. 25, § 19(a) and (b) requires the Department to ensure that energy efficiency programs use competitive procurement processes to the fullest extent practicable.
Costs for the Competitively Procured Services analysis include Program Planning and Administration; Marketing and Advertising; Sales, Technical Assistance & Training; and Evaluation and Market Research.
Costs for each year in 2016-2018 are represented in nominal dollars (2016$, 2017$, 2018$).

V.D. Outsourced/Competitively Procured Services

3. Historical Comparison

Statewide Electric

November 1, 2021

2019-2024 Competitively Procured Services										
Sector	Competitively Procured Services Costs ($)					Competitively Procured Services Costs as a Percent of Total Sector Costs (%)				
	Total Cost of Services	In-House Activities	Outsourced Activities			Total Cost of Services	In-House Activities	Outsourced Activities		
			Total Outsourced	Competitively Procured	Non-Competitively Procured			Total Outsourced	Competitively Procured	Non-Competitively Procured
A - Residential	**559,022,028**	**69,621,110**	**489,400,917**	**444,995,799**	**44,405,118**	**100%**	**12%**	**88%**	**80%**	**8%**
2019	84,427,373	9,774,063	74,653,310	69,445,555	5,207,754	100%	12%	88%	82%	6%
2020	85,799,262	9,684,608	76,114,653	70,937,182	5,177,472	100%	11%	89%	83%	6%
2021	87,632,566	10,219,781	77,412,786	72,140,503	5,272,283	100%	12%	88%	82%	6%
2022	95,659,266	12,585,281	83,073,985	73,919,689	9,154,296	100%	13%	87%	77%	10%
2023	100,145,629	13,388,914	86,756,714	77,210,949	9,545,765	100%	13%	87%	77%	10%
2024	105,357,932	13,968,463	91,389,469	81,341,921	10,047,548	100%	13%	87%	77%	10%
B - Income Eligible	**130,850,024**	**15,809,550**	**115,040,474**	**31,898,472**	**83,142,002**	**100%**	**12%**	**88%**	**24%**	**64%**
2019	18,962,214	2,145,789	16,816,425	4,056,586	12,759,839	100%	11%	89%	21%	67%
2020	19,016,564	2,117,558	16,899,006	4,170,975	12,728,031	100%	11%	89%	22%	67%
2021	19,552,516	2,188,144	17,364,372	4,366,444	12,997,928	100%	11%	89%	22%	66%
2022	22,803,968	2,952,893	19,851,075	6,325,935	13,525,140	100%	13%	87%	28%	59%
2023	23,948,822	2,922,493	21,026,329	6,567,479	14,458,850	100%	12%	88%	27%	60%
2024	26,565,940	3,482,673	23,083,267	6,411,053	16,672,214	100%	13%	87%	24%	63%
C - Commercial & Industrial	**448,032,440**	**170,129,587**	**277,902,853**	**243,389,652**	**34,513,201**	**100%**	**38%**	**62%**	**54%**	**8%**
2019	66,009,623	26,591,812	39,417,811	34,113,546	5,304,265	100%	40%	60%	52%	8%
2020	70,258,639	28,315,072	41,943,567	36,409,064	5,534,502	100%	40%	60%	52%	8%
2021	72,434,438	29,481,264	42,953,174	37,145,585	5,807,588	100%	41%	59%	51%	8%
2022	78,193,523	27,300,901	50,892,622	45,090,604	5,802,018	100%	35%	65%	58%	7%
2023	79,671,744	28,495,217	51,176,527	45,271,580	5,904,948	100%	36%	64%	57%	7%
2024	81,464,474	29,945,321	51,519,153	45,359,272	6,159,880	100%	37%	63%	56%	8%
Grand Total	**1,137,904,491**	**255,560,248**	**882,344,244**	**720,283,923**	**162,060,321**	**100%**	**22%**	**78%**	**63%**	**14%**
2019	169,399,210	38,511,664	130,887,545	107,615,687	23,271,858	100%	23%	77%	64%	14%
2020	175,074,464	40,117,238	134,957,226	111,517,221	23,440,005	100%	23%	77%	64%	13%
2021	179,619,520	41,889,189	137,730,331	113,652,532	24,077,799	100%	23%	77%	63%	13%
2022	196,656,757	42,839,075	153,817,682	125,336,228	28,481,454	100%	22%	78%	64%	14%
2023	203,766,194	44,806,623	158,959,571	129,050,007	29,909,563	100%	22%	78%	63%	15%
2024	213,388,346	47,396,457	165,991,889	133,112,247	32,879,642	100%	22%	78%	62%	15%

Notes:

General Laws c. 25, § 19(a) and (b) requires the Department to ensure that energy efficiency programs use competitive procurement processes to the fullest extent practicable.

Costs for the Competitively Procured Services analysis include Program Planning and Administration; Marketing and Advertising; Sales, Technical Assistance & Training; and Evaluation and Market Research.

The 2019-2021 costs are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Electric, in nominal dollars (2019$, 2020$, 2021$).

For supporting information on the 2022-2024 values, see Table V.D.1. Costs for each year are represented in nominal dollars (2022$, 2023$, 2024$).

VII. Appendix

B.2. Summary of Activities

Statewide Electric
November 1, 2021

2022-2024 Summary								
Sector	Net Annual Savings							
	Summer Capacity (kW)	Electric Energy (MWh)	Natural Gas (Therms)	Oil (MMBTU)	Propane (MMBTU)	Wood (MMBTU)	Water (Gallons)	Total Savings (MMBTU)
2022	**264,145**	**469,890**	**(4,078,828)**	**762,621**	**266,406**	**-**	**73,826,765**	**3,928,696**
A - Residential	93,182	110,310	248,498	640,754	153,966	-	53,727,528	1,595,885
B - Income Eligible	5,618	26,532	33,793	118,522	28,393	-	19,547,860	337,052
C - Commercial & Industrial	165,346	333,047	(4,361,119)	3,345	84,047	-	551,377	1,995,758
2023	**300,602**	**378,145**	**(1,518,046)**	**1,062,655**	**451,153**	**-**	**75,936,784**	**3,991,771**
A - Residential	120,054	92,950	244,002	844,107	259,681	-	55,235,953	1,775,148
B - Income Eligible	5,864	24,065	36,258	128,514	31,646	-	20,113,801	330,990
C - Commercial & Industrial	174,685	261,131	(1,798,306)	90,035	159,826	-	587,030	1,885,633
2024	**347,295**	**290,793**	**(1,124,997)**	**1,704,738**	**641,839**	**-**	**78,358,615**	**4,134,827**
A - Residential	148,834	57,513	238,708	1,200,267	377,522	-	56,797,118	1,981,525
B - Income Eligible	5,761	20,881	39,544	143,212	35,719	-	20,943,488	318,808
C - Commercial & Industrial	192,701	212,399	(1,403,248)	361,259	228,598	-	618,010	1,834,495
Grand Total	**912,043**	**1,138,828**	**(6,721,871)**	**3,530,015**	**1,359,398**	**-**	**228,122,165**	**12,055,294**
A - Residential	362,070	260,773	731,207	2,685,127	791,168	-	165,760,599	5,352,558
B - Income Eligible	17,243	71,479	109,595	390,248	95,759	-	60,605,148	986,850
C - Commercial & Industrial	532,731	806,576	(7,562,673)	454,639	472,471	-	1,756,417	5,715,886

2022-2024 Summary										
Sector	TRC Benefits (2022$)							TRC Costs (2022$)		
	Capacity	Electric Energy	Natural Gas	Deliverable Fuels & Other	Non-Energy Impacts	Environmental Compliance Benefits	Total Benefits	PA Budget	Participant Costs	Total TRC Test Costs
2022	**345,193,439**	**856,360,372**	**(116,453,932)**	**1,180,086,727**	**342,096,381**	**1,110,241,416**	**2,607,282,988**	**781,286,521**	**183,875,361**	**965,161,882**
A - Residential	85,881,566	89,384,658	17,644,770	906,674,356	44,391,080	545,181,676	1,143,976,430	332,059,091	86,144,678	418,203,769
B - Income Eligible	17,990,524	43,412,360	1,846,761	157,129,838	88,008,381	107,016,784	308,387,864	116,214,052	768,200	116,982,252
C - Commercial & Industrial	241,321,349	723,563,355	(135,945,463)	116,282,534	209,696,920	458,042,956	1,154,918,694	333,013,378	96,962,483	429,975,861
2023	**316,792,654**	**584,069,901**	**(25,866,598)**	**1,703,994,246**	**348,446,522**	**1,244,760,147**	**2,927,436,725**	**896,679,759**	**217,887,271**	**1,114,567,030**
A - Residential	104,632,481	2,722,295	17,531,475	1,266,139,366	46,972,557	665,214,269	1,437,998,175	396,372,853	113,423,093	509,795,946
B - Income Eligible	15,071,121	39,707,828	1,988,927	173,328,051	88,816,481	112,377,755	318,912,408	118,053,090	566,778	118,619,868
C - Commercial & Industrial	197,089,051	541,639,777	(45,387,001)	264,526,830	212,657,484	467,168,122	1,170,526,142	382,253,816	103,897,400	486,151,216
2024	**363,548,482**	**271,351,241**	**(13,328,905)**	**2,543,749,644**	**394,800,543**	**1,480,543,688**	**3,560,121,006**	**1,130,200,217**	**297,525,703**	**1,427,725,920**
A - Residential	129,340,705	(162,820,836)	17,390,738	1,786,740,477	49,288,482	821,870,259	1,819,939,567	492,009,236	158,901,934	650,911,170
B - Income Eligible	12,336,839	33,478,269	2,179,001	195,501,627	90,158,951	119,230,310	333,654,686	121,919,164	(277,406)	121,641,758
C - Commercial & Industrial	221,870,938	400,693,808	(32,898,644)	561,507,541	255,353,109	539,443,118	1,406,526,753	516,271,817	138,901,175	655,172,992
Grand Total	**1,025,534,575**	**1,711,781,515**	**(155,649,435)**	**5,427,830,617**	**1,085,343,446**	**3,835,545,251**	**9,094,840,718**	**2,808,166,497**	**699,288,335**	**3,507,454,832**
A - Residential	319,854,753	(70,713,883)	52,566,984	3,959,554,198	140,652,120	2,032,266,204	4,401,914,172	1,220,441,180	358,469,705	1,578,910,885
B - Income Eligible	45,398,484	116,598,457	6,014,689	525,959,515	266,983,813	338,624,850	960,954,958	356,186,307	1,057,572	357,243,878
C - Commercial & Industrial	660,281,339	1,665,896,940	(214,231,108)	942,316,904	677,707,513	1,464,654,196	3,731,971,588	1,231,539,010	339,761,058	1,571,300,069

2022-2024 Summary										
Sector	TRC Cost-Effectiveness		Cost of Saved Energy (PA Budget per annual savings unit)				Participants	Avg Measure Life (yrs.)	Avoided CO2e (Metric Tons)	
	B/C Ratio	Net Benefits	Summer Capacity ($/kW)	Electric Energy ($/MWh)	Natural Gas Costs ($/Therm)	Total Savings ($/MMBTU)			2025	2030
2022	**2.70**	**1,642,121,106**	**2,958**	**1,663**	**(192)**	**199**	**1,216,414**	**10**	**172,553**	**108,790**
A - Residential	2.74	725,772,661	3,564	3,010	1,336	208	1,181,265	11	80,601	73,125
B - Income Eligible	2.64	191,405,612	20,687	4,380	3,439	345	28,850	12	15,262	12,634
C - Commercial & Industrial	2.69	724,942,833	2,014	1,000	(76)	167	6,298	8	76,689	23,030
2023	**2.63**	**1,812,869,695**	**2,983**	**2,371**	**(591)**	**225**	**1,300,830**	**11**	**203,788**	**149,247**
A - Residential	2.82	928,202,229	3,302	4,264	1,624	223	1,264,608	12	104,492	99,713
B - Income Eligible	2.69	200,292,540	20,134	4,906	3,256	357	29,726	12	16,675	13,698
C - Commercial & Industrial	2.41	684,374,926	2,188	1,464	(213)	203	6,496	9	82,622	35,836
2024	**2.49**	**2,132,395,086**	**3,254**	**3,887**	**(1,005)**	**273**	**1,400,727**	**12**	**268,599**	**216,982**
A - Residential	2.80	1,169,028,396	3,306	8,555	2,061	248	1,362,713	13	148,332	139,950
B - Income Eligible	2.74	212,012,929	21,162	5,839	3,083	382	30,960	13	18,154	15,248
C - Commercial & Industrial	2.15	751,353,761	2,679	2,431	(368)	281	7,054	10	102,113	61,785
Grand Total	**2.59**	**5,587,385,886**	**3,079**	**2,466**	**(418)**	**233**	**3,917,970**	**11**	**644,940**	**475,018**
A - Residential	2.78	2,823,003,287	3,390	5,276	1,674	227	3,808,586	12	333,425	312,788
B - Income Eligible	2.69	603,711,080	20,661	5,041	3,259	361	89,536	12	50,091	41,579
C - Commercial & Industrial	2.41	2,160,671,519	2,294	1,631	(219)	217	19,848	9	261,424	120,651

Calculated Fields

Formulas used in pivot tables

Statewide Electric

November 1, 2021

Field	Formula
B/C Ratio	='Total Benefits '/'Total Resource Costs (First Yr$)'
Net Benefits	='Total Benefits '-'Total Resource Costs (First Yr$)'
Avg Measure Life	=ROUND('Total Net Lifetime Adjusted (MMBTU)'/'Total Net Annual Adjusted (MMBTU)',0)
PA Budget (First Yr$)	='Total Program Costs (First Yr$)'+'Performance Incentive (First Yr$)'
Summer Cost (TRC Cost First Yr$/Summer kW)	='Total Resource Costs (First Yr$)'/'Net Summer Capacity (kW)'
Energy Cost (TRC Cost First Yr$/Annual MWh)	='Total Program Costs (First Yr$)'/'Net Annual Electric Energy (MWh)'
Natural Gas Costs (PA Cost First Yr$/Annual Therm)	='PA Budget (First Yr$)'/'Net Annual Natural Gas (Therms)'
Summer Cost (PA Cost First Yr$/Summer kW)	='PA Budget (First Yr$)'/'Net Summer Capacity (kW)'
Energy Cost (PA Cost First Yr$/Annual MWh)	='PA Budget (First Yr$)'/'Net Annual Electric Energy (MWh)'
Natural Gas Costs (TRC Cost First Yr$/Annual Therm)	='Total Program Costs (First Yr$)'/'Net Annual Natural Gas (Therms)'
Total Savings Cost (PA Cost First Yr$/Annual MMBTU)	='PA Budget (First Yr$)'/'Total Net Annual Adjusted (MMBTU)'
Total Savings Cost (TRC Cost First Yr$/Annual MMBTU)	='Total Resource Costs (First Yr$)'/'Total Net Annual Adjusted (MMBTU)'
Total PA Budget (Programs + PI + Benefit Burden)	='Total Program Costs'+'Performance Incentive'+'Benefit Burden'
Total PA Budget (Program + PI)	='Total Program Costs'+'Performance Incentive'
Program Costs / Participant	='Total Program Costs'/Participants
Resource Benefit / Program Cost	='Total Resource Benefits'/'Total Program Costs'
Resource Benefit / Participant	='Total Resource Benefits'/Participants

Notes

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

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

Energy Efficiency Data Tables

Overview

Statewide Gas
November 1, 2021

DATA OVERVIEW

The following data tables provide a summary of the Program Administrator's benefits, costs, savings, and cost-effectiveness for 2019 through 2024. The 2019 through 2021 planned values are consistent with each Program Administrator's 2019-2021 Three-Year Plan. The 2019 and 2020 evaluated values are consistent with each Program Administrator's 2019 and 2020 Plan-Year Reports. The 2021 year-to-date data represents the most up-to-date estimated actual values available through through June 30, 2021 (Q2). The 2022-2024 planned values are consistent with each Program Administrator's 2022-2024 Three-Year Plan.

SUPPORTING INFORMATION

The data included in these tables is based on other supporting models. The primary supporting models used by the Program Administrators are the Benefit-Cost Screening model, each Program Administrator's EES calculation support documents, and the Performance Incentive model. These exhibits should be referenced when looking for more detailed analyses, such as measure level detail and EES calculations. High-level summaries for each of these models are provided below, along with information on plan details that are not summarized in the following plan tables.

Benefit-Cost Screening Models

The Benefit-Cost Screening model provides measure level savings and benefits. This model uses the avoided cost values from the 2021 Avoided Energy Supply Cost study prepared by Synapse Energy Economics. The models also provide Program Administrator-specific information, including avoided T&D costs.

GHG

The avoided CO2e (metric tons) in the savings table (table IV.D.3.2.i) are calculated consistent with the methodology stipulated by the Massachusetts Executive Office of Energy and Environmental Affairs in Letter from Sec. Theoharides, "Greenhouse Gas Emissions Reduction Goal for Mass Save," July 15, 2021. See: https://www.mass.gov/doc/greenhouse-gas-emissions-reduction-goal-for-mass-save/download

EM&V Activities

The Evaluation, Monitoring & Verification Section of the Joint Statewide Three-Year Plan describes in detail the EM&V activities planned for 2022-2024.

Performance Incentive Model

The Performance Incentive model filed as part of the Joint Statewide Three-Year Plan provides support for the performance incentive dollars proposed for collection by the Program Administrator. Note that performance incentives are not applicable to the Cape Light Compact.

EES Calculations

Each Program Administrator's Energy Efficiency Surcharge analysis provides supporting information on the EES rates proposed for effect in 2022-2024, including how the rates are calculated for each customer sector, and how revenue is collected from each customer sector.

2022-2024 Plan Data Tables

Template Version: October 28, 2021

PA-Specific Information

FILING INFORMATION

Distribution Company	Gas	
Program Administrator	Statewide Gas	*PA-specific*
Date of Filing/Draft	November 1, 2021	

FILING DATES AND DOCKETS

Reporting Period	Filing Date	DPU Docket Number
2019 Planned	February 2, 2019	Statewide Gas
2020 Planned	February 2, 2019	Statewide Gas
2021 Planned	February 2, 2019	Statewide Gas
2019 Evaluated	May 29, 2020	D.P.U. 20-50
2020 Evaluated	June 4, 2021	D.P.U. 21-70
2021 YTD	through June 30, 2021 (Q2)	n/a
2022 Planned	November 1, 2021	Statewide Gas
2023 Planned	November 1, 2021	Statewide Gas
2024 Planned	November 1, 2021	Statewide Gas

RATES FOR ADJUSTMENTS

2020 Nominal Discount Rate	2.33%	
2021 Nominal Discount Rate	2.33%	
2023 Nominal Discount Rate	1.98%	
2024 Nominal Discount Rate	1.98%	
2022 Electric LI Rate Subsidy, Resi	44.63%	*PA-specific*
2022 Electric LI Rate Subsidy, C&I	55.37%	*PA-specific*
2023 Electric LI Rate Subsidy, Resi	45.72%	*PA-specific*
2023 Electric LI Rate Subsidy, C&I	54.28%	*PA-specific*
2024 Electric LI Rate Subsidy, Resi	45.72%	*PA-specific*
2024 Electric LI Rate Subsidy, C&I	54.28%	*PA-specific*
Effective Tax Rate	27.32%	*PA-specific*

Energy Efficiency Guidelines 3.4.6 requires that "Benefits and costs that are projected to occur over the term of each Energy Efficiency Program shall be stated in present value terms, using a discount rate that is equal to a twelve-month average of the historic yields from the ten-year United States Treasury note, using the previous calendar year to determine the twelve-month average." The Program Administrators calculated the discount rate used in the 2022-2024 Plan consistently with this methodology, but averaged interest rates over the previous three years (instead of the previous one year) to account for the anomalous impact of the COVID-19 pandemic on interest rates.

Slicers for Pivot Tables

Tables with Master Data source

Gas	Berkshire
Electric	Eversource Gas (EGMA)
(blank)	Eversource Gas (NSTAR)
	Liberty
	National Grid Gas
	Statewide Gas
	Unitil Gas
	Cape Light Compact
	Eversource Electric
	National Grid Electric
	Statewide Electric
	Unitil Electric
	(blank)

Tables with Master Sector source

Gas	Berkshire
Electric	Eversource Gas (EGMA)
(blank)	Eversource Gas (NSTAR)
	Liberty
	National Grid Gas
	Statewide Gas
	Unitil Gas
	Cape Light Compact
	Eversource Electric
	National Grid Electric
	Statewide Electric
	Unitil Electric
	(blank)

IV.B. Program Administrator Funding Sources

1. Summary Table

Statewide Gas

November 1, 2021

2022 Gas Ratepayer Funds				
Sector	**Total Program Costs**	**Performance Incentives**	**Other Funding**	**Total Ratepayer Funds**
A - Residential	205,201,685	5,499,816	-	210,701,501
B - Income Eligible	75,763,756	2,561,604	-	78,325,360
C - Commercial & Industrial	82,850,612	3,614,023	-	86,464,635
Grand Total	**363,816,053**	**11,675,444**	**-**	**375,491,496**

2023 Gas Ratepayer Funds				
Sector	**Total Program Costs**	**Performance Incentives**	**Other Funding**	**Total Ratepayer Funds**
A - Residential	219,861,261	6,095,415	-	225,956,676
B - Income Eligible	83,109,955	2,765,123	-	85,875,078
C - Commercial & Industrial	100,173,906	4,109,675	-	104,283,580
Grand Total	**403,145,122**	**12,970,212**	**-**	**416,115,335**

2024 Gas Ratepayer Funds				
Sector	**Total Program Costs**	**Performance Incentives**	**Other Funding**	**Total Ratepayer Funds**
A - Residential	239,090,468	6,768,015	-	245,858,483
B - Income Eligible	91,580,792	3,047,938	-	94,628,730
C - Commercial & Industrial	115,130,127	4,573,987	-	119,704,114
Grand Total	**445,801,387**	**14,389,940**	**-**	**460,191,327**

2022-2024 Gas Ratepayer Funds				
Sector	**Total Program Costs**	**Performance Incentives**	**Other Funding**	**Total Ratepayer Funds**
A - Residential	664,153,415	18,363,246	-	682,516,660
B - Income Eligible	250,454,503	8,374,665	-	258,829,168
C - Commercial & Industrial	298,154,645	12,297,685	-	310,452,330
Grand Total	**1,212,762,563**	**39,035,596**	**-**	**1,251,798,158**

Notes:

Ratepayer funds for each year are represented in nominal dollars (2022$, 2023$, 2024$).

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Gas
November 1, 2021

2022 Program Administrator Budget ($)										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**7,685,090**	**7,011,704**	**151,940,879**	**37,283,908**	**1,280,104**	**205,201,685**	**5,499,816**	**210,701,501**	**298.33**	**2.44**
A1 - Residential New Buildings	265,857	147,857	8,404,186	1,101,318	-	9,919,218	258,359	10,177,577	2,027.64	2.71
A1a - Residential New Homes & Renovations	265,857	147,857	8,404,186	1,101,318	-	9,919,218	258,359	10,177,577	2,027.64	2.71
A2 - Residential Existing Buildings	6,064,618	6,061,354	142,034,714	30,904,112	1,518	185,066,315	5,241,457	190,307,773	270.99	2.56
A2a - Residential Coordinated Delivery	3,741,241	1,648,443	101,473,829	7,471,203	-	114,334,716	4,032,695	118,367,411	2,088.29	3.02
A2b - Residential Conservation Services (RCS)	693,261	2,391,606	40,256	19,925,740	-	23,050,863	-	23,050,863		-
A2c - Residential Retail	1,552,856	2,020,816	40,520,628	1,144,231	-	45,238,532	1,074,965	46,313,497	906.64	2.49
A2d - Residential Behavior	77,260	489	-	2,362,937	1,518	2,442,204	133,797	2,576,001	4.22	6.26
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-		
A3 - Residential Hard-to-Measure	1,354,615	802,494	1,501,980	5,278,477	1,278,586	10,216,152	-	10,216,152		-
A3a - Residential Statewide Marketing	1,857	577,637	-	-	-	579,494	-	579,494		-
A3b - Residential Statewide Database	11,402	-	-	-	-	11,402	-	11,402		-
A3c - Residential DOER Assessment	833,443	-	-	-	-	833,443	-	833,443		-
A3d - Residential Sponsorships & Subscriptions	62,744	10,979	-	5,468	12,227	91,418	-	91,418		-
A3e - Residential Workforce Development	20,810	-	-	4,598,384	-	4,619,194	-	4,619,194		-
A3f - Residential Evaluation and Market Research	-	-	-	-	1,266,359	1,266,359	-	1,266,359		-
A3g - Residential EEAC Consultants	350,060	-	-	-	-	350,060	-	350,060		-
A3h - Residential R&D and Demonstration	-	15,000	62,500	116,583	-	194,083	-	194,083		-
A3i - Residential HEAT Loan	-	92,778	1,439,480	162,743	-	1,695,000	-	1,695,000		-
A3j - Residential Education	74,300	106,100	-	395,300	-	575,700	-	575,700		-
B - Income Eligible	**2,612,343**	**1,981,216**	**57,938,066**	**12,259,036**	**973,094**	**75,763,756**	**2,561,604**	**78,325,360**	**8,230.66**	**1.76**
B1 - Income Eligible Existing Buildings	2,110,373	1,787,671	57,938,066	11,483,264	-	73,319,374	2,561,604	75,880,978	7,965.11	1.82
B1a - Income Eligible Coordinated Delivery	2,110,373	1,787,671	57,938,066	11,483,264	-	73,319,374	2,561,604	75,880,978	7,965.11	1.82
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-		
B2 - Income Eligible Hard-to-Measure	501,970	193,545	-	775,772	973,094	2,444,382	-	2,444,382		-
B2a - Income Eligible Statewide Marketing	-	193,193	-	-	-	193,193	-	193,193		-
B2b - Income Eligible Statewide Database	21,519	-	-	-	-	21,519	-	21,519		-
B2c - Income Eligible DOER Assessment	301,339	-	-	-	-	301,339	-	301,339		-
B2d - Income Eligible Sponsorships & Subscriptions	18,994	352	-	1,967	801	22,114	-	22,114		-
B2e - Income Eligible Workforce Development	-	-	-	773,805	-	773,805	-	773,805		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	972,293	972,293	-	972,293		-
B2g - Low-Income Energy Affordability Network (LEAN)	**160,119**	**-**	**-**	**-**	**-**	**160,119**	**-**	**160,119**		**-**
C - Commercial & Industrial	**3,315,613**	**3,012,559**	**54,896,580**	**19,471,751**	**2,154,108**	**82,850,612**	**3,614,023**	**86,464,635**	**13,371.63**	**4.10**
C1 - C&I New Buildings	376,519	581,663	4,285,073	2,561,666	-	7,804,921	523,597	8,328,518	39,220.71	7.40
C1a - C&I New Buildings & Major Renovations	376,519	581,663	4,285,073	2,561,666	-	7,804,921	523,597	8,328,518	39,220.71	7.40
C2 - C&I Existing Buildings	2,374,513	2,182,418	50,440,882	13,923,214	-	68,921,027	3,090,427	72,011,453	11,492.58	4.09
C2a - C&I Existing Building Retrofit	1,837,785	1,967,012	41,080,587	7,582,613	-	52,467,997	2,381,759	54,849,756	13,865.75	4.45
C2b - C&I New & Replacement Equipment	536,728	215,406	9,360,295	6,340,601	-	16,453,029	708,668	17,161,697	7,434.72	2.94
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-		
C3 - C&I Hard-to-Measure	564,582	248,478	170,625	2,986,871	2,154,108	6,124,664	-	6,124,664		-
C3a - C&I Statewide Marketing	-	213,478	-	-	-	213,478	-	213,478		-
C3b - C&I Statewide Database	10,597	-	-	10,451	-	21,048	-	21,048		-
C3c - C&I DOER Assessment	387,283	-	-	-	-	387,283	-	387,283		-
C3d - C&I Sponsorships & Subscriptions	48,528	20,525	-	2,933	11,195	83,180	-	83,180		-
C3e - C&I Workforce Development	4,868	-	-	2,179,534	-	2,184,402	-	2,184,402		-
C3f - C&I Evaluation and Market Research	-	-	-	-	2,142,913	2,142,913	-	2,142,913		-
C3g - C&I EEAC Consultants	93,307	-	-	-	-	93,307	-	93,307		-
C3h - C&I R&D and Demonstration	20,000	14,475	170,625	793,953	-	999,053	-	999,053		-
Grand Total	**13,613,047**	**12,005,480**	**264,775,525**	**69,014,695**	**4,407,306**	**363,816,053**	**11,675,444**	**375,491,496**	**517.35**	**2.67**

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Gas
November 1, 2021

2023 Program Administrator Budget ($)										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**7,595,870**	**7,894,018**	**164,798,959**	**38,217,833**	**1,354,580**	**219,861,261**	**6,095,415**	**225,956,676**	**316.64**	**2.41**
A1 - Residential New Buildings	239,200	146,204	8,398,307	1,102,705	-	9,886,417	303,197	10,189,613	2,021.76	2.95
A1a - Residential New Homes & Renovations	239,200	146,204	8,398,307	1,102,705	-	9,886,417	303,197	10,189,613	2,021.76	2.95
A2 - Residential Existing Buildings	5,972,608	6,951,483	154,912,423	31,805,347	1,579	199,643,440	5,792,218	205,435,658	289.56	2.50
A2a - Residential Coordinated Delivery	3,676,488	1,767,601	112,030,942	7,428,576	-	124,903,607	4,510,508	129,414,114	2,155.82	2.97
A2b - Residential Conservation Services (RCS)	716,515	2,749,273	40,960	20,847,163	-	24,353,911	-	24,353,911		-
A2c - Residential Retail	1,503,301	2,434,102	42,840,520	1,119,367	-	47,897,289	1,145,410	49,042,699	942.09	2.38
A2d - Residential Behavior	76,304	508	-	2,410,241	1,579	2,488,632	136,301	2,624,933	4.29	6.14
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-		
A3 - Residential Hard-to-Measure	1,384,063	796,331	1,488,230	5,309,781	1,353,001	10,331,405	-	10,331,405		-
A3a - Residential Statewide Marketing	1,931	577,901	-	-	-	579,832	-	579,832		-
A3b - Residential Statewide Database	11,402	-	-	-	-	11,402	-	11,402		-
A3c - Residential DOER Assessment	848,115	-	-	-	-	848,115	-	848,115		-
A3d - Residential Sponsorships & Subscriptions	64,337	11,008	-	5,632	12,293	93,270	-	93,270		-
A3e - Residential Workforce Development	20,983	-	-	4,641,848	-	4,662,831	-	4,662,831		-
A3f - Residential Evaluation and Market Research	-	-	-	-	1,340,708	1,340,708	-	1,340,708		-
A3g - Residential EEAC Consultants	357,995	-	-	-	-	357,995	-	357,995		-
A3h - Residential R&D and Demonstration	-	3,500	38,750	69,183	-	111,433	-	111,433		-
A3i - Residential HEAT Loan	-	92,778	1,449,480	162,743	-	1,705,000	-	1,705,000		-
A3j - Residential Education	79,300	111,144	-	430,375	-	620,819	-	620,819		-
B - Income Eligible	**2,330,570**	**2,779,248**	**62,535,104**	**14,470,064**	**994,969**	**83,109,955**	**2,765,123**	**85,875,078**	**8,819.99**	**1.67**
B1 - Income Eligible Existing Buildings	1,807,214	2,585,511	62,535,104	13,693,222	-	80,621,051	2,765,123	83,386,174	8,555.86	1.72
B1a - Income Eligible Coordinated Delivery	1,807,214	2,585,511	62,535,104	13,693,222	-	80,621,051	2,765,123	83,386,174	8,555.86	1.72
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-		
B2 - Income Eligible Hard-to-Measure	523,356	193,737	-	776,842	994,969	2,488,904	-	2,488,904		-
B2a - Income Eligible Statewide Marketing	-	193,374	-	-	-	193,374	-	193,374		-
B2b - Income Eligible Statewide Database	21,511	-	-	-	-	21,511	-	21,511		-
B2c - Income Eligible DOER Assessment	316,522	-	-	-	-	316,522	-	316,522		-
B2d - Income Eligible Sponsorships & Subscriptions	19,568	363	-	2,026	825	22,782	-	22,782		-
B2e - Income Eligible Workforce Development	-	-	-	774,816	-	774,816	-	774,816		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	994,144	994,144	-	994,144		-
B2g - Low-Income Energy Affordability Network (LEAN)	**165,755**	**-**	**-**	**-**	**-**	**165,755**	**-**	**165,755**		**-**
C - Commercial & Industrial	**5,925,023**	**3,102,571**	**71,477,237**	**17,388,254**	**2,280,822**	**100,173,906**	**4,109,675**	**104,283,580**	**15,977.97**	**3.58**
C1 - C&I New Buildings	344,785	595,221	4,348,717	2,588,414	-	7,877,138	533,892	8,411,030	37,780.04	7.34
C1a - C&I New Buildings & Major Renovations	344,785	595,221	4,348,717	2,588,414	-	7,877,138	533,892	8,411,030	37,780.04	7.34
C2 - C&I Existing Buildings	4,981,865	2,254,280	66,822,269	11,848,777	-	85,907,191	3,575,782	89,482,974	14,173.77	3.50
C2a - C&I Existing Building Retrofit	4,458,635	2,027,843	56,167,459	5,353,557	-	68,007,494	2,780,943	70,788,436	17,710.28	3.64
C2b - C&I New & Replacement Equipment	523,230	226,437	10,654,810	6,495,220	-	17,899,698	794,840	18,694,537	8,059.30	2.96
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-		
C3 - C&I Hard-to-Measure	598,372	253,070	306,250	2,951,063	2,280,822	6,389,577	-	6,389,577		-
C3a - C&I Statewide Marketing	-	220,829	-	-	-	220,829	-	220,829		-
C3b - C&I Statewide Database	21,764	-	-	-	-	21,764	-	21,764		-
C3c - C&I DOER Assessment	399,531	-	-	-	-	399,531	-	399,531		-
C3d - C&I Sponsorships & Subscriptions	49,393	20,541	-	3,021	11,230	84,186	-	84,186		-
C3e - C&I Workforce Development	5,010	-	-	2,221,964	-	2,226,974	-	2,226,974		-
C3f - C&I Evaluation and Market Research	-	-	-	-	2,269,592	2,269,592	-	2,269,592		-
C3g - C&I EEAC Consultants	97,673	-	-	-	-	97,673	-	97,673		-
C3h - C&I R&D and Demonstration	25,000	11,700	306,250	726,077	-	1,069,027	-	1,069,027		-
Grand Total	**15,851,463**	**13,775,837**	**298,811,300**	**70,076,151**	**4,630,372**	**403,145,122**	**12,970,212**	**416,115,335**	**567.77**	**2.55**

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Gas
November 1, 2021

2024 Program Administrator Budget ($)										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**7,982,108**	**8,022,590**	**181,709,328**	**39,886,580**	**1,489,861**	**239,090,468**	**6,768,015**	**245,858,483**	**341.17**	**2.33**
A1 - Residential New Buildings	328,892	147,549	6,690,197	1,110,030	-	8,276,668	217,817	8,494,485	1,919.67	2.42
A1a - Residential New Homes & Renovations	328,892	147,549	6,690,197	1,110,030	-	8,276,668	217,817	8,494,485	1,919.67	2.42
A2 - Residential Existing Buildings	6,225,168	7,068,859	173,540,902	33,532,470	1,642	220,369,041	6,550,197	226,919,239	316.41	2.44
A2a - Residential Coordinated Delivery	3,849,541	1,904,060	125,675,272	8,102,144	-	139,531,016	5,149,567	144,680,583	2,257.59	2.90
A2b - Residential Conservation Services (RCS)	781,294	3,036,309	41,677	21,843,636	-	25,702,917	-	25,702,917		-
A2c - Residential Retail	1,518,199	2,127,962	47,823,952	1,128,198	-	52,598,311	1,259,889	53,858,200	996.92	2.25
A2d - Residential Behavior	76,134	528	-	2,458,492	1,642	2,536,797	140,742	2,677,539	4.36	6.10
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-		
A3 - Residential Hard-to-Measure	1,428,048	806,182	1,478,230	5,244,080	1,488,219	10,444,759	-	10,444,759		-
A3a - Residential Statewide Marketing	2,008	578,176	-	-	-	580,184	-	580,184		-
A3b - Residential Statewide Database	11,402	-	-	-	-	11,402	-	11,402		-
A3c - Residential DOER Assessment	866,645	-	-	-	-	866,645	-	866,645		-
A3d - Residential Sponsorships & Subscriptions	65,977	11,038	-	5,801	12,362	95,179	-	95,179		-
A3e - Residential Workforce Development	40,672	-	-	4,549,545	-	4,590,217	-	4,590,217		-
A3f - Residential Evaluation and Market Research	-	-	-	-	1,475,857	1,475,857	-	1,475,857		-
A3g - Residential EEAC Consultants	362,043	-	-	-	-	362,043	-	362,043		-
A3h - Residential R&D and Demonstration	-	3,000	28,750	55,538	-	87,288	-	87,288		-
A3i - Residential HEAT Loan	-	92,778	1,449,480	167,743	-	1,710,000	-	1,710,000		-
A3j - Residential Education	79,300	121,190	-	465,454	-	665,944	-	665,944		-
B - Income Eligible	**2,395,524**	**2,831,541**	**69,567,503**	**15,746,271**	**1,039,954**	**91,580,792**	**3,047,938**	**94,628,730**	**9,191.28**	**1.61**
B1 - Income Eligible Existing Buildings	1,866,058	2,638,073	69,567,503	14,970,885	-	89,042,519	3,047,938	92,090,456	8,936.53	1.65
B1a - Income Eligible Coordinated Delivery	1,866,058	2,638,073	69,567,503	14,970,885	-	89,042,519	3,047,938	92,090,456	8,936.53	1.65
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-		
B2 - Income Eligible Hard-to-Measure	529,466	193,468	-	775,385	1,039,954	2,538,274	-	2,538,274		-
B2a - Income Eligible Statewide Marketing	-	193,095	-	-	-	193,095	-	193,095		-
B2b - Income Eligible Statewide Database	21,468	-	-	-	-	21,468	-	21,468		-
B2c - Income Eligible DOER Assessment	321,393	-	-	-	-	321,393	-	321,393		-
B2d - Income Eligible Sponsorships & Subscriptions	20,159	374	-	2,087	850	23,469	-	23,469		-
B2e - Income Eligible Workforce Development	-	-	-	773,299	-	773,299	-	773,299		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	1,039,104	1,039,104	-	1,039,104		-
B2g - Low-Income Energy Affordability Network (LEAN)	**166,446**	**-**	**-**	**-**	**-**	**166,446**	**-**	**166,446**		**-**
C - Commercial & Industrial	**6,222,313**	**3,179,449**	**85,613,856**	**17,642,909**	**2,471,600**	**115,130,127**	**4,573,987**	**119,704,114**	**18,388.46**	**3.23**
C1 - C&I New Buildings	345,936	578,368	4,426,157	2,656,098	-	8,006,560	570,714	8,577,274	38,308.90	7.56
C1a - C&I New Buildings & Major Renovations	345,936	578,368	4,426,157	2,656,098	-	8,006,560	570,714	8,577,274	38,308.90	7.56
C2 - C&I Existing Buildings	5,260,901	2,346,124	80,947,073	12,125,818	-	100,679,916	4,003,273	104,683,189	16,635.81	3.09
C2a - C&I Existing Building Retrofit	4,687,346	2,083,645	67,765,853	5,467,748	-	80,004,591	3,121,679	83,126,269	20,818.26	3.21
C2b - C&I New & Replacement Equipment	573,556	262,479	13,181,220	6,658,070	-	20,675,325	881,594	21,556,919	9,359.59	2.63
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-		
C3 - C&I Hard-to-Measure	615,477	254,957	240,625	2,860,993	2,471,600	6,443,651	-	6,443,651		-
C3a - C&I Statewide Marketing	-	225,675	-	-	-	225,675	-	225,675		-
C3b - C&I Statewide Database	22,238	-	-	-	-	22,238	-	22,238		-
C3c - C&I DOER Assessment	412,025	-	-	-	-	412,025	-	412,025		-
C3d - C&I Sponsorships & Subscriptions	50,286	20,557	-	3,112	11,267	85,222	-	85,222		-
C3e - C&I Workforce Development	4,783	-	-	2,151,994	-	2,156,777	-	2,156,777		-
C3f - C&I Evaluation and Market Research	-	-	-	-	2,460,333	2,460,333	-	2,460,333		-
C3g - C&I EEAC Consultants	101,144	-	-	-	-	101,144	-	101,144		-
C3h - C&I R&D and Demonstration	25,000	8,725	240,625	705,887	-	980,237	-	980,237		-
Grand Total	**16,599,945**	**14,033,580**	**336,890,687**	**73,275,760**	**5,001,415**	**445,801,387**	**14,389,940**	**460,191,327**	**621.75**	**2.42**

IV.C. Program Administrator Budgets

1. Summary Table

Statewide Gas
November 1, 2021

2022-2024 Program Administrator Budget ($)										
Program	Program Costs						Performance Incentive	Total Program Administrator Budget	Program Cost per Participant	Resource Benefit per Program Cost
	Program Planning and Administration	Marketing and Advertising	Participant Incentive	Sales, Technical Assistance & Training	Evaluation and Market Research	Total Program Costs				
A - Residential	**23,263,068**	**22,928,313**	**498,449,167**	**115,388,321**	**4,124,546**	**664,153,415**	**18,363,246**	**682,516,660**	**318.85**	**2.39**
A1 - Residential New Buildings	833,949	441,610	23,492,690	3,314,053	-	28,082,302	779,373	28,861,675	1,992.57	2.71
A1a - Residential New Homes & Renovations	833,949	441,610	23,492,690	3,314,053	-	28,082,302	779,373	28,861,675	1,992.57	2.71
A2 - Residential Existing Buildings	18,262,393	20,081,696	470,488,038	96,241,929	4,740	605,078,797	17,583,873	622,662,669	292.47	2.50
A2a - Residential Coordinated Delivery	11,267,270	5,320,104	339,180,044	23,001,922	-	378,769,339	13,692,769	392,462,109	2,170.68	2.96
A2b - Residential Conservation Services (RCS)	2,191,070	8,177,188	122,894	62,616,540	-	73,107,692	-	73,107,692		-
A2c - Residential Retail	4,574,355	6,582,879	131,185,101	3,391,797	-	145,734,132	3,480,264	149,214,396	949.41	2.37
A2d - Residential Behavior	229,698	1,525	-	7,231,671	4,740	7,467,633	410,839	7,878,473	4.29	6.16
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-		
A3 - Residential Hard-to-Measure	4,166,726	2,405,007	4,468,439	15,832,338	4,119,806	30,992,316	-	30,992,316		-
A3a - Residential Statewide Marketing	5,796	1,733,713	-	-	-	1,739,509	-	1,739,509		-
A3b - Residential Statewide Database	34,206	-	-	-	-	34,206	-	34,206		-
A3c - Residential DOER Assessment	2,548,203	-	-	-	-	2,548,203	-	2,548,203		-
A3d - Residential Sponsorships & Subscriptions	193,058	33,025	-	16,901	36,882	279,866	-	279,866		-
A3e - Residential Workforce Development	82,465	-	-	13,789,776	-	13,872,242	-	13,872,242		-
A3f - Residential Evaluation and Market Research	-	-	-	-	4,082,924	4,082,924	-	4,082,924		-
A3g - Residential EEAC Consultants	1,070,098	-	-	-	-	1,070,098	-	1,070,098		-
A3h - Residential R&D and Demonstration	-	21,500	130,000	241,305	-	392,805	-	392,805		-
A3i - Residential HEAT Loan	-	278,334	4,338,439	493,228	-	5,110,000	-	5,110,000		-
A3j - Residential Education	232,900	338,435	-	1,291,129	-	1,862,463	-	1,862,463		-
B - Income Eligible	**7,338,437**	**7,592,005**	**190,040,673**	**42,475,371**	**3,008,017**	**250,454,503**	**8,374,665**	**258,829,168**	**8,759.65**	**1.67**
B1 - Income Eligible Existing Buildings	5,783,645	7,011,254	190,040,673	40,147,372	-	242,982,944	8,374,665	251,357,609	8,498.33	1.73
B1a - Income Eligible Coordinated Delivery	5,783,645	7,011,254	190,040,673	40,147,372	-	242,982,944	8,374,665	251,357,609	8,498.33	1.73
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-		
B2 - Income Eligible Hard-to-Measure	1,554,792	580,751	-	2,327,999	3,008,017	7,471,560	-	7,471,560		-
B2a - Income Eligible Statewide Marketing	-	579,663	-	-	-	579,663	-	579,663		-
B2b - Income Eligible Statewide Database	64,497	-	-	-	-	64,497	-	64,497		-
B2c - Income Eligible DOER Assessment	939,254	-	-	-	-	939,254	-	939,254		-
B2d - Income Eligible Sponsorships & Subscriptions	58,721	1,088	-	6,080	2,476	68,365	-	68,365		-
B2e - Income Eligible Workforce Development	-	-	-	2,321,920	-	2,321,920	-	2,321,920		-
B2f - Income Eligible Evaluation and Market Research	-	-	-	-	3,005,541	3,005,541	-	3,005,541		-
B2g - Low-Income Energy Affordability Network (LEAN)	**492,319**	**-**	**-**	**-**	**-**	**492,319**	**-**	**492,319**		**-**
C - Commercial & Industrial	**15,462,949**	**9,294,579**	**211,987,672**	**54,502,914**	**6,906,531**	**298,154,645**	**12,297,685**	**310,452,330**	**15,921.54**	**3.59**
C1 - C&I New Buildings	1,067,240	1,755,252	13,059,948	7,806,178	-	23,688,618	1,628,203	25,316,821	38,424.36	7.43
C1a - C&I New Buildings & Major Renovations	1,067,240	1,755,252	13,059,948	7,806,178	-	23,688,618	1,628,203	25,316,821	38,424.36	7.43
C2 - C&I Existing Buildings	12,617,279	6,782,822	198,210,224	37,897,809	-	255,508,134	10,669,482	266,177,615	14,108.68	3.50
C2a - C&I Existing Building Retrofit	10,983,765	6,078,499	165,013,899	18,403,918	-	200,480,082	8,284,380	208,764,462	17,483.22	3.68
C2b - C&I New & Replacement Equipment	1,633,514	704,322	33,196,325	19,493,891	-	55,028,052	2,385,102	57,413,154	8,283.61	2.83
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-		
C3 - C&I Hard-to-Measure	1,778,431	756,505	717,500	8,798,927	6,906,531	18,957,893	-	18,957,893		-
C3a - C&I Statewide Marketing	-	659,982	-	-	-	659,982	-	659,982		-
C3b - C&I Statewide Database	54,599	-	-	10,451	-	65,050	-	65,050		-
C3c - C&I DOER Assessment	1,198,839	-	-	-	-	1,198,839	-	1,198,839		-
C3d - C&I Sponsorships & Subscriptions	148,207	61,623	-	9,067	33,692	252,588	-	252,588		-
C3e - C&I Workforce Development	14,662	-	-	6,553,491	-	6,568,153	-	6,568,153		-
C3f - C&I Evaluation and Market Research	-	-	-	-	6,872,838	6,872,838	-	6,872,838		-
C3g - C&I EEAC Consultants	292,125	-	-	-	-	292,125	-	292,125		-
C3h - C&I R&D and Demonstration	70,000	34,900	717,500	2,225,917	-	3,048,317	-	3,048,317		-
Grand Total	**46,064,455**	**39,814,897**	**900,477,512**	**212,366,606**	**14,039,093**	**1,212,762,563**	**39,035,596**	**1,251,798,158**	**569.30**	**2.54**

Notes:
Budgets for each year are represented in nominal dollars (2022$, 2023$, 2024$).
Refer to common definitions for allocation of costs.

IV.C. Program Administrator Budgets

3. Program Planning and Administration

Statewide Gas

November 1, 2021

Program Planning and Administration Expenditures							
Year	Internal Costs	External Costs					Total Program Planning and Administration
	Labor, benefits, employee expenses, materials, and overhead	Legal Services	Assessments	Other Vendor Services	Hard to Measure Sponsorships & Subscriptions	Total External Costs	
2022	$ 4,606,900	$ 572,797	$ 1,519,516	$ 4,102,512	$ 86,444	$ 6,281,269	$ 10,888,169
2023	$ 4,812,710	$ 535,667	$ 1,620,366	$ 3,796,293	$ 88,072	$ 6,040,397	$ 10,853,107
2024	$ 5,144,209	$ 578,390	$ 1,722,906	$ 3,864,089	$ 89,749	$ 6,255,134	$ 11,399,343
Grand Total	**$ 14,563,818**	**$ 1,686,854**	**$ 4,862,788**	**$ 11,762,893**	**$ 264,265**	**$ 18,576,801**	**$ 33,140,619**

Notes:

Assessments include costs associated with the Department of Energy Resource (DOER), Residential Conservation Services (RCS), Energy Efficiency Advisory Council (EEAC) Consultants, and the Low-Income Energy Affordability Network (LEAN).

Other Vendor Services include costs associated with third-party consultants that assist with program planning and administration.

The data included in the Hard to Measure Sponsorship and Subscriptions column is consistent with the hard-to-measure Sponsorships & Subscriptions lines in the Budget table.

IV.C. Program Administrator Budgets

2.2 Budget Historical Comparison

Statewide Gas
November 1, 2021

2019-2024 Residential Program Administrator Budget									
PA Budget Categories	Program Administrator Budget ($)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	5,648,705	5,058,378	5,883,480	5,019,711	6,053,434	4,600,414	7,685,090	7,595,870	7,982,108
Marketing and Advertising	5,457,608	4,305,762	5,569,996	4,210,704	5,705,916	2,446,358	7,011,704	7,894,018	8,022,590
Participant Incentive	101,194,976	1,218,714,742	103,626,121	134,098,054	106,455,258	###########	151,940,879	164,798,959	181,709,328
Sales, Technical Assistance & Training	32,145,723	29,604,592	34,480,705	23,868,977	35,110,042	20,753,695	37,283,908	38,217,833	39,886,580
Evaluation and Market Research	3,158,376	1,931,203	3,397,066	2,491,183	3,513,274	2,040,363	1,280,104	1,354,580	1,489,861
Performance Incentive	3,204,012	3,594,748	3,328,635	1,940,938	3,475,248	1,369,533	5,499,816	6,095,415	6,768,015
Total Program Administrator Budget	**150,809,401**	###########	**156,286,003**	**171,629,567**	**160,313,173**	###########	**210,701,501**	**225,956,676**	**245,858,483**

2019-2024 Income Eligible Program Administrator Budget									
PA Budget Categories	Program Administrator Budget ($)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	2,267,045	1,905,457	2,307,648	1,876,262	2,360,312	1,585,879	2,612,343	2,330,570	2,395,524
Marketing and Advertising	927,187	439,367	948,380	554,339	982,239	474,808	1,981,216	2,779,248	2,831,541
Participant Incentive	43,530,217	224,867,840	43,836,113	27,468,895	44,243,187	49,978,651	57,938,066	62,535,104	69,567,503
Sales, Technical Assistance & Training	9,502,105	8,849,356	9,726,317	6,041,311	9,807,972	5,683,171	12,259,036	14,470,064	15,746,271
Evaluation and Market Research	1,281,192	689,378	1,356,422	1,004,382	1,406,563	798,714	973,094	994,969	1,039,954
Performance Incentive	1,157,129	1,075,875	1,202,609	368,425	1,245,891	536,650	2,561,604	2,765,123	3,047,938
Total Program Administrator Budget	**58,664,876**	**237,827,273**	**59,377,490**	**37,313,614**	**60,046,164**	**59,057,874**	**78,325,360**	**85,875,078**	**94,628,730**

2019-2024 Commercial & Industrial Program Administrator Budget									
PA Budget Categories	Program Administrator Budget ($)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	2,688,569	2,177,050	2,778,309	2,165,741	2,895,023	2,309,051	3,315,613	5,925,023	6,222,313
Marketing and Advertising	2,676,430	2,886,578	2,824,303	2,464,332	2,888,578	923,356	3,012,559	3,102,571	3,179,449
Participant Incentive	33,998,678	22,905,233	34,782,432	26,083,413	35,418,188	15,480,157	54,896,580	71,477,237	85,613,856
Sales, Technical Assistance & Training	12,707,500	12,552,963	13,245,474	12,666,699	13,485,445	10,903,698	19,471,751	17,388,254	17,642,909
Evaluation and Market Research	2,309,741	2,910,077	2,415,548	2,581,673	2,427,878	1,660,949	2,154,108	2,280,822	2,471,600
Performance Incentive	2,909,185	1,879,747	3,045,539	1,036,691	3,161,834	1,747,836	3,614,023	4,109,675	4,573,987
Total Program Administrator Budget	**57,290,104**	**45,311,648**	**59,091,605**	**46,998,548**	**60,276,946**	**33,025,048**	**86,464,635**	**104,283,580**	**119,704,114**

2019-2024 Total Program Administrator Budget									
PA Budget Categories	Program Administrator Budget ($)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	10,604,320	9,140,884	10,969,438	9,061,715	11,308,769	8,495,344	13,613,047	15,851,463	16,599,945
Marketing and Advertising	9,061,225	7,631,707	9,342,679	7,229,374	9,576,732	3,844,522	12,005,480	13,775,837	14,033,580
Participant Incentive	178,723,872	1,466,487,815	182,244,666	187,650,362	186,116,633	###########	264,775,525	298,811,300	336,890,687
Sales, Technical Assistance & Training	54,355,329	51,006,911	57,452,496	42,576,986	58,403,459	37,340,565	69,014,695	70,076,151	73,275,760
Evaluation and Market Research	6,749,309	5,530,659	7,169,036	6,077,238	7,347,716	4,500,026	4,407,306	4,630,372	5,001,415
Performance Incentive	7,270,326	6,550,371	7,576,783	3,346,054	7,882,974	3,654,019	11,675,444	12,970,212	14,389,940
Total Program Administrator Budget	**266,764,381**	###########	**274,755,098**	**255,941,729**	**280,636,283**	###########	**375,491,496**	**416,115,335**	**460,191,327**

Notes:

Budgets for each year are represented in nominal dollars (2019$ through 2024$).

2019-2021 planned values are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Gas.

2019 evaluated values are from the Program Administrator's 2019 Plan Year Report, D.P.U. 20-50.

2020 evaluated values are from the Program Administrator's 2020 Plan Year Report, D.P.U. 21-70.

2021 YTD values are estimated actual cost through through June 30, 2021 (Q2).

For supporting information on the 2022-2024 values, see Table IV.C.1.

The Program Administrators have better aligned cost allocations across Program Administrators for this Three-Year Plan, consistent with the Department's directives in the 2016-2018 Three-Year Plan Order (January 31, 2016). As a result, historical budget categories may not be directly comparable for each Program Administrator.

IV.C. Program Administrator Budgets

2.2 Budget Historical Comparison

Statewide Gas

November 1, 2021

PA Budget Categories	2019-2024 Residential Program Administrator Budget								
	Budget Categories as a Percent of Total Program Administrator Budget (%)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	4%	0%	4%	3%	4%	0%	4%	3%	3%
Marketing and Advertising	4%	0%	4%	2%	4%	0%	3%	3%	3%
Participant Incentive	67%	96%	66%	78%	66%	102%	72%	73%	74%
Sales, Technical Assistance & Training	21%	2%	22%	14%	22%	-1%	18%	17%	16%
Evaluation and Market Research	2%	0%	2%	1%	2%	0%	1%	1%	1%
Performance Incentive	2%	0%	2%	1%	2%	0%	3%	3%	3%
Total Program Administrator Budget	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

PA Budget Categories	2019-2024 Income Eligible Program Administrator Budget								
	Budget Categories as a Percent of Total Program Administrator Budget (%)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	4%	1%	4%	5%	4%	3%	3%	3%	3%
Marketing and Advertising	2%	0%	2%	1%	2%	1%	3%	3%	3%
Participant Incentive	74%	95%	74%	74%	74%	85%	74%	73%	74%
Sales, Technical Assistance & Training	16%	4%	16%	16%	16%	10%	16%	17%	17%
Evaluation and Market Research	2%	0%	2%	3%	2%	1%	1%	1%	1%
Performance Incentive	2%	0%	2%	1%	2%	1%	3%	3%	3%
Total Program Administrator Budget	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

PA Budget Categories	2019-2024 Commercial & Industrial Program Administrator Budget								
	Budget Categories as a Percent of Total Program Administrator Budget (%)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	5%	5%	5%	5%	5%	7%	4%	6%	5%
Marketing and Advertising	5%	6%	5%	5%	5%	3%	3%	3%	3%
Participant Incentive	59%	51%	59%	55%	59%	47%	63%	69%	72%
Sales, Technical Assistance & Training	22%	28%	22%	27%	22%	33%	23%	17%	15%
Evaluation and Market Research	4%	6%	4%	5%	4%	5%	2%	2%	2%
Performance Incentive	5%	4%	5%	2%	5%	5%	4%	4%	4%
Total Program Administrator Budget	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

PA Budget Categories	2019-2024 Total Program Administrator Budget								
	Budget Categories as a Percent of Total Program Administrator Budget (%)								
	2019		2020		2021		2022	2023	2024
	Planned	Evaluated	Planned	Evaluated	Planned	YTD	Planned	Planned	Planned
Program Planning and Administration	4%	1%	4%	4%	4%	-1%	4%	4%	4%
Marketing and Advertising	3%	0%	3%	3%	3%	0%	3%	3%	3%
Participant Incentive	67%	95%	66%	73%	66%	103%	71%	72%	73%
Sales, Technical Assistance & Training	20%	3%	21%	17%	21%	-2%	18%	17%	16%
Evaluation and Market Research	3%	0%	3%	2%	3%	0%	1%	1%	1%
Performance Incentive	3%	0%	3%	1%	3%	0%	3%	3%	3%
Total Program Administrator Budget	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Notes:

Budgets for each year are represented in nominal dollars (2019$ through 2024$).

2019-2021 planned values are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Gas.

2019 evaluated values are from the Program Administrator's 2019 Plan Year Report, D.P.U. 20-50.

2020 evaluated values are from the Program Administrator's 2020 Plan Year Report, D.P.U. 21-70.

2021 YTD values are estimated actual cost through through June 30, 2021 (Q2).

For supporting information on the 2022-2024 values, see Table IV.C.1.

The Program Administrators have better aligned cost allocations across Program Administrators for this Three-Year Plan, consistent with the Department's directives in the 2016-2018 Three-Year Plan Order (January 31, 2016). As a result, historical budget categories may not be directly comparable for each Program Administrator.

IV.D. Cost-Effectiveness

1. Summary Table

Statewide Gas
November 1, 2021

2022 Total Resource Cost Test (2022$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**2.27**	**314,773,589**	**561,861,353**	**205,201,685**	**5,499,816**	**36,386,262**	**247,087,763**
A1 - Residential New Buildings	3.82	25,857,389	35,020,356	9,919,218	258,359	(1,014,610)	9,162,966
A1a - Residential New Homes & Renovations	3.82	25,857,389	35,020,356	9,919,218	258,359	(1,014,610)	9,162,966
A2 - Residential Existing Buildings	2.31	299,132,352	526,840,997	185,066,315	5,241,457	37,400,872	227,708,645
A2a - Residential Coordinated Delivery	2.88	250,276,881	383,268,997	114,334,716	4,032,695	14,624,705	132,992,116
A2b - Residential Conservation Services (RCS)	0.00	(23,050,863)	-	23,050,863	-	-	23,050,863
A2c - Residential Retail	1.86	59,188,517	128,278,182	45,238,532	1,074,965	22,776,168	69,089,665
A2d - Residential Behavior	5.94	12,717,817	15,293,818	2,442,204	133,797	-	2,576,001
A2e - Residential Active Demand Reduction		-	-	-	-	-	-
A3 - Residential Hard-to-Measure	0.00	(10,216,152)	-	10,216,152	-	-	10,216,152
B - Income Eligible	**3.14**	**167,982,783**	**246,309,053**	**75,763,756**	**2,561,604**	**910**	**78,326,270**
B1 - Income Eligible Existing Buildings	3.25	170,427,165	246,309,053	73,319,374	2,561,604	910	75,881,888
B1a - Income Eligible Coordinated Delivery	3.25	170,427,165	246,309,053	73,319,374	2,561,604	910	75,881,888
B1b - Income Eligible Active Demand Reduction		-	-	-	-	-	-
B2 - Income Eligible Hard-to-Measure	0.00	(2,444,382)	-	2,444,382	-	-	2,444,382
C - Commercial & Industrial	**3.48**	**287,210,841**	**403,016,356**	**82,850,612**	**3,614,023**	**29,340,880**	**115,805,515**
C1 - C&I New Buildings	6.61	51,987,243	61,259,094	7,804,921	523,597	943,334	9,271,852
C1a - C&I New Buildings & Major Renovations	6.61	51,987,243	61,259,094	7,804,921	523,597	943,334	9,271,852
C2 - C&I Existing Buildings	3.40	241,348,262	341,757,262	68,921,027	3,090,427	28,397,547	100,409,000
C2a - C&I Existing Building Retrofit	3.37	184,022,686	261,684,727	52,467,997	2,381,759	22,812,284	77,662,040
C2b - C&I New & Replacement Equipment	3.52	57,325,576	80,072,535	16,453,029	708,668	5,585,262	22,746,959
C2c - C&I Active Demand Reduction		-	-	-	-	-	-
C3 - C&I Hard-to-Measure	0.00	(6,124,664)	-	6,124,664	-	-	6,124,664
Grand Total	**2.75**	**769,967,213**	**1,211,186,762**	**363,816,053**	**11,675,444**	**65,728,052**	**441,219,549**

IV.D. Cost-Effectiveness

1. Summary Table

Statewide Gas
November 1, 2021

2023 Total Resource Cost Test (2022$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**2.29**	**335,236,155**	**595,878,372**	**215,592,529**	**5,977,069**	**39,072,619**	**260,642,217**
A1 - Residential New Buildings	3.78	28,600,444	38,888,386	9,694,466	297,310	296,166	10,287,942
A1a - Residential New Homes & Renovations	3.78	28,600,444	38,888,386	9,694,466	297,310	296,166	10,287,942
A2 - Residential Existing Buildings	2.32	316,766,526	556,989,986	195,767,248	5,679,759	38,776,454	240,223,460
A2a - Residential Coordinated Delivery	2.90	269,688,707	411,662,648	122,478,532	4,422,933	15,072,476	141,973,941
A2b - Residential Conservation Services (RCS)	0.00	(23,881,066)	-	23,881,066	-	-	23,881,066
A2c - Residential Retail	1.81	58,258,272	130,052,757	46,967,336	1,123,171	23,703,978	71,794,485
A2d - Residential Behavior	5.93	12,700,613	15,274,581	2,440,314	133,654	-	2,573,968
A2e - Residential Active Demand Reduction		-	-	-	-	-	-
A3 - Residential Hard-to-Measure	0.00	(10,130,815)	-	10,130,815	-	-	10,130,815
B - Income Eligible	**3.06**	**173,213,715**	**257,366,643**	**81,496,328**	**2,711,437**	**(54,837)**	**84,152,928**
B1 - Income Eligible Existing Buildings	3.15	175,654,296	257,366,643	79,055,747	2,711,437	(54,837)	81,712,347
B1a - Income Eligible Coordinated Delivery	3.15	175,654,296	257,366,643	79,055,747	2,711,437	(54,837)	81,712,347
B1b - Income Eligible Active Demand Reduction		-	-	-	-	-	-
B2 - Income Eligible Hard-to-Measure	0.00	(2,440,581)	-	2,440,581	-	-	2,440,581
C - Commercial & Industrial	**3.10**	**292,880,495**	**432,314,458**	**98,228,972**	**4,029,883**	**37,175,107**	**139,433,962**
C1 - C&I New Buildings	6.69	51,984,169	61,121,666	7,724,199	523,526	889,772	9,137,497
C1a - C&I New Buildings & Major Renovations	6.69	51,984,169	61,121,666	7,724,199	523,526	889,772	9,137,497
C2 - C&I Existing Buildings	2.99	247,161,846	371,192,792	84,239,254	3,506,357	36,285,335	124,030,946
C2a - C&I Existing Building Retrofit	2.87	186,182,012	285,902,963	66,687,089	2,726,949	30,306,913	99,720,951
C2b - C&I New & Replacement Equipment	3.51	60,979,835	85,289,829	17,552,165	779,408	5,978,422	24,309,994
C2c - C&I Active Demand Reduction		-	-	-	-	-	-
C3 - C&I Hard-to-Measure	0.00	(6,265,520)	-	6,265,520	-	-	6,265,520
Grand Total	**2.65**	**801,330,366**	**1,285,559,473**	**395,317,829**	**12,718,388**	**76,192,890**	**484,229,107**

IV.D. Cost-Effectiveness

1. Summary Table

Statewide Gas
November 1, 2021

2024 Total Resource Cost Test (2022$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**2.26**	**349,905,122**	**626,520,036**	**229,896,441**	**6,507,756**	**40,210,717**	**276,614,914**
A1 - Residential New Buildings	3.39	19,262,281	27,318,652	7,958,395	209,441	(111,466)	8,056,371
A1a - Residential New Homes & Renovations	3.39	19,262,281	27,318,652	7,958,395	209,441	(111,466)	8,056,371
A2 - Residential Existing Buildings	2.32	340,685,956	599,201,384	211,894,931	6,298,315	40,322,183	258,515,429
A2a - Residential Coordinated Delivery	2.91	293,968,069	448,204,310	134,165,466	4,951,544	15,119,230	154,236,240
A2b - Residential Conservation Services (RCS)	0.00	(24,714,533)	-	24,714,533	-	-	24,714,533
A2c - Residential Retail	1.76	58,544,017	135,534,096	50,575,686	1,211,441	25,202,953	76,990,079
A2d - Residential Behavior	6.01	12,888,402	15,462,979	2,439,246	135,330	-	2,574,576
A2e - Residential Active Demand Reduction		-	-	-	-	-	-
A3 - Residential Hard-to-Measure	0.00	(10,043,114)	-	10,043,114	-	-	10,043,114
B - Income Eligible	**3.00**	**181,333,297**	**272,201,723**	**88,059,128**	**2,930,732**	**(121,434)**	**90,868,426**
B1 - Income Eligible Existing Buildings	3.08	183,773,963	272,201,723	85,618,462	2,930,732	(121,434)	88,427,759
B1a - Income Eligible Coordinated Delivery	3.08	183,773,963	272,201,723	85,618,462	2,930,732	(121,434)	88,427,759
B1b - Income Eligible Active Demand Reduction		-	-	-	-	-	-
B2 - Income Eligible Hard-to-Measure	0.00	(2,440,666)	-	2,440,666	-	-	2,440,666
C - Commercial & Industrial	**2.90**	**298,907,003**	**456,211,584**	**110,702,892**	**4,398,098**	**42,203,590**	**157,304,580**
C1 - C&I New Buildings	7.04	54,712,276	63,770,553	7,698,674	548,768	810,835	9,058,277
C1a - C&I New Buildings & Major Renovations	7.04	54,712,276	63,770,553	7,698,674	548,768	810,835	9,058,277
C2 - C&I Existing Buildings	2.76	250,390,593	392,441,031	96,808,352	3,849,330	41,392,755	142,050,438
C2a - C&I Existing Building Retrofit	2.64	188,750,819	303,660,027	76,928,080	3,001,637	34,979,492	114,909,209
C2b - C&I New & Replacement Equipment	3.27	61,639,775	88,781,004	19,880,272	847,693	6,413,263	27,141,229
C2c - C&I Active Demand Reduction		-	-	-	-	-	-
C3 - C&I Hard-to-Measure	0.00	(6,195,866)	-	6,195,866	-	-	6,195,866
Grand Total	**2.58**	**830,145,423**	**1,354,933,343**	**428,658,461**	**13,836,586**	**82,292,873**	**524,787,920**

IV.D. Cost-Effectiveness

1. Summary Table

Statewide Gas
November 1, 2021

2022-2024 Total Resource Cost Test (2022$)							
Program	Benefit-Cost Ratio	Net Benefits	Total TRC Test Benefits	Costs			
				Total Program Costs	Performance Incentive	Participant Costs	Total TRC Test Costs
A - Residential	**2.27**	**999,914,866**	**1,784,259,761**	**650,690,655**	**17,984,641**	**115,669,599**	**784,344,895**
A1 - Residential New Buildings	3.68	73,720,115	101,227,394	27,572,079	765,110	(829,910)	27,507,279
A1a - Residential New Homes & Renovations	3.68	73,720,115	101,227,394	27,572,079	765,110	(829,910)	27,507,279
A2 - Residential Existing Buildings	2.32	956,584,833	1,683,032,368	592,728,495	17,219,531	116,499,509	726,447,534
A2a - Residential Coordinated Delivery	2.90	813,933,658	1,243,135,955	370,978,714	13,407,173	44,816,410	429,202,297
A2b - Residential Conservation Services (RCS)	0.00	(71,646,462)	-	71,646,462	-	-	71,646,462
A2c - Residential Retail	1.81	175,990,806	393,865,035	142,781,554	3,409,577	71,683,098	217,874,229
A2d - Residential Behavior	5.96	38,306,832	46,031,378	7,321,765	402,781	-	7,724,546
A2e - Residential Active Demand Reduction		-	-	-	-	-	-
A3 - Residential Hard-to-Measure	0.00	(30,390,081)	-	30,390,081	-	-	30,390,081
B - Income Eligible	**3.06**	**522,529,795**	**775,877,419**	**245,319,212**	**8,203,773**	**(175,361)**	**253,347,623**
B1 - Income Eligible Existing Buildings	3.15	529,855,424	775,877,419	237,993,583	8,203,773	(175,361)	246,021,994
B1a - Income Eligible Coordinated Delivery	3.15	529,855,424	775,877,419	237,993,583	8,203,773	(175,361)	246,021,994
B1b - Income Eligible Active Demand Reduction		-	-	-	-	-	-
B2 - Income Eligible Hard-to-Measure	0.00	(7,325,629)	-	7,325,629	-	-	7,325,629
C - Commercial & Industrial	**3.13**	**878,998,339**	**1,291,542,398**	**291,782,476**	**12,042,004**	**108,719,577**	**412,544,058**
C1 - C&I New Buildings	6.78	158,683,688	186,151,312	23,227,793	1,595,891	2,643,941	27,467,625
C1a - C&I New Buildings & Major Renovations	6.78	158,683,688	186,151,312	23,227,793	1,595,891	2,643,941	27,467,625
C2 - C&I Existing Buildings	3.02	738,900,702	1,105,391,085	249,968,633	10,446,114	106,075,637	366,490,383
C2a - C&I Existing Building Retrofit	2.91	558,955,517	851,247,717	196,083,166	8,110,345	88,098,690	292,292,201
C2b - C&I New & Replacement Equipment	3.43	179,945,185	254,143,368	53,885,466	2,335,769	17,976,947	74,198,182
C2c - C&I Active Demand Reduction		-	-	-	-	-	-
C3 - C&I Hard-to-Measure	0.00	(18,586,050)	-	18,586,050	-	-	18,586,050
Grand Total	**2.66**	**2,401,443,001**	**3,851,679,578**	**1,187,792,343**	**38,230,418**	**224,213,815**	**1,450,236,576**

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. The calculation of program benefits includes calculations of the social value of greenhouse gas emissions reductions except in the cases of conversions from fossil fuel heating and cooling to fossil fuel heating and cooling.

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

2.3 TRC Cost Historical Comparison

Statewide Gas

November 1, 2021

2019-2024 TRC Costs (2019$ and 2022$)												
TRC Costs Categories	TRC Costs ($)						TRC Cost Categories as a Percent of Total TRC Costs (%)					
	2019 Evaluated	2020 Evaluated	2021 Planned	2022 Planned	2023 Planned	2024 Planned	2019 Evaluated	2020 Evaluated	2021 Planned	2022 Planned	2023 Planned	2024 Planned
A - Residential												
PA Budget	1,263,209,426	167,721,652	153,095,795	210,701,501	221,569,598	236,404,197	95%	88%	72%	85%	85%	85%
Participant Cost	61,980,870	23,326,762	59,302,341	36,386,262	39,072,619	40,210,717	5%	12%	28%	15%	15%	15%
Residential Total TRC Costs	1,325,190,295	191,048,414	212,398,136	247,087,763	260,642,217	276,614,914	100%	100%	100%	100%	100%	100%
B - Income Eligible												
PA Budget	237,827,273	36,464,003	57,342,856	78,325,360	84,207,765	90,989,860	100%	100%	100%	100%	100%	100%
Participant Cost	0	(171,086)	10,799	910	(54,837)	(121,434)	0%	0%	0%	0%	0%	0%
Low-Income Total TRC Costs	237,827,273	36,292,917	57,353,655	78,326,270	84,152,928	90,868,426	100%	100%	100%	100%	100%	100%
C - Commercial & Industrial												
PA Budget	45,311,648	45,928,416	57,563,249	86,464,635	102,258,855	115,100,991	78%	84%	73%	75%	73%	73%
Participant Cost	12,651,563	8,615,956	21,283,997	29,340,880	37,175,107	42,203,590	22%	16%	27%	25%	27%	27%
C&I Total TRC Costs	57,963,211	54,544,372	78,847,245	115,805,515	139,433,962	157,304,580	100%	100%	100%	100%	100%	100%
Grand Total												
PA Budget	1,546,348,346	250,114,071	268,001,899	375,491,496	408,036,218	442,495,047	95%	89%	77%	85%	84%	84%
Participant Cost	74,632,433	31,771,632	80,597,137	65,728,052	76,192,890	82,292,873	5%	11%	23%	15%	16%	16%
Grand Total TRC Costs	1,620,980,779	281,885,703	348,599,036	441,219,549	484,229,107	524,787,920	100%	100%	100%	100%	100%	100%

Notes:

2019 values are from the Program Administrator's 2019 Plan Year Report D.P.U. 20-50, in 2019$.
2020 values are from the Program Administrator's 2020 Plan Year Report D.P.U. 21-70, in 2019$.
2021 values are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Gas, in 2019$.
For supporting information on the 2022-2024 values, see Table IV.D.1. The 2022-2024 values are in 2022$.

IV.D Cost-Effectiveness

3.1.i. Benefits Summary Table

Statewide Gas
November 1, 2021

	2022 Benefits ($)							
Program	**Electric Capacity**	**Electric Energy**	**Natural Gas**	**Oil**	**Propane**	**Wood**	**Motor Gasoline**	**Motor Diesel**
A - Residential	**8,306,886**	**2,127,952**	**476,649,454**	**-**	**-**	**-**	**-**	**-**
A1 - Residential New Buildings	121,295	483,697	26,249,533	-	-	-	-	-
A1a - Residential New Homes & Renovations	121,295	483,697	26,249,533	-	-	-	-	-
A2 - Residential Existing Buildings	8,185,591	1,644,255	450,399,922	-	-	-	-	-
A2a - Residential Coordinated Delivery	5,719,705	10,285,433	316,568,012	-	-	-	-	-
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-
A2c - Residential Retail	2,465,887	(8,641,178)	118,538,092	-	-	-	-	-
A2d - Residential Behavior	-	-	15,293,818	-	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-
B - Income Eligible	**5,183,755**	**5,544,193**	**121,791,160**	**-**	**-**	**-**	**-**	**-**
B1 - Income Eligible Existing Buildings	5,183,755	5,544,193	121,791,160	-	-	-	-	-
B1a - Income Eligible Coordinated Delivery	5,183,755	5,544,193	121,791,160	-	-	-	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**2,423,831**	**(28,580,696)**	**361,046,606**	**-**	**-**	**-**	**-**	**-**
C1 - C&I New Buildings	-	-	57,734,301	-	-	-	-	-
C1a - C&I New Buildings & Major Renovations	-	-	57,734,301	-	-	-	-	-
C2 - C&I Existing Buildings	2,423,831	(28,580,696)	303,312,305	-	-	-	-	-
C2a - C&I Existing Building Retrofit	2,401,045	(25,730,395)	252,084,414	-	-	-	-	-
C2b - C&I New & Replacement Equipment	22,786	(2,850,301)	51,227,892	-	-	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-
Grand Total	**15,914,472**	**(20,908,552)**	**959,487,221**	**-**	**-**	**-**	**-**	**-**

	2023 Benefits ($)							
Program	**Electric Capacity**	**Electric Energy**	**Natural Gas**	**Oil**	**Propane**	**Wood**	**Motor Gasoline**	**Motor Diesel**
A - Residential	**9,113,517**	**(987,700)**	**507,905,611**	**-**	**-**	**-**	**-**	**-**
A1 - Residential New Buildings	152,766	569,856	28,394,590	-	-	-	-	-
A1a - Residential New Homes & Renovations	152,766	569,856	28,394,590	-	-	-	-	-
A2 - Residential Existing Buildings	8,960,751	(1,557,556)	479,511,020	-	-	-	-	-
A2a - Residential Coordinated Delivery	6,299,407	10,790,201	340,879,921	-	-	-	-	-
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-
A2c - Residential Retail	2,661,344	(12,347,757)	123,356,518	-	-	-	-	-
A2d - Residential Behavior	-	-	15,274,581	-	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-
B - Income Eligible	**5,825,712**	**5,910,063**	**126,578,047**	**-**	**-**	**-**	**-**	**-**
B1 - Income Eligible Existing Buildings	5,825,712	5,910,063	126,578,047	-	-	-	-	-
B1a - Income Eligible Coordinated Delivery	5,825,712	5,910,063	126,578,047	-	-	-	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**3,915,261**	**(50,254,235)**	**399,601,690**	**-**	**-**	**-**	**-**	**-**
C1 - C&I New Buildings	-	-	57,781,817	-	-	-	-	-
C1a - C&I New Buildings & Major Renovations	-	-	57,781,817	-	-	-	-	-
C2 - C&I Existing Buildings	3,915,261	(50,254,235)	341,819,873	-	-	-	-	-
C2a - C&I Existing Building Retrofit	3,878,609	(44,812,008)	283,494,400	-	-	-	-	-
C2b - C&I New & Replacement Equipment	36,652	(5,442,227)	58,325,473	-	-	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-
Grand Total	**18,854,489**	**(45,331,872)**	**1,034,085,347**	**-**	**-**	**-**	**-**	**-**

IV.D Cost-Effectiveness

3.1.i. Benefits Summary Table

Statewide Gas
November 1, 2021

	2024 Benefits ($)							
Program	**Electric Capacity**	**Electric Energy**	**Natural Gas**	**Oil**	**Propane**	**Wood**	**Motor Gasoline**	**Motor Diesel**
A - Residential	**10,039,189**	**(5,528,805)**	**539,757,224**	**-**	**-**	**-**	**-**	**-**
A1 - Residential New Buildings	101,417	348,739	19,569,535	-	-	-	-	-
A1a - Residential New Homes & Renovations	101,417	348,739	19,569,535	-	-	-	-	-
A2 - Residential Existing Buildings	9,937,772	(5,877,544)	520,187,689	-	-	-	-	-
A2a - Residential Coordinated Delivery	7,070,320	11,226,235	372,727,954	-	-	-	-	-
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-
A2c - Residential Retail	2,867,452	(17,103,779)	131,996,757	-	-	-	-	-
A2d - Residential Behavior	-	-	15,462,979	-	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-
B - Income Eligible	**6,809,671**	**6,423,531**	**133,427,365**	**-**	**-**	**-**	**-**	**-**
B1 - Income Eligible Existing Buildings	6,809,671	6,423,531	133,427,365	-	-	-	-	-
B1a - Income Eligible Coordinated Delivery	6,809,671	6,423,531	133,427,365	-	-	-	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**5,766,567**	**(69,933,849)**	**431,352,144**	**-**	**-**	**-**	**-**	**-**
C1 - C&I New Buildings	-	-	60,567,054	-	-	-	-	-
C1a - C&I New Buildings & Major Renovations	-	-	60,567,054	-	-	-	-	-
C2 - C&I Existing Buildings	5,766,567	(69,933,849)	370,785,090	-	-	-	-	-
C2a - C&I Existing Building Retrofit	5,712,937	(59,589,917)	306,075,809	-	-	-	-	-
C2b - C&I New & Replacement Equipment	53,630	(10,343,932)	64,709,281	-	-	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-
Grand Total	**22,615,428**	**(69,039,123)**	**1,104,536,733**	**-**	**-**	**-**	**-**	**-**

	2022-2024 Benefits ($)							
Program	**Electric Capacity**	**Electric Energy**	**Natural Gas**	**Oil**	**Propane**	**Wood**	**Motor Gasoline**	**Motor Diesel**
A - Residential	**27,459,593**	**(4,388,553)**	**1,524,312,289**	**-**	**-**	**-**	**-**	**-**
A1 - Residential New Buildings	375,478	1,402,292	74,213,658	-	-	-	-	-
A1a - Residential New Homes & Renovations	375,478	1,402,292	74,213,658	-	-	-	-	-
A2 - Residential Existing Buildings	27,084,115	(5,790,846)	1,450,098,631	-	-	-	-	-
A2a - Residential Coordinated Delivery	19,089,432	32,301,869	1,030,175,887	-	-	-	-	-
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-
A2c - Residential Retail	7,994,683	(38,092,714)	373,891,367	-	-	-	-	-
A2d - Residential Behavior	-	-	46,031,378	-	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-
B - Income Eligible	**17,819,137**	**17,877,787**	**381,796,572**	**-**	**-**	**-**	**-**	**-**
B1 - Income Eligible Existing Buildings	17,819,137	17,877,787	381,796,572	-	-	-	-	-
B1a - Income Eligible Coordinated Delivery	17,819,137	17,877,787	381,796,572	-	-	-	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**12,105,659**	**(148,768,781)**	**1,192,000,440**	**-**	**-**	**-**	**-**	**-**
C1 - C&I New Buildings	-	-	176,083,172	-	-	-	-	-
C1a - C&I New Buildings & Major Renovations	-	-	176,083,172	-	-	-	-	-
C2 - C&I Existing Buildings	12,105,659	(148,768,781)	1,015,917,268	-	-	-	-	-
C2a - C&I Existing Building Retrofit	11,992,591	(130,132,320)	841,654,623	-	-	-	-	-
C2b - C&I New & Replacement Equipment	113,068	(18,636,461)	174,262,645	-	-	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-
Grand Total	**57,384,389**	**(135,279,547)**	**3,098,109,301**	**-**	**-**	**-**	**-**	**-**

IV.D Cost-Effectiveness

3.1.i. Benefits Summary Table

Statewide Gas
November 1, 2021

2022 Benefits ($)						
Program	**Water**	**Total Resource Benefits**	**Non-Resource Benefits**	**Total TRC Test Benefits**	**Resource Benefits per Participant**	**Total Environmental Compliance Benefits (Social Cost of Carbon)**
A - Residential	**12,642,239**	**499,726,531**	**62,134,822**	**561,861,353**	**727**	**319,385,290**
A1 - Residential New Buildings	-	26,854,525	8,165,831	35,020,356	5,489	11,627,417
A1a - Residential New Homes & Renovations	-	26,854,525	8,165,831	35,020,356	5,489	11,627,417
A2 - Residential Existing Buildings	12,642,239	472,872,006	53,968,991	526,840,997	692	307,757,873
A2a - Residential Coordinated Delivery	12,277,139	344,850,288	38,418,709	383,268,997	6,299	233,709,451
A2b - Residential Conservation Services (RCS)	-	-	-	-		-
A2c - Residential Retail	365,100	112,727,901	15,550,282	128,278,182	2,259	63,649,229
A2d - Residential Behavior	-	15,293,818	-	15,293,818	26	10,399,193
A2e - Residential Active Demand Reduction	-	-	-	-		-
B - Income Eligible	**636,837**	**133,155,944**	**113,153,109**	**246,309,053**	**14,466**	**75,984,916**
B1 - Income Eligible Existing Buildings	636,837	133,155,944	113,153,109	246,309,053	14,466	75,984,916
B1a - Income Eligible Coordinated Delivery	636,837	133,155,944	113,153,109	246,309,053	14,466	75,984,916
B1b - Income Eligible Active Demand Reduction	-	-	-	-		-
C - Commercial & Industrial	**4,868,928**	**339,758,669**	**63,257,688**	**403,016,356**	**54,835**	**223,466,988**
C1 - C&I New Buildings	-	57,734,301	3,524,793	61,259,094	290,122	41,132,790
C1a - C&I New Buildings & Major Renovations	-	57,734,301	3,524,793	61,259,094	290,122	41,132,790
C2 - C&I Existing Buildings	4,868,928	282,024,368	59,732,894	341,757,262	47,028	182,334,198
C2a - C&I Existing Building Retrofit	4,868,928	233,623,991	28,060,735	261,684,727	61,740	151,785,353
C2b - C&I New & Replacement Equipment	-	48,400,376	31,672,159	80,072,535	21,871	30,548,846
C2c - C&I Active Demand Reduction	-	-	-	-		-
Grand Total	**18,148,003**	**972,641,144**	**238,545,618**	**1,211,186,762**	**1,383**	**618,837,194**

2023 Benefits ($)						
Program	**Water**	**Total Resource Benefits**	**Non-Resource Benefits**	**Total TRC Test Benefits**	**Resource Benefits per Participant**	**Total Environmental Compliance Benefits (Social Cost of Carbon)**
A - Residential	**13,180,349**	**529,211,777**	**66,666,595**	**595,878,372**	**762**	**338,130,083**
A1 - Residential New Buildings	-	29,117,212	9,771,174	38,888,386	5,954	11,988,803
A1a - Residential New Homes & Renovations	-	29,117,212	9,771,174	38,888,386	5,954	11,988,803
A2 - Residential Existing Buildings	13,180,349	500,094,565	56,895,422	556,989,986	725	326,141,280
A2a - Residential Coordinated Delivery	12,802,163	370,771,692	40,890,956	411,662,648	6,399	251,487,121
A2b - Residential Conservation Services (RCS)	-	-	-	-		-
A2c - Residential Retail	378,187	114,048,291	16,004,465	130,052,757	2,243	64,168,125
A2d - Residential Behavior	-	15,274,581	-	15,274,581	26	10,486,034
A2e - Residential Active Demand Reduction	-	-	-	-		-
B - Income Eligible	**665,812**	**138,979,633**	**118,387,010**	**257,366,643**	**14,749**	**77,730,690**
B1 - Income Eligible Existing Buildings	665,812	138,979,633	118,387,010	257,366,643	14,749	77,730,690
B1a - Income Eligible Coordinated Delivery	665,812	138,979,633	118,387,010	257,366,643	14,749	77,730,690
B1b - Income Eligible Active Demand Reduction	-	-	-	-		-
C - Commercial & Industrial	**4,891,947**	**358,154,663**	**74,159,795**	**432,314,458**	**57,127**	**236,020,458**
C1 - C&I New Buildings	-	57,781,817	3,339,849	61,121,666	277,131	41,106,780
C1a - C&I New Buildings & Major Renovations	-	57,781,817	3,339,849	61,121,666	277,131	41,106,780
C2 - C&I Existing Buildings	4,891,947	300,372,846	70,819,946	371,192,792	49,558	194,913,678
C2a - C&I Existing Building Retrofit	4,891,947	247,452,948	38,450,015	285,902,963	64,441	160,887,201
C2b - C&I New & Replacement Equipment	-	52,919,897	32,369,931	85,289,829	23,827	34,026,477
C2c - C&I Active Demand Reduction	-	-	-	-		-
Grand Total	**18,738,108**	**1,026,346,073**	**259,213,400**	**1,285,559,473**	**1,445**	**651,881,231**

IV.D Cost-Effectiveness

3.1.i. Benefits Summary Table

Statewide Gas
November 1, 2021

2024 Benefits ($)						
Program	Water	Total Resource Benefits	Non-Resource Benefits	Total TRC Test Benefits	Resource Benefits per Participant	Total Environmental Compliance Benefits (Social Cost of Carbon)
A - Residential	**13,688,508**	**557,956,116**	**68,563,920**	**626,520,036**	**796**	**358,845,775**
A1 - Residential New Buildings	-	20,019,691	7,298,961	27,318,652	4,643	7,813,461
A1a - Residential New Homes & Renovations	-	20,019,691	7,298,961	27,318,652	4,643	7,813,461
A2 - Residential Existing Buildings	13,688,508	537,936,425	61,264,959	599,201,384	772	351,032,315
A2a - Residential Coordinated Delivery	13,295,473	404,319,982	43,884,328	448,204,310	6,542	274,489,599
A2b - Residential Conservation Services (RCS)	-	-	-	-		-
A2c - Residential Retail	393,035	118,153,465	17,380,631	135,534,096	2,239	66,015,509
A2d - Residential Behavior	-	15,462,979	-	15,462,979	27	10,527,206
A2e - Residential Active Demand Reduction	-	-	-	-		-
B - Income Eligible	**702,804**	**147,363,372**	**124,838,351**	**272,201,723**	**14,790**	**81,671,057**
B1 - Income Eligible Existing Buildings	702,804	147,363,372	124,838,351	272,201,723	14,790	81,671,057
B1a - Income Eligible Coordinated Delivery	702,804	147,363,372	124,838,351	272,201,723	14,790	81,671,057
B1b - Income Eligible Active Demand Reduction	-	-	-	-		-
C - Commercial & Industrial	**4,914,940**	**372,099,801**	**84,111,782**	**456,211,584**	**59,431**	**245,435,124**
C1 - C&I New Buildings	-	60,567,054	3,203,499	63,770,553	289,795	43,059,743
C1a - C&I New Buildings & Major Renovations	-	60,567,054	3,203,499	63,770,553	289,795	43,059,743
C2 - C&I Existing Buildings	4,914,940	311,532,748	80,908,284	392,441,031	51,476	202,375,381
C2a - C&I Existing Building Retrofit	4,914,940	257,113,769	46,546,259	303,660,027	66,904	167,274,166
C2b - C&I New & Replacement Equipment	-	54,418,979	34,362,025	88,781,004	24,635	35,101,215
C2c - C&I Active Demand Reduction	-	-	-	-		-
Grand Total	**19,306,252**	**1,077,419,290**	**277,514,053**	**1,354,933,343**	**1,503**	**685,951,956**

2022-2024 Benefits ($)						
Program	Water	Total Resource Benefits	Non-Resource Benefits	Total TRC Test Benefits	Resource Benefits per Participant	Total Environmental Compliance Benefits (Social Cost of Carbon)
A - Residential	**39,511,096**	**1,586,894,425**	**197,365,337**	**1,784,259,761**	**762**	**1,016,361,148**
A1 - Residential New Buildings	-	75,991,428	25,235,966	101,227,394	5,392	31,429,681
A1a - Residential New Homes & Renovations	-	75,991,428	25,235,966	101,227,394	5,392	31,429,681
A2 - Residential Existing Buildings	39,511,096	1,510,902,997	172,129,371	1,683,032,368	730	984,931,467
A2a - Residential Coordinated Delivery	38,374,774	1,119,941,962	123,193,993	1,243,135,955	6,418	759,686,171
A2b - Residential Conservation Services (RCS)	-	-	-	-		-
A2c - Residential Retail	1,136,322	344,929,657	48,935,378	393,865,035	2,247	193,832,864
A2d - Residential Behavior	-	46,031,378	-	46,031,378	26	31,412,433
A2e - Residential Active Demand Reduction	-	-	-	-		-
B - Income Eligible	**2,005,453**	**419,498,949**	**356,378,470**	**775,877,419**	**14,672**	**235,386,664**
B1 - Income Eligible Existing Buildings	2,005,453	419,498,949	356,378,470	775,877,419	14,672	235,386,664
B1a - Income Eligible Coordinated Delivery	2,005,453	419,498,949	356,378,470	775,877,419	14,672	235,386,664
B1b - Income Eligible Active Demand Reduction	-	-	-	-		-
C - Commercial & Industrial	**14,675,815**	**1,070,013,133**	**221,529,265**	**1,291,542,398**	**57,139**	**704,922,570**
C1 - C&I New Buildings	-	176,083,172	10,068,141	186,151,312	285,617	125,299,313
C1a - C&I New Buildings & Major Renovations	-	176,083,172	10,068,141	186,151,312	285,617	125,299,313
C2 - C&I Existing Buildings	14,675,815	893,929,961	211,461,124	1,105,391,085	49,361	579,623,257
C2a - C&I Existing Building Retrofit	14,675,815	738,190,709	113,057,009	851,247,717	64,375	479,946,719
C2b - C&I New & Replacement Equipment	-	155,739,252	98,404,115	254,143,368	23,444	99,676,538
C2c - C&I Active Demand Reduction	-	-	-	-		-
Grand Total	**56,192,363**	**3,076,406,507**	**775,273,071**	**3,851,679,578**	**1,444**	**1,956,670,382**

IV.D Cost-Effectiveness

3.1.iii. Benefits Historical Comparison

Statewide Gas

November 1, 2021

2019-2024 Benefits ($)													
Sector	Electric		Natural Gas	Oil	Propane	Wood	Motor Gasoline	Motor Diesel	Water	Total Energy Benefits	Non-Resource Impacts	Total TRC Test Benefits	Total Environmental Compliance Benefits
	Capacity	Electric Energy											
A - Residential													
2019 Evaluated	8,114,432	10,909,399	249,112,982	-	-	-	-	-	8,183,517	276,320,330	50,243,443	346,582,866	54,417,504
2020 Evaluated	8,012,709	9,569,309	254,985,480	-	-	-	-	-	10,534,471	283,101,969	45,300,433	357,472,672	46,066,626
2021 Planned	8,880,304	9,988,097	254,552,551	-	-	-	-	-	6,439,826	279,860,779	38,997,245	351,180,295	45,475,724
2022 Planned	8,306,886	2,127,952	476,649,454	-	-	-	-	-	12,642,239	499,726,531	62,134,822	561,861,353	319,385,290
2023 Planned	9,113,517	(987,700)	507,905,611	-	-	-	-	-	13,180,349	529,211,777	66,666,595	595,878,372	338,130,083
2024 Planned	10,039,189	(5,528,805)	539,757,224	-	-	-	-	-	13,688,508	557,956,116	68,563,920	626,520,036	358,845,775
B - Income Eligible													
2019 Evaluated	2,950,429	1,821,866	61,723,808	-	-	-	-	-	332,758	66,828,860	34,391,485	121,461,118	11,976,181
2020 Evaluated	2,043,618	1,267,405	38,373,119	-	-	-	-	-	963,570	42,647,712	19,323,420	77,788,556	6,725,611
2021 Planned	3,602,470	2,132,370	61,004,354	-	-	-	-	-	194,578	66,933,772	35,214,611	127,492,769	10,395,870
2022 Planned	5,183,755	5,544,193	121,791,160	-	-	-	-	-	636,837	133,155,944	113,153,109	246,309,053	75,984,916
2023 Planned	5,825,712	5,910,063	126,578,047	-	-	-	-	-	665,812	138,979,633	118,387,010	257,366,643	77,730,690
2024 Planned	6,809,671	6,423,531	133,427,365	-	-	-	-	-	702,804	147,363,372	124,838,351	272,201,723	81,671,057
C - Commercial & Industrial													
2019 Evaluated	2,402	(11,355)	161,574,312	-	-	-	-	-	10,331,340	171,896,699	8,286,958	182,433,900	35,206,828
2020 Evaluated	(495,472)	(1,486,895)	155,333,570	-	-	-	-	-	7,900,095	161,251,297	7,777,416	171,365,563	27,716,264
2021 Planned	80,632	53,616	244,219,861	-	-	-	-	-	17,155,656	261,509,765	7,045,264	280,007,598	35,121,248
2022 Planned	2,423,831	(28,580,696)	361,046,606	-	-	-	-	-	4,868,928	339,758,669	63,257,688	403,016,356	223,466,988
2023 Planned	3,915,261	(50,254,235)	399,601,690	-	-	-	-	-	4,891,947	358,154,663	74,159,795	432,314,458	236,020,458
2024 Planned	5,766,567	(69,933,849)	431,352,144	-	-	-	-	-	4,914,940	372,099,801	84,111,782	456,211,584	245,435,124
Grand Total													
2019 Evaluated	11,067,263	12,719,909	472,411,102	-	-	-	-	-	18,847,615	515,045,890	92,921,886	650,477,885	101,600,513
2020 Evaluated	9,560,855	9,349,819	448,692,169	-	-	-	-	-	19,398,136	487,000,978	72,401,269	606,626,792	80,508,502
2021 Planned	12,563,406	12,174,084	559,776,767	-	-	-	-	-	23,790,061	608,304,317	81,257,119	758,680,661	90,992,843
2022 Planned	15,914,472	(20,908,552)	959,487,221	-	-	-	-	-	18,148,003	972,641,144	238,545,618	1,211,186,762	618,837,194
2023 Planned	18,854,489	(45,331,872)	1,034,085,347	-	-	-	-	-	18,738,108	1,026,346,073	259,213,400	1,285,559,473	651,881,231
2024 Planned	22,615,428	(69,039,123)	1,104,536,733	-	-	-	-	-	19,306,252	1,077,419,290	277,514,053	1,354,933,343	685,951,956

IV.D Cost-Effectiveness

3.1.iii. Benefits Historical Comparison

Statewide Gas

November 1, 2021

2019-2024 Benefits, Percent of Total TRC Test Benefits (%)													
Sector	Electric		Natural Gas	Oil	Propane	Wood	Motor Gasoline	Motor Diesel	Water	Total Energy Benefits	Non-Resource Impacts	Total TRC Test Benefits	Total Environmental Compliance Benefits
	Capacity	Electric Energy											
A - Residential													
2019 Evaluated	2%	3%	72%	0%	0%	0%	0%	0%	2%	80%	14%	100%	16%
2020 Evaluated	2%	3%	71%	0%	0%	0%	0%	0%	3%	79%	13%	100%	13%
2021 Planned	3%	3%	72%	0%	0%	0%	0%	0%	2%	80%	11%	100%	13%
2022 Planned	1%	0%	85%	0%	0%	0%	0%	0%	2%	89%	11%	100%	57%
2023 Planned	2%	0%	85%	0%	0%	0%	0%	0%	2%	89%	11%	100%	57%
2024 Planned	2%	-1%	86%	0%	0%	0%	0%	0%	2%	89%	11%	100%	57%
B - Income Eligible													
2019 Evaluated	2%	1%	51%	0%	0%	0%	0%	0%	0%	55%	28%	100%	10%
2020 Evaluated	3%	2%	49%	0%	0%	0%	0%	0%	1%	55%	25%	100%	9%
2021 Planned	3%	2%	48%	0%	0%	0%	0%	0%	0%	53%	28%	100%	8%
2022 Planned	2%	2%	49%	0%	0%	0%	0%	0%	0%	54%	46%	100%	31%
2023 Planned	2%	2%	49%	0%	0%	0%	0%	0%	0%	54%	46%	100%	30%
2024 Planned	3%	2%	49%	0%	0%	0%	0%	0%	0%	54%	46%	100%	30%
C - Commercial & Industrial													
2019 Evaluated	0%	0%	89%	0%	0%	0%	0%	0%	6%	94%	5%	100%	19%
2020 Evaluated	0%	-1%	91%	0%	0%	0%	0%	0%	5%	94%	5%	100%	16%
2021 Planned	0%	0%	87%	0%	0%	0%	0%	0%	6%	93%	3%	100%	13%
2022 Planned	1%	-7%	90%	0%	0%	0%	0%	0%	1%	84%	16%	100%	55%
2023 Planned	1%	-12%	92%	0%	0%	0%	0%	0%	1%	83%	17%	100%	55%
2024 Planned	1%	-15%	95%	0%	0%	0%	0%	0%	1%	82%	18%	100%	54%
Grand Total													
2019 Evaluated	2%	2%	73%	0%	0%	0%	0%	0%	3%	79%	14%	100%	16%
2020 Evaluated	2%	2%	74%	0%	0%	0%	0%	0%	3%	80%	12%	100%	13%
2021 Planned	2%	2%	74%	0%	0%	0%	0%	0%	3%	80%	11%	100%	12%
2022 Planned	1%	-2%	79%	0%	0%	0%	0%	0%	1%	80%	20%	100%	51%
2023 Planned	1%	-4%	80%	0%	0%	0%	0%	0%	1%	80%	20%	100%	51%
2024 Planned	2%	-5%	82%	0%	0%	0%	0%	0%	1%	80%	20%	100%	51%

Notes:

2019 values are from the Program Administrator's 2019 Plan Year Report D.P.U. 20-50, in 2019$.

2020 values are from the Program Administrator's 2020 Plan Year Report D.P.U. 21-70, in 2019$.

2021 values are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Gas, in 2019$.

For supporting information on the 2022-2024 values, see Table IV.D.3.1.i. The 2022-2024 values are in 2022$.

IV.D. Cost-Effectiveness

3.2.i. Savings Summary Table

Statewide Gas
November 1, 2021

Program	# of Participants	2022 Net Savings											
		Electric						Natural Gas		Deliverable Fuels			
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (Source MMBTU)		(Therms)		Oil (MMBTU)		Propane (MMBTU)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**687,826**	**1,051**	**(433)**	**487**	**10,368**	**3,608**	**69,861**	**12,831,523**	**171,321,527**	-	-	-	-
A1 - Residential New Buildings	4,892	12	41	154	3,829	1,083	22,476	695,821	16,176,698	-	-	-	-
A1a - Residential New Homes & Renovations	4,892	12	41	154	3,829	1,083	22,476	695,821	16,176,698	-	-	-	-
A2 - Residential Existing Buildings	682,934	1,039	(474)	332	6,539	2,525	47,385	12,135,703	155,144,829	-	-	-	-
A2a - Residential Coordinated Delivery	54,750	674	257	2,433	44,257	17,169	268,129	4,483,414	96,152,011	-	-	-	-
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	49,897	364	(731)	(2,101)	(37,718)	(14,643)	(220,744)	3,059,614	54,400,143	-	-	-	-
A2d - Residential Behavior	578,286	-	-	-	-	-	-	4,592,675	4,592,675	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**9,205**	**552**	**30**	**1,130**	**24,953**	**8,010**	**152,639**	**2,661,464**	**55,244,359**	-	-	-	-
B1 - Income Eligible Existing Buildings	9,205	552	30	1,130	24,953	8,010	152,639	2,661,464	55,244,359	-	-	-	-
B1a - Income Eligible Coordinated Delivery	9,205	552	30	1,130	24,953	8,010	152,639	2,661,464	55,244,359	-	-	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**6,196**	**361**	**(683)**	**(8,162)**	**(123,876)**	**(57,469)**	**(765,914)**	**9,346,324**	**135,484,629**	-	-	-	-
C1 - C&I New Buildings	199	-	-	-	-	-	-	1,125,887	20,183,594	-	-	-	-
C1a - C&I New Buildings & Major Renovations	199	-	-	-	-	-	-	1,125,887	20,183,594	-	-	-	-
C2 - C&I Existing Buildings	5,997	361	(683)	(8,162)	(123,876)	(57,469)	(765,914)	8,220,437	115,301,036	-	-	-	-
C2a - C&I Existing Building Retrofit	3,784	358	(681)	(7,437)	(111,559)	(52,363)	(690,380)	6,683,825	91,584,924	-	-	-	-
C2b - C&I New & Replacement Equipment	2,213	3	(2)	(725)	(12,316)	(5,106)	(75,534)	1,536,613	23,716,111	-	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**703,227**	**1,964**	**(1,086)**	**(6,546)**	**(88,554)**	**(45,850)**	**(543,414)**	**24,839,311**	**362,050,515**	-	-	-	-

Program	# of Participants	2023 Net Savings											
		Electric						Natural Gas		Deliverable Fuels			
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (Source MMBTU)		(Therms)		Oil (MMBTU)		Propane (MMBTU)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**694,355**	**1,082**	**(654)**	**(286)**	**(2,617)**	**(1,613)**	**(6,115)**	**13,350,819**	**182,135,022**	-	-	-	-
A1 - Residential New Buildings	4,890	14	49	184	4,568	1,271	26,529	771,451	18,054,022	-	-	-	-
A1a - Residential New Homes & Renovations	4,890	14	49	184	4,568	1,271	26,529	771,451	18,054,022	-	-	-	-
A2 - Residential Existing Buildings	689,465	1,068	(703)	(470)	(7,185)	(2,884)	(32,644)	12,579,368	164,081,000	-	-	-	-
A2a - Residential Coordinated Delivery	57,938	702	269	2,541	46,180	17,711	276,494	4,808,369	103,186,790	-	-	-	-
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	50,841	366	(972)	(3,011)	(53,365)	(20,595)	(309,137)	3,168,211	56,291,422	-	-	-	-
A2d - Residential Behavior	580,686	-	-	-	-	-	-	4,602,788	4,602,788	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**9,423**	**587**	**31**	**1,198**	**26,435**	**8,418**	**160,055**	**2,820,218**	**58,709,990**	-	-	-	-
B1 - Income Eligible Existing Buildings	9,423	587	31	1,198	26,435	8,418	160,055	2,820,218	58,709,990	-	-	-	-
B1a - Income Eligible Coordinated Delivery	9,423	587	31	1,198	26,435	8,418	160,055	2,820,218	58,709,990	-	-	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**6,270**	**541**	**(644)**	**(14,294)**	**(217,174)**	**(99,447)**	**(1,323,551)**	**10,175,580**	**147,306,158**	-	-	-	-
C1 - C&I New Buildings	209	-	-	-	-	-	-	1,127,359	20,191,201	-	-	-	-
C1a - C&I New Buildings & Major Renovations	209	-	-	-	-	-	-	1,127,359	20,191,201	-	-	-	-
C2 - C&I Existing Buildings	6,061	541	(644)	(14,294)	(217,174)	(99,447)	(1,323,551)	9,048,221	127,114,957	-	-	-	-
C2a - C&I Existing Building Retrofit	3,840	536	(640)	(12,911)	(193,668)	(89,823)	(1,181,332)	7,322,442	101,229,226	-	-	-	-
C2b - C&I New & Replacement Equipment	2,221	5	(5)	(1,383)	(23,505)	(9,624)	(142,219)	1,725,779	25,885,731	-	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**710,048**	**2,210**	**(1,267)**	**(13,382)**	**(193,357)**	**(92,643)**	**(1,169,611)**	**26,346,617**	**388,151,170**	-	-	-	-

IV.D. Cost-Effectiveness

3.2.i. Savings Summary Table

Statewide Gas
November 1, 2021

Program	2022 Net Savings													
	Other								Total Savings MMBTU		Electric Energy, no Fuel Switching or ADR (MWh)		Avoided CO2e (Metric Tons)	
	Wood (MMBTU)		Motor Gasoline (MMBTU)		Motor Diesel (MMBTU)		Water (Gallons)							
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	2025	2030
A - Residential	-	-	-	-	-	-	**52,861,040**	**733,437,347**	**1,286,760**	**17,202,014**	**487**	**10,368**	**50,765**	**50,448**
A1 - Residential New Buildings	-	-	-	-	-	-	-	-	70,665	1,640,146	154	3,829	5,602	5,580
A1a - Residential New Homes & Renovations	-	-	-	-	-	-	-	-	70,665	1,640,146	154	3,829	5,602	5,580
A2 - Residential Existing Buildings	-	-	-	-	-	-	52,861,040	733,437,347	1,216,095	15,561,868	332	6,539	45,163	44,868
A2a - Residential Coordinated Delivery	-	-	-	-	-	-	51,448,126	712,243,641	465,510	9,883,330	2,433	44,257	25,294	24,773
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	-	-	-	-	-	-	1,412,914	21,193,707	291,318	5,219,270	(2,101)	(37,718)	19,870	20,095
A2d - Residential Behavior	-	-	-	-	-	-	-	-	459,267	459,267	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	-	-	-	-	-	-	**3,425,527**	**36,862,132**	**274,157**	**5,677,075**	**1,130**	**24,953**	**14,335**	**14,203**
B1 - Income Eligible Existing Buildings	-	-	-	-	-	-	3,425,527	36,862,132	274,157	5,677,075	1,130	24,953	14,335	14,203
B1a - Income Eligible Coordinated Delivery	-	-	-	-	-	-	3,425,527	36,862,132	274,157	5,677,075	1,130	24,953	14,335	14,203
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	-	-	-	-	-	-	**59,936,310**	**280,161,548**	**877,164**	**12,782,549**	**(8,162)**	**(123,876)**	**59,073**	**50,571**
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	112,589	2,018,359	-	-	9,256	9,196
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	112,589	2,018,359	-	-	9,256	9,196
C2 - C&I Existing Buildings	-	-	-	-	-	-	59,936,310	280,161,548	764,575	10,764,190	(8,162)	(123,876)	49,817	41,375
C2a - C&I Existing Building Retrofit	-	-	-	-	-	-	59,936,310	280,161,548	616,019	8,468,112	(7,437)	(111,559)	37,056	28,547
C2b - C&I New & Replacement Equipment	-	-	-	-	-	-	-	-	148,556	2,296,077	(725)	(12,316)	12,761	12,828
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	-	-	-	-	-	-	**116,222,877**	**1,050,461,027**	**2,438,081**	**35,661,638**	**(6,546)**	**(88,554)**	**124,173**	**115,222**

Program	2023 Net Savings													
	Other								Total Savings MMBTU		Electric Energy, no Fuel Switching or ADR (MWh)		Avoided CO2e (Metric Tons)	
	Wood (MMBTU)		Motor Gasoline (MMBTU)		Motor Diesel (MMBTU)		Water (Gallons)							
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	2025	2030
A - Residential	-	-	-	-	-	-	**55,222,363**	**766,202,840**	**1,333,469**	**18,207,388**	**(286)**	**(2,617)**	**53,103**	**52,989**
A1 - Residential New Buildings	-	-	-	-	-	-	-	-	78,416	1,831,931	184	4,568	5,581	5,559
A1a - Residential New Homes & Renovations	-	-	-	-	-	-	-	-	78,416	1,831,931	184	4,568	5,581	5,559
A2 - Residential Existing Buildings	-	-	-	-	-	-	55,222,363	766,202,840	1,255,053	16,375,456	(470)	(7,185)	47,522	47,430
A2a - Residential Coordinated Delivery	-	-	-	-	-	-	53,755,836	744,204,924	498,548	10,595,173	2,541	46,180	27,113	26,695
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	-	-	-	-	-	-	1,466,528	21,997,916	296,226	5,320,005	(3,011)	(53,365)	20,409	20,735
A2d - Residential Behavior	-	-	-	-	-	-	-	-	460,279	460,279	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	-	-	-	-	-	-	**3,567,479**	**38,618,772**	**290,439**	**6,031,054**	**1,198**	**26,435**	**15,190**	**15,072**
B1 - Income Eligible Existing Buildings	-	-	-	-	-	-	3,567,479	38,618,772	290,439	6,031,054	1,198	26,435	15,190	15,072
B1a - Income Eligible Coordinated Delivery	-	-	-	-	-	-	3,567,479	38,618,772	290,439	6,031,054	1,198	26,435	15,190	15,072
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	-	-	-	-	-	-	**60,646,901**	**282,004,823**	**918,111**	**13,407,065**	**(14,294)**	**(217,174)**	**63,535**	**55,102**
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	112,736	2,019,120	-	-	9,272	9,272
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	112,736	2,019,120	-	-	9,272	9,272
C2 - C&I Existing Buildings	-	-	-	-	-	-	60,646,901	282,004,823	805,375	11,387,945	(14,294)	(217,174)	54,263	45,831
C2a - C&I Existing Building Retrofit	-	-	-	-	-	-	60,646,901	282,004,823	642,421	8,941,590	(12,911)	(193,668)	40,657	32,098
C2b - C&I New & Replacement Equipment	-	-	-	-	-	-	-	-	162,954	2,446,354	(1,383)	(23,505)	13,606	13,732
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	-	-	-	-	-	-	**119,436,743**	**1,086,826,435**	**2,542,019**	**37,645,506**	**(13,382)**	**(193,357)**	**131,828**	**123,164**

IV.D. Cost-Effectiveness

3.2.i. Savings Summary Table

Statewide Gas
November 1, 2021

Program	# of Participants	2024 Net Savings											
		Electric						Natural Gas		Deliverable Fuels			
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (Source MMBTU)		(Therms)		Oil (MMBTU)		Propane (MMBTU)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**700,787**	**1,093**	**(965)**	**(1,429)**	**(22,700)**	**(8,633)**	**(121,157)**	**13,764,946**	**189,954,766**	-	-	-	-
A1 - Residential New Buildings	4,312	9	31	114	2,837	737	16,309	556,567	12,906,223	-	-	-	-
A1a - Residential New Homes & Renovations	4,312	9	31	114	2,837	737	16,309	556,567	12,906,223	-	-	-	-
A2 - Residential Existing Buildings	696,476	1,084	(996)	(1,543)	(25,536)	(9,370)	(137,466)	13,208,379	177,048,542	-	-	-	-
A2a - Residential Coordinated Delivery	61,805	725	279	2,623	47,847	17,128	283,203	5,224,639	112,407,284	-	-	-	-
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	52,761	359	(1,275)	(4,166)	(73,384)	(26,498)	(420,669)	3,375,795	60,033,312	-	-	-	-
A2d - Residential Behavior	581,910	-	-	-	-	-	-	4,607,946	4,607,946	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**9,964**	**637**	**32**	**1,295**	**28,544**	**8,551**	**171,105**	**2,974,667**	**61,948,780**	-	-	-	-
B1 - Income Eligible Existing Buildings	9,964	637	32	1,295	28,544	8,551	171,105	2,974,667	61,948,780	-	-	-	-
B1a - Income Eligible Coordinated Delivery	9,964	637	32	1,295	28,544	8,551	171,105	2,974,667	61,948,780	-	-	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**6,261**	**720**	**(860)**	**(19,734)**	**(301,239)**	**(128,815)**	**(1,809,984)**	**10,746,939**	**155,976,147**	-	-	-	-
C1 - C&I New Buildings	209	-	-	-	-	-	-	1,176,634	21,059,195	-	-	-	-
C1a - C&I New Buildings & Major Renovations	209	-	-	-	-	-	-	1,176,634	21,059,195	-	-	-	-
C2 - C&I Existing Buildings	6,052	720	(860)	(19,734)	(301,239)	(128,815)	(1,809,984)	9,570,304	134,916,952	-	-	-	-
C2a - C&I Existing Building Retrofit	3,843	714	(853)	(17,111)	(256,660)	(111,692)	(1,543,606)	7,734,775	107,175,365	-	-	-	-
C2b - C&I New & Replacement Equipment	2,209	6	(8)	(2,623)	(44,579)	(17,123)	(266,378)	1,835,529	27,741,586	-	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**717,012**	**2,450**	**(1,794)**	**(19,867)**	**(295,395)**	**(128,896)**	**(1,760,036)**	**27,486,552**	**407,879,693**	-	-	-	-

Program	# of Participants	2022-2024 Net Savings											
		Electric						Natural Gas		Deliverable Fuels			
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (Source MMBTU)		(Therms)		Oil (MMBTU)		Propane (MMBTU)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential	**2,082,968**	**3,226**	**(2,052)**	**(1,228)**	**(14,949)**	**(6,638)**	**(57,410)**	**39,947,288**	**543,411,315**	-	-	-	-
A1 - Residential New Buildings	14,094	35	122	452	11,234	3,091	65,315	2,023,838	47,136,944	-	-	-	-
A1a - Residential New Homes & Renovations	14,094	35	122	452	11,234	3,091	65,315	2,023,838	47,136,944	-	-	-	-
A2 - Residential Existing Buildings	2,068,875	3,191	(2,173)	(1,681)	(26,183)	(9,729)	(122,725)	37,923,450	496,274,371	-	-	-	-
A2a - Residential Coordinated Delivery	174,494	2,101	805	7,597	138,284	52,007	827,826	14,516,422	311,746,085	-	-	-	-
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	153,499	1,089	(2,978)	(9,278)	(164,467)	(61,736)	(950,550)	9,603,619	170,724,877	-	-	-	-
A2d - Residential Behavior	1,740,882	-	-	-	-	-	-	13,803,409	13,803,409	-	-	-	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	**28,592**	**1,776**	**92**	**3,623**	**79,932**	**24,979**	**483,798**	**8,456,349**	**175,903,129**	-	-	-	-
B1 - Income Eligible Existing Buildings	28,592	1,776	92	3,623	79,932	24,979	483,798	8,456,349	175,903,129	-	-	-	-
B1a - Income Eligible Coordinated Delivery	28,592	1,776	92	3,623	79,932	24,979	483,798	8,456,349	175,903,129	-	-	-	-
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	**18,727**	**1,622**	**(2,188)**	**(42,190)**	**(642,288)**	**(285,731)**	**(3,899,449)**	**30,268,843**	**438,766,934**	-	-	-	-
C1 - C&I New Buildings	617	-	-	-	-	-	-	3,429,881	61,433,990	-	-	-	-
C1a - C&I New Buildings & Major Renovations	617	-	-	-	-	-	-	3,429,881	61,433,990	-	-	-	-
C2 - C&I Existing Buildings	18,110	1,622	(2,188)	(42,190)	(642,288)	(285,731)	(3,899,449)	26,838,962	377,332,945	-	-	-	-
C2a - C&I Existing Building Retrofit	11,467	1,608	(2,173)	(37,459)	(561,887)	(253,878)	(3,415,319)	21,741,042	299,989,516	-	-	-	-
C2b - C&I New & Replacement Equipment	6,643	14	(15)	(4,731)	(80,401)	(31,852)	(484,130)	5,097,921	77,343,429	-	-	-	-
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**2,130,286**	**6,624**	**(4,148)**	**(39,795)**	**(577,305)**	**(267,389)**	**(3,473,061)**	**78,672,480**	**1,158,081,378**	-	-	-	-

IV.D. Cost-Effectiveness

3.2.i. Savings Summary Table

Statewide Gas
November 1, 2021

Program	2024 Net Savings													
	Other								Total Savings MMBTU		Electric Energy, no Fuel Switching or ADR (MWh)		Avoided CO2e (Metric Tons)	
	Wood (MMBTU)		Motor Gasoline (MMBTU)		Motor Diesel (MMBTU)		Water (Gallons)							
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	2025	2030
A - Residential	-	-	-	-	-	-	**57,474,265**	**797,413,994**	**1,367,862**	**18,874,319**	**(1,429)**	**(22,700)**	**67,223**	**55,126**
A1 - Residential New Buildings	-	-	-	-	-	-	-	-	56,394	1,306,932	114	2,837	4,004	3,989
A1a - Residential New Homes & Renovations	-	-	-	-	-	-	-	-	56,394	1,306,932	114	2,837	4,004	3,989
A2 - Residential Existing Buildings	-	-	-	-	-	-	57,474,265	797,413,994	1,311,468	17,567,388	(1,543)	(25,536)	63,220	51,137
A2a - Residential Coordinated Delivery	-	-	-	-	-	-	55,946,958	774,504,379	539,592	11,523,931	2,623	47,847	29,424	29,120
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	-	-	-	-	-	-	1,527,308	22,909,615	311,082	5,582,662	(4,166)	(73,384)	21,568	22,017
A2d - Residential Behavior	-	-	-	-	-	-	-	-	460,795	460,795	-	-	12,227	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	-	-	-	-	-	-	**3,750,543**	**40,852,604**	**306,018**	**6,365,983**	**1,295**	**28,544**	**16,028**	**15,924**
B1 - Income Eligible Existing Buildings	-	-	-	-	-	-	3,750,543	40,852,604	306,018	6,365,983	1,295	28,544	16,028	15,924
B1a - Income Eligible Coordinated Delivery	-	-	-	-	-	-	3,750,543	40,852,604	306,018	6,365,983	1,295	28,544	16,028	15,924
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	-	-	-	-	-	-	**61,380,235**	**283,916,331**	**945,879**	**13,787,631**	**(19,734)**	**(301,239)**	**65,870**	**61,463**
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	117,663	2,105,920	-	-	9,669	9,669
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	117,663	2,105,920	-	-	9,669	9,669
C2 - C&I Existing Buildings	-	-	-	-	-	-	61,380,235	283,916,331	828,216	11,681,711	(19,734)	(301,239)	56,201	51,794
C2a - C&I Existing Building Retrofit	-	-	-	-	-	-	61,380,235	283,916,331	661,786	9,173,930	(17,111)	(256,660)	42,179	37,507
C2b - C&I New & Replacement Equipment	-	-	-	-	-	-	-	-	166,430	2,507,781	(2,623)	(44,579)	14,022	14,286
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	-	-	-	-	-	-	**122,605,044**	**1,122,182,928**	**2,619,759**	**39,027,933**	**(19,867)**	**(295,395)**	**149,122**	**132,513**

Program	2022-2024 Net Savings													
	Other								Total Savings MMBTU		Electric Energy, no Fuel Switching or ADR (MWh)		Avoided CO2e (Metric Tons)	
	Wood (MMBTU)		Motor Gasoline (MMBTU)		Motor Diesel (MMBTU)		Water (Gallons)							
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	2025	2030
A - Residential	-	-	-	-	-	-	**165,557,668**	**2,297,054,181**	**3,988,091**	**54,283,721**	**(1,228)**	**(14,949)**	**171,092**	**158,563**
A1 - Residential New Buildings	-	-	-	-	-	-	-	-	205,475	4,779,009	452	11,234	15,187	15,129
A1a - Residential New Homes & Renovations	-	-	-	-	-	-	-	-	205,475	4,779,009	452	11,234	15,187	15,129
A2 - Residential Existing Buildings	-	-	-	-	-	-	165,557,668	2,297,054,181	3,782,617	49,504,712	(1,681)	(26,183)	155,905	143,435
A2a - Residential Coordinated Delivery	-	-	-	-	-	-	161,150,919	2,230,952,944	1,503,649	32,002,434	7,597	138,284	81,831	80,587
A2b - Residential Conservation Services (RCS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A2c - Residential Retail	-	-	-	-	-	-	4,406,749	66,101,237	898,626	16,121,937	(9,278)	(164,467)	61,847	62,848
A2d - Residential Behavior	-	-	-	-	-	-	-	-	1,380,341	1,380,341	-	-	12,227	-
A2e - Residential Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B - Income Eligible	-	-	-	-	-	-	**10,743,550**	**116,333,508**	**870,614**	**18,074,111**	**3,623**	**79,932**	**45,553**	**45,198**
B1 - Income Eligible Existing Buildings	-	-	-	-	-	-	10,743,550	116,333,508	870,614	18,074,111	3,623	79,932	45,553	45,198
B1a - Income Eligible Coordinated Delivery	-	-	-	-	-	-	10,743,550	116,333,508	870,614	18,074,111	3,623	79,932	45,553	45,198
B1b - Income Eligible Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C - Commercial & Industrial	-	-	-	-	-	-	**181,963,446**	**846,082,702**	**2,741,154**	**39,977,244**	**(42,190)**	**(642,288)**	**188,479**	**167,136**
C1 - C&I New Buildings	-	-	-	-	-	-	-	-	342,988	6,143,399	-	-	28,197	28,137
C1a - C&I New Buildings & Major Renovations	-	-	-	-	-	-	-	-	342,988	6,143,399	-	-	28,197	28,137
C2 - C&I Existing Buildings	-	-	-	-	-	-	181,963,446	846,082,702	2,398,166	33,833,845	(42,190)	(642,288)	160,282	139,000
C2a - C&I Existing Building Retrofit	-	-	-	-	-	-	181,963,446	846,082,702	1,920,226	26,583,633	(37,459)	(561,887)	119,892	98,153
C2b - C&I New & Replacement Equipment	-	-	-	-	-	-	-	-	477,940	7,250,213	(4,731)	(80,401)	40,390	40,847
C2c - C&I Active Demand Reduction	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	-	-	-	-	-	-	**358,264,664**	**3,259,470,391**	**7,599,859**	**112,335,077**	**(39,795)**	**(577,305)**	**405,123**	**370,898**

IV.D Cost-Effectiveness

3.1.iii. Benefits Historical Comparison

Statewide Gas

November 1, 2021

2019-2024 Net Savings													
Sector	# of Participants	Electric						Natural Gas		Deliverable Fuels			
		Annual Capacity (kW)		Electric Energy (MWh)		Electric Energy (MMBTU)		(Therms)		Oil (MMBTU)		Propane (MMBTU)	
		Summer	Winter	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential													
2019 Evaluated	5,221,003	2,111	1,978	10,848	97,134	49,334	436,333	15,842,219	178,564,526	-	-	-	-
2020 Evaluated	557,458	1,522	1,161	6,853	86,031	33,708	415,906	14,269,425	181,663,463	-	-	-	-
2021 Planned	795,634	1,610	1,107	7,083	93,870	51,566	615,515	16,503,878	186,148,428	-	-	-	-
2022 Planned	687,826	1,051	(433)	487	10,368	3,608	69,861	12,831,523	171,321,527	-	-	-	-
2023 Planned	694,355	1,082	(654)	(286)	(2,617)	(1,613)	(6,115)	13,350,819	182,135,022	-	-	-	-
2024 Planned	700,787	1,093	(965)	(1,429)	(22,700)	(8,633)	(121,157)	13,764,946	189,954,766	-	-	-	-
B - Income Eligible													
2019 Evaluated	16,047	410	20	805	17,503	4,131	87,393	2,303,225	44,810,930	-	-	-	-
2020 Evaluated	11,094	275	15	545	11,969	2,911	61,463	1,465,932	27,531,803	-	-	-	-
2021 Planned	14,006	502	24	988	20,785	7,333	138,666	2,287,504	44,951,353	-	-	-	-
2022 Planned	9,205	552	30	1,130	24,953	8,010	152,639	2,661,464	55,244,359	-	-	-	-
2023 Planned	9,423	587	31	1,198	26,435	8,418	160,055	2,820,218	58,709,990	-	-	-	-
2024 Planned	9,964	637	32	1,295	28,544	8,551	171,105	2,974,667	61,948,780	-	-	-	-
C - Commercial & Industrial													
2019 Evaluated	21,387	0	1	(6)	(107)	(47)	(727)	8,380,287	122,012,957	-	-	-	-
2020 Evaluated	4,142	(98)	(107)	(806)	(12,639)	(6,318)	(88,583)	8,104,951	116,812,160	-	-	-	-
2021 Planned	7,498	15	2	33	549	159	2,547	13,793,639	190,538,716	-	-	-	-
2022 Planned	6,196	361	(683)	(8,162)	(123,876)	(57,469)	(765,914)	9,346,324	135,484,629	-	-	-	-
2023 Planned	6,270	541	(644)	(14,294)	(217,174)	(99,447)	(1,323,551)	10,175,580	147,306,158	-	-	-	-
2024 Planned	6,261	720	(860)	(19,734)	(301,239)	(128,815)	(1,809,984)	10,746,939	155,976,147	-	-	-	-
Grand Total													
2019 Evaluated	5,258,437	2,521	1,999	11,646	114,530	53,418	522,999	26,525,731	345,388,412	-	-	-	-
2020 Evaluated	572,694	1,699	1,069	6,593	85,361	30,301	388,785	23,840,308	326,007,427	-	-	-	-
2021 Planned	817,138	2,127	1,133	8,104	115,203	59,058	756,728	32,585,022	421,638,497	-	-	-	-
2022 Planned	703,227	1,964	(1,086)	(6,546)	(88,554)	(45,850)	(543,414)	24,839,311	362,050,515	-	-	-	-
2023 Planned	710,048	2,210	(1,267)	(13,382)	(193,357)	(92,643)	(1,169,611)	26,346,617	388,151,170	-	-	-	-
2024 Planned	717,012	2,450	(1,794)	(19,867)	(295,395)	(128,896)	(1,760,036)	27,486,552	407,879,693	-	-	-	-

Notes:

2019 values are from the Program Administrator's 2019 Plan Year Report D.P.U. 20-50.

2020 values are from the Program Administrator's 2020 Plan Year Report D.P.U. 21-70.

2021 values are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Gas.

For supporting information on the 2022-2024 values, see Table IV.D.3.2.i.

The Program Administrators have developed new participant definitions through the common assumptions working group for this Three-Year Plan. Historical participant numbers may not be comparable.

IV.D Cost-Effectiveness

3.1.iii. Benefits Historical Comparison

Statewide Gas

November 1, 2021

Sector	2019-2024 Net Savings									
	Other								Total Savings	
	Wood (MMBTU)		Motor Gasoline (MMBTU)		Motor Diesel (MMBTU)		Water (Gallons)		MMBTU	
	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime	Annual	Lifetime
A - Residential										
2019 Evaluated	-	-	-	-	-	-	71,558,331	500,908,319	1,277,638	13,519,149
2020 Evaluated	-	-	-	-	-	-	47,270,138	655,797,972	981,863	11,376,243
2021 Planned	-	-	-	-	-	-	56,311,145	394,178,013	1,105,562	11,702,421
2022 Planned	-	-	-	-	-	-	52,861,040	733,437,347	1,286,760	17,202,014
2023 Planned	-	-	-	-	-	-	55,222,363	766,202,840	1,333,469	18,207,388
2024 Planned	-	-	-	-	-	-	57,474,265	797,413,994	1,367,862	18,874,319
B - Income Eligible										
2019 Evaluated	-	-	-	-	-	-	2,909,701	20,367,907	159,019	3,026,080
2020 Evaluated	-	-	-	-	-	-	5,240,632	59,760,040	86,914	1,674,717
2021 Planned	-	-	-	-	-	-	1,701,430	11,910,010	139,835	2,655,342
2022 Planned	-	-	-	-	-	-	3,425,527	36,862,132	274,157	5,677,075
2023 Planned	-	-	-	-	-	-	3,567,479	38,618,772	290,439	6,031,054
2024 Planned	-	-	-	-	-	-	3,750,543	40,852,604	306,018	6,365,983
C - Commercial & Industrial										
2019 Evaluated	-	-	-	-	-	-	64,805,383	636,736,722	582,340	8,638,029
2020 Evaluated	-	-	-	-	-	-	44,354,009	489,165,124	454,391	6,891,610
2021 Planned	-	-	-	-	-	-	107,618,704	1,057,031,280	620,480	8,980,718
2022 Planned	-	-	-	-	-	-	59,936,310	280,161,548	877,164	12,782,549
2023 Planned	-	-	-	-	-	-	60,646,901	282,004,823	918,111	13,407,065
2024 Planned	-	-	-	-	-	-	61,380,235	283,916,331	945,879	13,787,631
Grand Total										
2019 Evaluated	-	-	-	-	-	-	139,273,415	1,158,012,948	2,018,997	25,183,258
2020 Evaluated	-	-	-	-	-	-	96,864,779	1,204,723,136	1,523,168	19,942,570
2021 Planned	-	-	-	-	-	-	165,631,279	1,463,119,304	1,865,877	23,338,481
2022 Planned	-	-	-	-	-	-	116,222,877	1,050,461,027	2,438,081	35,661,638
2023 Planned	-	-	-	-	-	-	119,436,743	1,086,826,435	2,542,019	37,645,506
2024 Planned	-	-	-	-	-	-	122,605,044	1,122,182,928	2,619,759	39,027,933

Notes:

2019 values are from the Program Administrator's 2019 Plan Year Report D.P.U. 20-50.

2020 values are from the Program Administrator's 2020 Plan Year Report D.P.U. 21-70.

2021 values are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Gas.

For supporting information on the 2022-2024 values, see Table IV.D.3.2.i.

The Program Administrators have developed new participant definitions through the common assumptions working group for this Three-Year Plan. Historical participant numbers may not be comparable.

IV.H. Performance Incentive

1. Summary Table

Statewide Gas
November 1, 2021

2022 Performance Incentives					
Sector	Total Program Costs	Pre-Tax		After-Tax	
		Performance Incentives	% of Program Costs	Performance Incentives	% of Program Costs
A - Residential	205,201,685	5,499,816	3%	3,997,266	2%
B - Income Eligible	75,763,756	2,561,604	3%	1,861,774	2%
C - Commercial & Industrial	82,850,612	3,614,023	4%	2,626,672	3%
Grand Total	**363,816,053**	**11,675,444**	**3%**	**8,485,712**	**2%**

2023 Performance Incentives					
Sector	Total Program Costs	Pre-Tax		After-Tax	
		Performance Incentives	% of Program Costs	Performance Incentives	% of Program Costs
A - Residential	219,861,261	6,095,415	3%	4,430,147	2%
B - Income Eligible	83,109,955	2,765,123	3%	2,009,692	2%
C - Commercial & Industrial	100,173,906	4,109,675	4%	2,986,911	3%
Grand Total	**403,145,122**	**12,970,212**	**3%**	**9,426,750**	**2%**

2024 Performance Incentives					
Sector	Total Program Costs	Pre-Tax		After-Tax	
		Performance Incentives	% of Program Costs	Performance Incentives	% of Program Costs
A - Residential	239,090,468	6,768,015	3%	4,918,993	2%
B - Income Eligible	91,580,792	3,047,938	3%	2,215,241	2%
C - Commercial & Industrial	115,130,127	4,573,987	4%	3,324,374	3%
Grand Total	**445,801,387**	**14,389,940**	**3%**	**10,458,608**	**2%**

2022-2024 Performance Incentives					
Sector	Total Program Costs	Pre-Tax		After-Tax	
		Performance Incentives	% of Program Costs	Performance Incentives	% of Program Costs
A - Residential	664,153,415	18,363,246	3%	13,346,407	2%
B - Income Eligible	250,454,503	8,374,665	3%	6,086,707	2%
C - Commercial & Industrial	298,154,645	12,297,685	4%	8,937,957	3%
Grand Total	**1,212,762,563**	**39,035,596**	**3%**	**28,371,071**	**2%**

Notes:
Performance Incentives for each year are represented in nominal dollars (2022$, 2023$, 2024$).
For supporting information on the Performance Incentive, refer to the Performance Incentive Model.
Performance Incentives are not applicable to the Cape Light Compact.

V.B. Allocation of Funds

1. Low-Income Minimum

Statewide Gas

November 1, 2021

2022 Sector Cost Allocation		
Sector	Program Budget	
	($)	(% of Total)
A - Residential	205,201,685	56.4%
B - Income Eligible	75,763,756	20.8%
C - Commercial & Industrial	82,850,612	22.8%
Grand Total	**363,816,053**	**100%**

2023 Sector Cost Allocation		
Sector	Program Budget	
	($)	(% of Total)
A - Residential	219,861,261	54.5%
B - Income Eligible	83,109,955	20.6%
C - Commercial & Industrial	100,173,906	24.8%
Grand Total	**403,145,122**	**100%**

2024 Sector Cost Allocation		
Sector	Program Budget	
	($)	(% of Total)
A - Residential	239,090,468	53.6%
B - Income Eligible	91,580,792	20.5%
C - Commercial & Industrial	115,130,127	25.8%
Grand Total	**445,801,387**	**100%**

2022-2024 Sector Cost Allocation		
Sector	Program Budget	
	($)	(% of Total)
A - Residential	664,153,415	54.8%
B - Income Eligible	250,454,503	20.7%
C - Commercial & Industrial	298,154,645	24.6%
Grand Total	**1,212,762,563**	**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.

V.D. Outsourced/Competitively Procured Services

1. Summary Table

Statewide Gas
November 1, 2021

2022-2024 Competitively Procured Services										
Sector	Competitively Procured Services Costs ($)					Competitively Procured Services Costs as a Percent of Total Sector Costs (%)				
	Total Cost of Services	In-House Activities	Outsourced Activities			Total Cost of Services	In-House Activities	Outsourced Activities		
			Total Outsourced	Competitively Procured	Non-Competitively Procured			Total Outsourced	Competitively Procured	Non-Competitively Procured
2022	**96,344,552**	**19,793,871**	**76,550,681**	**57,740,344**	**18,810,337**	**100%**	**21%**	**79%**	**60%**	**20%**
A - Residential	51,747,519	5,068,179	46,679,340	43,385,460	3,293,880	100%	10%	90%	84%	6%
B - Income Eligible	17,301,206	3,447,000	13,854,206	2,459,760	11,394,446	100%	20%	80%	14%	66%
C - Commercial & Industrial	27,295,827	11,278,692	16,017,135	11,895,124	4,122,011	100%	41%	59%	44%	15%
2023	**101,568,718**	**21,953,496**	**79,615,222**	**59,561,152**	**20,054,071**	**100%**	**22%**	**78%**	**59%**	**20%**
A - Residential	53,487,354	5,152,623	48,334,731	45,001,131	3,333,600	100%	10%	90%	84%	6%
B - Income Eligible	20,051,139	5,009,971	15,041,168	2,554,530	12,486,638	100%	25%	75%	13%	62%
C - Commercial & Industrial	28,030,225	11,790,902	16,239,323	12,005,491	4,233,833	100%	42%	58%	43%	15%
2024	**106,161,893**	**22,970,840**	**83,191,054**	**61,671,165**	**21,519,888**	**100%**	**22%**	**78%**	**58%**	**20%**
A - Residential	55,856,090	5,499,675	50,356,415	46,881,152	3,475,263	100%	10%	90%	84%	6%
B - Income Eligible	21,494,040	5,069,146	16,424,894	2,697,753	13,727,141	100%	24%	76%	13%	64%
C - Commercial & Industrial	28,811,764	12,402,019	16,409,745	12,092,261	4,317,484	100%	43%	57%	42%	15%
Grand Total	**304,075,163**	**64,718,206**	**239,356,957**	**178,972,661**	**60,384,296**	**100%**	**21%**	**79%**	**59%**	**20%**
A - Residential	161,090,963	15,720,477	145,370,486	135,267,743	10,102,744	100%	10%	90%	84%	6%
B - Income Eligible	58,846,385	13,526,117	45,320,267	7,712,043	37,608,224	100%	23%	77%	13%	64%
C - Commercial & Industrial	84,137,815	35,471,612	48,666,203	35,992,876	12,673,328	100%	42%	58%	43%	15%

Notes:

General Laws c. 25, § 19(a) and (b) requires the Department to ensure that energy efficiency programs use competitive procurement processes to the fullest extent practicable.
Costs for the Competitively Procured Services analysis include Program Planning and Administration; Marketing and Advertising; Sales, Technical Assistance & Training; and Evaluation and Market Research.
Costs for each year in 2016-2018 are represented in nominal dollars (2016$, 2017$, 2018$).

V.D. Outsourced/Competitively Procured Services

3. Historical Comparison

Statewide Gas
November 1, 2021

2019-2024 Competitively Procured Services										
Sector	Competitively Procured Services Costs ($)					Competitively Procured Services Costs as a Percent of Total Sector Costs (%)				
	Total Cost of Services	In-House Activities	Outsourced Activities			Total Cost of Services	In-House Activities	Outsourced Activities		
			Total Outsourced	Competitively Procured	Non-Competitively Procured			Total Outsourced	Competitively Procured	Non-Competitively Procured
A - Residential	**305,569,423**	**27,772,035**	**277,797,388**	**256,787,189**	**21,010,199**	**100%**	**9%**	**91%**	**84%**	**7%**
2019	45,876,922	3,785,874	42,091,048	38,561,068	3,529,979	100%	8%	92%	84%	8%
2020	48,779,593	4,081,049	44,698,544	41,137,049	3,561,496	100%	8%	92%	84%	7%
2021	49,821,945	4,184,635	45,637,310	41,821,329	3,815,981	100%	8%	92%	84%	8%
2022	51,747,519	5,068,179	46,679,340	43,385,460	3,293,880	100%	10%	90%	84%	6%
2023	53,487,354	5,152,623	48,334,731	45,001,131	3,333,600	100%	10%	90%	84%	6%
2024	55,856,090	5,499,675	50,356,415	46,881,152	3,475,263	100%	10%	90%	84%	6%
B - Income Eligible	**101,036,642**	**18,053,418**	**82,983,224**	**13,997,671**	**68,985,553**	**100%**	**18%**	**82%**	**14%**	**68%**
2019	13,743,732	1,440,418	12,303,314	2,046,563	10,256,751	100%	10%	90%	15%	75%
2020	14,114,538	1,521,671	12,592,867	2,118,321	10,474,546	100%	11%	89%	15%	74%
2021	14,331,987	1,565,211	12,766,776	2,120,745	10,646,031	100%	11%	89%	15%	74%
2022	17,301,206	3,447,000	13,854,206	2,459,760	11,394,446	100%	20%	80%	14%	66%
2023	20,051,139	5,009,971	15,041,168	2,554,530	12,486,638	100%	25%	75%	13%	62%
2024	21,494,040	5,069,146	16,424,894	2,697,753	13,727,141	100%	24%	76%	13%	64%
C - Commercial & Industrial	**146,823,401**	**56,945,021**	**89,878,380**	**65,532,420**	**24,345,960**	**100%**	**39%**	**61%**	**45%**	**17%**
2019	20,139,347	6,847,353	13,291,994	9,524,034	3,767,960	100%	34%	66%	47%	19%
2020	21,066,701	7,156,288	13,910,413	9,944,813	3,965,601	100%	34%	66%	47%	19%
2021	21,479,537	7,469,768	14,009,769	10,070,697	3,939,071	100%	35%	65%	47%	18%
2022	27,295,827	11,278,692	16,017,135	11,895,124	4,122,011	100%	41%	59%	44%	15%
2023	28,030,225	11,790,902	16,239,323	12,005,491	4,233,833	100%	42%	58%	43%	15%
2024	28,811,764	12,402,019	16,409,745	12,092,261	4,317,484	100%	43%	57%	42%	15%
Grand Total	**553,429,466**	**102,770,474**	**450,658,992**	**336,317,280**	**114,341,712**	**100%**	**19%**	**81%**	**61%**	**21%**
2019	79,760,001	12,073,645	67,686,356	50,131,666	17,554,690	100%	15%	85%	63%	22%
2020	83,960,833	12,759,008	71,201,825	53,200,182	18,001,643	100%	15%	85%	63%	21%
2021	85,633,470	13,219,615	72,413,855	54,012,771	18,401,083	100%	15%	85%	63%	21%
2022	96,344,552	19,793,871	76,550,681	57,740,344	18,810,337	100%	21%	79%	60%	20%
2023	101,568,718	21,953,496	79,615,222	59,561,152	20,054,071	100%	22%	78%	59%	20%
2024	106,161,893	22,970,840	83,191,054	61,671,165	21,519,888	100%	22%	78%	58%	20%

Notes:

General Laws c. 25, § 19(a) and (b) requires the Department to ensure that energy efficiency programs use competitive procurement processes to the fullest extent practicable.

Costs for the Competitively Procured Services analysis include Program Planning and Administration; Marketing and Advertising; Sales, Technical Assistance & Training; and Evaluation and Market Research.
The 2019-2021 costs are from the Program Administrator's 2019-2021 Three-Year Plan, Statewide Gas, in nominal dollars (2019$, 2020$, 2021$).

For supporting information on the 2022-2024 values, see Table V.D.1. Costs for each year are represented in nominal dollars (2022$, 2023$, 2024$).

VII. Appendix

B.2. Summary of Activities

Statewide Gas
November 1, 2021

2022-2024 Summary								
Sector	Net Annual Savings							
	Summer Capacity (kW)	Electric Energy (MWh)	Natural Gas (Therms)	Oil (MMBTU)	Propane (MMBTU)	Wood (MMBTU)	Water (Gallons)	Total Savings (MMBTU)
2022	**1,964**	**(6,546)**	**24,839,311**	**-**	**-**	**-**	**116,222,877**	**2,438,081**
A - Residential	1,051	487	12,831,523	-	-	-	52,861,040	1,286,760
B - Income Eligible	552	1,130	2,661,464	-	-	-	3,425,527	274,157
C - Commercial & Industrial	361	(8,162)	9,346,324	-	-	-	59,936,310	877,164
2023	**2,210**	**(13,382)**	**26,346,617**	**-**	**-**	**-**	**119,436,743**	**2,542,019**
A - Residential	1,082	(286)	13,350,819	-	-	-	55,222,363	1,333,469
B - Income Eligible	587	1,198	2,820,218	-	-	-	3,567,479	290,439
C - Commercial & Industrial	541	(14,294)	10,175,580	-	-	-	60,646,901	918,111
2024	**2,450**	**(19,867)**	**27,486,552**	**-**	**-**	**-**	**122,605,044**	**2,619,759**
A - Residential	1,093	(1,429)	13,764,946	-	-	-	57,474,265	1,367,862
B - Income Eligible	637	1,295	2,974,667	-	-	-	3,750,543	306,018
C - Commercial & Industrial	720	(19,734)	10,746,939	-	-	-	61,380,235	945,879
Grand Total	**6,624**	**(39,795)**	**78,672,480**	**-**	**-**	**-**	**358,264,664**	**7,599,859**
A - Residential	3,226	(1,228)	39,947,288	-	-	-	165,557,668	3,988,091
B - Income Eligible	1,776	3,623	8,456,349	-	-	-	10,743,550	870,614
C - Commercial & Industrial	1,622	(42,190)	30,268,843	-	-	-	181,963,446	2,741,154

2022-2024 Summary										
Sector	TRC Benefits (2022$)							TRC Costs (2022$)		
	Capacity	Electric Energy	Natural Gas	Deliverable Fuels & Other	Non-Energy Impacts	Environmental Compliance Benefits	Total Benefits	PA Budget	Participant Costs	Total TRC Test Costs
2022	**15,914,472**	**(20,908,552)**	**959,487,221**	**18,148,003**	**238,545,618**	**618,837,194**	**1,211,186,762**	**375,491,496**	**65,728,052**	**441,219,549**
A - Residential	8,306,886	2,127,952	476,649,454	12,642,239	62,134,822	319,385,290	561,861,353	210,701,501	36,386,262	247,087,763
B - Income Eligible	5,183,755	5,544,193	121,791,160	636,837	113,153,109	75,984,916	246,309,053	78,325,360	910	78,326,270
C - Commercial & Industrial	2,423,831	(28,580,696)	361,046,606	4,868,928	63,257,688	223,466,988	403,016,356	86,464,635	29,340,880	115,805,515
2023	**18,854,489**	**(45,331,872)**	**1,034,085,347**	**18,738,108**	**259,213,400**	**651,881,231**	**1,285,559,473**	**408,036,218**	**76,192,890**	**484,229,107**
A - Residential	9,113,517	(987,700)	507,905,611	13,180,349	66,666,595	338,130,083	595,878,372	221,569,598	39,072,619	260,642,217
B - Income Eligible	5,825,712	5,910,063	126,578,047	665,812	118,387,010	77,730,690	257,366,643	84,207,765	(54,837)	84,152,928
C - Commercial & Industrial	3,915,261	(50,254,235)	399,601,690	4,891,947	74,159,795	236,020,458	432,314,458	102,258,855	37,175,107	139,433,962
2024	**22,615,428**	**(69,039,123)**	**1,104,536,733**	**19,306,252**	**277,514,053**	**685,951,956**	**1,354,933,343**	**442,495,047**	**82,292,873**	**524,787,920**
A - Residential	10,039,189	(5,528,805)	539,757,224	13,688,508	68,563,920	358,845,775	626,520,036	236,404,197	40,210,717	276,614,914
B - Income Eligible	6,809,671	6,423,531	133,427,365	702,804	124,838,351	81,671,057	272,201,723	90,989,860	(121,434)	90,868,426
C - Commercial & Industrial	5,766,567	(69,933,849)	431,352,144	4,914,940	84,111,782	245,435,124	456,211,584	115,100,991	42,203,590	157,304,580
Grand Total	**57,384,389**	**(135,279,547)**	**3,098,109,301**	**56,192,363**	**775,273,071**	**1,956,670,382**	**3,851,679,578**	**1,226,022,761**	**224,213,815**	**1,450,236,576**
A - Residential	27,459,593	(4,388,553)	1,524,312,289	39,511,096	197,365,337	1,016,361,148	1,784,259,761	668,675,296	115,669,599	784,344,895
B - Income Eligible	17,819,137	17,877,787	381,796,572	2,005,453	356,378,470	235,386,664	775,877,419	253,522,984	(175,361)	253,347,623
C - Commercial & Industrial	12,105,659	(148,768,781)	1,192,000,440	14,675,815	221,529,265	704,922,570	1,291,542,398	303,824,481	108,719,577	412,544,058

2022-2024 Summary										
Sector	TRC Cost-Effectiveness		Cost of Saved Energy (PA Budget per annual savings unit)				Participants	Avg Measure Life (yrs.)	Avoided CO2e (Metric Tons)	
	B/C Ratio	Net Benefits	Summer Capacity ($/kW)	Electric Energy ($/MWh)	Natural Gas Costs ($/Therm)	Total Savings ($/MMBTU)			2025	2030
2022	**2.75**	**769,967,213**	**191,171**	**(57,364)**	**15**	**154**	**703,227**	**15**	**124,173**	**115,222**
A - Residential	2.27	314,773,589	200,548	432,928	16	164	687,826	13	50,765	50,448
B - Income Eligible	3.14	167,982,783	141,833	69,321	29	286	9,205	21	14,335	14,203
C - Commercial & Industrial	3.48	287,210,841	239,317	(10,593)	9	99	6,196	15	59,073	50,571
2023	**2.65**	**801,330,366**	**184,628**	**(30,491)**	**15**	**161**	**710,048**	**15**	**131,828**	**123,164**
A - Residential	2.29	335,236,155	204,783	(773,926)	17	166	694,355	14	53,103	52,989
B - Income Eligible	3.06	173,213,715	143,381	70,266	30	290	9,423	21	15,190	15,072
C - Commercial & Industrial	3.10	292,880,495	189,096	(7,154)	10	111	6,270	15	63,535	55,102
2024	**2.58**	**830,145,423**	**180,619**	**(22,273)**	**16**	**169**	**717,012**	**15**	**149,122**	**132,513**
A - Residential	2.26	349,905,122	216,288	(165,462)	17	173	700,787	14	67,223	55,126
B - Income Eligible	3.00	181,333,297	142,872	70,263	31	297	9,964	21	16,028	15,924
C - Commercial & Industrial	2.90	298,907,003	159,860	(5,833)	11	122	6,261	15	65,870	61,463
Grand Total	**2.66**	**2,401,443,001**	**185,085**	**(30,808)**	**16**	**161**	**2,130,286**	**15**	**405,123**	**370,898**
A - Residential	2.28	999,914,866	207,206	(168,820)	17	168	2,082,968	14	171,092	158,563
B - Income Eligible	3.07	522,529,795	142,696	69,950	30	291	28,592	21	45,553	45,198
C - Commercial & Industrial	3.16	878,998,339	196,091	(7,860)	10	111	18,727	15	188,479	167,136

Calculated Fields

Formulas used in pivot tables

Statewide Gas

November 1, 2021

Field	Formula
B/C Ratio	='Total Benefits '/'Total Resource Costs (First Yr$)'
Net Benefits	='Total Benefits '-'Total Resource Costs (First Yr$)'
Avg Measure Life	=ROUND('Total Net Lifetime Adjusted (MMBTU)'/'Total Net Annual Adjusted (MMBTU)',0)
PA Budget (First Yr$)	='Total Program Costs (First Yr$)'+'Performance Incentive (First Yr$)'
Summer Cost (TRC Cost First Yr$/Summer kW)	='Total Resource Costs (First Yr$)'/'Net Summer Capacity (kW)'
Energy Cost (TRC Cost First Yr$/Annual MWh)	='Total Program Costs (First Yr$)'/'Net Annual Electric Energy (MWh)'
Natural Gas Costs (PA Cost First Yr$/Annual Therm)	='PA Budget (First Yr$)'/'Net Annual Natural Gas (Therms)'
Summer Cost (PA Cost First Yr$/Summer kW)	='PA Budget (First Yr$)'/'Net Summer Capacity (kW)'
Energy Cost (PA Cost First Yr$/Annual MWh)	='PA Budget (First Yr$)'/'Net Annual Electric Energy (MWh)'
Natural Gas Costs (TRC Cost First Yr$/Annual Therm)	='Total Program Costs (First Yr$)'/'Net Annual Natural Gas (Therms)'
Total Savings Cost (PA Cost First Yr$/Annual MMBTU)	='PA Budget (First Yr$)'/'Total Net Annual Adjusted (MMBTU)'
Total Savings Cost (TRC Cost First Yr$/Annual MMBTU)	='Total Resource Costs (First Yr$)'/'Total Net Annual Adjusted (MMBTU)'
Total PA Budget (Programs + PI + Benefit Burden)	='Total Program Costs'+'Performance Incentive'+'Benefit Burden'
Total PA Budget (Program + PI)	='Total Program Costs'+'Performance Incentive'
Program Costs / Participant	='Total Program Costs'/Participants
Resource Benefit / Program Cost	='Total Resource Benefits'/'Total Program Costs'
Resource Benefit / Participant	='Total Resource Benefits'/Participants

Notes

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

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

APPENDIX D: EEAC LETTER ON GREENHOUSE GAS EMISSIONS REDUCTION GOAL FOR MASS SAVE

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Charles D. Baker
GOVERNOR

Karyn E. Polito
LIEUTENANT GOVERNOR

Kathleen A. Theoharides
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1081
http://www.mass.gov/eea

July 15, 2021

RE: **Greenhouse Gas Emissions Reduction Goal for Mass Save**

Dear Mass Save Program Administrators,

On March 26, 2021, Governor Baker signed comprehensive legislation that codifies the Baker-Polito Administration's commitment to achieve Net Zero emissions in 2050 and furthers the Commonwealth's nation-leading efforts to combat climate change and protect vulnerable communities. An Act Creating A Next-Generation Roadmap For Massachusetts Climate Policy (the Climate Act) builds upon the framework established in the Administration's 2050 Decarbonization Roadmap (2050 Roadmap) and 2030 Interim Clean Energy and Climate Plan (2030 Interim CECP) and requires the Commonwealth to pursue ambitious emissions reduction goals in a cost-effective and equitable manner while creating jobs and opportunities for economic development throughout Massachusetts.

The Climate Act made significant changes to the Global Warming Solutions Act (the GWSA). Among other requirements, the Climate Act requires the Secretary of Energy and Environmental Affairs to set a goal, expressed in tons of carbon dioxide equivalent, every three years for the succeeding Mass Save Energy Efficiency Plans' necessary contribution to meeting each statewide greenhouse gas (GHG) limit and sublimit adopted under the GWSA. Our Mass Save programs will be a key policy driver to meeting our GHG emissions reduction requirements and the programs must reflect this imperative.

Section 106 of the Climate Act requires me to establish the first goal for the Mass Save Energy Efficiency Plans no later than July 15, 2021. Since this deadline precedes the finalization of the statewide GHG emissions limits and sublimits to be adopted under the GWSA, as amended by the Climate Act, these first Mass Save goals are informed by the 2050 Roadmap and

2030 Interim CECP, both released in 2020.[1] By this letter, I set the following GHG emissions reduction goals for the 2022–2024 Energy Efficiency Plans, which are currently being reviewed by the Energy Efficiency Advisory Council (EEAC), pursuant to the Green Communities Act, G.L. c. 25, § 21(c), and which you must submit by October 31, 2021, to the Department of Public Utilities (DPU) for a decision, pursuant to G.L. c. 25, § 21(d).

The Green Communities Act requires that:

> *Every 3 years, on or before April 30, the electric distribution companies and municipal aggregators with certified efficiency plans shall jointly prepare an energy efficiency investment plan [the statewide electric energy efficiency plan] and the natural gas distribution companies shall jointly prepare a natural gas efficiency investment plan [the statewide natural gas energy efficiency plan].*

Greenhouse Gas Emissions Reduction Goals

Below in Table 1, I set goals for the statewide electric energy efficiency plan and the statewide natural gas energy efficiency plan for 2022–2024. These goals represent the aggregate GHG emissions reductions to be achieved with energy efficiency measures implemented in 2022–2024 and are expressed as aggregate metric tons of carbon dioxide equivalent, to be measured at the conclusion of the three-year plan period. As required by section 3B of chapter 21N, these goals were selected with a view towards their necessary contribution to meeting the limits and sublimits that will be adopted under the GWSA. The detailed methodology and assumptions supporting the goals may be found in Appendix 1.

Because these GHG emission limits and sublimits will be in place every five years beginning in 2025 and ending in 2050, in order to count towards meeting the goal, a GHG emissions reduction achieved by the plan must be sufficiently long-lasting so that it will "contribut[e] to meeting" those future limits and sublimits. G.L. c. 21N, § 3B. In order to resolve the disconnect between the three-year time period for the plans and the 5 year time period between successive limits (and sublimits) under the GWSA, I have decided that an emissions reduction measure must be sufficiently permanent to contribute to meeting, at a minimum, the next two statewide goals adopted pursuant to M.G.L. c. 25, § 21(d)(5) in order to count towards achieving the goals set forth in Table 1 below.[2] I have set these goals for the Energy Efficiency Plans with that limitation in mind. Therefore, I expect that, when the DPU

[1] I note that the 2030 Interim CECP was designed to achieve a reduction of 45% below 1990 levels in 2030, prior to the Climate Act requiring that I adopt a more stringent 2030 limit of at least 50% below 1990 levels.

[2] The Plans for 2046–2048 will, of course, need to contribute only to the 2050 goal. The legislature may wish to consider amending the law before the 2049–2051 plans are established, as any goal set in 2048 will not be realized until after the 2050 limit is achieved. Alternatively, the legislature might consider changing the Energy Efficiency Plans to five-year terms and synchronize with the GWSA limits and sublimits.

issues its "statement . . . indicating the degree to which the activities undertaken pursuant to the performance of each plan met the goal for the plan set by the secretary pursuant to section 3B of chapter 21N" that the DPU will not consider emissions reductions that will no longer be effective in 2030. M.G.L. c. 25, § 21(d)(5). Therefore, the goals below are expressed in cumulative annual metric tons of CO2e reductions expected in 2030, directly associated with the measures implemented in 2022–2024.

The Climate Act requires that every three years a new goal to be established for the succeeding plans' contribution to future GHG emission limits and sublimits. Each successive goal will incrementally build upon the reductions to GHG emissions achieved under prior plans.

Table 1: Greenhouse Gas Emissions Reduction Goal

	2022–2024 Joint Statewide Energy Efficiency Plan (electric)	**2022–2024 Joint Statewide Gas Efficiency Plan (gas)**
Emissions Reductions in metric tons of CO_2e	504,000	341,000

As the Climate Act requires both economy-wide and sector limits, I recommend that the plans include emissions reductions in the following individual sectors:

Table 2: Sector-Specific Goals

	Residential and Income Eligible Electric Energy Efficiency	**Residential and Income Eligible Gas Efficiency**	**Commercial and Industrial Electric Energy Efficiency**	**Commercial and Industrial Gas Efficiency**
2025 Cumulative Annual Emissions Reduction (metric tons of CO_2e)	392,000	252,000	296,000	156,000
2030 Cumulative Annual Emissions Reduction (metric tons of CO_2e)	351,000	191,000	153,000	150,000

Priorities

Meeting the Climate Act's 2050 Net Zero limit and 2030 limit of at least 50% GHG emissions reductions relative to 1990 levels will require a significant increase in the scope and scale of building retrofits, through a focus on envelope improvements and efficient electrification. Consistent with the EEAC Resolution of March 24, 2021, [3] I expect the Mass Save Program Administrators to achieve the GHG goals established above through:

[3] https://ma-eeac.org/wp-content/uploads/FINAL-EEAC-Priorities-Resolution_Adopted-3.24.2021.pdf

- Equitable program investments that ensure weatherization and electrification of homes and businesses in environmental justice communities and low-moderate income households;
- Significantly increasing the number of buildings retrofitted and weatherized each year;
- Significantly ramping up electrification of existing buildings through heat pump goals that set the Commonwealth on a path to achieving one million homes and 300–400 million square feet of commercial buildings using electric heat pump for space heating by 2030;
- Eliminating measures that increase the use of natural gas for space heating, including those associated with combined heat and power or fuel cells, since they are not consistent with the GHG emission reduction goals;
- Prioritizing measures consistent with the 2050 Roadmap and 2030 Interim CECP, such as insulation and heat pumps, and reduce support for measures like lighting and fossil-fuel heating incentives;
- Committing to phase out fossil fuel incentives aligned with the Interim 2030 CECP policy recommendations; and
- Significantly increasing workforce development investments through coordination with the Massachusetts Clean Energy Center, to increase diversity and expand the workforce necessary to achieve our GHG goals and provide economic opportunities.

Conclusion

As set forth above, the final 2022–2024 Energy Efficiency Plans filed with the DPU in October of this year must be designed to realize the GHG goal set forth above and should focus on programs that accelerate market transformation needed to achieve Net Zero in 2050. Consistent with the Climate Act, each Plan should "be constructed to meet or exceed the [respective] goal" set forth above. M.G.L. c. 25, § 21(d)(4). I encourage the Mass Save Program Administrators and the EEAC to prioritize energy efficiency investments that reduce GHG emissions and are aligned with the state's 2050 Roadmap.

I look forward to the collaborative work of the Program Administrators and the EEAC to continue and enhance Massachusetts's national leadership on energy efficiency while boldly combatting climate change and ensuring these programs are accessible to low- and moderate-income residents and environmental justice communities.

Sincerely,

K. Theoharides

Kathleen Theoharides
Secretary of Energy and Environmental Affairs

APPENDIX 1
ASSUMPTIONS AND METHODOLOGY

Greenhouse Gas Emissions Reduction Requirement for Mass Save® - Methodology

Interim Clean Energy & Climate Plan for 2030

The primary actions in the Interim Clean Energy & Climate Plan (CECP) for 2030 relevant to the Mass Save® plans[4] include retirement and replacement of space heating and cooling equipment, domestic hot water equipment, and key components that comprise a building's envelope, such as windows and insulation. The sum of these changes to equipment and envelope stock in any given year in the full CECP (2021 – 2030) over time results in a net change in annual energy consumption, which, through the emissions factors described below, results in a projection of net change in annual greenhouse gas (GHG) emissions.

The aggregation of the equipment turnover modeled in 2022, 2023, and 2024, and the resulting year-over-year changes in energy consumption, correspond to the measures and annual energy savings comprising the 2022–2024 Mass Save plans. Since Mass Save only covers the service territories of the Commonwealth's investor-owned gas and electric utilities, for the purposes of this computation, a portion of the changes to statewide energy savings (reflecting an estimate of built square feet serviced by municipal-owned utilities) are excluded from the Mass Save GHG reduction requirement. The resulting annual energy savings from each of the three years are summed to produce a cumulative annual energy savings representing the impact of all relevant measures installed from January 1, 2022 through December 31, 2024. Since the actions described in the CECP reflect long-lived building components, no degradation by 2030 is assumed.

In the CECP, cumulative annual energy savings are simply multiplied by the average emission factors noted below to arrive at the cumulative annual GHG emission reduction that the 2022–2024 Mass Save plans should achieve in order to align with the reductions specified in the CECP. Because the emissions limits and sublimits specified in M.G.L. Ch. 21(N) reflect emissions in 2025 and 2030, separate quantifications of GHG emission reductions are estimated, anticipating future deployment of non-emitting electricity resources.

Mass Save Plans by Fuels

The Mass Save® programs are established every three years and require two joint statewide plans; an energy efficiency plan funded through electric ratepayers, and a gas efficiency plan funded through gas ratepayers. The joint statewide energy efficiency plan includes electric, heating oil, and propane energy efficiency measures, including fuel switching from delivered

[4] Mass Save refers to the joint effort of the Massachusetts electric and gas program administrators to implement energy efficiency measures pursuant to G.L. c. 25, sec. 21.

fuels to electricity and active demand management programs. The joint statewide gas efficiency plan includes measures that apply to natural gas usage. The net change in use of these fuels (electricity, gas, heating oil, and propane) is the source of GHG emissions reductions achieved through the Mass Save program.

Sectors

The budgeting and implementation of these two statewide plans is conducted on a sector basis, with funding provided by residential ratepayers for residential and income-eligible programs, and by commercial ratepayers for commercial and industrial programs.

Measures

The Mass Save plans are implemented through investments that result in a reduction and/or shift in fuel or energy use in buildings over time. These fuel-use and energy-saving quantities are calculated in the benefit-cost models during the development of each of the three-year plans. The plans include a budget and target energy-savings level for each program, initiative, and measure to be implemented over the three-year term. Each measure also has an expected measure life, calculated based on independent monitoring and evaluation studies. The "measure life" is a forecast of the average expected time that a measure is predicted to perform above and beyond what would otherwise have occurred absent the Mass Save program. These energy savings by fuel and the evaluated timespan of these measures were used to calculate GHG emissions reductions. Measure lives are rounded to the nearest 6 months and range from 1 year to 25 years, depending on the durability of the measure.

Timing of GHG Emission Reductions

For the 2022–2024 Mass Save plans (2022–2024 Plans), investments begin on January 1, 2022, and continue until December 31, 2024. As a result, the first full year during which the maximum energy reductions for the 2022–2024 investments will occur is calendar year 2025. Due to the long measure lives of many Mass Save investments, the majority of GHG emission reductions from investments made during the 2022–2024 Plan are expected to continue in 2030, with a smaller proportion in 2040, and have little quantifiable emissions impact in 2050.

Historically, the Mass Save programs have reported GHG emissions on both an annual basis, and over the full lifetime of a measure or set of measures. Both metrics take a single year in isolation and ignore the emissions reductions of preceding and subsequent years, the gradual decay of the emissions reductions over time, or changes to the emissions impacts of a unit of energy conserved (see electricity emission factors below). This approach does not allow for alignment and comparison between the historical Mass Save program reporting and the annual statewide

inventory of Mass DEP[5] and the GHG reporting requirements of the Commonwealth. Accordingly, the Mass Save GHG emissions reduction goals are being set, and will be required to be reported on, as the aggregate GHG emissions reductions to be achieved with energy efficiency measures implemented in 2022–2024 and are expressed as aggregate metric tons of carbon dioxide equivalent, to be measured at the conclusion of the three-year plan period.

Evaluated Measure lives

Because evaluated measure lives can be changed by future evaluation studies, DOER and the Mass Save program administrators will use the measure lives as currently calculated effective July 1, 2021 and anticipated for the 2022–2024 plans as the basis for setting and assessing achievement towards this GHG emissions reduction goal.

Part Year Measure Application

For a subset of measures, their expected measure life results in the end of life part-way through either 2025 or 2030. For example, measures with a measure life of 7 years installed in the 3rd quarter of 2023 would be modeled to end their expected energy savings and corresponding GHG emissions reduction in the 3rd quarter of 2030. In the real world, there will be a gradual decay in measure emission reductions over a much wider time horizon, averaging 7 years in this example. For simplicity of calculation, DOER and the Program Administrators will assume that all measures installed at any time during a plan year, for example in 2023 with a 7-year measure life, will count as having 50% of their annual GHG emissions reduction in calendar year 2030, and so forth for other measure lives that end during calendar year 2025 or 2030.

Adjusted Gross Savings

The Mass Save programs conduct evaluation studies to assess the extent to which supported measures would have been otherwise installed absent their intervention. Based on these evaluation studies, they apply net-to-gross adjustment factors that generally reduce claimable 'net' savings from the adjusted gross savings achieved by the measures installed. Net savings are the best way of showing the economic benefit of the Mass Save program investments. However, adjusted gross savings are the more applicable metric for the purpose of quantifying GHG emission reductions. Accordingly, the adjusted gross savings are used to set and assess progress towards achieving the Mass Save GHG reduction goal.

[5] https://www.mass.gov/lists/massdep-emissions-inventories

Emission Factors

To set a transparent and fair GHG emissions reduction requirement, the emission factors used to set the GHG reduction goal should also be used to report and assess progress towards achieving the Mass Save GHG reduction goal. This consistency across multiple years argues for simplicity and transparency in selecting the emission factors, while accounting for predictable changes in these factors over time.

Electric Sector GHG Emission Factors

For the purposes of developing the CECP for 2030[6] and the Massachusetts Decarbonization Roadmap for 2050,[7] the Executive Office of Energy and Environmental Affairs (EEA) produced a forecast of emission factors from the electric generation sector for each 5-year increment from 2020 to 2050 and an interpolation for each year in between. The 2030 CECP is still under development, so the emission factors listed below, while fixed for this Mass Save GHG emission reduction goal, are subject to change in the final 2030 CECP, pending additional policies that impact gross load, deployment of non-emitting electricity sources, or settlement of clean energy attributes. This use of the current EEA forecast of average electric emission factors, shown in Table 3 below, allows for a consistent basis for both planning and evaluating the 2022–2024 plans' achievement of their GHG emissions reduction goals. Based on the broad mix of Mass Save program measures and the years-long time horizon for evaluating them, the average annual emissions factor, rather than more granular marginal emission factor will be applied to all measures.

Table 3. Average Electric Emission Factors by Year for Massachusetts in 2025 and 2030

Year	Metric Tons of Emissions per MWh (metric tons of CO_2e)
2025	0.1869
2030	0.1065

On-Site Fuel GHG Emission Factors

The emission factors of fossil fuels relevant to the Mass Save programs, natural gas, #2 heating oil, propane, are much more stable over time than the average emission factor for electricity utilized by buildings in Massachusetts over the course of a calendar year. While the carbon content and GHG emissions of these fuels vary over time, for ease of transparency and simplicity, the Program Administrators should hold emission factors constant, based on carbon dioxide emissions from combustion of these fuels, using currently reported national values from the US Energy Information Administration (EIA)[8] and reproduced below with units of metric tons of CO_2e per million BTU in Table 4:

[6] https://www.mass.gov/info-details/massachusetts-clean-energy-and-climate-plan-for-2030
[7] https://www.mass.gov/info-details/ma-decarbonization-roadmap
[8] https://www.eia.gov/environment/emissions/co2_vol_mass.php accessed on July 1, 2021

Table 4: EIA Carbon Dioxide Emissions Coefficients by Fuel

Year	Natural Gas (metric tons of CO_2e/MMBtu)	Heating Oil (metric tons of CO_2e/MMBtu)	Propane (metric tons of CO_2e/MMBtu)
2025	0.05307	0.07879	0.06307
2030	0.05307	0.07879	0.06307

In holding these emission factors constant, this assumption does not include upstream emissions, such as from methane leaks in the natural gas distribution network or leakage of SF_6 in the electric transmission and distribution grid. Equally this assumption ignores the potential for renewable fuel blending such as bio-fuels and renewable natural gas or green hydrogen being introduced into these fuels in the 2025 and 2030 time horizon, which would reduce the GHG emissions reductions from energy efficiency measures. This assumption of unchanged fuel emissions factors assists in the avoidance of double-counting between Mass Save investments and other potential policy actions that might change the carbon content in the supply of these fuels. It allows Mass Save to compare investing in a measure to a counterfactual of not doing so.

Other Unanticipated Variables

In the event of unforeseen and unanticipated variables leading to notable changes between the 2022–2024 plan forecast and the 2025 and 2030 reporting years, the Mass Save Program Administrators and the Massachusetts Department of Energy Resources will endeavor to follow the principles of transparency and simplicity in quantifying any modifications needed and agreed to by both parties in reporting the results of the 2022–2024 plans.

Reporting on the Mass Save GHG Emissions Reduction Goal

To provide a fair evaluation of the Mass Save program implementation results, the final set of energy savings and resulting GHG emission reductions need to use a consistent set of assumptions to the set that were used to calculate the requirement initially. However, by 2025 and 2030 there will be updated information related to savings, measure lives, emissions factors and so on, that if applied would change the results. In recognition of this inevitable outcome, the reporting on the success of each the plan's achievement of its GHG emissions reduction goal will be done in two separate sets of calculations. The first is an 'apple-to-apples' calculation using the available information in July 2021 to evaluate the Mass Save plan results using the same set of assumptions used to set this goal. The second is a 'best-available-data' calculation using updated assumptions on emissions factors, measure effectiveness, measure lives, and other variables that incorporate updated data at the time of reporting. The former 'apples-to-apples' calculation is intended to provide a fair benchmark to evaluate the success of the plans in meeting this goal.

The ‘best-available-data’ calculation is intended separately to inform progress towards the Commonwealth’s GWSA limits and sublimits.

APPENDIX E: EQUITY TARGETS

MA EEAC Equity Working Group
Equity Targets for 2022-2024 Three-Year Plan

The Massachusetts Energy Efficiency Advisory Council (EEAC) and Program Administrators (PAs) are committed to improving the equitable delivery of energy efficiency programs. In 2020, the EEAC established the Equity Working Group (EWG) to focus attention on customer groups identified through analysis of nonparticipants. Based on this evaluation research, the EEAC identified underservice to moderate-income customers, renters and landlords, households with a primary language other than English, and small businesses when compared to other program participants. The EWG agrees that it should be priority of the Mass Save® programs to remedy past underservice in order to ensure program equity moving forward. The EWG also recognizes that equitable decarbonization also prevents customers and communities historically underserved from being further left behind.

The EWG is comprised of voting EEAC Councilors, representatives of the PAs and the Low-Income Energy Affordability Network (LEAN), representatives of environmental justice organizations, and the EEAC Consultants. (Appendix A provides the EWG membership with affiliations.) The EWG has worked collaboratively with stakeholders and other members of the public who have called for more equitable delivery of services over the years.

The EWG has developed the following targets for the consideration of the full EEAC in order to guide investments in equity and assess performance in the 2022-2024 Energy Efficiency Plan. The EWG understands that the framework that is crafted today, at the beginning of this important journey for a new three-year plan, is a starting point. As the EEAC learns throughout the implementation process, it may find that metrics will need to change over time. All members of the EWG have agreed, through a consensus-based discussion, to these targets.

Principles

- Targets are results-oriented and time-bound.
- Targets are established statewide except for EJ Communities, which are established individually for each PA.
- PAs will report on equity efforts in quarterly report narratives.
- Targets are year-over-year unless otherwise stated. When performance in an early year exceeds a percent increase goal, baseline will not change, and overage can count toward later year targets.
- Participants can and should be counted in as many customer segments as appropriate (e.g., a moderate-income renter household will show up in participant counts for both moderate-income and renter).
- "Environmental Justice Municipalities" will be defined for the purposes of this framework as: [PA-served communities where (1) greater than 33% of the population resides in an environmental justice block group and the municipality (as a whole) meets the EJ municipality's income criteria and at least one additional criterion (e.g., minority or English isolation) (based on 2020 data posted at state website); and (2) consumption weighted participation rate from the Residential Non-Participant Customer Profile Study does not exceed 30%]. The list of Environmental Justice Municipalities is set forth at Appendix B.

EJ Municipalities

- Increase Plan over Plan investment[1] by each PA in Environmental Justice Municipalities. Percent increases will be established for each PA and each sector separately.[2]
- Increase number of participants in Environmental Justice Municipalities Plan over Plan by a percent to be set for each PA individually.
- Baselines to be established using 2019-2021 actual data normalized with the 2022-2024 BCR model with lighting removed from the baseline and actuals.
- Data to be reported annually in the Q4 report.

Workforce

- Conduct EM&V study and share initial results in 2022 to analyze whether and to what extent substantial disparities exist between the availability and PA utilization of state-certified minority and woman-owned business enterprises (M/WBE) in procurement for lead vendors and subcontractors by the PAs (statewide and individually) related to energy efficiency programs and services, including actionable recommendations for how to increase both the availability and PA utilization.
- Over the three-year term, at least 120 people will complete training and be placed in relevant industry positions through Clean Energy Pathways, with at least 90 people being Women, Black, Indigenous, or People of Color, fluent in language(s) other than English, and/or from EJ block groups at time of enrollment. PAs will emphasize the value of retention to the measurable success of Clean Energy Pathways and will study success in achieving retention in both training and job placement in the evaluation of the program.
- PAs will track and report annually on the number of M/WBEs contracts and spend for contracts that are directly between PAs and vendors that are M/WBEs and also report total number and spend of all direct contracts.
- PAs will hold at least two workshops per year for contractors to provide education on PA programs in order to increase ability of new M/WBE vendors to participate; PAs to target advertising for the workshop to likely M/WBE contractors.
- At least once per year, the PAs will perform direct targeted outreach to all Massachusetts-certified M/WBEs listed in the Massachusetts Supplier Diversity Office's Directory of Certified Businesses with a Description of Services that indicates that they provide services or equipment that are likely eligible for Mass Save contracts, subcontracts, or incentives. A description of the outreach methods and number and types of businesses contacted will be reported annually in the Q4 report.

Partnerships

- Partnerships with municipalities, community organizations, or business associations will be established in at least 75% of Environmental Justice Municipalities. These partnerships may be

[1] "Plan over Plan" is 2019-2021 compared to 2022-2024. "Investment" is defined as incentives and money spent for Clean Energy Pathways internships, Municipal Partners, targeted marketing, and other direct/geographically targeted investments.

[2] PAs will gather and report data on 2019-2021 EJ investment by PA and by sector by the end of Q1 in 2022. Percent increases will be established by the EEAC and PAs by the end of Q2 in 2022.

formal "Municipal and Community Partnership" arrangements or other partnerships[3] outside of that program that aim to improve service to one or more of the identified underserved customer groups.

- Track and report annually the number of customer accounts participating and units served in the PA programs in the established Municipal and Community Partnerships municipalities, broken out and reported by sector and by renters, moderate-income qualified, English-isolated customers, and small business turnkey.
- Track and report annually the number of outreach activities (marketing campaigns, events, community engagements, etc.) initiated and completed by Municipal and Community Partner for each underserved customer segment focused on by each Partner (renter, moderate-income, English-isolated, and small/microbusiness).
- Track and report annually the level of program investment (award amount) for each Partnership Team and which segments each Partnership Team is focusing their efforts on.

Renters

- Increase renter unit participation by 24% from 2021 to 2024, achieved as an increase of 7% in 2022, 7.5% in 2023, and 8% in 2023 in RCD (baseline to be established using 2021 actual data normalized with the 2022-2024 BCR model). PAs will prepare a strategic plan with detailed examples of how the PAs will serve renters, with a draft by the end of Q2 2022, and a final by the end of Q3 2022.
- Increase number of renter units served in attached low-rise buildings by at least 16% from 2022 to 2024, achieved as an increase of 8% year over year for both Residential RCD and Income Eligible Coordinated Delivery, which shall be reported separately (2022 to be baseline year). Report separately the number of attached low-rise projects that are 25+ units.
- Data to be reported twice each year.

Moderate Income

- Increase number of moderate-income weatherization jobs by 700% from baseline to 2024, achieved as an increase of 100% year over year (baseline to be established using 2019 actual data).
- Increase number of moderate-income heating systems replaced by 56% from 2022 to 2024, achieved as an increase of 25% year over year (2022 to be baseline year).
- Data to be reported quarterly.

English Isolated[4]

- Increase number of participants who receive a Home Energy Assessment (HEA) in Residential Coordinated Delivery or online assessment, or energy assessment in Income Eligible Coordinated Delivery, in Spanish or Portuguese by 21% from 2022 to 2024, achieved as an

[3] Partnerships may include municipalities or regional or community-based organizations with which the PAs have established cooperative agreements to collaborate, including through memorandums of understanding and/or memorandums of agreement. Partnerships are also intended to focus on increasing energy efficiency services, including K-12 and vocational education, electrification, and energy burden reduction, as identified by and targeted toward historically underserved populations.

[4] Defined as households in which no one 14 and over speaks English only or speaks a language other than English at home and speaks English very well.

increase of 10% year over year in Residential and Income Eligible sectors, which sectors shall be reported separately (2022 to be baseline year). Data to be reported twice each year.

- Increase by 10% from 2022 to 2024, achieved as an increase of 5% year over year the number of participants who receive weatherization after receiving an HEA in Residential Coordinated Delivery or energy assessment in Income Eligible Coordinated Delivery in Spanish or Portuguese (2022 to be baseline year). Data to be reported twice each year.
- A Mass Save Language Access Plan will be developed, with analysis completed in 2022 for Residential Coordinated Delivery and Income Eligible Coordinated Delivery, and implementation commencing by the end of the second quarter of 2023. The full Language Access Plan will be completed by the end of Q1 2024. The Plan will address how customers are to be served in their preferred language, and will coordinate PA language resources to allow PAs, lead vendors, contractors, and suppliers to access needed translation and interpretation services.
- By the end of 2024, the PAs will be able to offer Home Energy Assessments (either performed by a fluent contractor or with an interpreter) in five languages other than English, which are currently expected to be Spanish, Portuguese, Mandarin, Cantonese, and Haitian Creole.

Small Business

- Complete 600 small business weatherization projects in 2022, 700 in 2023, and 800 in 2024.
- By 2024, complete a repeat of the C&I 2020 nonparticipant study to analyze participation rates of small and microbusinesses (including small nonprofit organizations) and study barriers to participation. Comparing results of the 2020 and the 2024 studies, increase the percentage of population savings achieved (combined for electric and gas) for non-lighting end uses among microbusinesses by 5%.

Appendix A: MA EEAC Equity Working Group Members, with Affiliations

Name	Position
Maggie McCarey	DOER
Alexis Washburn	DOER
Cindy Arcate	Representing Massachusetts Non-Profits
Charlie Harak	Representing Organized Labor
Cammy Peterson (Chair)	Representing Commonwealth Cities & Towns
Mary Wambui (Chair)	Representing Residential Consumers
Jo Ann Bodemer	AGO
Amanda Formica	National Grid
Ruth Georges	Eversource
Stephanie Terach	Liberty Utilities
Margaret Downey	Cape Light Compact
Brian Beote	Action Inc.
James Collins	ABCD
Elizabeth Chant	EEAC Consultant
Margie Lynch	EEAC Consultant
Crystal Johnson	EEAC Consultant
Eugenia Gibbons	Healthcare Without Harm/Green Justice Coalition
Caitlin Peale Sloan	Conservation Law Foundation
Andrew Yarrows	Conservation Law Foundation
Cindy Luppi	Clean Water Action/Green Justice Coalition

Appendix B: Environmental Justice Municipalities

- Attleboro
- Boston (select zip codes, see below)
    - Allston 02134
    - Brighton 02135
    - Dorchester 02121
    - Dorchester 02122
    - Dorchester 02124
    - Dorchester 02125
    - East Boston 02128
    - Fenway/Longwood 02115
    - Mattapan 02126
    - Mission Hill 02120
    - Roxbury 02119
- Brockton
- Chelsea
- Chicopee
- Eastham
- Everett
- Fall River
- Fitchburg
- Gardner
- Gloucester
- Great Barrington
- Haverhill
- Holbrook
- Lawrence
- Lowell
- Lynn
- Malden
- Methuen
- Montague
- New Bedford
- North Adams
- Northampton
- Palmer
- Peabody
- Pittsfield
- Quincy
- Randolph
- Revere
- Southbridge
- Springfield
- Stoughton
- Taunton
- Wareham
- Webster
- West Springfield
- Williamstown
- Worcester

APPENDIX F: POTENTIAL STUDIES

Please see the separate file for Appendix F.

APPENDIX G: PA-SPECIFIC PROGRAMMING

Cape Light Compact Program Enhancements

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. Both the Compact's Governing Board and the Energy Efficiency Advisory Council ("Council") support and voted to approve the Compact's enhancements. The Compact proposes statewide enhancements in accordance with its authority under G.L. c. 164, §134(b) and in an effort to best meet the needs and demands of its customer base.

In developing drafts of the 2022-2024 Three-Year Plan, the Compact staff identified enhancements that are the result of the Compact's administration of its 2019-2021 Three-Year Plan, direction from the Compact's Governing Board and stakeholder input. Compact staff presented these proposed enhancements to the Compact's Governing Board at several meetings throughout the preparation of the 2022-2024 Three-Year Plan. The Governing Board conducted its final review of the Compact's proposed plan enhancements, savings goals, and budgets at its October 14, 2021 Governing Board meeting and voted to approve the proposed plan.

The following is a high-level summary of the Compact's program enhancements proposed for the 2022-2024 Three Year Plan term. A more detailed summary addressing the reporting required by the Department in *Cape Light Compact JPE*, D.P.U. 18-116 at 132-33 (2019) is set forth in Exhibit Compact-2 (Pre-filed Testimony of Margaret T. Downey), as well as in supporting Exhibit Compact-8 (Relevant Compact Governing Board Presentations and Meeting Minutes), Exhibit Compact-9 (Description of the Cape & Vineyard Electrification Offering) and Exhibit Compact-10 (Relevant Council Meeting Minutes, Resolutions and Materials).

Residential and Income Eligible Program Enhancements

Residential New Buildings and Residential New Homes and Renovations

The Compact desires to promote equitable service to low-and moderate-income customers under the Residential New Buildings and Residential New Homes and Renovations programs. In addition, the Compact's member municipalities have a strong desire to mitigate climate change and provide affordable year-round housing to residents on the Cape & Vineyard. To this end, the Compact plans to offer additional incentives up to 100% for low-and moderate-income residential multifamily new construction projects, for envelope, non-fossil fuel heating systems and funding for engineering studies and operations and maintenance contracts.

The Council reviewed these enhancements and expressly approved of them in its October 27, 2021 Resolution on the 2022-2024 Three Year Plan.

Cape & Vineyard Electrification Offering ("CVEO")

CVEO is a comprehensive strategic electrification and energy optimization offering that is aligned with the Green Communities Act, the Global Warming Solutions Act and the more recent Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy. CVEO combines home weatherization with the following cost-effective technologies:

(1) cold climate air source heat pump ("heat pump");
(2) battery storage; and
(3) solar photovoltaics ("PV").

The Compact is planning to limit the offering to 250 customers in non-gas heated homes during plan years 2022-2023. CVEO is also limited to low-income (less than or equal to 60% of state median income ("SMI")) and moderate- income (61-80% of SMI) customers. Through CVEO, these customers will: (1) convert oil, propane or electric resistance heat systems to heat pumps; (2) install solar PV systems to support electrification of their heating system; and (3) install battery storage for demand response and resiliency.

The enhanced incentives planned for by customers/income level are set forth below.

Income Level (SMI)		Customers			Heat Pumps	Solar PV + Storage
		2022	2023	Total		
Low-Income	<=60%	100	50	150	100% of cost covered (EE funds)	100% of cost covered (EE Funds and non-EE funds)
Moderate Income	61-80%	66	34	100	100% of cost covered (EE funds)	75+% of cost covered (EE funds and non-EE funds) $5,000 customer contribution cap
Total Participants		166	84	**250**		

The Compact is proposing these enhanced incentives by utilizing an innovative third-party ownership ("TPO") model for solar PV + battery storage systems, which allows the TPO to monetize tax credits and other incentive programs to reduce the impact on ratepayers.

CVEO is designed to leverage outside funding from the Federal investment tax credit, depreciation, the SMART Program, ConnectedSolutions, Clean Peak Standard, APS, and CPS.

The Council adopted an April 15, 2020 Resolution in support of CVEO and supported the current CVEO proposal as part of its review of the draft 2022-2024 Three Year Plan.

Commercial & Industrial ("C&I") Program Enhancements

The Compact proposes to offer up to 100% incentives for municipal customers, small non-profits, small businesses and micro businesses. The Compact Governing Board has a long-standing history of targeting these particular customer classes in C&I energy efficiency programming. In addition, the Commercial and Industrial Small Business Nonparticipant Customer Profile Study[1] identified several of these customer classes as having low participation rates in the energy efficiency programs. The Department has approved similar enhancements in prior Compact plans.

These enhanced incentives are also intended to help reduce the energy consumption or costs of municipalities or other governmental bodies and to help support economic development and promote job retention (e.g., lowering energy consumption or costs of small businesses assists small businesses in staying afloat and retaining employees).

The Council reviewed these enhancements and expressly approved of them in its October 27, 2021 Resolution on the 2022-2024 Three Year Plan.

[1] Available on the Council website at https://ma-eeac.org/wp-content/uploads/Final-MA19X11_B_SBNONPART-Report-20200415-1.pdf.

Eversource PA-Specific Materials

Residential and School Education

In addition to the statewide education plan, Eversource (the "Company") provides an array of additional offerings in their Residential and School Education Program. The Company recognizes the need to encourage future customers to embrace positive energy behaviors. As such, Eversource strives to provide educators with the tools they need to teach children positive energy behaviors, provide energy education and bring awareness to green job opportunities. The Company will continue to provide these offerings and develop new program components as opportunities arise during the plan term.

Eversource offers in-class programs for Grades K-8. These educational, entertaining programs teach students to be more aware of their energy habits and to develop positive energy usage habits that conserve and use natural resources wisely. Many of these programs have won national and regional awards for their creativeness and effectiveness. All these programs are science-based learning and align with the Massachusetts State Frameworks.

Eversource will continue to expand the vocational high school work force development program that currently prepares students to sit for the LEED Green Associate exam. Eversource will expand the internship opportunities available to students who pass the LEED Green Associate exam and are interested in pursuing a career in energy efficiency. The program will develop the next generation of creative problem solvers by offering teachers and students the tools they need to design a sustainable future. This program will help narrow the green skills gap in Massachusetts and encourage students to seek out jobs in energy efficiency.

The Eversource Residential and School Education Program is working closely with the Company's work force development team to ensure the K-12 education programs introduce careers in energy efficiency and green jobs. Eversource believes educating students at an early age will reveal opportunities for them to enter the energy efficiency or green job career paths. In addition, a career exploration workshop will be offered to high school students to introduce them to these careers as well as the path and credentials needed for each career.

Eversource is committed to increasing inclusion and participation in its education programs. To effectively reach students from all populations, the Company is undergoing an extensive review of each education program's offering to ensure that all programs accommodate the diverse needs of students and school districts. This process includes prioritizing increasing program development in environmental justice communities, revising program offerings to be more inclusive of the students with individual learning plans, and expanding efforts to incorporate career exploration. These priority areas are fundamental to ensuring the Company's ability to engage youth and young adults in the clean energy sector and illustrates Eversource's ongoing investment in serving customers of all ages.

Some of the programs Eversource offers K-12 students include:

- The Eversource Challenge is a prompt-based student contest for Grades K-12 to showcase the student's knowledge of saving energy, energy-efficient technologies and sustainability. The contest includes challenges ranging from poster making for

first graders to developing an energy efficiency plan for high school students. First, second and third place prizes are awarded for each grade level.

- "Kids Green Their School Program" developed and administered by "e" inc., targets inner-city, hard to reach schools in Metro-Boston to educate children, youth and caregivers about energy conservation and sustainability through standards-based science curriculum and hands-on activities. This market usually lacks the resources to educate students on STEM and sustainability. The program provides an in-depth sustainability program with two simple goals: (1) Teach children in schools some of the science underpinning an important environmental resource (in this case: energy) that the school wants to conserve so the children gain an understanding of how it is produced and what challenges are associated with it in the world; (2) Involve the children in some simple conservation tasks. To achieve these goals, students are taught concepts through a series of hands-on experiments and games. The program encourages positive energy behavior and teaches the skills needed to make a difference that can lead to a sustainable future. The program also encourages lowering the school's energy footprint and bringing home the lessons learned to lower the student's home energy footprint as well and to encourage participation in energy efficiency programs offered by Program Administrators.

- In-class and virtual programming is offered to students in Grades K – 8. Wattsville® is offered to K-2 students to teach energy efficiency and the importance of saving energy, The National Theatre for Children offers Grades 3-5 skits featuring a variety of characters and scenes that introduce students to different topics in saving energy and new technologies and for Grade 6-8 students Eversource offers EnergyQuest® which allows students the opportunity to become energy investigators in an interactive environment to learn more about energy usage and new technologies.

- The EcoRise Green Building Academy advances the goal of Eversource to enrich Massachusetts communities by engaging high school students with rich green building instructional, internship, and credentialling opportunities. The EcoRise Green Building Academy (GBA)—formerly known as the LEED Prep Program—is an innovative program that advances environmental and STEM learning, sustainable communities, workforce development, and youth engagement. With this program, teachers across Massachusetts are using their school building and grounds as teaching tools to advance concepts related to sustainability, green building, and energy efficiency. The foundation of the program is the EcoRise *Green Building Lessons for a Sustainable Future* curriculum, a comprehensive course that helps students gain both the skills and knowledge necessary to acquire the LEED Green Associate™ credential by the time they graduate from high school. In addition to the hands-on lessons, participating teachers are paired with green professional mentors and have access to in-person and virtual professional learning opportunities and year-round support. Eversource continues to recruit new schools to the program every year.

- Teacher workshops are offered statewide with other Program Administrators. Eversource goes beyond the state workshops and offers additional workshops for teachers in the Eversource electric and gas service territories. These workshops offer curriculum and resources to teachers so they can teach the lessons to their students. In conjunction with these workshops many schools throughout the Eversource territory have participated in the NEED Youth Awards program. Eversource has had many national and regional winners in this awards program.

- During the pandemic, Eversource introduced at home family lessons and activities for students to do while learning remotely. Students performed activities and experiments on the benefits of insulation, a vampire load scavenger hunt, compared various types of lighting and also built solar cookers. Students were encouraged to share photos on social media of their families completing the activities. Eversource intends to continue these family lessons into 2022 and beyond.

- To educate residential customers, Eversource has supplied local libraries with KILL-A-WATT meters for patrons to check out. The kit allows customers to explore three types of electric use: plug, lighting, and mechanical. The kits measure and record the amount of electricity consumed by a small appliance. A booklet that gives tips on reducing energy consumption and costs is provided with the meters. This initiative will be updated to educate customers on new technologies available and the benefits associated with these technologies.

Eversource is committed to working with all communities and schools in its territory to enhance education and customer awareness of energy savings opportunities, tips and new energy efficient technologies. Eversource encourages all of its students and customers to be responsible energy consumers.

APPENDIX H: STRATEGIC EVALUATION PLAN

mass save
Savings through energy efficiency

2022-2024

Massachusetts Statewide Energy Efficiency

Strategic Evaluation Plan

October 2021 Filing

November 1, 2021

WE ARE MASS SAVE®:

BERKSHIRE GAS
An AVANGRID Company

Cape Light Compact

EVERSOURCE

Liberty

nationalgrid

Unitil

TABLE OF CONTENTS

SECTION 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 supports the development and continuous improvement of cost-effective demand side management (DSM) programs as they adapt to changing markets. Evaluation plays an essential role in the program lifecycle, from conducting market research in support of new program designs, to developing program theory, to assessing demonstration projects for new offers, and ultimately evaluating verified savings and benefits from mature programs. Massachusetts has invested heavily in EM&V research, and leads the country in terms of comprehensive, in-depth evaluation. From 2016-2020, the PAs conducted over 200 EM&V studies,[1] at a cost of over $96 million.[2]

The EM&V studies are managed by the Evaluation Management Committee (EMC). The EMC is a collaborative group of energy efficiency Program Administrators (PAs) and the Energy Efficiency Advisory Council (EEAC or Council) EM&V Consultants. Every three years, as part of the statewide planning process, the EMC reflects on lessons learned from past research, seeks input from stakeholders, and identifies research priorities for the coming term. To prepare this Strategic Evaluation Plan (SEP), the EMC conducted a series of planning workshops in January and February 2021, involving PA evaluation staff, EEAC EM&V Consultants, EM&V vendors, PA program implementers, EEAC implementation Consultants, and Department of Energy Resources (DOER) staff. These workshops identified lessons learned from evaluations conducted in the 2019-2021 Plan term and identified future research priorities. In addition, EMC representatives attended each of the six EEAC planning workshops from November 2020 through January 2021, and incorporated requests for evaluation research and recommendations pertaining to evaluation into the 2022-2024 Plan.[3] The resulting 2022-2024 SEP is EMC's roadmap that will guide EM&V studies for the next three years.

The 2022-2024 term will be a time of rapid change and innovation, and EM&V is actively engaged to support the programs as they adapt. The PAs are placing top priority on electrification, equity, and workforce development, and evaluation will follow these program priorities. To support electrification, EM&V will help quantify and document the conditions under which heat pumps benefit customers and save energy, barriers to heat pump adoption, and progress toward transforming the HVAC market to favor heat pump adoption. With regard to equity, EM&V will provide research to support expanding participation among key demographic groups, such as renters, moderate-income customers, and English-isolated customers, groups which have been less likely to participate in programs in the past. The PAs are establishing a new, more comprehensive workforce development program with a focus not only on training the existing workforce and introducing new skills for increasingly sophisticated equipment, but also bringing new people into the field. This includes groups that have been underrepresented in the past, such as women and minorities. As the PAs work to establish programs that create a more diverse workforce that is prepared to support future energy efficiency goals, EM&V will be there to clarify program theory, identify indicators of success, and track progress over time.

At the same time, evaluation will reduce its focus on studies for measures that are no longer a focus of the programs. For example, while energy efficiency programs have historically invested substantial efforts in improving lighting efficiency, lighting markets have evolved; much of the residential market, and an increasing portion of the commercial and industrial (C&I) market, no longer needs PA support to motivate purchases of efficient lighting. For many years EM&V has helped

[1] Source: Completed studies from 2016 Plan Year Report, 2016-2018 Term Report, 2017 Plan Year Report, 2018 Plan Year Report, and 2019-2021 Three Year Plan.
[2] Source: 2019-2020 evaluation study budgets, plus 2016-2018 Evaluation and Market Research spending for electric and gas. Note the 2016 -2018 figures Include evaluation staff salaries, which account for approximately 10% to 20% of the total, as well as potential studies, which are conducted outside the EM&V framework.
[3] For meeting materials from these workshops, see https://ma-eeac.org/latest-council-meetings-materials/.

track the evolution of lighting markets, and as markets have transformed, EM&V has provided data to inform programs about where incentives and other support are still needed, and what remaining potential exists for lighting. However, that same level of lighting research is no longer required.

PA programs are also adapting to focus on new opportunities such as networked lighting controls and performance optimization opportunities (e.g., Energy Management Systems (EMS) and retrocommissioning (RCx)). EM&V is providing data to support these efforts so that programs can understand potential savings from these measures. PAs are also seeking to expand participation in well-established non-lighting opportunities, such as weatherization and heating, ventilation, and air conditioning (HVAC) incentives. The PAs continue to innovate with new Active Demand Response (ADR) programs designed to reduce system peak demand, and EM&V has responded by evaluating each new demonstration project and program offer, including electric vehicle (EV) charging equipment, batteries, and winter demand curtailment.

The EMC is focused on identifying the research that is needed most to help programs adapt and improve. The EMC has developed a balanced portfolio of research designed to provide program accountability and insights. Evaluation resources are allocated in light of current and expected future contributions to savings, uncertainty around savings, new measures, and need to support program changes. The EMC is committed to providing transparent and rigorous EM&V studies that are useful, timely, and targeted to provide the most value to programs and ratepayers.

SECTION 2: TYPES OF EM&V STUDIES

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. EM&V includes the following types of studies, which are often conducted in coordination with each other:

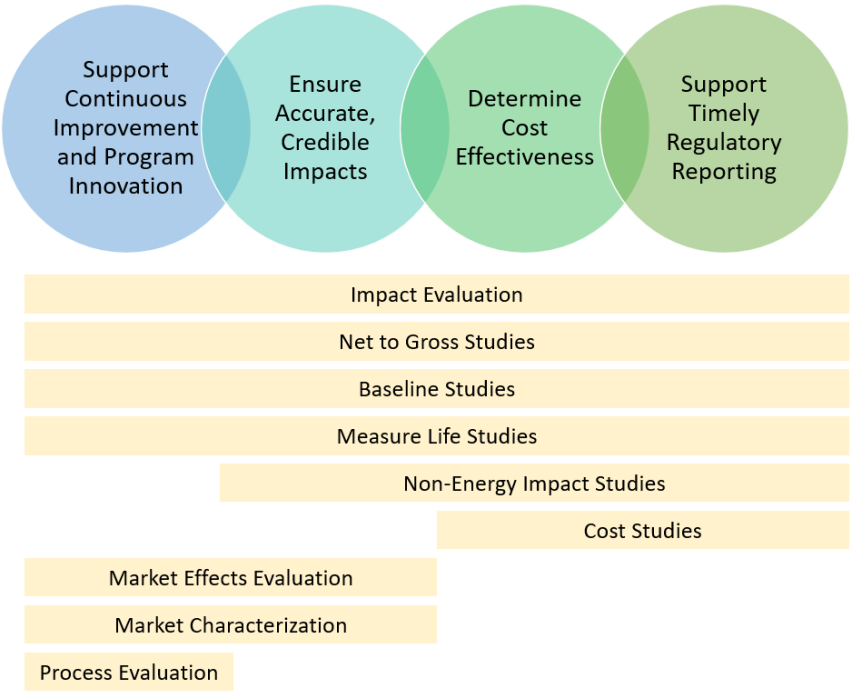
- **Impact evaluation** refers to the measurement of gross energy and demand (electric and natural gas) savings achieved within program populations. Impact evaluations may also include the study of key impact factors to estimate savings and benefits, such as in-service rates and other resource savings, including water and non-utility fuels (e.g., propane and oil).
- **Net-to-gross (NTG) studies** refer to specific research that quantifies program influence by estimating free-ridership and the various components of spillover (e.g., participant and/or non-participant spillover).
- **Baseline studies** refer to specific research to determine baselines, such as industry-standard practice baselines. Baseline research is sometimes conducted concurrently with impact evaluation research.
- **Measure life studies** research equipment life and the effects of measure persistence. Equipment life is the number of years that a measure is installed and will operate until failure. Measure persistence takes into account business turnover, early retirement of installed equipment, and other reasons measures might be removed or discontinued.
- **Non-energy impact (NEI) studies** refer to research that estimates NEIs of DSM measures, including participant and utility benefits. These impacts include changes in operations and maintenance (O&M), comfort, productivity, avoided arrearages, etc.
- **Cost studies** include research to determine the total and incremental costs of DSM measures.
- **Market effects evaluation** refers to the measurement of the long-term effects that programs or measures have on the structure and functioning of their target markets (e.g., changing product availability and pricing).
- **Market characterization** refers to the systematic assessment of product and service markets for the purpose of improving the design and 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.

SECTION 3: PURPOSES OF EVALUATION

The key purposes of EM&V are to support continuous program improvement and program innovation, ensure accurate and credible impacts, determine cost effectiveness, and support timely regulatory reporting to the Department of Public Utilities (DPU) and the ISO New England (ISO). These purposes are interactive and are all equally important. Figure 1 and subsequent sections outline these purposes and their interaction with study types.

Figure 1: Purposes of Evaluation and Study Types



3.1 SUPPORT CONTINUOUS IMPROVEMENT AND PROGRAM INNOVATION

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 above.

3.2 ENSURE ACCURATE, CREDIBLE IMPACTS

EM&V ensures that program impacts reported to stakeholders are credible and sufficiently accurate for decision-making. Program impacts include gross 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. As shown in Figure 1 above, nearly all of the evaluation study types are designed to support accurate and credible impacts.

3.3 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 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.

3.4 SUPPORT TIMELY REGULATORY REPORTING

Fundamentally, EM&V is used to meet regulatory commitments to the DPU and the 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 PAs' internal departments.[4]

SECTION 4: EM&V FRAMEWORK AND APPROACH

4.1 BACKGROUND

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 has 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, 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.

[4] Such as load forecasting, planning, and program implementation.

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 evaluation efforts across fuels (e.g., electric and gas energy efficiency measures) to the maximum extent possible. The PAs will be the main mechanism for contracting with the independent evaluators and will work with evaluation contractors to maintain privacy of customer data.

4.2 EVALUATION MANAGEMENT COMMITTEE

The PAs and the EM&V Consultants established the EMC to mirror the structure of the other statewide management committees, the Residential Management Committee (RMC) and the C&I Management Committee (CIMC). 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 2019 the EMC formed a subcommittee to develop, document, and implement an ex-ante review process, through which energy efficiency projects could receive evaluation review on the front-end to vet and provide feedback on project assumptions, including the baseline. The group worked together to implement a consistent statewide ex-ante review process that was approved by the EEAC Consultants and rolled out for implementation use in 2020. This policy has helped program evaluators work more closely with program implementers and provide greater assurance of baseline assumptions for high-profile projects. The EMC will continue to establish appropriate working groups to address issues as they arise and keep the EM&V process running smoothly.

4.3 APPEALS PROCESS

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 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.

The EMC has been critical to keeping communication channels open. To date, all disagreements have been resolved through a 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.

4.4 CONSIDERATIONS FOR STUDY PRIORITIZATION/PLANNING

In planning EM&V studies, the EMC considers multiple factors, which are collectively intended to assess potential evaluation activities, identify priorities, and determine the appropriate timing of all evaluation efforts. These factors are consistent with the EM&V purposes described above. 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 or potential future savings.
    - Requests from program implementers.
    - Regulatory requirements or policy relevance.
- **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, applicability to Massachusetts (if from other jurisdictions), 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.
- **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 programs to be evaluated.
- **Flexibility**. Unanticipated evaluation needs may arise over time. To ensure that these issues may be addressed, the PAs will allocate sufficient resources for unplanned, ad hoc evaluation efforts, including Quick Hit studies.[5] 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 between small and large PAs, natural gas and electric PAs, or across definable economic/demographic areas of the

[5] Quick Hit studies expedite the standard staged process of decision making. They are used to produce answers to important researchable questions in an expedited manner, and thus provide more timely feedback to program managers and implementation staff. They typically have targeted scopes and budgets of less than $100,000.

state. When appropriate, evaluation research activities may be implemented in a manner that ensures consideration, identification, and documentation of any such legitimate differences.

4.5 EVALUATION LIFECYCLE

The stages through which a project moves from initial concept to completion are shown in Figure 2 below.

Figure 2: Stages of Evaluation

Stage	Document Under Review	Description
Stage One: Conceptual Framework	1-Page Summary	Document provides conceptual framework for the project, including a very high-level budget and timeline, as well as the objective or goal.
Stage Two: Preliminary (High-Level) Work Plan	2- to 3-Page Summary	Stage 2 work plan provides strategies to meet research objectives, 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 One plan.
Stage Three: Detailed Work Plan	3- to 25-Page Work Plan	Stage 3 work plan provides detailed sampling and analysis plans, specific staffing needs, and milestone deliverables.
Stage Four: 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 Five: Reporting	Draft Report	Reporting includes the period from draft report through final report and any review/communications/meetings in between.
Stage Six: Complete	Final Report	Report is finalized, published on the EEAC website, 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 able to not only better manage the review process but also effectively stage studies across the four research areas.

The methods by which various stakeholders, such as program implementers, DOER, and EEAC counselors, are engaged can vary based on the stage of evaluation. The PAs have hosted strategic evaluation planning meetings to encourage participation in the early stages of the evaluation planning process and solicit input from a wide variety of program stakeholders. There is also 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. Input from non-utility stakeholders represented on the Council generally flows through the EM&V Consultants. A representative from the EMC attends RMC and CIMC meetings as frequently as possible in order to facilitate coordination and solicit feedback from the various management councils and working groups.

Much of the stakeholder engagement about particular evaluation studies happens through the RMC and CIMC and associated subcommittees. PA evaluation staff keep management committees and subcommittees appraised of progress throughout the evaluation process, and frequently ask for input from PA staff involved in implementing programs, particularly on deliverables such as draft evaluation plans, surveys, and draft reports. PA evaluation staff will often ask evaluators to present their results in draft or final stages so that PA implementers can understand or request clarification of report findings and recommendations.

4.6 APPLICATION OF EVALUATION RESULTS AND INTEGRATION WITH PROGRAMS

Evaluation studies generally produce two types of results; a given study may produce one or both types. The first type of result is recommendations for changes or improvement to program design. PA EM&V staff discuss these recommendations with the relevant management committee, which then decides whether each recommendation will be adopted. The results of these determinations are reported with each three-year term report. In addition to formally tracking the status of recommendations, PA EM&V staff typically coordinate closely with PA program implementers to ensure they understand the implications of evaluation findings in terms of impacts on savings, how markets are evolving, and opportunities to refine program designs. EM&V staff seek to ensure consistent, ongoing communication of evaluation research, so that programs can leverage insights from EM&V studies.

Additionally, evaluation studies may produce results that affect program savings. These research results may include changes or updates to:

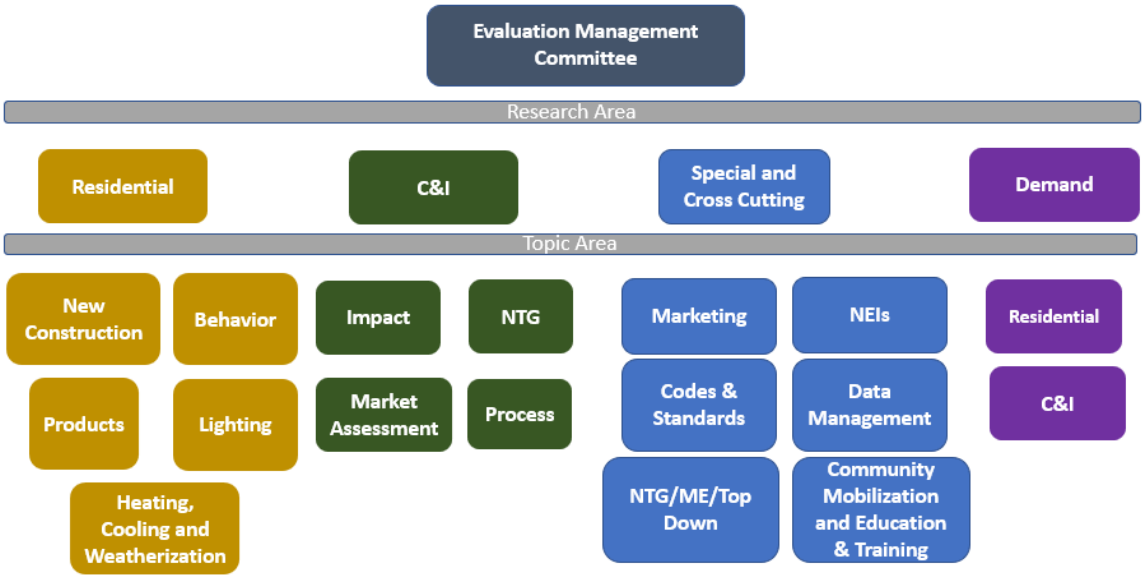
- Baseline equipment or practices.
- High-efficiency equipment or practices.
- Deemed savings or algorithms for calculating energy savings.
- Measure life.
- Other resource impacts, specifically water savings from energy efficiency measures.
- Impact factors, including:
    - In-service rate,
    - Savings persistence factor,
    - Realization rate,
    - Summer and winter peak demand coincidence factors,
    - Free-ridership and spillover rates, and
    - NTG ratios.

These research results are documented in the Technical Reference Manual (TRM), which describes how the PAs calculate savings for energy efficiency and ADR measures. In addition, the impact factors are used to update the Benefit Cost Ratio (BCR) model, which is used to calculate cost effectiveness and report on savings. Each year, as evaluation results become available, PA staff use the findings to update the TRM and each PA's BCR model. Beginning with the 2022-2024 plan, evaluation results will be applied prospectively, in accordance with DPU Order 20-150, which states that "the Department finds that the prospective application of gross and net savings impact factors to the next program year without a three-year lock-in period will improve the timing of evaluation studies, simplify the planning process, and increase certainty for Program Administrators while still providing timely feedback." Accordingly, all evaluation results that affect program savings and are finalized by an agreed-upon lock-down date in a given year will be incorporated into the TRM and BCR models to be used in the subsequent year. As in the past, PAs will track adoption of evaluation recommendations related to program design and report the status of each recommendation in the Energy Efficiency Term Report filed at the end of each term.

SECTION 5: RESEARCH AREAS OVERVIEW

In Massachusetts, EM&V is divided into four major research areas: Residential, C&I, Special and Cross Cutting (SCC), and Demand Response. Each of these research areas includes multiple topic areas, as shown in Figure 3 below.

Figure 3: Research Area Overview



SECTION 6: BUDGET

In the 2022-2024 term, the EMC expects to dedicate $47.2 million to EM&V studies.[2] This budget includes funding for independent third-party evaluators to conduct research managed by the EMC. The budget represents a 10% reduction from the planned EM&V study budget for the 2019-2021 term of $52 million. This revised budget reflects an intention to focus EM&V research on plan priorities, with less research on measures and initiative that are not a key focus of the plan, have been evaluated recently and are not expected to meaningfully change, or are not expected to make a material difference to overall program savings. The budget is intended to be oriented towards future needs and priorities, rather than assuming that EM&V spending will remain at the same level as it has in the past.

EMC expects to divide the study budget for 2022 to 2024 between the research areas as shown in Figure 4 below. Note that the SCC research area includes not only evaluation research, but also data management, which enables a third-party vendor to serve as a centralized warehouse of program tracking for all PAs to facilitate responses to data requests for evaluation.

[2] This study budget excludes PA staff labor and expenses, potential studies, costs for the AESC study, non-study consultant costs, and maintenance of the TRM.

Figure 4: EM&V Study Budget by Research Area Budgets

	Total 2022-2024 EM&V Study Budget (Million $)	Percentage
Overall Evaluation Study Budget	$ 47.2	100%
Research Area Budgets		
Commercial and Industrial	$ 16.6	35%
Residential	$ 10.8	23%
Income Eligible	$ 4.7	10%
Special and Cross Cutting	$ 12.7	27%
Demand Response	$ 2.4	5%

Figure 5 shows the 2019-2021 and 2022-2024 budget allocations by fuel and sector categories (where the Special and Cross Cutting and Demand Response research area spending is distributed to each of the three sectors). The budget allocation across fuels for 2022-2024 is based on budgeted evaluation spending by fuel in 2019-2020. The budget allocation across sectors for 2022-2024 is informed by prior spending levels, anticipated needs for research in the 2022-2024 term, and contribution to portfolio benefits. In particular, EMC has slightly increased the allocation of budget to C&I evaluations to reflect recent spending trends, planned studies, and the fact that C&I savings accounted for the 53 percent of benefits across the portfolio in 2019-2020.

Figure 5: EM&V Study Budget by Sector Categories and Fuel

	Budgeted Percentage 2019-2021	Budgeted Percentage 2022-2024
Fuel		
Electric	70%	70%
Gas	30%	30%
Sector Categories		
Commercial and Industrial	39%	51%
Residential	47%	39%
Income Eligible	14%	10%

The EMC conducts a competitive Request for Proposal (RFP) process to award contracts to independent evaluation contractors, who are currently awarded three-year contracts to conduct research identified by the EMC in the following areas:[6]

- C&I Impact and NTG evaluations.
- C&I Market Assessment.
- C&I Process Evaluation.

[6] Note that Income Eligible Sector evaluations are conducted as part of the Residential Sector evaluations and are not broken out into a separate contract.

- Residential Heating, Cooling and Water Heating Equipment, Residential Consumer Products, Residential Weatherization, and Residential Behavior.
- Residential New Homes & Renovations and Residential Lighting.
- Special and Cross Cutting Codes & Standards, Market Effects/NTG, NEIs, and Top-Down Modeling.
- Special and Cross-Cutting Data Management.
- Special and Cross-Cutting Statewide Marketing.
- Special and Cross-Cutting Community Mobilization Initiatives, Education and Training.
- Demand Response: C&I.
- Demand Response: Residential.

In addition to the research area budgets above, PAs will continue to allocate resources to PA evaluation staff, including part of all of the staff costs of the approximately 28 staff representatives who participate in the EMC, as well as contractor support for PAs to manage evaluation studies, and administrative support for the EMC itself.

Note that the Evaluation and Market Research budget filed with the DPU also includes funding for limited research conducted outside the EM&V framework, including the Avoided Energy Supply Cost Study and potential studies conducted every three years by the PAs, as well as costs for maintaining the electronic Technical Reference Manual (eTRM).

SECTION 7: C&I SECTOR RESEARCH AREA

The C&I Sector research area includes all C&I initiatives, except for those covered by the SCC and Demand Response research areas. It consists of four evaluation topic areas: Impact, NTG, Process, and Market Assessment. The C&I initiatives subject to evaluation include the following:

- C&I New Buildings and Major Renovations
- C&I Existing Buildings Retrofit
- C&I New and Replacement Equipment
- Active Demand Response[7]

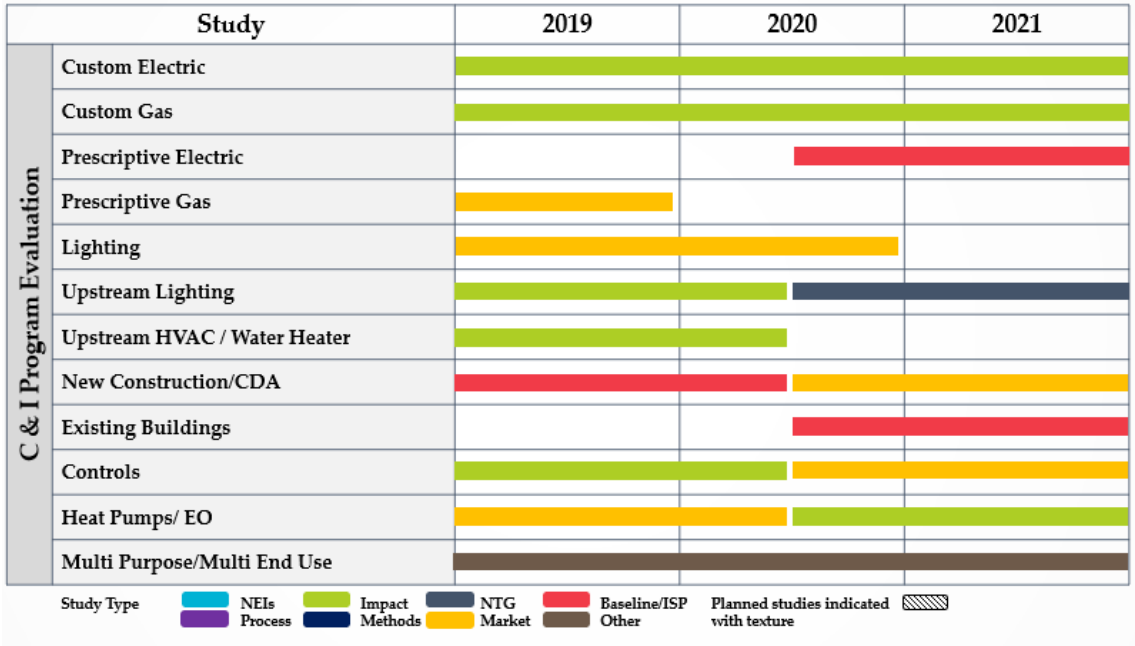
7.1 LESSONS LEARNED FROM 2019-2021 TERM

From 2019 to 2021, the PAs and EM&V Consultants supported over 30 C&I evaluation studies across a range of programs and end-uses. The EMC has prioritized impact research focused on measures that produce the vast majority of savings, particularly C&I lighting and custom program offerings, but also HVAC and water heating equipment, equipment controls, and heat pumps. In addition, the EMC has prioritized conducting baseline research and market characterizations, in order to assess typical equipment installed without program intervention as well as the evolution of key markets such as lighting. The EMC is also conducting research on emerging issues, such as controls and performance optimization offerings, which

[7] ADR evaluation studies are included in the SCC research area.

may become increasingly important as lighting savings decline. Figure 6 summarizes the C&I Sector research completed over the 2019-2021 term.

Figure 6: C&I Research Completed 2019-2021



The C&I Sector research described above has produced a considerable number of key takeaways which will help inform research priorities for the 2022-2024 term. At a high level, those takeaways can be categorized as follows:

- **Lighting.** The EMC has conducted annual lighting market assessments involving data collection from customers and market actors. This research has produced evidence of rapid market transformation in the C&I lighting segment. Despite recent impacts of the COVID-19 pandemic on product sales, the lighting market is expected to continue transforming rapidly, and further near-term study may be warranted to ensure effective program design.
- **Custom "Rolling" Impact.** During the 2016–2018 term, the EMC shifted impact evaluations to a more frequent and/or rolling approach. Over the course of the 2019-2021 term, this rolling approach has been the main framework for custom natural gas and electric evaluations, with smaller sample sizes evaluated on a more frequent basis. This practice has decreased the lag time between project completion and evaluation to about one year, down from as many as three to four years. Additionally, the rolling approach helps to mitigate variability and maintain greater consistency in realization rates from year to year. This evaluation approach also ensures that those subsegments of the C&I portfolio comprising the most savings always receive appropriate review for accuracy. The trade-off to improved accuracy has been substantial increases in evaluation spending. Rolling impact evaluation has required significant upfront investment in establishing samples for the first and second rounds of evaluation; however, it is not yet clear if these costs will decline in coming years, or if so by how much. It is likely that EMC will need to consider how to continue to conduct needed impact evaluation at lower cost.
- **Industry Standard Practice (ISP) Repository.** The EMC has developed a collection of baseline studies (the ISP Repository), which has been received favorably by stakeholders. The main benefits of having established ISP baselines include ensuring that savings assumptions are accurate, and baselines used to calculate savings are understood at the start of each project. The EMC has worked to align expectations of evaluation, implementation, and engineering stakeholders about what baselines will be used for program measures, thereby alleviating

uncertainty about baselines that can lead to unexpected savings once a completed project is evaluated. Each year EMC reviews and updates the ISP Repository to make sure the data are current and engages stakeholders in discussions about what updates are required. EMC expects to continue to update and recalibrate the ISP Repository in the 2022-2024 term.

- **On-Site Saturation.** An on-site saturation study was conducted during the 2019-2021 term to paint a comprehensive picture of the installed base of energy equipment at C&I customers' facilities. The study was designed to involve on-site data collection, but the COVID-19 pandemic forced the scope to change. Ultimately field work was terminated prematurely in favor of a telephone data collection approach with participants from the prior on-site saturation study. The complications from COVID-19 coupled with other considerations about how to make the study more valuable to stakeholders has caused the evaluation team to consider how to rescope subsequent research. As this type of study is typically done at least once every three years, it is expected to be conducted again in the 2022-2024 term albeit it in a somewhat modified form.
- **Controls.** For lighting, savings from controls measures have historically contributed little savings to PA portfolios as compared to their lamp or fixture counterparts. However, as baselines for lamps and fixtures continue to rise with rapid market transformation, the importance of lighting controls products will increase. In the non-lighting space, controls have been a focus for the programs in the HVAC and food service spaces, though it has been challenging to determine savings from non-lighting controls. The importance of controls in non-lighting applications will increase as further code revisions and changes to standard practice put pressure on the claimable savings of the underlying equipment associated with controls. In the case of both lighting and non-lighting controls, determination of the baseline is vital to effective measurement of the controls savings. Establishing an accurate baseline requires data from the period before the controls were installed, which has historically been a challenge. However, evaluation recognizes the importance of these measures and plans to investigate feasible methods for collecting pre/post data in the 2022-2024 Plan.
- **Performance Optimization Offerings.** While these offerings weren't a specific focus of 2019-2021 research, they are frequently evaluated as part of custom impact evaluation work and, like controls, will become a more important piece of the C&I portfolio in the future. Examples of performance optimization measures and approaches include RCx, strategic energy management, and operation and maintenance support. They may or may not involve a capital equipment installation, though the measure is frequently more intangible and can involve behavioral change. Evaluations of RCx, controls optimization, and other performance optimization measures have been included as part of custom HVAC impact evaluations. Results have been mixed, though the measures' importance to stakeholders will likely necessitate further research into these measures in the next plan period, and that could take the form of impact, market assessment, or process research.
- **The COVID-19 Pandemic.** It has become evident that COVID-19 has had an impact on C&I customer operations such as hours of operation, usage intensity, and vacancy rates, and the long-term impacts are unknown. While the evaluation team has not developed any targeted studies to determine the specific impacts that the pandemic is having on the operations of C&I customers during the 2019-2021 term, some evidence has been collected as part of impact evaluation work. In addition, statewide subcommittees comprising evaluation and implementation stakeholders have focused on assessing the impacts of COVID-19 on certain C&I subsegments (e.g., ventilation practices in K-12 schools) and determining how programs can continue to offer energy efficiency measures to those customers. Additional research on COVID's longer-term impact on C&I customers may be warranted.

7.2 RESEARCH PRIORITIES FOR THE 2022-2024 TERM

Much of the C&I research intended for development in the 2022-2024 Plan term is informed by the 2019-2021 research takeaways. In addition, gaps in research have also been identified and have been included for consideration in 2022-2024 research.

- **Strategic Electrification.** At the end of the 2018-2021 term, the PAs began offering incentives for transitioning from delivered fuel (oil and propane) heating systems to small (<5.4 tons) electric heat pumps. PA implementation teams leveraged the delivered fuel savings (and associated electric consumption increases), associated with installing central heat pumps and ductless mini-split heat pumps to displace delivered fuel systems, from the evaluation work conducted in the residential sector. Several additional electrification measures – including off-road transport equipment such as forklifts and tractors, larger-scale (>5.4 tons) heat pump systems, and heat pumps displacing gas heating systems – will be offered in the 2022-2024 term. Research is needed to refine the savings estimates for these existing and planned electrification measures.
- **Prescriptive Impact Evaluation.** During the 2019-2021 term, the C&I evaluation team has conducted some prescriptive evaluation through impact evaluations of small business/turnkey offerings and impact evaluations of upstream lighting and water heaters. However, an evaluation of prescriptive downstream programs and/or other upstream product offerings either hasn't been done in many years or has not been done at all. Although downstream prescriptive savings are less than custom savings, they do contribute considerably to the portfolio. Moreover, as the PAs' focus on upstream/midstream delivery expands, it is becoming increasingly important for the evaluation team to focus impact evaluation efforts on prescriptive offerings. *Planned Start: 2022. Stage 1: Included in Appendix.*
- **eTRM Review**. Although the EMC updates the eTRM every year with all new evaluation results, a comprehensive review of C&I measures in the Massachusetts eTRM has never been conducted. Recent stakeholder feedback has suggested that a review of assumptions and citations is warranted. For example, in some cases newer sources of information from other jurisdictions becomes available and could be reflected in the eTRM. As this kind of review has been pursued by evaluators in neighboring states with energy efficiency programs, the research in Massachusetts is expected to be similar and will emphasize updating older references, ensuring that measures are characterized accurately, and that savings calculations are up to date. *Planned Start: 2022. Stage 1: Included in Appendix.*
- **Process Research.** There has been some recent C&I process evaluation research that was conducted in concert with the NTG work being administered under the SCC contract, but overall process work has largely been absent in the C&I space during the 2019-2021 term. While specific research has not been scoped yet, study delivery may leverage other ongoing evaluation activities, such as impact and NTG work, to maximize data collection and reduce the number of customer touchpoints required. *Planned Start/Stage 1s: As needed.*
- **ISP/Baseline Research.** A continuation of the current ISP Repository update process and annual baseline research to support it is expected for the 2022-2024 term. *Planned Start: Each Year. Stage 1: Included in Appendix.*
- **Rolling Impact Evaluation.** The rolling impact evaluation model is expected to continue through the 2022-2024 term. Stakeholders will need consider which offerings are appropriate for rolling evaluation, and it will be necessary to balance investment in rolling impact evaluation with other research priorities. At this point, the EMC expects to continue rolling impact evaluation for both custom electric and custom natural gas measures. *Planned Start: Each Year. Stage 1: Included in Appendix.*

- **Controls Research.** Impact evaluations of controls measures, both lighting and non-lighting, are likely in the 2022-2024 term, though these will be dependent upon developing successful methods of data collection. Pre-controls installation data is required in addition to post-install data in order to accurately quantify savings, and stakeholders will need to develop a process to collect this information if impact evaluations are to be useful. The evaluation team intends to have pre-installation data collection part of the controls research work scope, and stakeholders anticipate that it will require extensive collaboration between evaluation and implementation teams. *Planned Start: 2022. Stage 1: Included in Appendix.*
- **Performance Optimization Research.** Further scoping of this research is needed, starting with a literature review of program support in other jurisdictions for measures such as strategic energy management and RCx. As program support for performance optimization opportunities is anticipated to grow, additional evaluation research may include: early impact and process evaluation of performance optimization offerings to ensure program design is effective and savings are quantified appropriately, investigation of energy management information systems (EMIS) in facilitating energy savings, establishing best practices for EMIS/building automation systems, standardizing program offerings in a way that reduces the uncertainty in claimable savings, and developing communication protocols and a continuous feedback loop between evaluation and implementation to allow for updates to be made to assumptions in real-time. *Planned Start: Undefined. Stage 1: Included in Appendix.*
- **On-Site Saturation Research**. A reboot of the study done in the current 2019-2021 term is likely for 2022-2024, though rescoping is necessary. A focus on non-lighting measures may be warranted, with research being more targeted towards certain customer segments and/or end-uses. Taking a more targeted approach could yield more actionable insights for stakeholders as opposed to the traditional study approach which stakeholders have indicated is too broad. In addition, a panel approach is being considered, in which a group of customers agrees to periodically share targeted data based on stakeholder priorities at the time. This approach could also benefit COVID-19 research efforts. *Planned Start: Undefined. Stage 1: Included in Appendix.*
- **COVID-19 Research.** During the 2019-2021 term, EM&V has adapted its research practices and consideration of factors such as baselines and operating conditions in light of the COVID-19 pandemic. At this point, it is unclear if business characteristics will ultimately revert to pre-pandemic norms or a "new normal" is being established which will need to be reflected in program assumptions in the future. Moving forward, research on COVID's longer-term impact on C&I customers may be warranted to inform stakeholder policies around these issues. *Planned Start/Stage 1s: As needed.*
- **Equity**. Ensuring that the programs are delivering offerings equitably is a priority for the PAs and stakeholders. Research has shown that microbusinesses have consistent patterns of lower population savings and account participation rates than other small and non-small businesses. Having said that, at the location level, over half of microbusiness locations have been served between 2012 and 2017, owing largely to upstream lighting initiatives. Expanding program participation to additional non-lighting offers could potentially deliver "deeper" savings to microbusinesses. As part of the Equity Targets Framework, PAs have committed to conduct an EM&V study to analyze participation of microbusinesses (including small nonprofit organizations) and study barriers to participation. Additionally, further assessment of participation barriers for nonprofit organizations, small businesses, and microbusinesses may be warranted and would be a continuation of small business non-participant evaluation research conducted in the 2019-2021 term. *Planned Start: 2023. Stage 1s: As needed.*

SECTION 8: RESIDENTIAL SECTOR RESEARCH AREA

The Residential Sector research area includes all evaluation for Residential and Income Eligible Sector initiatives, except for those covered by the SCC and Demand Response research areas. The research area consists of four separate topic areas: Retrofit and HVAC, Retail Products, New Construction, and Behavior. Income-eligible programs are included in these topic areas. The Residential Sector initiatives subject to evaluation include the following:

- Residential New Homes and Renovations.
- Residential Coordinated Delivery.
- Residential Retail.
- Residential Behavior.
- Income-Eligible Coordinated Delivery.

8.1 LESSONS LEARNED FROM 2019-2021 TERM

From 2019 to 2021, the PAs and EM&V Consultants supported over 30 residential evaluation studies in five major study areas: impact evaluations, process evaluations, NTG evaluations, baseline research, and market characterization. Figures 7 and 8 below summarize the research conducted. In the Residential Sector, many evaluations span multiple study designs. For example, a study might include an impact component to quantify savings estimates and impact factors, with a corresponding process component to investigate customer satisfaction, barriers to measure uptake, and trade ally judgements on program effectiveness. These studies seek then, not only to quantify program impacts, but to provide focused, actionable recommendations to improve Residential Sector program performance and efficiency.

Figure 7: Residential New Construction & Lighting Evaluation Activity in 2019-2021

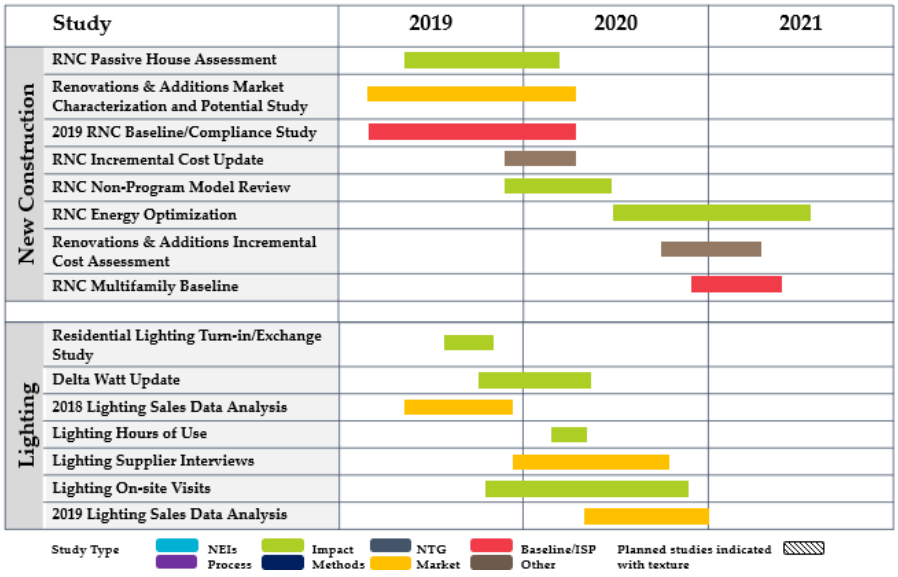
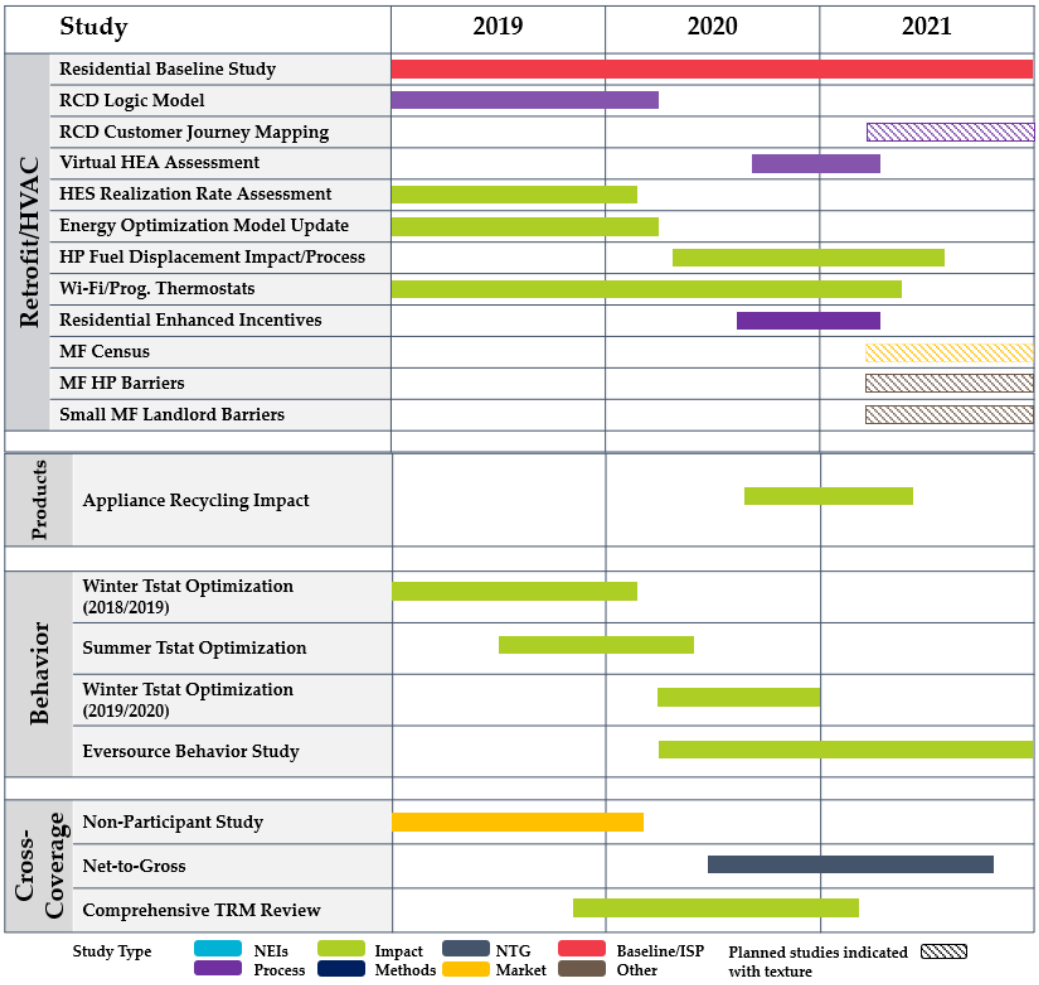


Figure 8: Residential HVAC, Products, Behavior & Cross Coverage Evaluation Activity in 2019-2021



The Residential Sector research area had a robust research agenda over the 2019-2021 term and has produced a considerable number of key takeaways which will help inform research priorities for the 2022-2024 term. At a high level, those takeaways can be categorized as follows:

- **New Construction:** Studies in the Residential New Construction (RNC) topic area have identified and reinforced the need for early intervention in the construction of new buildings. It is critical to engage market actors during the design process to encourage participants to incorporate the advanced building practices required to achieve ultra-low-load buildings (e.g., Net Zero Ready or Passive House). Many of these advanced practices require developers, architects, and builders to alter structural elements of a building's design, compared with standard practice – like wall cavity depths, building orientation, and window positioning – to achieve the desired savings. This lesson is fundamental for framing the RNC program's future efforts in guiding the market to the next tier of super-efficient homes.
- **Baseline Studies:** The *Residential Baseline Study* enables the PAs to track adoption and saturation of measures over time. Of particular note, the PAs have learned that the saturations of cooling end uses are increasing as well as the saturations of emerging technologies such as Electric Vehicles (EVs), solar photovoltaic (PV) systems, heat pump technologies, and connected devices. The Baseline study has also proven valuable for developing potential studies, load shapes, updating measure-specific baselines (used for improving TRM savings values), and determining the frequency of equipment replacements.

- **Non-Participants:** In the 2018-2021 term, the PAs committed to developing a better understanding of the characteristics of non-participants and what would motivate them to participate. The *Non-Participant Customer Profile Study* revealed that moderate-income households, renter households, and limited English-proficiency customers participated at a lower rate than other populations in 2013-2017, based on analysis of location participation. The study further found that non-participants are more likely to be renters and reside in smaller multi-unit buildings when compared to those customers taking advantage of Residential Sector programs. The *Residential Non-Participant Market Barriers Study* identified that the key barriers to participation include a lack of trust in the utility, non-participants' prioritization of basic needs, a need for greater information/understanding around efficiency programs, and a perception of energy efficiency as irrelevant or not applicable. Interestingly, the study found that non-financial barriers are more prevalent than financial barriers for non-participants.
- **Strategic Electrification**: During the 2018-2021 term, the PAs began focusing on offering incentives for transitioning from delivered fuel (oil and propane) heating systems to electric heat pumps. Prior to program changes that emphasized heating benefits, evaluators found that ductless mini-split heat pumps were installed more often for cooling than for heating. To better understand the market, evaluators assessed the total and incremental costs associated with installing different configurations and types of heat pumps. Evaluators are currently working to quantify delivered fuel savings (and associated electric consumption increases) for installing central heat pumps and ductless mini-split heat pumps to displace delivered fuel heating systems. This research is addressing customer decision-making and motivations. More research is needed to refine these savings estimates and determine under what conditions it makes most sense to incentivize installation of heat pumps for strategic electrification.

8.2 RESEARCH PRIORITIES FOR THE 2022-2024 TERM

EMC's strategy for planning Residential Sector impact evaluations is dependent on three key factors: (1) the size of each core initiative or end-use, (2) when each core initiative or end-use was last evaluated, and (3) whether the program has undergone recent and significant changes. Large programs or major end-uses within programs are evaluated relatively frequently to ensure the largest contributors to savings in the statewide portfolio are accurate. In addition, the PAs and EM&V Consultants may consider evaluating programs that have a smaller contribution to savings if savings estimates are viewed as uncertain or in need of updating. Finally, if a program undergoes significant changes or is newly developed, the EMC may consider completing an evaluation to understand how well the program is performing and identify any issues with the delivery as early as possible.

In the coming term, the focus of Residential EM&V will be on strategic electrification, equity, baselines, and income-eligible programs.

- **Strategic Electrification.** The PAs plan to examine strategic electrification in both RNC and retrofit applications. This will include research on barriers to fuel switching, baseline assessments of saturation, and updating impact factors. EMC will examine the barriers facing builders, realtors, consumers, and HVAC contractors when constructing, selling, and buying all-electric homes. The PAs also plan to focus efforts on the performance of heat pumps in homes of varying thermal efficiency, particularly during colder periods, and what the optimized control settings should be to achieve the most efficient heating. One of the goals will be to determine how well these heat pumps can provide full heating for homes when fully displacing the existing heating system, and what to do with other areas such as bathrooms where it might not be feasible to locate a heat pump (indoor head). EMC expects to complete this as part of a large metering study for all heat pump types. EMC will design an accompanying process evaluation to identify the optimal situations for incentivizing installation of heat pumps by assessing customer

motivations and barriers as well as determining how contractors are sizing heat pump systems for homes. EMC will also conduct research to determine the cost effectiveness of natural gas to electric fuel switching, considering different configurations, cost of installation, and operations based on current fuel/electric costs. Several additional electrification measures – including conversion of residential small equipment, such as leaf blowers and lawnmowers, from gasoline to electric – will be offered in the 2022-2024 term. Research is needed to refine the savings estimates for these existing and planned electrification measures. Finally, EMC will consider conducting research into additional topics such as integration of heat pumps with solar power, demand response, and battery storage, as well as how to best coordinate weatherization and heat pump messaging, program designs, sales and installations. *Planned Start: 2022 if status of program design allows. Stage 1s: Included in Appendix.*

- **Baselines.** EMC plans to continue updating the *Residential Baseline Study* (i.e., saturation) to collect information on adoption of various connected devices, trends in electrification (such as saturation of heat pump technology and EVs) and trends in the post-pandemic landscape. For example, EMC expects an increase in home energy usage due to increased occupancy. Other upcoming baseline research includes an updated low-rise RNC baseline study, as well as a consideration of when to use the existing conditions or ISP for customers undergoing major renovations (see SCC Market Effects section for more information). *Planned Start: 2022. Stage 1 included in the Appendix.*
- **Income Eligible Programs.** The income-eligible programs will be a major evaluation focus during the next term. EMC will conduct both process and impact evaluations for this sector. Process evaluations will focus on identifying the strengths and weaknesses of the current system, understanding the different participation trends, drivers, and results across CAP agencies, barriers to customer awareness and participation, and potential program changes that could enhance full program participation. Other areas of focus will be how to improve outreach to renters and small multifamily building owners, understanding the journey of English-isolated customers through the program and the barriers they encounter, as well as ways to improve customer trust with the energy efficiency provider. Impact evaluation updates will cover both single family and multifamily with a particular focus on multifamily custom measures and energy optimization measures. *Planned Start: 2022. Stage 1s: Included in Appendix.*
- **Equity.** EMC intends to continue identifying and recommending ways to overcome program participation barriers by key residential populations[8] (low- and moderate-income customers, renters, and English-isolated customers). Using the *Residential Non-Participant Market Barrier Study* and the *Non-Participant Customer Profile Study* as a baseline, EMC plans to assess progress in expanding participation among these key demographic groups. EMC may also consider analysis of additional demographic characteristics, such as race, or other factors correlated with participation, such as age of housing stock. Beginning in 2021, the EMC is developing detailed customer journey mapping for English-isolated customers and may develop customer journey mapping for other key groups mentioned above in the 2022-2024 term. *Planned Start: 2022. Stage 1 plans to be developed.*

The EMC is also looking to provide data on participation trends to municipalities, community groups, and other interested stakeholders and to educate them on data availability. For example, PAs are looking to expand the maps they have prepared leveraging the Google Earth platform to show overlays of rates of past participation, density of rental units, income levels, and density of limited English proficiency customers. The PAs are currently testing the maps for use by municipal partners, and once they are finalized the PAs will create maps for all towns in PA territory and post them on the Mass Save® Data website (masssavedata.com). The EMC will also track participation in Environmental Justice communities. Evaluation will conduct research to help implementers identify potential community-based organization/municipal partners

[8] Participation of small and microbusinesses is discussed in Section 7.2, C&I Research Priorities for the 2022-2024 term, under the header “Equity”.

at the local level, what specific populations they serve, and how they could help increase participation.[9] *Planned Start: 2022. Stage 1: Included in Appendix.*

EMERGING ISSUES

In addition to the above topics, the EMC is considering the following topics and will conduct Stage 1 planning as needed during the 2022-2024 term:

- Impact evaluation of the Residential Coordinated Delivery High-Rise Initiative (likely done in conjunction with income eligible multifamily impact evaluation).
- Incremental costs study for the RNC Low-Rise offering, potentially including costs related to fuel choice.

SECTION 9: SPECIAL AND CROSS-CUTTING RESEARCH AREA

As described above, the SCC research area contains six topic areas: NEIs, NTG, Market Effects, Statewide Marketing, Codes & Standards, Community Mobilization and Training, Work Force Development, and Data Management. Due to the unique nature of these topic areas, each one is discussed in turn below.

9.1 NON-ENERGY IMPACTS

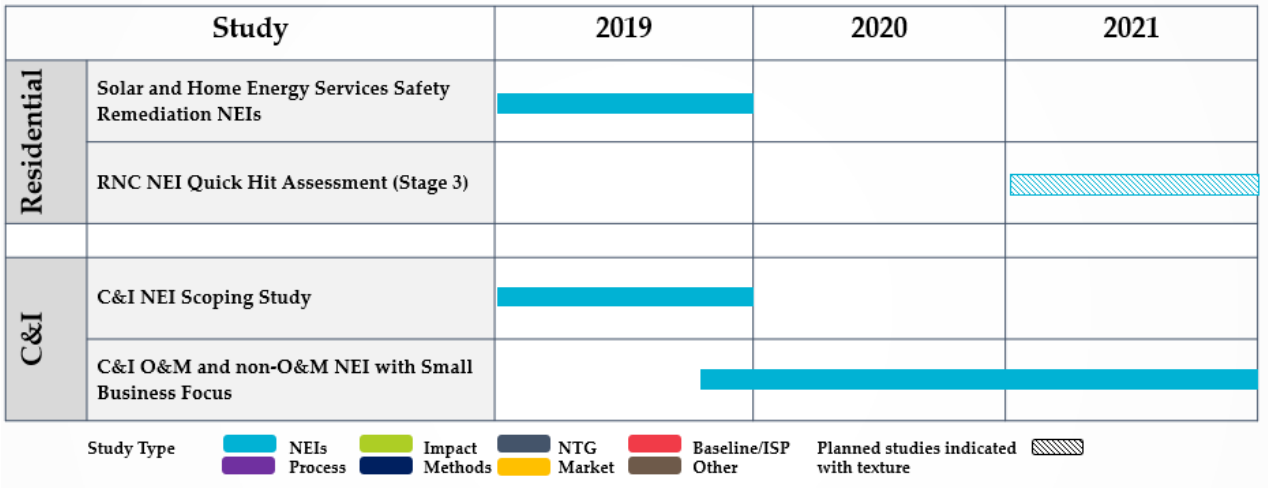
NEIs include effects beyond energy savings that are attributable to energy efficiency programs. Examples of NEIs include reduced labor or non-labor O&M costs and benefits associated with improved occupant health and safety. The goal of NEI studies is to provide guidance to the EMC by quantifying participant NEIs associated with various measures.

9.1.1 LESSONS LEARNED FROM RESEARCH COMPLETED IN THE 2019-2021 TERM

From 2019 to 2021, the PAs and EM&V Consultants supported five NEI studies in two categories: Residential and C&I, as shown in Figure 9. In the residential category, studies were completed for solar and home energy services safety and for low-income multifamily health and safety. In the C&I sector, an initial NEI scoping study was completed, which recommended areas of focus for a full C&I NEI study. The full study was initiated in 2020 and includes O&M NEIs, non-O&M NEIs for the small business segment, and an exploration of C&I health and safety NEIs.

[9] In addition to the equity work described here, the EMC will conduct an evaluation to develop NEIs specific to moderate-income customers; this work will be conducted under the SCC research area.

Figure 9: NEI Studies in 2019-2021 Term



The NEI research conducted during the 2019-2021 term suggests the following key takeaways:

- **Importance:** NEIs are increasingly a topic of interest to evaluation, implementation, and stakeholders for future research during the next three-year term. Stakeholders are very interested in pursuing additional NEI research in several areas. However, budget and time constraints on NEI studies could limit how much of this research the PAs can pursue.
- **Granularity:** Recent research found that it is difficult to balance the desire to have more granular NEI values for smaller segments of measures and/or customers with the need to achieve the response rates necessary to quantify NEIs.
- **Streamlining:** Where possible, it may be valuable to combine NEI research with other ongoing studies, both to reduce customer burden from interviews and to minimize budget impacts of doing more NEI research.
- **Gaps Remain:** Some research gaps previously identified, such as those identified in the *NEI Framework Study* and *C&I Scoping Study*, still remain. These gaps include: C&I health and safety NEIs, non-O&M NEIs for a broader set of measures and sectors, moderate-income program NEIs, and NEIs for market-rate multifamily building owners.

9.1.2 RESEARCH PRIORITIES FOR THE 2022-2024 TERM

In addition to completing current studies, there are several new areas of interest for NEI research, some of which would fill the gaps identified above:

C&I Health and Safety

The *C&I NEI Scoping Study* recommended further research on C&I health and safety NEIs. A Stage 1 plan for a C&I H&S NEI study was scoped in 2020, with the intention of starting the study sometime during 2021. This study would use a combination of primary research and a secondary literature review to estimate health & safety NEIs. The study is still in the planning stages, but may focus on measure groups including lighting, HVAC, and pipe insulation. *Planned Start: 2022. Stage 1 included in the Appendix*.

Moderate-Income Customers

There is also interest in exploring NEIs that may apply to the moderate-income customer group, particularly related to weatherization. Previous research has focused only on the market-rate and income-eligible groups, but research specific to the moderate-income group could reveal unique NEIs that may enable the PAs to better serve these customers. The results of this study would be used to replace the proxy value agreement between the PAs and EM&V Consultants. *Planned Start: 2022. Stage 1 included in the Appendix.*

Additional Research Opportunities and Considerations

The following categories represent additional research opportunities that the PAs and EM&V Consultants will track over the 2022-2024 term:

- **Strategic Electrification.** As strategic electrification becomes a greater statewide focus, particularly for electrifying space heating and cooking, research into associated NEIs may be valuable for PAs in developing these offerings. The PAs could consider undertaking a study to quantify participant NEIs, particularly health- and safety-related NEIs, associated with the PAs' energy optimization programs. It could include a literature review to document the NEIs that have been monetized from other energy efficiency administrators' strategic electrification efforts. It could also identify or develop methodologies for primary research to investigate additional NEIs that may accrue from strategic electrification for areas such as decreased risk of carbon monoxide poisoning, decreased risk of fires/explosions, improved indoor air quality and associated health benefits, increased occupant comfort, decreased noise, and reduced carbon emissions.
- **NEI Communication and Marketing**. A process study could focus on the best ways for the PAs to communicate and market NEIs, both internally to implementers and externally to customers. Improving communications around what NEIs are available, and to which measures they apply can help program implementers offer a better overall project to customers and increase customer awareness of the full set of benefits they receive from DSM measures.
- **NEIs for Environmental Justice Communities**. Given the focus on equity in the 2022-2024 term, there may be interest in studying NEIs for Environmental Justice communities, distinct from NEIs for moderate-income customers.
- **Large C&I Non-O&M NEIs**. Depending on the results of the current studies C&I O&M and non-O&M for small business, additional opportunity may exist to establish values for non-O&M NEIs for large C&I customers. There also may be measures that were not selected for study in the current project that are important to large customers.

9.2 NET-TO-GROSS

NTG studies estimate the share of savings that are attributable to a program, accounting for free-riders and spillover. Free-riders refers to program participants who receive program incentives but who would have adopted the energy efficient product or service even without the program intervention. Spillover refers to the energy savings that occurs because of the influence of an energy efficiency program, but without direct financial or technical assistance from the program.

9.2.1 LESSONS LEARNED FROM RESEARCH COMPLETED IN THE 2019-2021 TERM

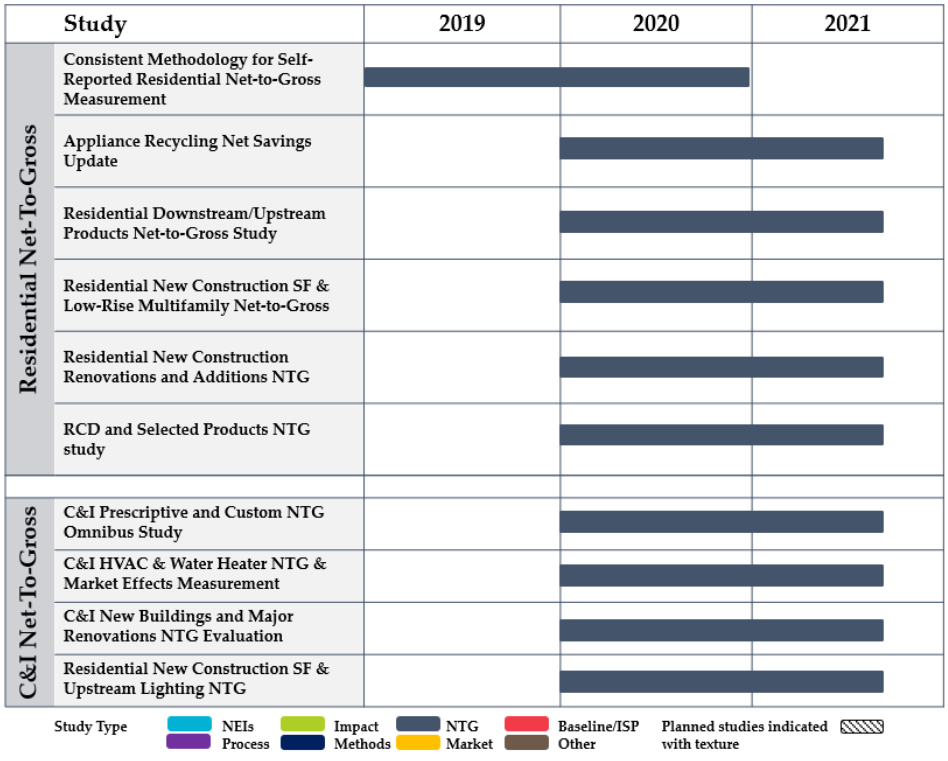
The NTG topic area has been very active over the 2019-2021 term, particularly in 2020. Given that under the current (2019-2021) policy framework, the NTG values are locked and then applied prospectively to the next three-year term, the PAs and

EM&V Consultants have agreed that conducting NTG studies as close as possible to the end of the cycle yields NTG values which are most applicable to the subsequent term. Beginning in the 2022-24 term, NTG values will no longer be locked, meaning that they may be studied and updated mid-term. Timing of NTG studies may spread out over the next term as a result of this change. Overall, the EMC has undertaken 10 studies in the 2019-2021 term that are all scheduled to finish in 2021 in time to inform the 2022-2024 term. These are included in Figure 10 below.

The NTG research conducted during the 2019-2021 term suggests the following key takeaways:

- **Performance Optimization Offerings.** Some measures and offerings that are focused on behavioral changes rather than equipment upgrades may require different NTG approaches. This is especially true if specific data must be collected prior to project implementation.
- **Consistent Methodologies.** There is benefit in establishing consistent methodologies for NTG. For example, establishing a standard approach for self-reported residential NTG research streamlined review for subsequent NTG surveys developed for residential customers. Additionally, results suggest that a residential self-report NTG sensitivity analysis would be useful follow up.
- **Interaction of NTG and Baselines.** Ongoing attention is needed to ensure that NTG and ISP baseline methodologies and assumptions are compatible. Research in prior terms suggested how to set up NTG surveys depending on the type of baseline used. The EMC continues to discuss how to ensure that savings are not over- or under-claimed when NTG and ISP baselines are used together.

Figure 10: NTG Studies 2019-2021



RESEARCH PRIORITIES FOR THE 2022-2024 TERM

In addition to completing current studies, there are several new areas of interest for NTG research.

Residential Self-Report NTG Methodology Review

This study is intended to revise the residential self-report NTG methodology previously developed according to the experience and lessons learned during the current term and based on the results of a sensitivity analysis. *Planned Start: 2022. Stage 1 included in the Appendix.*

Emerging Issues

- **NTG Policy Change.** The DPU has issued guidelines which will allow NTG values to be updated up to once per year, instead of once per term, beginning with the 2022-24 term. This change creates an opportunity to measure NTG when updates are needed, which is more often for some measures than others (e.g., measures in a fast-changing market or with new delivery strategies may have more frequent updates). This will allow NTG research to be more efficient by updating research when it is needed (rather than a fixed frequency of once per term), while spreading out the research during the term rather than stacking all the NTG studies at the very end of the term. This policy change will affect the planning and staging of NTG studies, as well as processes to ensure that program data will be available in time to conduct NTG research.
- **Performance optimization opportunities**, such as behavioral measures and SEM, may require different NTG approaches, which the EMC will seek to develop.
- **Corporate Sustainability Policies and Practices**. A potential area for future research is an exploration of PA influence on establishing corporate sustainability policies and practices.
- **Fuel Switching in C&I New Construction.** The PAs and DOER have agreed to research a C&I electrification NTG value in 2022. This value will account for customers who would have installed a heat pump on their own without program influence and will support the program-simplifying assumption of either a gas or delivered fuel baseline for all C&I fuel switching heat pumps.

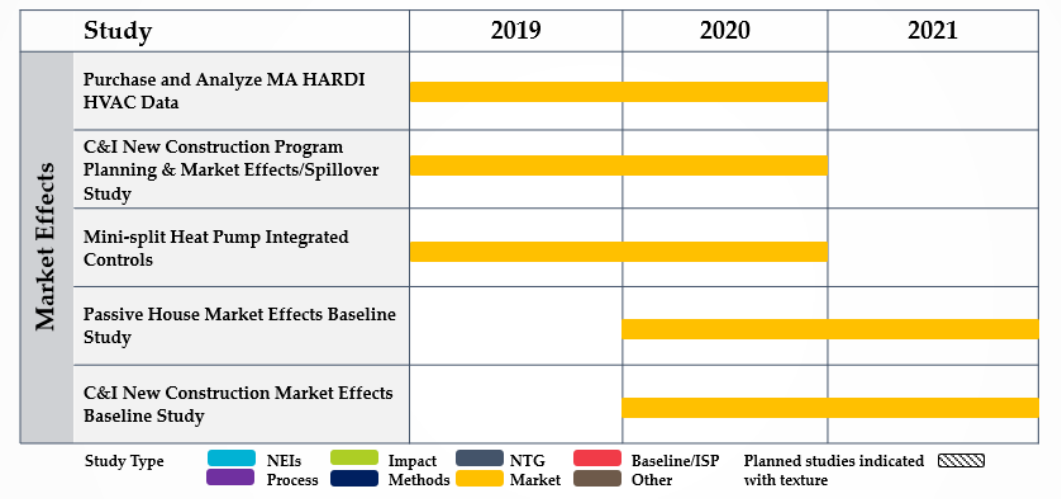
9.3 MARKET EFFECTS

Market effects studies seek to measure long-term structural changes in a market that are caused by energy efficiency programs and lead to increased adoption of energy-efficient products, services, or practices. Examples of market effects include increased availability of efficient technologies produced by manufacturers and/or sold through retail channels, reduced prices for efficient models, and increased market share of efficient equipment. Market effects are closely related to spillover but may go beyond what is typically counted as spillover as part of NTG studies.

9.3.1 LESSONS LEARNED FROM RESEARCH COMPLETED IN THE 2019-2021 TERM

From 2019 to 2021, the PAs and EM&V Consultants supported five studies in the Market Effects area, three of which completed in 2020, with the remaining two scheduled to finish in 2021. The studies focused on documenting market effects indicators for programs that are expected to generate market effects and monitoring market effects indicators in preparation for future quantification.

Figure 11: Market Effects Studies: 2019-2021



The market effects research conducted during the 2019-2021 term suggests the following key takeaways:

- **Documentation of Program Theory and Baselines:** For program offers where the program theory shows that the intent is to generate market effects, it is important to measure key market indicators before the program begins to transform the market. Evaluators have found that when launching new programs, it is challenging to measure baselines early in the program lifecycle. EMC will strive to document baselines and monitor market effects indicators so that market effects can be quantified in the future. These would include, for example, integrated controls for Ductless Minisplit Heat Pumps (DMSHPs) and Non-Residential New Construction (Paths 1 & 2). In some cases, such as Residential Renovations and Additions, there are opportunities to document program theory and logic (PTLM) models, even if there are not currently plans to measure market effects.
- **Potential New Areas to Measure Market Effects and Spillover:** Research suggests that programs may be generating market effects for C&I and residential HVAC systems. There may be an opportunity to further explore these market effects through use of a manufacturer panel. In addition, evaluators have noted possible spillover from the Non-Residential New Construction program affecting the existing non-residential building retrofit market, as well as the non-participating new construction market.

9.3.2 RESEARCH PRIORITIES FOR THE 2022-2024 TERM

In the 2022-2024 term, the EMC would like to prioritize the following market effects studies:

- **Market transformation baseline and barriers studies for residential and C&I heat pumps**. Given PA commitment to transform the HVAC market to support heat pump adoption in accordance with the Commonwealth's climate

change goals, it will be necessary to begin the process of evaluating market transformation for heating electrification. This will include identifying barriers to market transformation, documenting a program theory for the PAs' market transformation efforts, identifying key performance indicators, and establishing baselines.

- **DMSHP Integrated Controls.** The evaluation will monitor market effects indicators identified in the completed Evidence for Market Effects from Support for DMSHP Integrated Controls study and identify new market effects indicators not previously captured. *Planned Start: 2022. Stage 1 included in the Appendix/Stage 1 as needed.*
- **Non-Residential New Construction Paths 1 & 2.** The research will focus on tracking market effects indicators which were determined in the completed C&I New Construction Program Planning & Market Effects/Spillover Study. *Planned Start: 2024. Stage 1 included in the Appendix/Stage 1 as needed.*
- **Passive House.** The study will involve monitoring market effects indicators identified in the *Passive House Market Effects Baseline Study*. *Planned Start: 2024. Stage 1 included in the Appendix/Stage 1 as needed.*
- **Renovations & Additions.** This research will identify market effects indicators for renovations and additions within the Residential New Construction program. *Planned Start: 2022. Stage 1 included in the Appendix/Stage 1 as needed.*
- **Emerging Issues.** For the 2022-2024 term, the EMC would also like to assess the market transformation potential of any new clean energy technologies and program offerings so that evaluators can track and quantify market effects. These studies will be conducted on an as-needed basis and are dependent on which clean energy technologies and program offerings emerge in the next term.

9.4 STATEWIDE MARKETING

Statewide marketing topic area research documents effects of PA statewide marketing efforts, as well as supporting PAs statewide marketing efforts, as necessary.

9.4.1 LESSONS LEARNED FROM 2019-2021

For the 2019-2021 term, the Statewide Marketing team conducted two research activities. The first included primary data collection and general population surveys of residential and small business customers. In addition, the research team also conducted a longitudinal assessment of key awareness metrics, including awareness of the Mass Save brand. The 2019 research described above found that customer awareness of the Mass Save brand continues to hold steady overall. The research team observed marked increases in awareness among Latino customers.

In terms of key themes, previous research conducted in this topic area suggests that PAs need to attempt to close gaps in customers' understanding of the Mass Save brand in the next term. This includes exploring why and how customers are or are not engaging with the Mass Save brand. Understanding these opportunities will be integral to improving the value and utility of the Mass Save brand across all customer segments. PAs will need to find ways to dig deeper into brand awareness, identify and engage hard-to-reach customers, and better understand how marketing can lead to increased participation.

9.4.2 RESEARCH PRIORITIES FOR THE 2022-2024 TERM

The key research priority for Statewide Marketing for the 2022-2024 term is to continue assessing core brand awareness of Mass Save. In addition, PAs and EM&V Consultants are interested in expanding the brand awareness study on the next term so that PAs can gain a deeper understanding of brand awareness statewide versus for each PA, and to identify ways to increase engagement (i.e., moving beyond basic awareness to deeper understanding of program offers and relevance to

customers) among groups with historically lower participation (e.g., renters, moderate-income customers, and English-isolated customers). Other priorities for the next term are to test the effectiveness of the Mass Save website and social media efforts. These efforts would go beyond what the PAs historically study for the Statewide Marketing topic area. *Planned Start: 2022; Stage 1 in Appendix.*

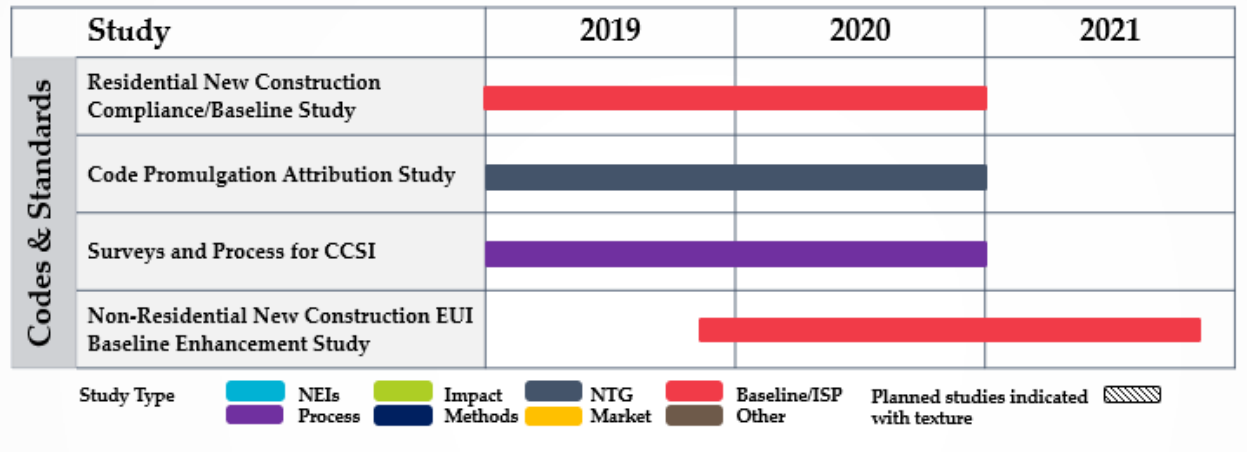
9.5 CODES & STANDARDS

Codes and Standards (C&S) evaluation work is designed to measure net savings attributable to PA C&S activities through measuring aspects such as baseline practices, code compliance, and attribution.

9.5.1 LESSONS LEARNED FROM RESEARCH COMPLETED FROM RESEARCH COMPLETED IN THE 2019-2021 TERM

From 2019 to 2021, the EMC supported four evaluation studies in the C&S topic area. Evaluators completed a *Residential New Construction Code Compliance and Baseline Study* in 2020; the results of this study were used to estimate compliance rates and update the Massachusetts User Defined Reference Home (UDRH) for Low-Rise Single-Family. The EMC is now in the process of completing another baseline study by 2021 which focuses on Non-Residential New Construction. Evaluators also completed two attribution studies in the 2019-2021 term designed to assess the degree to which savings could be attributed to PA efforts. These included the *Code Promulgation Attribution Study* and the *Code Compliance Support Initiatives (CCSI) Study*.

Figure 12: C&S Studies: 2019-2021



The C&S research conducted during the 2019-2021 term suggests the following key takeaways:

- **Integration:** PAs will need to continue to integrate new construction, code compliance, baseline, and attribution efforts as much as possible. Over time it is becoming increasingly difficult to extricate the effects of the various code initiatives related to the new construction program. The interrelated nature of code initiatives contributes to complexities in developing accurate methodologies for determining NTG factors.
- **Advocacy Efforts Increasing:** The PAs are increasingly focused on code advocacy, while continuing to foster code compliance. The savings potential from code advocacy likely outweighs those from enhancement. PAs are also involved in the stretch code amendment process, where PAs are supporting energy efficiency improvements to the stretch codes, which will encourage even more energy savings in stretch code communities.

9.5.2 RESEARCH PRIORITIES FOR THE 2022-2024 TERM

Baseline and Code Compliance Study

The proposed research will be comparable to the Residential New Construction Baseline and Code Compliance study (MA19X02), which began in 2019 and was completed in 2020. The study will again focus on Single-Family Low-Rise New Construction homes and will provide PAs with a new baseline/UDRH and code compliance rates. The timing of this study depends on when the next code amendment passes in the state legislature. *Planned Start: 2023-2024. Stage 1 included in the Appendix.*

Follow-up on Code Trainings

The evaluation will include surveys and interviews to document the effects of CCSI training and other PA code training efforts. These efforts will feed into the attribution process for residential and commercial code compliance savings. *Planned Start: TBD. Stage 1 included in Appendix.*

Emerging Issues

- **Retrofit Code Enhancement Baseline.** The Renovations and Additions offering of the RNC program and the Codes and Standards Compliance and Support Initiative may have an impact on increasing code compliance in major retrofit projects. Given this, the PAs may consider a study to determine baseline levels of code compliance in retrofit projects to set the stage for measuring those impacts over time.
- **Net Zero Building Legislation.** Pending legislation in the Massachusetts state legislature would call for the development of an optional net-zero building energy stretch code that could be adopted by municipalities. The possibility of a net-zero building energy stretch code provides potential opportunities for PA involvement, including developing and advocating for code provisions, supporting adoption of the code, and enhancing code compliance. The extent of relevant evaluations would vary based on the final legislation and type of PA involvement.
- **Design of Attribution Studies.** The EMC will need to think strategically about how to design attribution studies in the 2022-2024 term. One option would be to have a pre-intervention negotiation to define attribution up front. This is a policy decision, however, and keeping EM&V and evaluation vendors aware and involved in conversations will be crucial in the next term. The EMC will need to carefully consider methodologies used in future attribution studies to understand multiple program influences related to C&S initiatives.
- **Stretch Code Promulgation Attribution.** The Board of Building Regulations and Standards is in the process of considering and adopting an updated Stretch Code. If the final version of the stretch code the Board adopts includes amendments developed or influenced by the PAs, the PAs may consider undertaking an evaluation to estimate gross technical potential savings and an attribution factor for the efforts.

9.6 WORKFORCE DEVELOPMENT AND COMMUNITY MOBILIZATION, EDUCATION & TRAINING

This topic area includes research on PA efforts related to Workforce Development and Community Mobilization for all three sectors: Residential, Income Eligible, and C&I. In addition, the topic area also covers evaluations of the PAs' education and training efforts.

9.6.1 LESSONS LEARNED FROM RESEARCH COMPLETED IN THE 2019-2021 TERM

The EMC supported two research projects in the 2019-2021 term:~~,~~ the Eversource Onsite Facilities Training Program study for workforce development, and the Municipal Partnership Initiative PTLM for community, education, and training. Key takeaways from this research include:

- **Onsite Training.** Evaluation of the Eversource Onsite Facilities Training Program is in the beginning stages, but early indications are that it takes considerable time to engage customers, and participation in on-site training has been inconsistent, particularly given the challenges of the COVID-19 pandemic. The evaluators will assess the extent to which onsite training led to learning and behavior change occurred after training is complete.
- **Municipal Partnership Opportunities**. Municipalities find value in the opportunities the initiative affords them to collaborate with not only their PAs and local community-based organizations, but also other municipalities.
- **Need for Greater Municipal Partnership Support.** Municipalities are seeking increased PA support in helping them identify target customers groups by providing lists with customer information they can leverage for targeted outreach. As the Municipal & Community Partnership Strategy outreach methods are effective for reaching income-eligible populations and municipal leaders have expertise in engaging these customers, municipalities believe excluding this group as a target population is a missed opportunity.

Municipal leaders identified ongoing barriers to engaging English-isolated customers. They share concerns that these customers are not able to complete the full enrollment and participation journey due to lack of in-language infrastructure and support; this challenge is especially prominent for virtual platforms.

9.6.2 RESEARCH PRIORITIES FOR THE 2022-2024 TERM

The following are research priorities for the 2022-2024 term:

Statewide Workforce Development Program Evaluation

The EMC has already begun evaluating the Clean Energy Pathways workforce development program designed to bring diverse populations into the EE workforce. This work will continue in the 2022-2024 term. In addition, since a significant amount of funding has been dedicated to the Mass Clean Energy Center to run workforce development programs, PAs expect to evaluate progress of these programs in meeting workforce development goals. As part of the equity targets framework, PAs also agreed to conduct EM&V study in 2022 to analyze whether substantial disparities exist between the availability and PA utilization of state-certified minority and woman-owned business enterprises (M/WBE) in procurement for lead vendors and subcontractors by the PAs (statewide and individually) related to energy efficiency programs and services. *Planned Start: 2022. Stage 1 included in the Appendix.*

Emerging Issues

- **Framework to measure jobs/diversity.** Research could investigate how PA programs contribute to the Commonwealth's workforce, as well as understand how diverse the energy efficiency workforce is in Massachusetts. Any research would leverage existing EE jobs studies such as those conducted by E4TheFuture, E2,

and BW Research Partnership, which prepared the 2021 Energy Efficiency Jobs in America report, including a state-level analysis of EE jobs in Massachusetts.

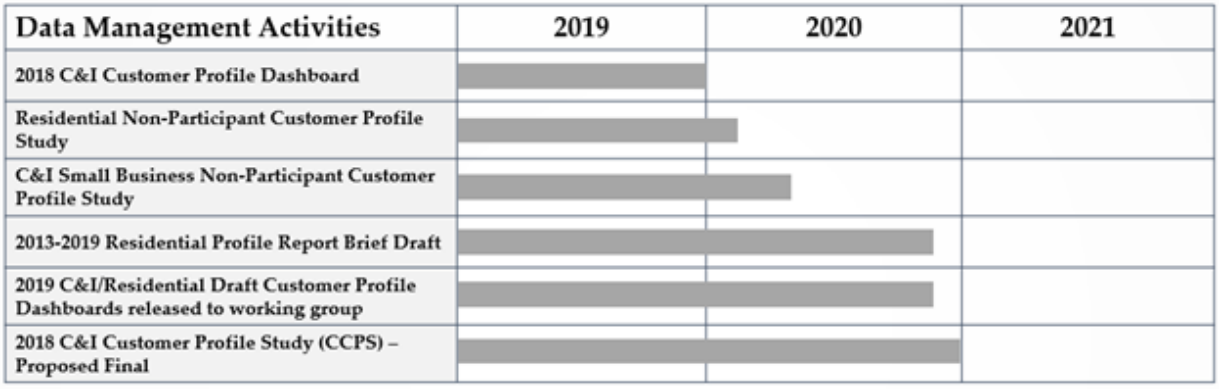
- **Identify community partnerships.** The research could help to identify key community partnerships who can engage local participants, and to understand unique barriers in specific areas such as Environmental Justice communities.
- **Community landscape analysis.** This analysis could help PAs understand community needs and local, energy efficiency, sustainability, and decarbonization goals. In addition, such a study would help identify key partners, and strategic engagement pathways for municipalities.

9.7 DATA MANAGEMENT

The Data Management topic area is a centralized approach to providing data to evaluation contractors, performing data analyses per PA guidance, and conducting customer profile analyses and reporting. The contractor for this work requests information annually, or more often if needed, to support evaluations from each PA about their customers' energy usage and energy efficiency program participation. The vendor puts these files through an extract, transform, and load (ETL) process, to clean and standardize the data and combine it with historic data in the MA data warehouse. Using geoprocessing and analytics tools, the contractor also combines PA data with third-party data sources including data from the MA tax assessor's office and the US Census American Community Survey. The data has been made available for use in public interactive dashboards (https://www.masssavedata.com/Public/CICustomerProfileDashboard).

The objective of the C&I and Residential Customer Profile Reports is to offer diverse views of participation, savings, and geographic dynamics within the PAs' energy efficiency programs. The Residential study covers the Residential and Low-Income sectors combined. The C&I Customer Profile report has been completed on an annual basis starting with 2011 data, and the Residential Custom Profile report has been completed on an annual basis starting with 2013 data. Each year the reports present an analysis of the PAs' billing and tracking data, which allows the stakeholders to accurately quantify and report on trends in participation and savings over time. The reports also develop narratives about these trends and their implications for a variety of stakeholder interests.

Figure 13: Data Management Activities from 2019-2021



The following reflects recent changes and improvements to the data management efforts:

- Launching of electronic dashboards and creation of data warehouse.

- Moving to a shorter profile report.
- Recurring vendor data requests.
- New tracker capturing users' needs and data availability.
- Additional coordination with study teams.

10. DEMAND RESPONSE RESEARCH AREA

The Demand Response research area includes all evaluation for Active Demand Response (ADR) initiatives, including impact and process evaluations. The research area consists of two separate topic areas—Residential and C&I—based on the sector of the ADR offering. The PAs first introduced ADR program offerings as demonstrations in the 2016-2018 term. In the 2019-2021 term, many of these initiatives moved from demonstrations to full program offerings and implementers have continued to increase the available ADR offerings. The ADR initiatives currently subject to evaluation include the following:

- Residential Wi-Fi Thermostats
- Residential EVs
- Residential Battery Storage
- C&I Connected Solutions
- Demonstration projects

ADR evaluation studies are conducted at both the statewide and the PA-specific level[10], depending on the type and scale of offering. As this is a relatively new research area, PAs may independently implement and evaluate smaller demonstration projects before scaling these up to full, statewide program offerings. Evaluations of PA-specific ADR programs are often conducted on a more ad-hoc basis, depending on participation and type of offering. For more established ADR programs offered at the statewide level, such as C&I Connected Solutions, the PAs conduct statewide evaluation studies on a regular basis. Both process and impact evaluations are important in the Demand Response research area. Process evaluations are critical to understand customer acceptance of ADR programs and barriers to enrollment, and help the PAs improve program delivery as these offerings reach maturity. Impact evaluations allow the program administrators to provide reliable, independently verifiable savings values when reporting savings to stakeholders.

10.1 LESSONS LEARNED FROM THE 2019-2021 TERM

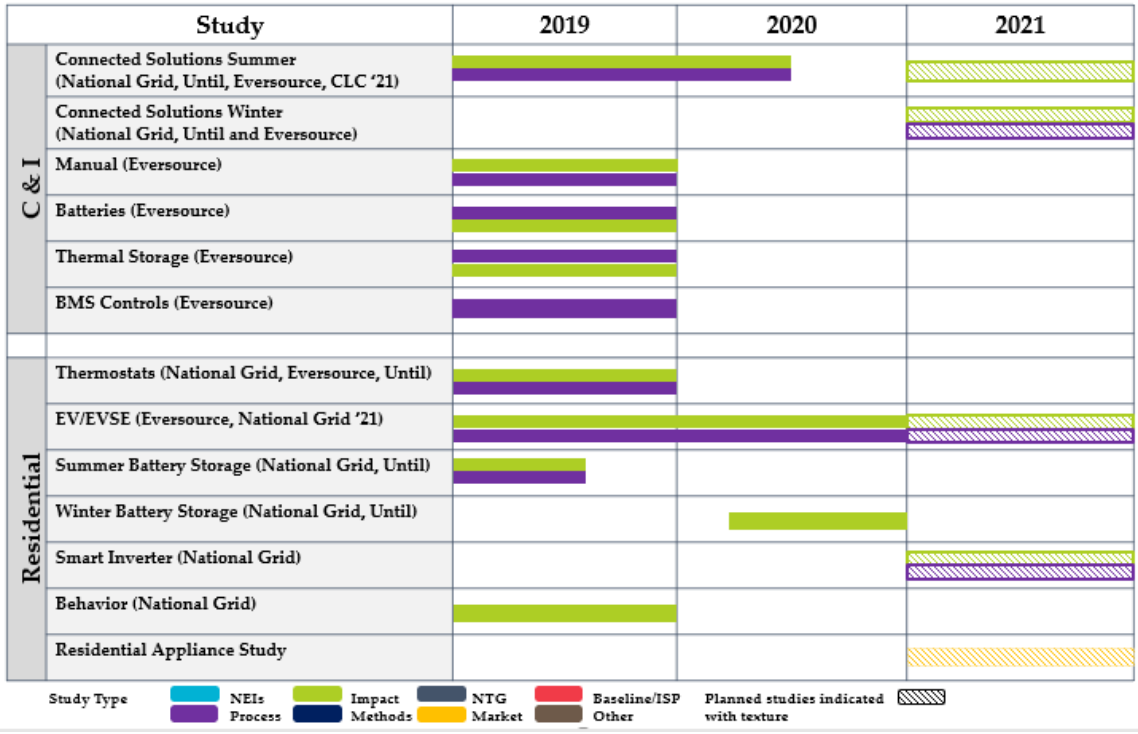
From 2019 to 2020, the PAs and EM&V Consultants supported eight Demand Response evaluation studies, and in 2021 have completed or are currently working on eight evaluation studies[11] in three major study areas: impact evaluations, process evaluations, and market characterization. Table 11 below depicts the timing and frequency with which EM&V evaluated each of the program offerings in 2019-2020 and what is currently being evaluated in 2021. The primary goals for these evaluation studies were to validate or update the current savings claims and provide recommendations to improve

[10] PA-specific studies are generally performed by the relevant statewide contractor team.

[11] For the EV research area, there will be 2 Eversource and 1 National Grid specific evaluation study. There will also be a study that compares the three different strategies included in each of the three studies.

the offerings in the future. Another aspect of each impact evaluation is to provide guidance on ways to increase future demand savings.

Figure 14: Demand Response Evaluation Activity in 2019-2021



The following section highlights some of the key themes from the demand response research area during the 2019-2021 term.

- **Collaboration.** One area that has been highly successful in demand response evaluation has been the collaboration among the implementation teams, vendors, and PAs. All these stakeholders have been actively engaged in the studies by providing feedback, helping to set up control groups, and collaborating with other PAs who might not have been directly involved in the study. Sharing lessons learned during the studies has not only been valuable in making sure that other PAs have learned from the recommendations highlighted in the studies but was also critical to ramping up the program offerings as quickly as possible.
- **Customer Satisfaction.** All the ADR offerings have experienced high levels of satisfaction and interest from participants in continuing the specific offering in the future. The residential Wi-Fi offering had high participant satisfaction with limited annual attrition, while the residential EV offering had 98 percent of their participants indicating that they are likely to participate in the program again, and similarly 97 percent of battery storage participants indicated they were likely to participate in the program again. For C&I Connected Solutions, all the survey participants across all three PAs indicated that their opinion of the PA was either positively impacted or unaffected by this program offering.
- **Increases in Demand Savings.** There has also been a trend of increasing demand savings from year to year for most offerings, showing that the changes in program design have resulted in positive changes in demand impacts. For example, residential Wi-Fi thermostats showed a significant increase in savings in moving from demonstration to statewide program.
- **Program Growth.** The studies have also shown that program participation continues to increase over time.

10.2 RESEARCH PRIORITIES FOR THE 2022-2024 TERM

In the 2022-2024 term, the EMC plans to focus evaluation on new offerings, offerings with high savings potential, integration of energy efficiency and ADR, and emerging issues or questions that might arise over the three-year plan, as described below.

- **New Offerings.** The EMC will be ready to evaluate any new program offerings that may be developed. Implementation and evaluation staff have worked closely in the past and have studied all new ADR offerings in the first year or two of their introductions. Evaluation would recommend continuing this approach into the 2022-2024 term and plan to study new offerings at least once in the first three years of introduction. This would include both process and impact components designed to help assist the program implementers in determining if the new offering is worthwhile to continue in the future, to help the implementers understand the expected demand savings, and also to understand how best to increase participation in the future. It is also possible that baseline or research pertinent to new offerings may be considered. *Planned Start/Stage 1s: TBD based on new offerings.*
- **Integration of EE and ADR.** Another area that the EMC plans to research is methods for integrating energy efficiency savings and ADR, which will take the form of a literature review. This research will survey the status of such integration efforts across the country, with the goal of identifying the pros and cons of this type of approach. *Planned Start: 2022. Stage 1: See Appendix.*
- **Existing Offerings.** The ADR offerings have undergone intensive evaluation during the first six years of their development. Due to this, the EMC does not plan to continue to evaluate these existing offerings at the same level of frequency; instead, these offerings will be evaluated periodically over the next several years, and likely not during the next two years (2022-2023). *Planned Start: 2024. Stage 1s will be developed as needed.*
- **C&I Targeted/Daily Dispatch.** One of the exceptions to reduction in frequency of evaluating existing offerings is for C&I targeted/daily dispatch, which is the largest of the ADR offerings in terms of overall claimable demand savings. Due to the magnitude of the savings and the manual nature of the demand savings coming from this offering, the EMC will continue to evaluate this offering every 2 to 3 years, mainly focusing on impacts but possibly involving process components as well. The short-term plan is to perform an impact study for the 2023 program offering, which will follow upon a planned evaluation of the summer program that is scheduled for 2021. *Planned start: 2023. Stage 1: See Appendix.*
- **Emerging Issues.** In the 2022-2024 term, there will likely be a greater degree of statewide collaboration on ADR evaluation studies, as more ADR programs move from small-scale demonstration to larger and more consistent statewide offerings. There could be questions or research tasks requested from implementers or stakeholders that need evaluation research. Although research will typically be focused on current offerings, if requested by implementers, EMC can conduct research on new areas such demand ADR for fleet EVs. There could also be questions that arise from the current list of studies to be conducted in 2021 that need further research. *Stage 1s will be developed as needed.*

SECTION 11: SUMMARY TABLE OF STAGE ONE PLANS

Figure 15 on the next page represents a summary of the preliminary evaluation plans, termed “Stage 1 Plans” that are included in this SEP. The Stage 1 plans included in this SEP represent research efforts that have already undergone preliminary scoping and are likely to take place in the 2022-2024 term; however, studies with a Stage 1 plan may not proceed in the 2022-2024 term, and studies without a Stage 1 plan may be added.

Figure 15: Stage 1 Plans

Research Area	Study Name	Brief Description
C&I	Custom Electric/Gas Rolling Impact Evaluation	Impact evaluation of custom gas & electric using rolling approach
C&I	Prescriptive Electric/Gas Impact Evaluation	Impact evaluation of prescriptive measures which could include upstream and/or downstream
C&I	Lighting Controls Impact Evaluation	Impact evaluation leveraging using pre/post analysis.
C&I	Existing Buildings Baseline Study	On site saturation study considering alternative approaches to onsite assessment, such as developing a customer panel for feedback
C&I	Baseline ISP Updates	Continuation of annual baseline and ISP Repository updates.
C&I	eTRM Review	Comprehensive review of prescriptive C&I measure assumptions in eTRM
C&I	Performance Optimization Measure Literature Review	Review of national best practices for program support and evaluation of performance optimization offerings
Residential	Income Eligible Process Evaluation	Process evaluations will focus on identifying the strengths and weaknesses of the current system, understanding the different participation trends and drivers across Community Action Agencies (CAAs) and barriers to customer awareness and participation
Residential	Income Eligible Single Family Impact Evaluation	Impact evaluation to develop deemed savings values for program measures
Residential	Multifamily (Market Rate and Income Eligible) Impact Evaluation	Impact evaluation(s) with particular focus on custom applications and energy optimization measures
Residential	Update of Non-Participant Study	To assess progress in expanding participation among key demographic groups
Residential	Heat Pump Crossover Temp Optimization	Quick hit study to get results based on rated information
Residential	HP Metering Impact Study	A large metering study for all heat pump types
Residential	RNC Low-Rise Baseline and Incremental Cost Update	Updating the RNC Low Rise baseline
Residential	RNC Electrification Barriers and Opportunities	Examine the barriers and opportunities facing builders, realtors, consumers, and HVAC contractors when constructing, selling, and buying all-electric homes
SCC	C&I Health & Safety NEIs	Assess health & safety related NEIs attributable to the C&I programs
SCC	Moderate Income NEI	Explore NEIs that may apply to the moderate-income customer group, particularly related to weatherization
SCC	RSR NTR Methodology Review	Revise RSRNTG methodology previously developed
SCC	DMSHP integrated controls MEs	Monitor market effects indicators identified in *MA 19X09-B: Evidence for Market Effects from Support for Ductless Mini-split Heat Pump Integrated Controls Study* and identify new market effects indicators not previously captured
SCC	NRNC Path 1 & 2 MEs	Track market effects indicators which were determined in *MA19X01-B: C&I New Construction Program Planning & Market Effects/Spillover Study*
SCC	Passive House MEs	Monitor market effects indicators identified in *MA20X11-B: Passive House Market Effects Baseline Study*
SCC	Follow-up on Code Trainings	Surveys and interviews to document the effects of CCSI training and other PA code training efforts
SCC	Marketing and Outreach Awareness Study	Ongoing longitudinal assessment of customer awareness and participation in energy efficiency
SCC	Minority and Women-Owned Business Enterprise Contractor Study	This study will explore the extent to which any disparities exist between PA utilization of state-certified M/WBEs and the availability of state-certified M/WBEs to serve as lead contractors and subcontractors for energy efficiency programs and services
DR	C&I Targeted Dispatch	In 2023, there will be a process and impact study for the C&I Targeted Dispatch program offering
DR	EE and DR Integrations Literature Review	Literature review that looks into how other utilities/states are integrating demand response and energy efficiency with a focus on combining benefit streams to look at offerings more holistic. This study will be included in the SEP but might not be able to make it into the May version

SECTION 12: C&I STAGE 1 PLANS

12.1 CUSTOM ELECTRIC ROLLING IMPACT EVALUATION

Study Name:	Impact Evaluation of Custom Electric Installations
Study Champion:	TBD
Research Area:	C&I Impact/NTG
Type of Study:	Impact Evaluation
Study Lead:	DNV
Applicable Fuel:	Electric
Underlying Program/Initiative:	Custom

BACKGROUND

Beginning with PY2016, the custom electric program offering has been evaluated for gross impacts each year. This study will continue the annual rolling impact evaluations to maintain a rolling three-year result.

OVERALL STUDY GOAL

The objective of this impact evaluation is to provide verification or re-estimation of electric energy and summer/winter peak demand savings estimates for a sample of custom electric projects through on-site and/or virtual inspection, monitoring, and analysis. In addition to the gross energy and demand realization rates, this study will also produce a lifetime savings adjustment factor (LSAF) based on an evaluation of measure event type and measure lifetime.

VALUE OF STUDY

The results of each annual study are combined with the prior two years to maintain a rolling three-year impact evaluation result. Realization rates may be separately determined for at the PA level for PAs that prefer their own result and at the statewide level for PAs who do not get a PA specific result. In recent years, Cape Light Compact, Eversource, and National Grid have each received PA specific results while Unitil has used the statewide results. In addition to producing new custom electric realization rates, the study will provide findings and recommendations for implementation to consider in its offerings.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

- **Task 1: Develop Sample Design:** The sample design will continue the three-year rolling approach, which began with PY2016. The rolling evaluation involves the annual gathering of data after with an independent sampling conducted for that interval. The independent samples from multiple intervals can be combined using propagation of error methods. The goal of the study will be to design a sample to estimate realization rates for electric energy savings and summer/winter peak demand savings, and to produce LSAFs. The target for annual energy savings will be set at the traditional ±10% at 90% confidence at the statewide level when sample results from three consecutive years of evaluation are combined (±10% at 80% confidence for peak demand savings).
- **Task 2: Develop Site Measurement and Evaluation Plans:** Site specific measurement, verification and analysis (MVA) plans for each sampled site will be developed. The plans outline evaluation methods, strategies, monitoring equipment placement, calibration, and analysis issues. The PAs and EEAC will provide comments and edits to clarify and improve the plans prior to them being finalized. Evaluation plans will specify the appropriate level of rigor for each site to ensure data is being collected efficiently and with enough confidence to meet stakeholder objectives.

- **Task 3: Data Gathering and Analysis:** Data collection may include physical and/or virtual inspection and inventory, interviews with facility personnel, observation of site operating conditions and equipment, short-term metering of usage, and EMS trends. At each site, evaluators will perform a facility walk-through that focuses on verifying the post-retrofit or installed conditions of each energy conservation measure (ECM). Site evaluation procedures and site analysis will be presented in a site report for each sampled site. Site results will be aggregated and expanded to the study population and other segments of interest using the weighting scheme developed in the sample design.
- **Task 4: Report Writing and Follow-up:** A results memo, which summarizes the results of the impact evaluation in time for the annual reporting filing deadline, will be provided. A written summary report containing the evaluation results and key findings following each round of custom impact evaluation will also be provided.

IMPLEMENTATION REVIEW

Total Budget Range: $750,000 - $1,500,000

Timeline: Annually (April to April)

12.2 CUSTOM NATURAL GAS ROLLING IMPACT EVALUATION

Study Name:	Impact Evaluation of Custom Gas Installations
Study Champion:	TBD
Research Area:	C&I Impact/NTG
Type of Study:	Impact Evaluation
Study Lead:	DNV
Applicable Fuel:	Natural Gas
Underlying Program/Initiative:	Custom

BACKGROUND:

Beginning with PY2016, the custom natural gas program offering has been evaluated for gross impacts each year. This study will continue the annual rolling impact evaluations to maintain a rolling three-year result.

OVERALL STUDY GOAL

The objective of this impact evaluation is to provide verification or re-estimation of annual energy therms savings estimates for a sample of custom natural gas projects through on-site and/or virtual inspection, monitoring, and analysis. In addition to the gross energy realization rates, this study will also produce a LSAF based on an evaluation of measure event type and measure lifetime.

VALUE OF STUDY

The results of each annual study are combined with the prior two years to maintain a rolling three-year impact evaluation result. Realization rates may be separately determined for at the PA level for PAs that prefer their own result and at the statewide level for PAs who do not get a PA-specific result. In recent years, Columbia Gas, Eversource, and National Grid have each received PA specific results while Berkshire Gas, Liberty, and Until has used the statewide results. In addition to producing new custom gas realization rates, the study will provide findings and recommendations for implementation to consider in its offerings.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

- **Task 1: Develop Sample Design:** The sample design will continue the three-year rolling approach, which began with PY2016. The rolling evaluation involves the annual gathering of data after with an independent sampling conducted for that interval. The independent samples from multiple intervals can be combined using propagation of error methods. The goal of the study will be to design a sample to estimate realization rates for gas energy savings and to produce LSAFs. The target for annual energy savings will be set at the traditional ±10% at 80% confidence at the statewide level when sample results from three consecutive years of evaluation are combined.
- **Task 2: Develop Site Measurement and Evaluation Plans:** Site specific measurement, verification and analysis (MVA) plans for each sampled site will be developed. The plans outline evaluation methods, strategies, monitoring equipment placement, calibration and analysis issues. The PAs and EEAC will provide comments and edits to clarify and improve the plans prior to them being finalized. Evaluation plans will specify the appropriate level of rigor for each site to ensure data is being collected efficiently and with enough confidence to meet stakeholder objectives.
- **Task 3: Data Gathering and Analysis:** Data collection may include physical and/or virtual inspection and inventory, interviews with facility personnel, observation of site operating conditions and equipment, short-term metering of usage, and EMS trends. At each site, evaluators will perform a facility walk-through that focuses on verifying the post-retrofit or installed conditions of each ECM. Site evaluation procedures and site analysis will be presented in a site report for each sampled site. Site results will be aggregated and expanded to the study population and other segments of interest using the weighting scheme developed in the sample design.
- **Task 4: Report Writing and Follow-up:** A results memo, which summarizes the results of the impact evaluation in time for the annual reporting filing deadline, will be provided. A written summary report containing the evaluation results and key findings following each round of custom impact evaluation will also be provided.

IMPLEMENTATION REVIEW

Total Budget: $600,000 - $1,200,000

Timeline: Annually (August - March)

12.3 PRESCRIPTIVE ELECTRIC/NATURAL GAS IMPACT EVALUATION

Study Name: Impact Evaluation of Prescriptive Installations
Study Champion: TBD
Research Area: C&I Impact/NTG
Type of Study: Impact
Study Lead: DNV
Applicable Fuel: Electric and Natural Gas
Underlying Program/Initiative: Prescriptive

BACKGROUND

It has been more than five years since the PAs conducted an impact evaluation of prescriptive measures. Further, as savings from lighting measures decline, the share of savings derived from prescriptive measures are likely to increase resulting in greater risk to savings when using older evaluated savings estimates.

OVERALL STUDY GOALS

The objective of this study is to provide verification or re-estimation of electric energy and demand and/or natural gas savings estimates for a subset of Prescriptive projects through site-specific inspection, monitoring, and analysis. The results of this study will be used to determine new deemed savings values and/or savings parameters for selected Prescriptive energy efficiency offerings. Evaluation results will be determined at the statewide level. The evaluation sample for this study will be designed in consideration of the 90% confidence level for energy (kWh) and the 80% confidence level for coincident peak summer and winter demand (kW) or natural gas therms savings.

VALUE OF STUDY

This study will produce results for one or more prescriptive offerings. This study will require program tracking data from the PAs by August of the study year for data review and sampling purposes. Data collection will be scheduled to capture the appropriate season for each sampled project with a summary report delivered in time for inclusion in the targeted annual filing. In addition to producing new deemed savings, baseline adjustments, or other savings factors, the study will provide findings and recommendations for implementation to consider in its offerings.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

- **Task 1: Program Tracking Data Review.** The evaluation team will review prescriptive program tracking data and produce a summary of savings, both electric and natural gas, by end-use. This summary will be shared with the PAs and EEAC to determine if any prescriptive offerings have been or will be moved to an upstream delivery model, or if any other significant program changes have occurred. Following this investigation, a stakeholder meeting will be established to determine which prescriptive offerings should be evaluated.
- **Task 2: Develop Sample Design.** The goal of the study is to design a sample to provide new statewide deemed savings values and/or savings parameters for selected end-uses. For electric measures, the primary variable of interest for the sample design is annual kWh savings, the PAs are also interested in coincident peak summer and winter kW because it is used in the ISO-NE FCM. The target for annual kWh will be set at the traditional ±10% at 90% confidence, while the target for summer and winter kW will be set at ±10% precision at 80% confidence during the design. For natural gas measures the sample design will be based on achieving ±10% precision at 80% confidence for annual therms savings.
- **Task 3: Develop Site Measurement and Evaluation Plans.** The study team will develop end-use specific MVA plans for each selected measure type. The plans outline on-site methods, strategies, monitoring equipment placement, calibration, and analysis issues. The PAs and EEAC will provide comments and edits to clarify and improve the plans prior to them being finalized.
- **Task 4: Data Gathering and Analysis.** Data collection will include physical and/or virtual inspection and inventory, interview with facility personnel, observation of site operating conditions and equipment, short-term metering of usage, and EMS trends. At each site, evaluators will perform a facility walk-through that focuses on verifying the post-retrofit or installed conditions of each ECM. The study team will apply the model-assisted stratified ratio estimation methodology to aggregate the site results and expand to the study population and other segments of interest.

- **Task 5: Report Writing**. The study team will provide the PAs with a written report containing the evaluation results and key findings.

IMPLEMENTATION REVIEW

Total Budget Range: $200,000 - $600,000 (depending on the measures selected following program tracking data review)

Timeline: Annually (August – April)

12.4 LIGHTING CONTROLS IMPACT EVALUATION

Study Name: Lighting Controls Impact Evaluation
Study Champion: TBD
Research Area: C&I Impact/NTG
Type of Study: Impact Evaluation
Study Lead: DNV
Applicable Fuel: Electric
Underlying Program/Initiative: All C&I Programs/Initiatives

12.5.1 BACKGROUND

Anticipated net savings from traditional lighting replacement projects continue to decline in the 2022-2024 term. This results in a shift in program plans towards lighting control measures. However, lighting control savings have not been as well vetted through evaluation as more traditional lighting measures, presenting a point of risk in the PAs savings claims. Given the expectation that lighting controls contribution to the overall portfolio will increase over time, it is essential that this research be undertaken early in the 2022-2024 term.

OVERALL STUDY GOAL

There are three primary objectives of this study:

1. To establish a framework for presenting gross control impacts that provide sufficient disaggregation to meet the needs of implementers, EEAC Consultants, and evaluators.
2. To quantify gross control impacts for controls installed through the initiatives using a combination of pre- and post-metering techniques.
3. To quantify the impact of RCx on savings associated with lighting controls.

VALUE OF STUDY

As lighting controls become a larger portion of initiative savings, it is important to understand impacts from specific control elements and configurations. Early evaluation results and close coordination with implementers will help provide feedback to implementers to inform savings estimate, program designs, and valuable direction for customers as they embrace greater control over their lighting systems.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

The PAs anticipate conducting a combination of secondary and primary research. Secondary research will focus on identifying impact results from other jurisdictions and previously completed studies in Massachusetts that can be leveraged to understand how best to disaggregate control impacts and to help inform M&V designs for the primary research.

- **Task 1: Secondary Research.** Secondary research will be used to inform discussions between implementers, EEAC Consultants, and evaluators as part of objective 1 and to help shape the M&V plans for objectives 2 and 3. The team anticipates two components of secondary research including a literature review to identify primary data collection in other jurisdictions with an emphasis on metering studies (especially any with pre/post metering) and leveraging historic Massachusetts research including the results of two recent studies: the *Lighting Controls Market Study* (MA20C11-E-LCR) and the controls metering portion of the *Upstream Lighting Impact Study* (MA19C06-E-UPLGHT), as well as results from the PY2017-18 *Custom Electric Impact Study* (MA19C07-E-CUSTELEC).
- **Task 2a: Primary Research – Pre/Post Metering of Control Installation.** To better understand the effects of lighting controls on energy usage, the team will install energy consumption meters at a sample of participating sites across initiatives. Leveraging a wider set of participants across initiatives will help expand the sample size and increase the ability to ascertain results that can be more broadly applied. The PAs and EEAC Consultants have expressed a strong desire to include pre/post metering to help reduce the number of assumptions being made. Historically, evaluators have often had to rely on post metering which requires developing assumptions about lighting operation absent controls. Achieving pre/post metering will require careful coordination with implementers to identify sites in rea -time so that metering equipment can be installed with sufficient lead time ahead of program measures – this will be most difficult for the Upstream Initiative but could be accomplished by receiving notification when fixtures with integrated controls are ordered. As part of the team's coordination, they will emphasize the value of installing meters to implementers as it will more accurately inform program savings. It will also be important to work with customers to understand if the use of spaces where controls are being installed will have the same level and type of use pre and post installation. Additional details on the approach and logistics for this metering will be discussed at greater depth in the Stage 3 plan. Note that National Grid successfully performed pre/post metering of small business lighting customers in its New York service territory in 2017 and 2018 – with evaluation contractors working directly with program vendors.
- **Task 2b: Primary Research – Pre/Post Metering RCx.** While advances in lighting controls have provided the ability for customers to easily set schedules, integrate occupancy sensors, dim, and dynamically control their lighting, realizing savings depends on customers taking advantage of these features. Absent proper education and setup, lighting controls may fall short of achieving their potential savings and may leave customers disappointed with lighting performance. Lighting system RCx or training can have a dramatic impact on the effectiveness of lighting controls. If program designers intend to include RCx activities as part of initiatives, this presents an opportunity for a controlled experiment. Working with implementers, the evaluation team will design an experiment that allows for installation of metering equipment before RCx activities take place with individual customers allowing for pre/post results to isolate the impact of RCx. As RCx activities naturally take place after equipment is installed, this should not have a negative impact on implementation activities, and it may be possible to integrate EM&V activities directly with implementation of RCx activities. Further, the results of the EM&V (if RCx is effective) will provide compelling evidence for future marketing of RCx activities. In so far as possible, the team will attempt to leverage the same sites used as part of Task 2 so that they have a complete picture of the chain of savings with a pre-controls baseline, post-controls/pre-RCx baseline, and post-RCx savings.
- **Task 3: Report Writing and Follow-up.** A final report, which summarizes the results of the evaluation study in time for the annual reporting filing deadline, will be provided.

IMPLEMENTATION REVIEW

Total Budget Range: $400,000 - $750,000

Timeline: August 2021 – December 2022

12.5 EXISTING BUILDINGS BASELINE STUDY

Study Name: Existing Building Baseline Saturation
Study Champion: TBD
Research Area: C&I Markets
Type of Study: Market Characterization
Study Lead: DNV
Applicable Fuel: Electric and Natural Gas
Underlying Program/Initiative: All C&I Programs/Initiatives

BACKGROUND

C&I baseline saturation data was collected as part of the *2016 C&I Market Characterization On-site Assessments Study* and the *2019 C&I Customer Onsite Baseline Saturation Study* (MA19C09). It is clear from past existing building baseline saturation studies that there is a need for more granular research on saturation of end-use measures with the ability to drilldown into equipment specifics. Historically, the only C&I end-use that has had this level of detail has been lighting, which has built up knowledge through a series of standalone lighting market studies. Unfortunately, the 2019 study was heavily impacted by the COVID-19 pandemic which greatly reduced the ability to collect more granular data through on-site visits. However, there were lessons learned from the 2019 study and the *2020 Lighting Market Model Study* which can be applied to future studies that may help glean more granular data and establish a panel study approach.

OVERALL STUDY GOAL

A primary goal of this study is to characterize the type, quantity, and efficiency of energy-using equipment for existing buildings in Massachusetts. Understanding changes in energy-using equipment over time is a secondary objective of the study. Setting up for the possibility of a panel study will be important to establish this capability.

VALUE OF STUDY

The baseline saturation study will provide a clear understanding of existing equipment inventory which can be used to help shape the PAs' programs and initiatives by providing key inputs to program designers and as inputs for potential studies. Data collected through this study will be a primary input into evaluation studies that need to understand the prevalence of various equipment types and efficiency levels to establish baselines. The value of the study for both planning and evaluation will be increased by incorporating a panel approach as has been done for the Residential Sector and recently for the *C&I Lighting Market Study*. A panel study offers the ability to establish a deeper and more robust understanding of trends within the market and more granular data on equipment types over time.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

For this study, the team will build upon lessons learned from C&I lighting, past C&I baseline studies, and advances in panel study designs that were implemented in Massachusetts for the Residential Sector.

- **Establishing desired level of granularity by end-use category.** Based on discussions with the PAs and EEAC Consultants, specific end-use categories require more granular details. For example, HVAC was identified as an area for which insufficient granularity exists. The study team will work with the PAs and EEAC Consultants to develop a list of desired end-uses, frequency, and level of granularity to be studied. Establishing which categories requires deep dives that capture data at a higher level and the frequency at which the data should be collected will help focus the team's research – reducing burden on customers and overall study budget.
- **Sub-sector identification and sample design.** The sample design for this study is complicated by the relative heterogeneity of the C&I Sector. The team anticipates working with the PAs and EEAC Consultants to identify sub-sectors that will allow for subsamples that are more homogenous. Sample design will likely be stratified based on NAICS codes, billing data, participation status, and location. In so far as sub-sectors of importance can be identified, the team will work to roll out the study in those sub-sectors first in a staged approach that will allow the study to make incremental progress, provide quick-hit results, and test panel procedures.
- **Leveraging impact evaluation studies.** Given the desire to include program participants in the baseline saturation study and the burden imposed on customers to participate in the program, the study team will leverage planned impact evaluation studies to supplement data collection efforts. Further, it is possible to piggyback data collection at site visits as part of impact evaluations. While this will somewhat increase the burden on individual customers, the data collection already taking place as part of these evaluations will reduce overall data collection needs for the baseline saturation study and overall customer burden by requiring fewer customers to interact with evaluators.
- **Data collection instrument.** Recognizing a need for more granular data collection, the team will re-design the existing data collection instruments used as part of the MA19C09 *Baseline Saturation Study*. This prior study included data collection instruments for on-site visits as well as virtual visits.
- **Recommendations for panel follow up activities.** This study is an opportunity to establish a C&I customer panel akin to the existing residential customer panel. Panel design should leverage the successes, failures, and lessons learned from the residential panel studies. Further, the team will leverage experience with building stock panel studies both in Massachusetts and in other jurisdictions. Throughout the study, all activities will be designed to allow for future panel activities.
- **Installation of advanced metering equipment (optional).** Understanding baseline operations and energy usage for participants and non-participants can be helpful for impact evaluations and identifying opportunities for energy and demand savings. Installing remote metering equipment at a subset of sites will provide insight into end-use usage patterns from baseline saturation participants. The metering equipment can be setup to report back results without the need for additional visits to customer sites. In so far as some of the baseline study participants elect to participate in programs, this will provide a convenient means to collect pre- and post-metering data. Note that pre/post metering data is a potential added bonus and not the primary focus of the metering.

IMPLEMENTATION REVIEW

Total Budget Range: $500,000 - $750,000 annually (budget will be dependent on scope and initiative coverage)

Timeline: Annually (January - December)

12.6 BASELINE ISP UPDATES

Study Name:	Ongoing C&I Industry Standard Practice Research & Repository
Study Champion:	TBD
Research Area:	C&I Impact/NTG
Type of Study:	Baseline/ISP
Study Lead:	DNV
Applicable Fuel:	Electric and Natural Gas
Underlying Program/Initiative:	All C&I Programs/Initiatives

BACKGROUND

Beginning in 2019, the C&I evaluation team began centralizing the process for prioritizing baseline ISP research and developed the first iteration of the Baseline Repository. The purpose of the Baseline Repository is to provide evaluation guidance on appropriate baselines for a list of measures. The Repository is maintained and updated annually with new measures and ISP findings.

OVERALL STUDY GOAL

The primary objectives of this study are two-fold:

1. Repository upkeep, which includes a formal roll-out of the Baseline Repository with educational outreach to potential stakeholders, incorporation of new data, and further refinement of procedures.
2. Conduct ISP research for measures prioritized through an established ISP working group.

VALUE OF STUDY

The Baseline Repository is a living reference document, to be reviewed at regular intervals and expanded upon completion of further ISP, baseline studies, custom measure decisions arrived at through other evaluations, or additional primary research. This study will continue the annual update and training provided to stakeholder groups to ensure that they are aware of the Repository and understand how to use it and what the implications are when it is not used. Research will be conducted only on an as-needed basis as determined through a working group facilitation process.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

Task 1: Annual update training. The evaluation team conducted 4 rollout training sessions in 2020. A shorter update training session will be required annually moving forward that highlights any changes in the Repository from the previous version. This will likely be conducted in conjunction with the custom screening tool training.

Task 2: ISP Working Group facilitation. The ISP working group will meet regularly throughout the year. One of the primary sources of content for these discussions will be the information surrounding Task 3 (Measure prioritization and selection) however other issues are likely to arise throughout the year that could benefit from discussion with the group. This will cover the work needed to organize and facilitate those meetings.

Task 3: Measure prioritization and selection. This task will cover the measure selection for research to be completed throughout the year, however it will not cover the actual primary research itself.

Task 4: Repository user question or feedback responses. As the repository is used more and more throughout MA, questions frequently arise on the content or feedback is received on how to improve the Repository. This task will provide an avenue for questions/feedback to be brought to the Repository team to ensure consistent responses appropriate updates are made to the Repository.

Task 5: Repository updates. As primary research is completed, it will be documented in the repository and released for public use.

IMPLEMENTATION REVIEW

Total Budget Range: $80,000 (base annual tasks) + $10,000 - $60,000 per ISP research effort dependent on appropriate level of rigor.

Timeline: Annual (January – December)

12.7 ELECTRONIC TECHNCIAL REFERENCE MANUAL REVIEW

Study Name: eTRM Review
Study Champion: TBD
Research Area: C&I Impact/NTG
Type of Study: Impact Evaluation
Study Lead: DNV
Applicable Fuel: Electric, Natural Gas
Underlying Program/Initiative: All C&I Programs/Initiatives

BACKGROUND

There are concerns that the current eTRM has key elements that are becoming dated, has gaps or areas of uncertainty among its savings parameters that could use further research, and carries measures that may no longer be needed. In addition, there is often activity in the Custom program that use prescriptive savings methods that are worthy of examination to understand the implications of this practice. Note that there are current efforts being undertaken to examine the PSD/TRMs in Connecticut and New Hampshire by DNV/ERS that this effort can benefit from; particularly for collectively addressing an approach to any common identified update needs.

OVERALL STUDY GOAL

The primary goal of the study is to systematically review the C&I measures in the eTRM to ensure measures remain relevant, assess validity of savings approach for custom offerings, savings parameter candidates for update are identified, and resources and studies to provide those updates are developed in conjunction with identified needs from adjacent states.

VALUE OF STUDY

This study will offer a significant milestone in the process of updating and refining the MA eTRM to ensure it is producing accurate savings claims. This effort could provide the basis for an annual maintenance effort and staged planning of measure introduction in partnership with implementation strategies.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

- Review of eTRM C&I Measures and savings parameters (electric and natural gas) to identify those with uncertain parameters, dated assumptions, validity for use within custom program, and susceptibility to rapid market changes. Develop means to prioritize parameters for review/update.
- Interview staff to gather and understand measures of particular concern or interest.
- Assess availability and suitability of regional studies available for use in the eTRM and any adjustments needed to optimize to MA characteristics.
- Assess MA gaps and needs relative to those observed in similar efforts in NH and CT.
- Leverage opportunities to design multistate studies with pooled or unique samples using principles outlined in the Rhode Island piggy backing study.

IMPLEMENTATION REVIEW:

Total Budget Range: $150,000 - $200,000

Timeline: 3 to 6 months

12.8 PERFORMANCE OPTIMIZATION MEASURE LITERATURE REVIEW

Study Name: Performance Optimization Offerings Literature Review
Study Champion: TBD
Research Area: C&I Markets
Type of Study: Literature Review
Study Lead: Cadeo
Applicable Fuel: Electric and Natural Gas
Underlying Program/Initiative: TBD

BACKGROUND

For years, lighting and other key widget-based efficiency improvements have helped C&I efficiency programs meet their goals. However, as market baselines for these end-uses become increasingly efficient, the PAs will need to look elsewhere for savings to buoy their programs. One potential source of such savings are performance optimization programs, or, in other words, programs that generate their savings through effective management of energy equipment or systems.

OVERALL STUDY GOAL

The overall goal of this study is to survey the national landscape and determine if any, performance optimization programs implemented in other parts of the country could be effectively incorporated into the PAs' C&I portfolio.

VALUE OF STUDY

Learning from the experiences—successful or not—of other program administrators implementing performance optimization programs is a prudent first step in potentially adding such a program to the PAs' C&I Sector offerings. The literature review described below will inform the PAs regarding the range of existing performance optimization programs, as well as allow them to leverage other program administrators. Literature reviews are a best practice and an essential first

step in program development as the review will help the PAs avoid previous programmatic missteps and increase the likelihood of program success. Potential information yielded might include insights into measure lifetimes, spillover, and workforce impacts.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

Task 1: MA Program Manager Interviews. At the outset of the study, the research team will meet with each PA, as well as their vendors. The research team will discuss their previous experience with any performance optimization programs, identify any such programs they know of, and how such programs could potentially buttress future C&I portfolios.

Task 2: Literature Review. Following these interviews, the research team will complete a nationwide (and perhaps international) scan to identify any active and/or previously active performance optimization programs. For example, the Pacific Northwest is an area that has more actively pursued performance optimization programs. After developing a list of such program, the team will complete a comprehensive review of each program (i.e., review all publicly available documentation, include evaluations, supporting research, and planning documents). The review team will focus on the potential applicability of each program in Massachusetts, as well as the identification of lessons learned that the PAs could apply to increase their chances of success.

Task 3: Non-PA Program Managers Interviews. Sometimes the documentation available online for programs – particularly more exploratory, pilot programs, which performance optimization programs can be – is insufficient to truly assess the applicability to Massachusetts and glean lessons learned. To overcome this common shortcoming, the research team will interview the utility and/or vendor program manager for any performance optimization programs identified as promising for potential launch in Massachusetts. These informal interviews will allow the research team to ask more detailed questions about how the program was planned, launched, implemented, and how the PAs might best proceed.

IMPLEMENTATION REVIEW

Total Budget Range: $50,000 - $75,000

Timeline: TBD

13. RESIDENTIAL STAGE 1 PLANS

13.1 INCOME ELIGIBLE PROCESS EVALUATION

Study Name: Income Eligible Process Evaluation
Study Champion: Kimberly Crossman
Research Area: Retrofit/HVAC Research Area
Type of Study: Market Research
Study Lead: TBD
Applicable Fuel(s): All Fuel Types
Underlying Program: Income Eligible Program

OVERALL STUDY GOAL:

The PAs, in coordination with the (LEAN and partnering CAPs, offer the Income Eligible Services (IES) program to comprehensively address building needs and reduce energy costs for income qualifying customers. The IES program serves both single-family and multifamily buildings occupied by families living under 60 percent of the state median income (SMI).

The most recent process evaluation of the Income Eligible program represented 2017-2018 activities.[12] Many of the needs, key findings, and recommendations highlighted in that report remain pertinent today,[13] such as anecdotal reporting of inconsistent service across CAPs, challenges resulting from not having sufficient granular or consistent reporting of participation metrics, and a continued focus on serving smaller (5-25) multi-unit buildings. The PAs and LEAN, in administering IES, also face new and emerging challenges including anticipated increase in eligible populations due to economic hardships resulting from COVID-19, overcoming barriers to heat pump installations, and making even more concerted efforts to equitably service the eligible population, including renters and English-isolated customers.

The IES program process evaluation will follow up key findings and recommendations reported in the prior evaluation as well as investigate and document the following types of research issues:

- Efforts to address data tracking and reporting needs, particularly the fact that some important participant, dwelling characteristics, audit information, recommendations, etc. are not available digitally.
- Implications of COVID-19 on population eligibility and sufficiency of budget and CAP resources to address customer needs.
- Effectiveness of outreach and funneling mechanisms and potential missed opportunities for customer engagement.
- Variation in service to income-eligible customers across CAP agencies.
- Coordination and opportunities related to serving moderate-income customers.
- Efforts and impacts of workforce development initiatives implemented by LEAN and the PAs.
- Barriers imposed by health and safety and other deferral issues.
- Customer experience and journey for target groups (English-isolated customers and renters).
- Experience with moderate-income customers and coordination to better serve that target segment.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

- **Task 1: Kick-off Meeting and Interviews with Stakeholders.** The first task is to come to consensus with the PAs, EEAC, and stakeholders (including the Equity Working Group) on research priorities. The prior process evaluation highlighted the importance of integrating LEAN and interested CAPs early in the process. First, the team will conduct interviews with the PAs as well as with LEAN staff. The interviews will ensure current understanding of program operations and critical evaluation needs.

  The evaluation team will then host one to two facilitated meetings to align on draft research questions and activities. The output of these meetings is a Stage 3 plan, specifying the final research objectives and activities to address those objectives, timeline, and data needs from LEAN and CAPs. The Stage 3 plan will also identify how, if

[12] Available at: https://ma-eeac.org/wp-content/uploads/RES-38-Income-Eligible-Evaluation-Report_FINAL_7Feb2019.pdf
[13] Based on review of the most recent Income Eligible Process Evaluation report and Income Eligible Services Workshop notes from November 2020 (November 10 – Workshop #2 Income Eligible Services ‹ MA Energy Efficiency Advisory Council (ma-eeac.org))

at all, this study will coordinate with other studies, including the I*ncome Eligible Impact Evaluation and Nonparticipant Market Characterization and Barriers Study*.

- **Task 2: CAA Surveys or Interviews.** The evaluation team will conduct telephone interviews with select CAA staff. The telephone interviews and/or email surveys will explore changes in market and demand due to COVID-19, any budget and resource constraints (including systems constraints), implications on service, and current and future concerns about program activities and performance. The research will also leverage CAA expertise and experience with English-isolated, renter, and moderate income populations to further investigate barriers and unique experiences of those customers.
- **Task 3: Participant Surveys.** The prior evaluation was limited due to inability to obtain participant data. For this next process evaluation, the evaluation team recommends building in sufficient time for coordination with LEAN and the CAAs to obtain participant data for analysis and surveys. The surveys will investigate issues such as: customers' experiences, initial barriers to participation; outreach effectiveness, and customer characteristics. The survey will also allow for cross-sectional analysis by CAA (to identify any variations of service) and groups of interest (e.g., English-isolated customers).
- **Task 4: Customer Interviews and Journey Mapping (focused on English-isolated customers).** The PAs and EEAC identified the need to better understand IES Program interactions with English-isolated customers across all stages of their journey. Customer Journey Mapping provides a mechanism for researching, documenting, and visualizing that journey and identify opportunities to enhance services to English-isolated customers, especially given the barriers that can be unique to this group. The quantitative survey research may provide a picture of this journey; however, qualitative research is often necessary to step through each stage of the process with a customer. The study will therefore include additional qualitative research (likely telephone or in-person interviews), likely leveraging the participant survey to cost-effectively recruit customers, using native-speaking interviewers if possible.
- **Task 5: Analysis and Reporting.** The evaluation team shall present preliminary results before submitting a draft report and work closely with the PAs, EEAC consultants, CAPs, and LEAN to reach consensus on the findings. The team will also share results through presentations with PAs, the Equity Working Group, and LEAN.

IMPLEMENTATION REVIEW

Budget: TBD

Timeline: 2022-2024 Implementation Planning Cycle

13.2 INCOME ELIGIBLE SINGLE FAMILY IMPACT EVALUATION

Study Name: Income Eligible Single Family Impact Evaluation

Study Champion: Kimberly Crossman

Research Area: Retrofit/HVAC Research Area

Type of Study: Impact Evaluation

Study Lead: TBD

Applicable Fuel(s): All Fuel Types

Underlying Program: Income Eligible Program

OVERALL STUDY GOAL

The primary goal of the Income Eligible (IE) Single Family (SF) Impact Evaluation is to estimate the gross, per-unit energy savings associated with every IE SF electric, natural gas, propane, and heating oil measure.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY:

Like past IE SF and HES impact evaluations, the evaluation team shall use a multi-faceted impact approach that relies on billing analysis, building simulation, and engineering algorithms. In some instances, the evaluation team shall use a combination of approaches to generate the most reliable result.

- **Task 1: IE SF Data-Focused Interviews.** The evaluation will begin by meeting with identified IE SF program data leads (CAPs, LEAN, both) to discuss the range of IE SF data available to support the evaluation. The team shall also use these meetings to discuss the data themselves to ensure the evaluation team correctly interprets, joins, and analyzes them. In past evaluations of this program some of the data have not been available in standard, digital formats. However, there have been great improvements in the ability of software to digitize data from paper audit forms and other relevant documents kept by these organizations, and the use of these digitization methods should be explored during this task. Also, these initial discussions will avoid the ambiguity that can slow down studies and/or invalid results.
- **Task 2: Billing Analysis.** To assess measures with larger savings, such as weatherization and heating system replacements, the evaluation team shall conduct a billing analysis. The exact cohort of IE SF participants (i.e., customers treated in the calendar year) included in the billing analysis will depend on the timing of the study itself although the goal will be to provide the PAs with the most current results possible. The analysis will include a matched control group and account for control for energy savings associated with non-PA funding sources (e.g., state WAP funds).
- **Task 3: Building Simulation.** For measures that do not lend themselves to billing analysis but generate interactive effects, the team shall rely on building simulation. Industry recognized modeling platforms such as BEopt, EnergyPlus, or another similar platform shall be used to create multiple model prototypes to reflect the range of IE SF participant building characteristics and heating and cooling system configurations. The team shall calibrate all models using actual IE SF energy consumption for the relevant subset of program participants.
- **Task 4: Engineering Algorithms.** The third approach – engineering algorithms – is the best option for measures with relatively small savings and that do not generate interactive effects (e.g., showerheads and aerators). The team shall rely heavily on the latest MA TRM for this task.
- **Task 5: Reporting.** The evaluation team shall present preliminary results before submitting a draft report and work closely with the PAs, EEAC consultants, CAPs, and LEAN to reach consensus on the findings, as well as how they should be applied prospectively to future program cycles.
- **Other Considerations.** Metering, surveys with participants (for measure persistence), and demonstration sites for new measures.

IMPLEMENTATION REVIEW

Budget: $125,000 - $225,000

Timeline: 2022-2024 Implementation Planning Cycle

13.3 MULTIFAMILY (MARKET RATE AND INCOME ELIGIBLE) IMPACT EVALUATION

Study Name:	Multifamily (Market Rate and Income Eligible) Impact Evaluation
Study Champion:	Kimberly Crossman
Research Area:	Retrofit/HVAC Research Area
Type of Study:	Impact Evaluation
Study Lead:	TBD
Applicable Fuel(s):	All Fuel Types
Underlying Program:	Residential Coordinated Delivery (RCD)

OVERALL STUDY GOAL

The primary goal of the Multifamily (MF) Impact Evaluation is to estimate the gross energy savings associated with all MF market rate (MR) and income eligible (IE) electric, natural gas, propane, and heating oil measures. This includes custom measures and, pending scoping discussions with the PAs, measures installed in common areas. The study could potentially also estimate net-to-gross values for measures installed through the MR program.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

The evaluation team shall use a variety of approaches to estimate savings including billing analysis, building simulation, engineering algorithms, and an engineering desk review of custom projects.

This study will leverage the previous completed (and periodically updated) MF Census project completed in the 2019-2021 implementation cycle. The study associated individual PA account numbers at the MF building/property level, which will enable the impact evaluation to estimate program impacts more confidently.

- **Task 1: MF Data-Focused Interviews.** Multifamily data is historically difficult to work; it is tracked at multiple levels (unit, building, and property) with usage associated with one or more accounts. As noted above, the MF Census Study has already addressed some of these persistent issues. However, to make sure our team understand the MF program data, as well as its linkages to PA account numbers, our team will work closely with identified PA, vendor, and CAP leads to ensure our team correctly interprets, joins, and analyzes the relevant program and usage data. In past evaluations of this program, some of the data have not been available in standard, digital formats. However, there have been great improvements in the ability of software to digitize data from paper audit forms and other relevant documents kept by these organizations, and the use of these digitization methods should be explored during this task.
- **Task 2: Billing Analysis.** Billing analysis is a powerful tool that, with sufficiently linked data, can answer important questions about whole building savings by accounting to interactions between improvements to common area, tenant spaces, and the larger building shell and mechanical systems. The evaluation team shall attempt a billing analysis for the subset of participating properties where certainty exists regarding the linkages to program improvements and PA account level usage. The exact cohort of MF participants (i.e., buildings treated in calendar year 2020) included in the billing analysis will depend on the timing of the study.
- **Task 3: Building Simulation.** Billing analysis can be problematic for MF evaluation since some measures are hard to tease out. Therefore, building simulation can be an increasingly important tool for assessing savings, although calibration also requires confidence in the linkages between participants/measures and PA consumption records. The evaluation team will leverage the MF models developed as part of the Heat Pump Fuel Displacement study (completed in 2021 by the Guidehouse team) to minimize costs and ensure consistency.

- **Task 4: Engineering Algorithms.** Engineering algorithm are the best and most cost-effective option for measures with relatively small savings and that do not generate interactive effects (e.g., showerheads and aerators). The evaluation team will rely heavily on the latest MA Technical Reference Manual for this task.
- **Task 5: Custom Measure Review.** While simulation is also helpful for assessing more common custom measures, it can be cost-prohibitive to create individual models for every custom measure. As such, the evaluation team shall complete an engineering desk review of a sample of custom measures. The review will focus on validating the accuracy of the claimed savings.
- **Task 6: Reporting.** The evaluation team shall present preliminary results before submitting a draft report and work closely with the PAs, EEAC consultants, CAPs, and LEAN to reach consensus on the findings, as well as how they should be applied prospectively to future program cycles.

IMPLEMENTATION REVIEW

Budget: $200,000 - $300,000

Timeline: 2022-2024 Implementation Planning Cycle

13.4 UPDATE ON NON-PARTICIPANT STUDYY

Study Name: Nonparticipant Market Characterization and Barriers Update Study
Study Champion: Kimberly Crossman
Research Area: Retrofit/HVAC Research Area
Type of Study: Market Research
Study Lead: TBD
Applicable Fuel(s): All Fuel Types
Underlying Program: Income Eligible Program

OVERALL STUDY GOAL:

In 2019, the PAs and EEAC enlisted expansive and in-depth research to characterize nonparticipants and identify barriers to participation. The research, which complemented the *Residential Nonparticipant Customer Profile Study*, identified barriers and opportunities to serve customers, focusing on three groups of interest: renters, moderate income, and English-isolated customers.

Further, in May 2020, the EEAC formed the Equity Working Group to identify and prioritize efforts to fulfill the need to equitably serve customers, again targeting efforts on these three priority populations (as well as small business). Through this working group, the PAs, EEAC, and stakeholders are working to integrate findings from the non-participant studies completed in 2019.

This study will update non-participant market characterization and barriers analysis and expand research to targeted areas of interest as identified by the Equity Working Group and PAs. The intent of this study is not to replicate all elements of 2019 research; rather, to provide longitudinal trend analysis and investigate areas worthy of deeper market analysis identified in the prior research and through Equity Working Group recommendations. Further, this study could provide an opportunity to work with the PAs' implementation team to identify their program needs (especially as they embark into the 2022-2024 Plan term) and embed research that could support program development and implementation.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

This study could go various directions based on priorities established by the PAs, EEAC, and Equity Working Group. This Stage 1 plan outlines options for the research which will need to be refined based on research needs.

- **Task 1: Kick-off Meeting with Stakeholders.** The first task is to come to consensus with stakeholders (PAs, EEAC, and the Equity Working Group) on research priorities. In preparation, the evaluation team will first review all publicly-available documentation published by the Equity Working Group, such as meeting agendas, summaries, and documentation. The team will then facilitate a kick-off discussion with stakeholders to a) prioritize the research needs and b) discuss which needs are best addressed through quantitative surveys versus in-depth qualitative research. Finally, the kick-off meeting will be used to identify studies or resources the evaluation team could leverage to avoid redundancy with prior research. The evaluation team will then complete a Stage 3 plan, specifying the final research objectives and activities to address those objectives.
- **Task 2: Conduct Research.** Guided by the final research objectives, the evaluation team will develop research tasks best suited to address those objectives. The types of research activities, as well as examples of the purpose or areas of investigation, are as follows. Note that this is not an inclusive list of options.

  The non-participant market characterization and barriers study highlighted the importance of having a research team that is reflective of the population being researched. Respondents were far more likely to be open with interviewers they were comfortable with. The evaluation team will explore engaging researchers from these and other disadvantaged communities (such as through the PAs' Workforce Development Initiative), allowing the evaluation team to better engage respondents and fully explore the market barriers affecting hard-to-reach, non-participating customers.

  - **Customer surveys.** Following a similar multi-mode methodology implemented in 2019, conduct longitudinal trend analysis and gather additional data on additional targeted areas such as: level / depth of participation (which may be helpful in further characterizing moderate income barriers); understanding (vs. awareness) of PA offerings, and; participation other programs and how that relates to future participation in PA offerings.
  - Assuming availability of program tracking and customer data, we recommend a consistent sampling and survey approach to maximize nonparticipant response with several possible modifications: a) targeted sampling and outreach efforts to English-isolated customers, and b) reduce level of effort and costs by reducing sample sizes, reducing incentives, and/or eliminating the telephone portion (which yielded the fewest responses).
- **In-home or in-agency interviews with English-isolated customers.** For various reasons, including trust barriers, the research could have been strengthened by better representing English-isolated customers. Leveraging relationships established with community and other organizations, it may be worthwhile more deeply investigating these English-isolated customers' perceptions, needs, interests, and lives, as they may be quite different than the general population in how they respond to PAs and clean energy-focused initiatives.
- **Focus groups with customers (ideally by segment of interest).** Focus groups are valuable for allowing a group to share as well as build from each other's' responses and can therefore allow the evaluation team to investigate issues that are more exploratory in nature. As an example, we could use focus groups to dig deeper into two barriers identified in the prior research: understanding and relevancy. While Mass Save awareness is high, the intercept interviews found that many customers did not truly understand the programs and were held back by uncertainty in processes and what the programs mean for them. Further, both the survey and qualitative research

heard "this isn't for me" for many reasons. Focus groups could investigate customers' responses to existing messaging and outreach vehicles and identify opportunities for PAs to overcome these barriers.

- **Task 3: Develop Case Studies.** Case studies bring stories to life. Integrated as part of the analysis plan as well as reporting, they serve to illustrate the complexities of human psychology, individualized needs, and related decision-making. Using non-identifiable yet respondent-specific examples that represent trends identified through the study, the evaluation team would summarize the personal situation, highlight the specific barrier(s), and identify potential opportunities for to engage customers in those unique situations as uncovered through the research.
- **Task 4: Interviews and Secondary Reviews.** To identify opportunities in other states and industries. Engaging nonparticipants, and equitable service to nonparticipants (particularly in disadvantaged populations) is a topic that many utilities – and other industries (such as healthcare) – are facing. Some jurisdictions and industries are further along in their thinking on these issues, but most are grappling with it now or will be in the figure. Starting with a literature review, the evaluation team will identify resources that may be useful for providing insights into these populations and barriers to participate. The team will then complete interviews with organizations, program administrators, and perhaps even experts such as behavioral economists, who can provide insight into outreach and engagement strategies (including behavioral economic resources which provide insight into decision-making) and effective practices to-date.
- **Task 5: Analysis and Reporting.** Much like the prior Nonparticipant Market Characterization and Barriers study, the evaluation team will develop a report that conveys the most critical information in a visual and easily digestible format. The team will provide interim deliverables along the timeframe of the study, which will be included in the final report for reference. The team will share also share results through presentations with PAs, the Equity Working Group, and other stakeholders (such as the Income Eligible Energy Advisory Network).

IMPLEMENTATION REVIEW

Budget: TBD

Timeline: 2022-2024 Implementation Planning Cycle

13.5 HEAT PUMP CROSSOVER TEMP OPTIMIZATION

Study Name: Heat Pump Crossover Temperature – Quick Hit
Study Champion: Kimberly Crossman
Research Area: Retrofit/HVAC Research Area
Type of Study: Impact Evaluation
Study Lead: TBD
Applicable Fuel(s): All Fuel Types
Underlying Program: All

OVERALL STUDY GOAL

The primary goal of the Heat Pump Crossover Temperature Impact Evaluation is to develop a calculator to estimate the ideal crossover temperature for integrated controls of dual-fuel heat pump systems based on several user inputs.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

When dual-fuel heat pump systems are installed, their integrated controls are programmed with a crossover temperature setting. For these systems, heat is provided by the heat pump when the outdoor air temperature is above the crossover temperature, and heat is provided by the backup fuel-fired system at lower outdoor air temperatures. The crossover temperature of a system has a large impact on customer energy costs and on the site and source emissions that result from system operation.

The ideal crossover temperature for a given system may vary with customer geography (relevant to climate and electric rates), backup fuel type (relevant to system efficiency and fuel rates), heat pump size and type (relevant to system performance), season of the year (relevant to electric generation mix), and building size, type, and weatherization status (relevant to heating load and building heat loss). This study will use building simulations to inform the development of a user-friendly calculator that estimates the optimal crossover temperature based on these variables. The calculator will be designed to estimate the optimal crossover temperatures that minimize customer costs. Due to the complexity of the variations just mentioned, the evaluation team should also consider providing one temperature for the customer to set and a similar number the PAs can suggest or recommend for the whole population. These numbers could be used in conjunction with the calculator.

The Energy Optimization Model (MA19R16-B-EO) updated for the PAs in 2020 calculates energy and cost impacts and takes crossover temperatures as fixed user inputs. The in-progress *MA20R24-B-HPFD: Heat Pump Fuel Displacement Process and Impact Study* is using contractor and customer surveys to explore how contractors typically set crossover temperatures and whether customers typically adjust or override these settings. Neither of these studies estimates optimal switchover temperatures.

- **Task 1: Establish Heat Pump Performance Curves.** Using a combination of literature review and interviews with manufacturers, the team will collect data on HP performance across full and partial loads and the range of outdoor temperatures typical in Massachusetts. From this work, the contractor will develop a set of performance curves that will be used in the building simulations.
- **Task 2: Data Collection and Building Simulation.** The evaluation team shall begin the evaluation by gathering, reviewing and synthesizing information relevant to the optimization calculation. The team will gather climate data, electric and fuel rates, heat pump performance curves, and forecasts of the ISO-NE seasonal electric generation mix. The evaluation team should have access to much of these data through other projects being performed for the PAs and other organizations, so much of the data collection phase is associated with reviewing and synthesizing these data to ensure the right information is being relied upon for this effort. The team will leverage building simulation models developed for the *Heat Pump Fuel Displacement Process and Impact Study*, which will model a small number of crossover temperature scenarios. The team shall conduct additional simulation runs with varying crossover temperature to estimate heating load and system performance for different heating systems and different building sizes and types.
- **Task 3: Calculator Development.** The team will create a user-friendly Excel-based calculator to estimate the crossover temperatures that minimize customer costs and emissions based on user-defined inputs regarding geography, backup fuel type, heat pump type, and building size and type.
- **Task 4: Reporting.** The evaluation team will present a preliminary calculator and draft memo and will work closely with the PAs and EEAC Consultants to refine the calculator and ensure it meets the program's needs.
- **Other Considerations.** Web interface for remote access to calculator.

IMPLEMENTATION REVIEW

Budget: $40,000 - $60,000

Timeline: 2022-2024 Implementation Planning Cycle

13.6 HP METERING IMPACT STUDY

Study Name:	Heat Pump Metering Study
Study Champion:	Kimberly Crossman
Research Area:	Retrofit/HVAC Research Area
Type of Study:	Impact Evaluation
Study Lead:	TBD
Applicable Fuel(s):	Electric/All Fuels
Underlying Program:	All

OVERALL STUDY GOAL

The primary goal of this study is to further understand how customers are using heat pumps in their home and whether installed heat pumps can meet the full heating loads of the home during the coldest days, and if not, what system sizes and configurations would be required. Another study goal is to further understand partial heating load displacement installations: what control settings are used, are the systems operating as intended, and how could system types and control settings be optimized to maximize efficiency of space heating?

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

The team will field customer surveys and conduct onsite metering to meet the research objectives. The team will meter additional CHP and DMSHP oversample sites within the ongoing Res 1 baseline study. Because the saturation of heat pumps within the population is still quite small, especially those with integrated controls for partial heating load displacement, the team will also recruit additional customers identified through the fuel displacement and standard heat pump program records to achieve target sample sizes.

- **Task 1: Develop Representative Sample Frame.** The team will develop a sample frame based on previous work for the *RES1 Baseline Study and Fuel Displacement Process and Impact Evaluation*. At this time, the sample of metered homes with CHPs or DMSHPs in the RES1 Baseline Study is less than 10. The team will seek to add metered sample to achieve 30 metered homes for each equipment type and fuel displacement scenario of interest: 30 CHP full displacement, 30 DMSHP full displacement, 30 CHP with integrated controls for partial displacement, and 30 DMSHP with integrated controls partial displacement[14]. In consultation with the PAs, the team will develop representativeness quotas for different baselines (e.g., replacement or early retirement of oil/propane/gas furnaces and boilers, existing electric resistance heat). If PAs desire statistically valid subsamples of any of these different applications, a larger sample will be required.
- **Task 2: Recruit Participants from Web Survey.** The team will recruit participants from the RES1 Baseline Study customer survey, including those with installed CHPs and DMSHPs. The team will also field a survey to participants in the 2020-2021 fuel displacement measures to achieve target sample sizes for both partial and full displacement installation scenarios. The web survey will ask customers to record quantity and type of all heating and cooling

[14] The PAs may consider foregoing the partial displacement sample since data will be limited for heat pumps that are not used at the coldest temperatures.

equipment in the home, whether an integrated control is used and associated switchover temperature setpoints, and customer's stated purchase intent (to provide heating, cooling, or both).

- **Task 3: Install Metering Equipment.** The team will install a suite of electric metering equipment to determine usage characteristics for all of the primary and secondary heating and cooling equipment in the home. This includes metering the heat pump compressor, indoor unit fans, and electric resistance backup heat separately, plus any existing electric resistance baseboards, furnace fans, boiler pumps, central air conditioners and room air conditioners.[15] Non-HVAC end uses will not be metered. The team will also install space temperature loggers to determine if the installed heating and cooling systems are able to maintain desired setpoint on peak days relative to average summer and winter days. While onsite, the team will record quantity and nameplate information for all heating and cooling equipment to determine installed capacity and efficiency.
- **Task 4: Analyze Data.** The team will analyze the data using the same analysis scripts developed for the baseline study and provide usage results for each heating and cooling end use installed at a heat pump site, equivalent full load hours, system switchover setpoints, and space temperature summaries for average and peak days. The evaluation team will also need to consider what effects infiltration has at various temperatures and wind conditions.
- **Task 6: Deliver Results.** The team will present draft results, then deliver results as part of a comprehensive baseline study report and as part of a separate memo if desired.

IMPLEMENTATION REVIEW

Budget: $400,000 - $600,000

Timeline: 2022-2024 Implementation Planning Cycle

13.7 RNC LOW-RISE BASELINE AND INCREMENTAL COST UPDATE

Study Name:	Residential New Construction Baseline and Incremental Cost Study
Study Champion:	Brian Greenfield, Eversource
Research Area:	Residential New Construction
Type of Study:	Baseline
Study Lead:	Zack Tyler, NMR
Applicable Fuel:	Electric, Natural Gas, Oil, Propane
Underlying Program/ Initiative	Residential New Home & Renovations

BACKGROUND

The Massachusetts PAs have conducted single-family residential new construction (RNC) baseline evaluations for each code cycle in Massachusetts since 2011. These studies monitor the measure-level efficiency in single-family new construction over time and provide the basis for updating the UDRH for the program. The last RNC baseline took place in 2019 and examined homes built under the 2017 Base Code and 2017 Stretch Code.[16] A new base energy code based on the 2018 IECC

[15] The evaluation team will be developing performance curves as a part of the Quick Hit Study. This study will need to attempt to measure energy inputs to heat pumps and heat produced to verify the accuracy of the performance curves.

[16] The 2017 base code refers to the 2015 IECC with Massachusetts amendments.

went into effect in November of 2020 and the state's Board of Building Regulations and Standards (BBRS) is currently considering an update to the Stretch energy code. This study would determine the measure-level efficiency for homes built under the new base and stretch energy codes. The study would also update incremental cost calculations to move from baseline construction practices to practices in program participant homes.

OVERALL STUDY GOAL

The goals of this study are to: 1) determine the measure-level efficiency values of single-family homes built under the new Massachusetts base energy code and the upcoming Massachusetts Stretch energy code, 2) update the program's UDRH, 3) estimate code compliance, and 4) update incremental cost calculations.

VALUE OF STUDY

The PAs have invested in previous studies to characterize the single-family RNC market, yet no studies have looked at baseline conditions of homes built under the new base energy code or upcoming stretch energy code. Updating the baseline measure-level efficiency values for homes built under the new codes is essential to properly quantify savings as building energy codes change and the market adopts more efficient building practices. Furthermore, the shift in baseline and program practices will alter the incremental costs associated with participating in the RNC program.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

The RNC baseline will follow the same general methodology as the previous RNC baseline studies conducted in 2011, 2015, 2017, and 2019. NMR will conduct 50 on-site inspections of non-participant homes in base code towns and 50 on-site inspection of non-participant homes in stretch code towns. The sample of homes will be designed to produce results that have an error of ±10 percent or less at the 90 percent confidence level. The sample will include targets by county based on construction activity as estimated by U.S. Census Building Permit data and targets for custom and spec-built homes. New homes will be identified by submitting a data request for new permanent electric service requests to the PAs. NMR will clean the new service request data to identify single-family homes built under the new codes.

NMR will recruit onsite participants by mailing study invitations to the occupants of newly constructed homes. Recruiting occupants, rather than builders, matches the methodology of the previous studies and avoids the potential bias associated with recruiting builders, which can result in only the most efficient builder participating in the study. The invitation will highlight an incentive ranging from $200-$250 for participating in on-site inspections. Recipients will be able to express interest in the study by mailing back a pre-stamped post card or by completing an online survey that will be linked in the postcard. Once NMR receives the notification of interest from potential participants, we schedule an onsite inspection for qualified participants at a time convenient for them. The invitation will also include access to a "self-audit" tool that allows respondents to take pictures of mechanical equipment and appliance model numbers for an additional incentive. The self-audit tool will increase the sample size of appliances and mechanical equipment and can include participants who do not elect to haven an onsite inspection.

Onsite inspections will be conducted by RESNET certified HERS raters. During the inspections, HERS raters will collect all the information needed to create full energy models of each home and to assess code compliance. NMR will create energy models of each home included in the onsite inspections. NMR will summarize the efficiency values of all key measures and assess code compliance using the "MA-REC" methodology used in the previous three baseline studies. The study will compare measure-level efficiency values between non-participant and participant homes, values over time, and values between codes. NMR will use the results to facilitate stakeholder conference calls to determine input values for an updated UDRH.

The update measure-level baseline efficiency values would serve as the basis for the incremental cost study. To update incremental cost calculations the study could use 1 of 2 methods: one that uses primary and secondary data collection or one that uses only secondary data collection. The primary data collection involves soliciting quotes from various market actors who work in Massachusetts for project scopes with varying levels of energy efficiency. Secondary data collection involves collecting cost data from sources such as the NREL National Energy Efficiency Measures Database and making adjustments from previous studies based on economic trends.[17]

IMPLEMENTATION REVIEW

Budget: $460,000

Total Budget Range: $425,000 - $490,000

Timeline: August 2022 – December 2023

13.8 RNC ELECTRIFICATION BARRIERS AND OPPORTUNITIES

Study Name: Residential New Construction Barriers to Electrification Study
Study Champion: Brian Greenfield, Eversource
Research Area: Residential New Construction
Type of Study: Market Research
Study Lead: Zack Tyler, NMR
Applicable Fuel: Electric, Natural Gas, Oil, Propane
Underlying Program/Initiative: Residential New Homes & Renovations

BACKGROUND

Energy Optimization (EO) has become an important focus for the PAs as they look for ways to cost-effectively reduce energy consumption and promote clean energy technologies. To move the EO effort forward in low-rise RNC, the PAs recently sponsored an *RNC EO Cost Study* to identify packages that yield high and/or cost-effective savings for new homes and provide insight into the upfront and long-term costs faced by customers incorporating high-efficiency systems into new housing units. This study will complement the *RNC EO Cost Study* by providing insight into barriers that may deter market actors from electrification in the RNC market where the *RNC EO Cost Study* identifies economically efficient opportunities to electrify.

OVERALL STUDY GOAL

The overall goal of the study is to identify and quantify behavioral or informational barriers that may prevent market actors from electrifying, especially when it is economically efficient for them to do so. The study will also develop preliminary recommendations on how to overcome these barriers.

VALUE OF STUDY

[17] National Renewable Energy Lab, website: https://remdb.nrel.gov/.

To scale EO in the RNC market, barriers that may prevent action on electrification by key market actors need to be identified and addressed. This study will shed light on real or perceived barriers faced by developers, contractors, and homebuyers in the Massachusetts RNC market.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

There may be several barriers to electrification in the RNC market that deter market actors. This study will focus on the behavioral and informational barriers, including but not limited to:

Behavioral barriers

- **Consumer and contractor preference for incumbent technologies:** consumers and contractors may have greater confidence in the status-quo technology with which they are familiar.
- **Cookstove preference:** preference for natural gas due to perception of better temperature control.
- **Changing thermostat settings:** some right-sized electric systems may require less aggressive thermostat setbacks than larger capacity systems to which customers may be accustomed.
- **Changes to traditional HVAC and water heating system design:** contractors, architects, and developers may need to change their designs to accommodate some electric equipment (e.g., to achieve room-level comfort with a small number of ductless air handlers or to provide sufficient air volume for heat pump water heaters in multifamily buildings, etc.).

Informational barriers – lack of information or misinformation

- **Awareness of heat pumps:** consumers, contractors, and developers may not be aware of heat pumps as alternatives to more traditional HVAC technologies.
- **Awareness of benefits:** When comparing heat supply options, consumers and developers may not be aware of or value the benefits of eliminating fossil fuel use.
- **Perceived quality:** heat pumps may have a reputation for inferior performance relative to the incumbent technology, especially in colder climates.

Task 1: Literature Review. The first task will be a review of the literature on building electrification to document any key market, behavioral, and informational barriers identified by other studies in the Northeast by NYSERDA, NEEP, and other organizations. This review will inform the primary research outlined in the following tasks.

Task 2: General and HVAC Contractor Survey or In-depth Interviews (IDIs). This task will assess and quantify any real or perceived barriers to electrification from the perspective of the contractors, including general and HVAC contractors. There are several recruitment options:

- Contractors that the evaluation team already web-scraped, bought from DataAxle, or pulled from program records. (Note that the team had low response rates with them in the past.).
- *20R23 RNC EO General Contractor Survey* respondents and interviewees (n=34) and several thousand non-responsive general contractors who were part of that sample frame. Any survey respondents or sample identified by the *Existing Homes EO Study*.

- *RLPNC 18-12: R&A Market Characterization and Potential Study* general contractor survey respondents (n=77) and several thousand non-responsive contractors who were part of that sample frame, and 10 HVAC contractor IDI respondents along with 90 non-responsive contractors.

Task 3: Homebuilder/Developer IDIs. This task will assess and quantify barriers from the perspective of the homebuilders/developers who make the financial decisions. The team anticipates reviewing program records or contacts provided by the program implementer to help identify key players in the RNC market.

Task 4: Homebuyer Survey. This task will quantify real or perceived barriers to electrification from the perspective of homebuyers. To the extent that reliable data exists, the sample would be stratified by buyers who recently bought an all-electric home versus a home with fossil-fuel heating or cooking. Recruitment options include:

- Mail to new home addresses identified in MLS listings and permit databases.
- Mail to new utility service requests from the PAs.
- Mail to RNC program participants.

Task 5: HERS Rater IDIs. IDIs with HERS Raters could provide further insight into barriers faced by builders as observed by the HERS Raters in the field. The evaluation team would recruit key raters from program participation records.

IMPLEMENTATION REVIEW

Total Budget Range: $75K-$125K

Timeline: Q1 2022-Q3 2022

SECTION 14: SCC STAGE 1 PLANS

14.1 C&I HEALTH AND SAFETY NON-ENERGY IMPACTS

Study Name: C&I Health and Safety NEI Study
Study Champion: TBD
Research Area: Special & Cross-cutting (NEIs)
Type of Study: Non-energy Impacts
Study Lead: TBD
Prioritization:
Applicable Fuel(s): Electric/Natural Gas/Oil/Propane
Underlying Program/ Initiative: Small and Large C&I Initiatives

OVERALL STUDY GOAL

The overall goal of the study is to assess and estimate health- and safety-related (H&S) NEIs attributable to Massachusetts' C&) energy efficiency programs. C&I measures and initiatives that currently lack H&S NEI estimates or have outdated estimates were identified through the *MA19X05-B-CINEI: 2020 C&I NEI Scoping Study* .

VALUE OF STUDY

PA implementation staff and EEAC consultants interviewed as part of the *2020 C&I NEI Scoping Study* indicated interest in estimating H&S NEIs from C&I programs. As recent Massachusetts H&S impact studies of the Income Eligible Sector demonstrate, energy efficiency measures can result in substantial NEIs; however, relatively little research has been conducted to quantify H&S impacts in the C&I Sector. A literature review identified three common energy upgrades in the C&I sector: LEDs, HVAC, and pipe insulation, hypothesized to produce a variety of potential C&I NEIs related to H&S. The study proposed in this Stage 1 work plan would aid in filling these H&S NEI research gaps for specific measures, programs, or initiatives that have not been addressed by previous C&I NEI research in Massachusetts and identified as priority by the PAs and EEAC Consultants.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

This study will build upon the methods recommended in the *2020 C&I NEI Scoping Study* to quantify and monetize the values of the H&S NEIs attributable to measures that the PAs identify as priority. Data being collected by the current C&I O&M and non-O&M NEI with Small Business Focus implementation study (MA20X10-B-CIOMNEI), such as information about the accessibility of data with which to quantify H&S and NEIs, will inform measure prioritization and sample sizes.

The study proposed in this Stage 1 work plan would employ a combination of primary research and literature-based secondary research to estimate select C&I H&S NEIs. The following three measure groups were identified as priority in the scoping study, lighting (both indoor and street-lighting), HVAC, and pipe insulation. Measure groups (e.g., HVAC), or measures within groups (e.g., motors/drivers, e EMS, RCx), may be revised based on results of the measure prioritization process.

This study would collect primary data through surveys of management and workers/occupants of large and small C&I customers, with the options of: (1) asking occupants to complete a daily or weekly health diary via a cell phone app, and (2) deploying noise sensors and/or indoor environmental quality (IEQ) data loggers in participating facilities to collect real-time data (e.g., temperature, relative humidity, indoor air contaminants). Data collection instruments would be administered pre- and post-energy upgrade, if feasible. This study would also collect metrics to quantify cost savings to participating municipalities attributable to improved street lighting. This would include obtaining primary data from Emergency Management or Medical Services about changes in traffic accidents and pedestrian injuries near locations with street lighting upgrades and the subsequent number of Emergency Management or Medical Services transports to medical facilities.

Depending on the findings of the MA20X10-B-CIOMNEI study about the availability of monetization data from primary sources, the study team may rely more heavily on secondary data than described here or explore alternative metrics for monetization. The study team will work with the PAs and EEAC Consultants to finalize an H&S NEI estimation approach that will meet Massachusetts' rigorous standards.

Optional Single-Measure Study. As a lower-cost option, the PAs could elect to limit the H&S analysis to one or two of the three measure groups or focus on a single measure within each group.

Optional IEQ Sub-sample Study. As another lower-cost option, the PAs could elect to select a sub-sample for participation in the IEQ study.

Task 1: Stage 3 planning. The Stage 3 plan will provide additional details on approaches and secondary sources, will develop a sample design and will identify the accessibility and availability of primary data to be leveraged as part of the project. The plan will also specifically address how the study will target the small and large business population for each measure group and identify adequate sample sizes for a robust analysis. Given the PAs' desire for near-term results, we will look for

opportunities to deliver results in stages. The team will work closely with the PAs and EEAC Consultants to expedite workplan development and approval to meet the desired timeline.

Task 2: Sample plan and coordination. To avoid overburdening respondents, the study team will carefully coordinate with the C&I and Data Management teams and the other SXC evaluations targeting C&I customers. The sampling approach will address representation of small business customers and measure groups.

Task 3: Primary Data Development Targets. The team anticipates conducting surveys with management and employees of participating customers, collecting daily or weekly data from employee health diaries, deploying noise sensors and IEQ monitors, and collecting data from emergency transport services. The team anticipates the data collection being completed pre- and post-efficiency upgrade or at regular intervals, as appropriate. The combination of survey and health diary data and real-time data collection through monitors will be designed to collect both qualitative and quantitative data. The qualitative data will be used to develop a general understanding of if/how participation has resulted in H&S NEIs and to substantiate findings produced by quantitative data. Quantitative results will be used as inputs for the monetization task. Categories of primary research/outreach are:

- **Management Surveys:** focus on pre-collected data.
- **Occupant/Worker Surveys:** focus on physical health metrics.
- **Work Limitation Questionnaire:** adapted from existing questionnaire.
- **Optional Daily Health Diary:** tracks health of individual workers, one month pre- and post-deployment.
- **Optional On-Site Noise and IAQ Monitors:** tracks levels of noise pollution and IAQ.

Task 5: Monetization: Monetization algorithms for H&S NEIs for which enough literature and data exist were developed through the *2020 C&I NEI Scoping Study*. As part of the study, the team designed a separate analytical approach for each NEI that considered the availability of relevant primary and secondary data. For respondents who are only able to provide incidence rates of various factors that contribute to NEIs, the study team will leverage secondary data to monetize incidence rates and quantify H&S NEIs that cannot be measured through primary data collection alone.

IMPLEMENTATION REVIEW

Budget: TBD

Timeline: May 2021 through May 2023 (assumes approval of Stage 3 plan prior to May 2021, and dependent on status of COVID-19 impacts)

14.2 MODERATE INCOME NEI

Study Name:	Moderate Income NEIs
Study Champion:	TBD
Research Area:	NEIs
Type of Study:	Non-energy Impacts
Study Lead:	Greg Clendenning, NMR
Applicable Fuel:	Electric/Natural Gas/Oil/Propane
Underlying Program/ Initiative:	Residential Coordinated Delivery/Moderate-Income Offering

BACKGROUND

Under the Home Energy Services (HES) initiative, the PAs began providing enhanced incentives to income-eligible households through the Moderate Income offering in April 2016. The PAs designed this offer to help overcome first-cost barriers for income-constrained customers who do not qualify for the Low-income program. The offer targets customers living in one-to-four-unit dwellings whose household incomes are between 61 percent and 80 percent of the state median income (SMI). The PAs have considered expanding this to between 80-100 percent and 100-120 percent of the SMI. The offer provides qualifying customers enhanced incentives for weatherization measures, such as insulation, and the PAs are considering enhanced incentives for HVAC measures, air sealing, and pre-weatherization barriers. This offer may generate a wide range of NEIs, including utility or PA NEIs and participant NEIs. However, PA NEIs from residential programs have traditionally been limited to low-income programs.

OVERALL STUDY GOAL

The overall goal of the study is to quantify PA and participant NEIs associated with the Massachusetts PAs' Moderate Income offering. The study will also examine whether the PAs realize additional NEIs because these offerings help prevent participating households from falling below the low-income threshold.

VALUE OF STUDY

The PAs can realize a number of NEIs from their low-income energy-efficiency programs because participating low-income customers are better able to pay their utility bills and would likely experience fewer natural gas-related emergencies. Similarly, participants can realize a wide range of NEIs, including several health and safety NEIs, from improvements made to their homes. This study will examine the extent to which offerings targeting moderate-income customers result in NEIs similar to those from offerings targeting low-income customers.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

For the Moderate Income offering, this study will attempt to quantify the following NEIs that are currently only claimed by the PAs for their low-income programs:

Program Administrator NEIs

- Arrearages.
- Bad debt write-offs.
- Terminations and reconnections.
- Rate discounts.
- Customer calls and collections notices.
- Safety-related emergency calls.
- Participant NEIs.

Participant NEIs

- Thermal comfort.
- Noise reduction.

- Home durability.
- Health and safety impacts, such as:
    - Thermal stress,
    - Asthma,
    - Missed days of work, and
    - Home fires.

The study will also examine whether the PAs realize additional NEIs because the Moderate Income offering helps prevent participating households from falling below the low-income threshold and thus accruing higher costs by becoming eligible for rate discounts and for the PAs' low-income programs.

The research will comprise up to three tasks.

1. The research will begin with a review of the NEI literature to determine if other studies have quantified PA NEIs and participant NEIs for Moderate Income offering and if these NEIs can be applied to the PAs' programs.
2. If some or all of the PA NEI values cannot be estimated through a review of the literature, the team will conduct an analysis of participants' and non-participants' utility data to estimate values of PA NEIs for the Moderate Income offering.
3. A final task will develop recommendations and proposed approaches for future primary research on participant NEIs for Moderate Income offering.

Task 1: Literature review. The team will focus on the studies reviewed for the 2011 residential and low-income NEI study and any new studies completed since 2011. This will include reviewing the income requirements of the programs studied to determine if NEI values could be estimated for and applied to MA moderate-income households from these studies. It will also include assessing the extent to which the NEIs currently claimed by the Program Administrators for low-income programs could be extended to Moderate Income offerings (i.e., what segments, if any, of the moderate-income population face similar economic or financial conditions or hardships as low-income residents).

Task 2 (Optional). Analysis of PA NEIs among program participants and non-participants. If the team is unable to derive PA NEIs from the literature, the team will attempt to draw a comparison group from either (a) lists of households that have received HES audits, were determined to be income-eligible for the offering, but did not elect to install the recommended weatherization measures, or from (b) customers who sought services under, but did not qualify for, the PAs' Low-Income single-family program, and chose not to participate in the Moderate Income offering. The analysis would compare participants to a non-participant comparison group. The analysis would ideally include 12 months of pre- and post-weatherization utility financial data for the participants and the same data for non-participants for the same period in time, such as monthly transaction data, customer calls, collections activities, and safety-related emergency calls. The team could conduct a similar analysis for either the current moderate-income population (61 percent and 80 percent of the SMI) or the expanded income groups being considered by the PAs (80-100 percent and 100-120 percent of the SMI).

An additional optional task, which we have not budgeted, is a GIS assessment of participants and non-participants that would help the PAs conduct targeted outreach to neighborhoods with higher levels of moderate-income households in order to increase program participation. The same analysis could identify neighborhoods with higher risks of poor health outcomes in order to examine health-related NEIs attributable to program participation.

Task 3: Proposed Approaches to Primary Research on NEIs for Moderate Income Offering. The team will develop recommendations and proposed approaches for future primary research on participant NEIs for the Moderate Income offering. This will include examining if and how existing MA studies of NEIs from low-income programs that were based on primary research could be leveraged to develop NEI estimates more cost effectively for the moderate-income segment. The approach will focus on those NEIs that can be reliably and cost effectively studied.

IMPLEMENTATION REVIEW

Total Budget Range:

- **Excluding optional Task 2:** $80,000 to $120,000,
- **All Tasks (1-3):** PA NEIs for 61 percent and 80 percent SMI population: $140,000 to $200,000.
- **All Tasks (1-3):** PA NEIs for proposed expanded income groups: $160,000 to $230,000.

Timeline:

- **If study excludes optional Task 2:** Q3 2021 to Q1 2022.
- **If study includes all tasks:** Q3 2021 to Q3 2022.

14.3 RSR NTR METHODOLOGY REVIEW

Study Name:	Residential Self-report NTG Methodology Review
Study Champion:	TBD
Research Area:	Residential
Type of Study:	NTG
Study Lead:	Carrie Koenig, Tetra Tech
Applicable Fuel:	Electric and Natural Gas
Underlying Program/ Initiative:	Various

BACKGROUND

In 2020, the evaluation team developed a methodology for consistent self-reported residential NTG measurement, which is documented in *MA19X03-B-RSRNTG: Consistent Methodology for Self-Reported Residential Net-to-Gross Measurement (*). The study's scope included a literature review of methods used in different parts of the nation, including those already used in Massachusetts, and the development of a series of questions that could be adapted to the downstream programs or initiatives being evaluated. The evaluation team worked with an advisory group, consisting of NTG experts from the residential evaluation team, the PAs, and the EEAC.

The methodology was developed just before the round of NTG evaluations fielded in 2020. While the questions to be used were not formally pretested, the majority of them had been used in several jurisdictions and were simply adapted to fit the Massachusetts programs and framework.

OVERALL STUDY GOAL

The most recent round of NTG evaluations were the first to implement the consistent methodology. As evaluation teams started using the questions and subsequently analyzed the responses, questions arose regarding implementing various self-report questions and related analysis. While some of these questions were to be expected, some presented opportunities for components of the methodology to be clarified to avoid misinterpretation. This study seeks to: (1) update the methodology document based on questions that arose during the first round of program evaluations, and (2) conduct sensitivity analysis around the NTG components, including the free-ridership intention and influence scores.

VALUE OF STUDY:

This study will help ensure that future NTG studies will implement the methodology consistently and assess whether the methodology is working as intended. It will identify lessons from the 2020 NTG studies to help improve future NTG studies. Completing the sensitivity analysis proposed in this study will provide confidence in the survey questions and algorithms used to calculate residential NTG and identify any highly sensitive calculations.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY:

The project will begin by convening a working group of PAs, EEAC, and residential evaluation consultants to guide the effort. The residential evaluation consultants will comprise those who developed or used the methodology document during 2020 or early 2021 evaluations. These consultants would be funded under their respective contracts.

The team anticipates the working group will provide input and feedback on topics such as the following:

- Identifying any gaps in the guidance document.
- Gathering input on any challenges encountered using the methodology.
- Clarifying any areas that need better instruction.
- The team will also review data from the different Massachusetts studies to perform sensitivity analysis. This will involve the following activities:
    - Compiling data collected from the various studies.
    - Reviewing the prevalence of “don’t know” and “refused” responses in the intent and influence components and exploring the use of different methods for scoring.
    - Assessing the impact of using average, mean, min or max scores when calculating free-ridership and spillover.

There will be two deliverables: (1) an updated methodology document that clarifies any areas identified by the residential evaluation consultants as unclear and addresses any gaps, and (2) a memo that summarizes the changes made to the methodology document and the results of the sensitivity analysis. The memo will focus on experience from the current studies while also looking ahead to future studies.

The team expects the working group to meet at least two times: once at the beginning of the work to address particular topics of question or concern and again at the end to review any findings from the analysis.

IMPLEMENTATION REVIEW

Total Budget Range: $100,000 - $150,000

Timeline: Q3 2021 – Q1 2022

14.4 DMSHP INTEGRATED CONTROLS MARKET EFFECTS STUDY

Study Name:	Ductless Mini-split Heat Pump Integrated Controls Market Effects Baseline Study
Study Champion:	TBD
Research Area:	NTG/Market Effects
Type of Study:	Market Effects
Study Lead:	Monica Nevius, NMR
Applicable Fuel:	Electric/Natural Gas/Oil/Propane
Underlying Program /Initiative:	Residential Existing Buildings/Residential Coordinated Delivery

BACKGROUND

Evaluation research has found that the lack of an easy way for customers to use ductless mini-split heat pumps (DMSHPs) in combination with fossil fuel heating equipment is a barrier to the adoption and use of cold-climate DMSHPs for heating. In 2018, the PAs developed a specification for integrated controls for use with DMSHPs to address this barrier and reached out to manufacturers to encourage them to produce equipment to meet it. In January 2019, the PAs began offering generous rebates for customers heating with delivered fuels who install DMSHPs with qualified integrated controls, with the intention of generating lasting market effects.

In April of 2020, NMR completed the study, *MA19X09-B-INTCTRME: Evidence for Market Effects from Support for Ductless Mini-split Heat Pump Integrated Controls*, which found the PAs to be partly responsible for launching the Massachusetts market for integrated controls for use with DMSHPs, accelerating the development of the Massachusetts market for DMSHP integrated controls for use in homes heated primarily by delivered fuels, and accelerating the development of the market for DMSHP integrated controls for use in homes heated primarily by delivered fuels in the Northeast region. This study also proposed indicators with which to track the market effects expected to be generated by the PAs' support of DMSHP integrated controls for use in homes heated primarily by delivered fuels and laid out an approach with which to quantify the market effects in the future. In late 2020, NMR team operationalized many of the proposed market effects indicators for the Guidehouse team to collect as part of the *MA20R24-B-HPFD: Heat Pump Fuel Displacement Process and Impact Study*. As of March 2021, this baseline indicator data had been collected but not analyzed.

OVERALL STUDY GOAL:

The goal of this evaluation is to analyze the market effects indicator data that Guidehouse collected in 2020 to document baselines for these indicators and to operationalize and measure baselines of market effects indicators that have not yet been measured. These data are meant to be used as input to a future study to quantify the market effects from the PAs' support, as outlined in study MA19X09-B-INTCTRME.

VALUE OF STUDY

This study will ensure that the PAs have all the baseline market effects indicator measurements that will be needed when the PAs are ready to quantify savings from market effects attributable to the ductless mini-split heat pump integrated controls offering. The study results will also help program staff and the evaluation team understand the state of the market, which will likely be useful in future program planning.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

This study will be based on analysis of secondary data obtained from various sources and primary data collected via interviews with program and implementation staff.

The work will begin with interviews of program and implementation staff (up to three interviews in total). The purpose of these interviews is to learn about any changes since the MA19X09-B-INTCTRME study in how the program supports integrated controls that should be reflected in logic model and indicators, the number of manufacturers that produce integrated controls, the technology, and the data tracked by the program. This information will inform the study team as they operationalize indicators not yet measured.

The study team will obtain and prepare for analysis data gathered from a customer survey and IDIs with contractors and distributors via the MA20R24-B-HPFD study. Using these data, information from the program and implementation staff interviews, rebate and other program tracking data, the most recent Massachusetts residential saturation study, and implementation staff interviews, the study team will develop quantitative and/or qualitative baseline values, as appropriate, for as many of the market effects indicators identified in the program logic and described in the MA19X09-B-INTCTRME study as possible.

This study plan includes the optional purchase of 2019 and 2020 HARDI AHSP data. These data are needed to calculate updated estimates of the rate of adoption of DMSHPs with integrated controls by the target market, the remaining number of Massachusetts homes in the target market, and the Massachusetts share of all residential DMSHP systems that included integrated controls for use in homes heated primarily by delivered fuels (i.e., rebates for DMSHP integrated controls for use in homes heated primarily by delivered fuels/Massachusetts sales of residential DMSHPs from HARDI data).

Deliverables for this study will include a Stage 3 work plan, updated logic model and market progress indicators lists (if needed), and draft and final reports that clearly lay out the values measured for each indicator, noting any new or existing indicators with missing values and proposing how to measure them. The reports will also suggest a rough timeframe for when next to measure each indicator and when the time might be ripe to quantify savings from market effects given what the results say about the status of the market for DMSHP integrated controls.

IMPLEMENTATION REVIEW

Budget: $75,000 - $125,000

Timeline: July 2021 – December 2021

14.5 NON-RESIDENTIAL NEW CONSTRUCTION PATH 1 AND 2 MARKET EFFECTS

Study Name:	Non-Residential New Construction Market Effects Indicator Tracking
Study Champion:	TBD
Research Area:	Cross-cutting (NTG/Market Effects)
Type of Study:	Market Effects
Study Lead:	Monica Nevius
Applicable Fuel:	Electric, Natural Gas
Underlying Program/ Initiative:	C&I New Buildings and Major Renovations

BACKGROUND

The C&I New Buildings and Major Renovations Program recently added two new program pathways designed to generate market effects. The *MA20X12-B-NRNCMEB Non-Residential New Construction (NRNC) Market Effects Baseline Study* has operationalized and is measuring baseline values for many of the short-term (within 1-3 years) market effects indicators for these pathways and expects to deliver these in Q3 2021. Only a few of the intermediate-term indicators, and none of the long-term ones, have been measured.

OVERALL STUDY GOAL

The goals of this study are to continue measuring indicators of market effects from Paths 1 and 2 of the C&I New Buildings and Major Renovations Program as needed to prepare for a future study to quantify the savings from market effects generated by these pathways and to develop a plan for this quantification. This includes remeasuring indicators for market effects expected to manifest in the short term and establishing baseline measurements for market effects indicators expected in the medium or longer term, as appropriate given the progress of the market.

VALUE OF STUDY

If the PAs are to claim market effects in the future, they must periodically measure market effects indicators in preparation to quantify the savings from them. Many market effects indicators are self-reported by market actors that the program expects to influence directly or indirectly. Waiting too long to measure these indicators can affect how respondents recall their decisions and the factors that influenced them. In addition, by the time this study is fielded, it will likely be time to establish baselines for some of the intermediate-term market effects indicators. A plan needs to be developed to quantify the savings from market effects, and this study will produce one. Finally, this study can serve to inform program implementation by identifying additional support the program could provide or actions that may need to be taken to meet program goals.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

The *MA20X12-B-NRNCMEB NRNC Market Effects Baseline Study* is currently measuring baseline program output and market effects indicators via a web survey of participating and non-participating market actors. This study will leverage and build on this approach to maintain a consistent data collection and sample development methodology. The team will begin this study with interviews of program staff (Task 1) to track any new developments with the program that might impact the PTLM. The team will work with the PAs to update the PTLM if necessary.

Informed by Task 1, and following the guidance outlined in the 2019 “Action Plan for Measuring Market Effects” and 2015 “Recommended Methods for Assessing Market Effects of Non-residential New Construction Programs,” the study team will identify a plan for quantifying the savings from market effects over time (Task 2). This plan will determine additional data collection needs in the study beyond indicator measurement.

The team will deliver a memo that summarizes the results of Tasks 1 and 2. This will include an overview of what was measured in MA20X12-B-NRNCMEB, what will be measured or remeasured in the current evaluation, and what, if any, indicators will not be measured until later, such as indicators of long-term outcomes that are not likely to have manifested by the time of this study. It will also summarize any adjustments needed to the PTLM due to programmatic or market changes and lay out the plan for quantifying the savings from market effects.

The team will then develop an updated version of the web survey instrument used for MA20X12-B-NRNCMEB to measure new and previously measured indicators as appropriate (Task 3). The sampling approach for this survey will address the evolution of the program and the need to treat participants as two discrete sub-samples as the team measures market

effects indicators for Paths 1 and 2. The budget for this Stage 1 plan assumes up to 100 web survey completes with no set targets by respondent type.

The NRNC market in Massachusetts is complex, intrinsically and because of multiple PA programs with potentially overlapping impacts and different local economies. Because of this, the team proposes an optional set of 10-15 in-depth interviews (IDIs) with market actors who have participated in Paths 1 and 2. The IDIs will assess influence of various PA initiatives, explore participants' experience with the program, identify other market forces and activities that could affect the adoption of efficient building practices in the NRNC market, and the possible effects of other PA offerings on the market.[18] They may also examine how the market could be evolving in ways not anticipated by the program, for example from long-term changes related to COVID.

This study will also update values for indicators that rely on secondary data, such as those that quantify program penetration or the number of projects that are pursuing certifications (Passive House, Zero-Net Energy) covered by bonus incentives in Path 1 (Task 4). Because the evaluation team does not yet have findings from the indicator baseline survey or secondary data analysis being conducted for MA20X12-B-NRNCMEB, it is premature to solidify the scope of data collection needed in the current evaluation. The team will need to reengage with the Program Administrators and EEAC closer to the execution of this study and assess additional data collection needs beyond indicator measurement that will support market effects quantification.

Deliverables planned for this study include a Stage 3 workplan; a memo that summarizes indicator measurement status and the plan for quantifying the savings from market effects over time, with a revised PTLM if appropriate; draft and final market actor web survey instruments; draft and final interview guides (if optional market actor IDIs are included); and a draft and final report.

IMPLEMENTATION REVIEW

Total Budget Range: $175,000-$250,000

Timeline: Spring 2023 to Spring 2024

14.6 PASSIVE HOUSE MARKET EFFECTS STUDY

Study Name: Passive House Market Effects Study
Study Champion: TBD (Current lead for MA20X11-B-PHMEB: Adam Wirtshafter, National Grid
Research Area: NTG/Market Effects
Type of Study: Market Effects, Process
Study Lead: Monica Nevius
Applicable Fuel: Electric/Natural Gas/Oil/Propane
Underlying Program /Initiative: Residential New Buildings/Residential New Homes & Renovations

BACKGROUND

[18] See https://ma-eeac.org/wp-content/uploads/Recommended-Methods-for-Assessing-Non-residential-New-Construction-Market-Effects.pdf for a discussion of other market forces and other PA efforts that could have been affecting the non-residential new construction market at the time (early 2015).

The PAs' Residential New Construction Passive House Multifamily Offering (referred to as "the Program") began in July of 2019. The *MA20X11-B-PHMEB Passive House Market Effects Baseline Study* has operationalized and is currently measuring baseline values for many of the short-term market effects indicators for the Program; the evaluation team expects to deliver these in Q3 2021. Only a few of the medium-term indicators, and none of the long-term ones, have been measured.

OVERALL STUDY GOAL

The goal of this evaluation is to continue the measurement of market effects indicators associated with the PAs' Program in preparation for a future study to quantify the savings from market effects generated by this offering, and to develop a plan for this quantification. This includes remeasuring indicators of market effects expected to manifest in the short term and establishing baseline measurements of market effects indicators expected in the medium- or longer-term, as appropriate given the progress of the market.

VALUE OF STUDY

It is important to establish baseline market effects indicators and repeatedly measure them throughout the program lifecycle, as assessing attribution and quantifying savings becomes increasingly difficult as time passes. This study will provide up-to-date measurements of the expected short- and medium-term indicators of market effects from the program. It will consider baseline measurements for medium-term indicators that were not measured as a part of MA20X11-B-PHMEB baseline market effects indicators study due to timing. The measurements from this study will help assess progress toward transformation of this market and will feed into a future study to quantify savings from market effects attributable to the Passive House offering. In addition, this study will determine the approach to quantify the savings from market effects. The approach will consider the effects of non-program related forces in the market and the possible effects of interactions between the Passive House offering and other PA efforts.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

The *MA20X11-B-PHMEB Stud*y is currently measuring baseline program output and market effects indicators via a web survey of participant and non-participant market actors. This study will leverage and build on the approach established in the *MA20X11-B-PHMEB Study* to maintain consistent data collection and sample development methods across studies.

The study will begin with two in-depth interviews (IDIs) with PA staff and implementation staff to identify any new developments with the program that might impact the PPTLM (Task 1). The evaluation team will work with the PAs to update the PTLM if necessary.

Informed by the results of Task 1 and the MA20X11-B-PHMEB baseline study, and following the guidance outlined in the 2019 "Action Plan for Measuring Market Effects" and 2014 "Methods for Measuring Market Effects of Massachusetts Energy Efficiency Programs," the study team will identify a plan for quantifying the savings from market effects over time (Task 2).[19][20] , Because the multifamily market overlaps with the non-residential new construction market, the team will also consider the guidance in the 2015 study "Recommended Methods of Assessing Non-residential New Construction Market Effects."[21] The team will deliver a memo that summarizes the results of Tasks 1 and 2. This will include listings of indicators for which a baseline has already been established, indicators to be measured and remeasured in this study, and which indicators will be measured in a subsequent market effects study. The memo will also summarize any adjustments needed to the PTLM and lay out the plan for quantifying the savings from market effects.

[19] Available at: https://ma-eeac.org/wp-content/uploads/Action_Plan_Measuring_Market_Effects_FINAL_2019.02.15.pdf
[20] Available at: https://ma-eeac.org/wp-content/uploads/Methods-for-Measuring-Market-Effects-of-Massachusetts-Energy-Efficiency-Programs.pdf
[21] Available at: https://ma-eeac.org/wp-content/uploads/Recommended-Methods-for-Assessing-Non-residential-New-Construction-Market-Effects.pdf

The team will review secondary data (Task 3) to understand the current state of the Passive House market in Massachusetts and measure indicators not captured via the web survey, such as the number of certified Passive House multifamily buildings and the number of market actors certified since MA20X11-B-PHMEB. This task will also involve reviewing the program participation data.

The team will draft an updated version of the web survey instrument that is being used in MA20X11-B-PHMEB (Task 4). This survey will measure the indicators outlined in the indicator summary memo. The budget for this Stage 1 plan assumes up to 100 completed web surveys of market actors (50 participant and 50 non-participant) with no set target on market actor type. Market actors may include developers, architects, engineers, builders, and contractors (such as HVAC or insulation) who operate in the multifamily new construction market. Non-participant market actors may include market actors who only work with the traditional residential new construction programs or those specializing in high-rise multifamily who do not participate in any PA-sponsored programs.

Since MA20X11-B-PHMEB is unfinished, it is premature to solidify the scope of data collection needed in this evaluation. The team will need to reengage with the Program Administrators and EEAC closer to the execution of this study to assess whether additional research tasks beyond those described above are necessary. As a result, we are proposing a budget range similar to the MA20X11-B-PHMEB evaluation but anticipate that additional scope discussions and research needs may bring increased costs.

Deliverables for this study will include a Stage 3 work plan; a memo summarizing the evaluation plan, results of the secondary data review, and the indicators that will be operationalized and measured in the web survey; draft and final web survey instruments; and draft and final reports.

IMPLEMENTATION REVIEW

Total Budget Range: $150,000-$250,000

Timeline: Fall 2023 to Fall 2024

14.7 FOLLOW-UP ON CODE TRAININGS

Study Name:	Codes and Standards Compliance Support (CSCS) Initiative Follow-up Surveys
Study Champion:	TBD
Research Area:	Cross-cutting (Codes & Standards)
Type of Study:	Process
Study Lead:	TBD
Applicable Fuel:	Electric and Natural Gas
Underlying Program/ Initiative:	C&I New Buildings & Major Renovations / Residential New Homes & Renovations

BACKGROUND

The Program Administrators have been sponsoring code trainings since 2014. The NMR Cross-cutting Codes & Standards evaluation team has periodically evaluated the trainings to document their effects on code enforcement and compliance and to identify opportunities to improve their effectiveness. These evaluation results have fed into market effects and NTG studies of support for residential and commercial code compliance. The last set of residential and C&I follow-up surveys took place in 2019, prior to the pandemic.

OVERALL STUDY GOAL

The primary goals of this study are to explore how the Codes and Standards Compliance and Support (CSCS) Initiative training attendees have used what they learned after the trainings, whether they attribute these changes to the trainings, and the areas of their practices that were affected. The study is also meant to yield suggestions for improving the CSCS initiative going forward in order to ensure it is continuing to positively impact code compliance and enforcement in Massachusetts.

VALUE OF STUDY

The surveys that will be carried out via this study will assess the applicability of what is learned through the trainings to everyday building practices and to enforcing the energy code. The findings may be factored into assessing attribution of savings from code compliance enhancement to the CSCS in future studies of NTG and market effects. The study will also yield insights into how the impacts of the CSCS trainings may have changed given the changes in the new construction market and the vastly increased use of online training since the start of the COVID-19 pandemic.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

As with the previous CSCS Initiative process study, this research involves designing, fielding, and analyzing a follow-up web-based survey of code compliance training attendees, which would be sent to training participants several months after attending a training. Team members NMR (residential) and Cadmus (C&I) will develop the survey instruments based on those used in 2019, adjusted for new topics covered by the trainings and to ensure relevant COVID impacts are investigated. NMR and Cadmus will obtain input from the PAs and the EEAC to ensure that the follow-up instruments cover issues the PAs and EEAC wish to address and omit any questions that do not provide actionable feedback.

The study team will email links for the web surveys on a rolling monthly basis to trainees for several months after they attend a training to allow for attendees to have incorporated what they learned into their work. The study team will ask training instructors to mention the surveys to trainees and encourage them to respond. The study team will also offer a gift card as an incentive to complete the survey. The team will continue to recruit respondents through email and telephone until the team reaches the anticipated survey completion quota of at least 60 percent of unique attendees.

The study team will deliver draft and final work plans and survey instruments, and draft and final written reports that summarize the findings from the surveys.

IMPLEMENTATION REVIEW

Budget: $100,000 to $120,000

Timeline: July 2021 to June 2022

14.8 MARKETING AND OUTREACH AWARENESS STUDY

Study Name: MA Statewide Marketing and Awareness Survey
Study Champion: Phil Moffit, Adam Wirtshafter
Research Area: Marketing and Evaluation
Type of Study: Marketing and Evaluation
Study Lead: Illume
Applicable Fuel: Natural Gas, Electric

Underlying Program/ Initiative: Mass Save Marketing, Education, and Outreach

BACKGROUND

Program and portfolio marketing play a critical role in raising awareness of the Mass Save brand, of energy-efficiency programs, and of the ways Massachusetts residents can connect to resources to improve their homes and businesses. While the study is designed to track and assess the effectiveness of the marketing effort, the marketing team also uses findings from the study to make decisions on media purchase buys, audience targeting, and messaging frame changes. These statewide surveys are important and necessary for the purposes of tracking and marketing decisions but are likely most useful when run on a biennial basis as opposed to an annual basis.

In 2019, the team's survey demonstrated that residential Mass Save brand awareness held relatively steady overall, but also showed a marked increase in brand awareness among Latino customers. The team also found two distinct residential customer groups – those who strongly believe that Mass Save messages are clear and those who do not—suggesting that while awareness remains relatively high for residential customers, there is a large group of customers with a surface level of awareness. These results suggest that there is still an opportunity to improve gaps in customers' understanding of the Mass Save brand and offerings.

OVERALL STUDY GOAL

The goals of the current study are to:

- Continue the longitudinal assessment of key awareness metrics, such as overall awareness and Mass Save brand familiarity.
- Assess whether changes in awareness are due to Mass Save campaign changes.
- Explore customers' depth of awareness and understanding the Mass Save brand and Mass Save's offerings.
- Measure customer awareness of specific energy efficiency programs.
- Explore the linkage between customers' brand and program awareness and target behavior changes that could lead to engagement with Mass Save programs.
- Explore non-participants' depth of knowledge of the Mass Save brand, its offerings, and what, if anything, about the messaging is keeping them from participating.
- If possible, explore how customers are learning about Mass Save, through general marketing, program marketing or a combination.

VALUE OF STUDY

This study provides an ongoing longitudinal assessment of customer awareness and participation in energy efficiency programs. Additionally, results from this survey can be used to inform future marketing and media strategies.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

The team recommends moving the cadence of the survey biennially given the costs associated with this large-scale survey effort. The brand awareness survey will mirror sampling methods used in previous surveys. Doing so will allow for continuity in longitudinal comparisons over time. As with prior years, the team anticipates surveying approximately 600

residential customers with an oversample of low-income and Spanish-speaking populations. The team will survey approximately 300 SMB customers using PA-supplied billing databases for the full SMB survey effort.

Ideally, the team will obtain PA customer data by August 1, allowing adequate time for data cleaning, analysis, and sampling. The team will use a mixed mode fielding approach, similar to 2019. This includes first sending all potential survey respondents an invitation postcard or email (to those for whom email addresses are available) with a web address where they can complete the survey. Customers will also be given a phone number if they prefer to complete the survey by phone. Non-respondents will then receive follow-up emails or phone calls.

Upon completion of survey implementation, the team will conduct a robust analysis and reporting period. The deliverable will include draft and final reports, in addition to a one-hour presentation to the marketing and evaluation stakeholders.

IMPLEMENTATION REVIEW

Budget: $240,000-$280,000

Timeline: June to January (this time frame is contingent upon PA data receipt by August 1)

- **June:** One-hour meeting with PAs, EEAC Consultants, and PA marketing teams to assess final research priorities for survey development; final research plan development, customer data request to PAs no later than June 1.
- **August:** survey development, receive PA customer data no later than August 1, data cleaning.
- **September:** sampling, soft survey launch.
- **October-November:** survey fielding.
- **December-January:** reporting, one-hour meeting to present results to PAs.

14.9 MINORITY AND WOMEN-OWNED BUSINESS ENTERPRISE CONTRACTOR STUDY

Study Name:	Minority & Women-Owned Business Enterprise Contractor Study
Study Champion:	TBD
Research Area:	Special & Cross-Cutting
Type of Study:	Market Research
Study Lead:	TBD; Opinion Dynamics
Applicable Fuel:	Electric, Natural Gas, Oil, Propane
Underlying Program/Initiative:	Various

BACKGROUND

As part of their 2022-2024 goals, the Massachusetts Program Administrators (PAs) seek to grow and diversify their business partner pool through a variety of strategies, which may include hosting contractor workshops, establishing an online vendor network, and increasing outreach to minority and woman-owned business enterprises (M/WBEs). To support these efforts, the PAs first seek to measure their baseline levels of partnership with M/WBEs. As such, this study will explore the extent to which any disparities exist between PA utilization of state-certified M/WBEs and the availability of state-certified M/WBEs to serve as lead contractors and subcontractors for energy efficiency programs and services. The analysis will focus on partnerships in the 2019-2021 program cycle and will consider contractors providing services statewide and to individual PAs.

OVERALL STUDY GOAL

The study seeks to answer the following research questions:

- What proportion of lead contractors and subcontractors for PA energy efficiency programs and services are state-certified M/WBEs?
- How prevalent are certified M/WBEs for the services represented in the study, as a proportion of all available businesses?
- For each vendor and subcontractor opportunity, was there an eligible state-certified M/WBE that could have been selected?
    - How, if at all, does availability of certified M/WBEs differ by industry, service type, and geography?
- What disparity, if any, exists between the availability of eligible M/WBEs and selection of W/WBEs for vendor and sub-contractor opportunities?
    - What is the extent of this disparity? (e.g., number of contracts, dollar value of contracts)
    - How, if at all, do disparities differ by industry, service type, and geography?
    - How, if at all, do disparities differ between lead contractors and subcontractors?
    - How do the findings of this analysis compare to other large organizations in the region?

VALUE OF STUDY

The findings of this analysis will provide the PAs and EEAC consultants with a baseline understanding of their current utilization of M/WBEs as partners in delivering energy efficiency services and programs.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

Opinion Dynamics will work with the PAs and EEAC consultants to finalize the definition of "contractor" and "subcontractor" for this study. To inform the approach and methodology detailed in the Stage 3 plan, we also plan to conduct interviews with procurement specialists at Eversource and National Grid who are responsible for administering the statewide PA procurement process (n=2). The purpose of these interviews will be to better understand the number and type of business partner contractors and subcontractors within the study period as well as the data that will be available to support the analysis.

Once the Stage 3 plan has been approved, we will compile the data needed to conduct the analysis, which we anticipate will include:

- **Statewide and PA-specific data on all procurements of contractor services for energy efficiency programs and services in 2019-2021:** Procurement data will be requested from the PAs, including information on which businesses applied to partner (e.g., by responding to an RFP, RFI, or RFQ) and were ultimately awarded each contract. We will conduct brief interviews with procurement specialists at individual PAs to review the data request and understand any variation in how procurement and M/WBE data is tracked at the PA level.
- **State-certified M/WBE businesses:**[22] Data on state-certified M/WBEs is available to the public as an online database. We will also reach out to the Commonwealth of Massachusetts Supplier Diversity Office to learn if additional information (e.g., previously certified businesses no longer active in the database) could be acquired through a public records request.

[22] Commonwealth of Massachusetts. Directory of Certified Businesses. Accessed October 13, 2021, at https://www.sdo.osd.state.ma.us/BusinessDirectory/BusinessDirectory.aspx.

- **Subcontractor businesses:** To supplement the data obtained from the PAs, we anticipate collecting data from each selected lead contractor to understand what subcontractors, if any, they utilized on each contract and the services provided by those subcontractors.
- **Available businesses:** We will analyze existing data and collect additional primary data as needed to estimate the number of businesses that provide each type of service represented in the study.

After compiling the data, we will review it to create a classification schema that allows for comparison between the PA and subcontractor data, the available business database, and the state-certified M/WBE database. This schema will provide a framework for consistent comparison that will allow us to identify which M/WBEs would have been eligible for each business partner opportunity, either as a lead contractor or a subcontractor, and what percentage of the "available" businesses they represent for each opportunity. We anticipate that the classification schema will account for two primary factors: (1) the industry, service offerings, and/or expertise required for the partnership and (2) the geographic requirements for the contractor or subcontractor (e.g., local, regional, statewide). We will finalize the classification schema in collaboration with the PAs and EEAC consultants. Once finalized, we will categorize each contractor in the PA database, each subcontractor record generated from our primary data collection, and each available business.

Finally, we will compare the databases to identify, for each lead contractor and subcontractor opportunity:

- Was a M/WBE selected as the lead vendor and/or subcontractor(s)?
- If not, was one or more M/WBEs available that met the geographic and service criteria?
- What percentage of the available businesses for each opportunity were certified M/WBEs?

The final dataset will be analyzed to identify the number and percent of lead contractor and subcontractor opportunities for which an M/WBE was selected, out of those opportunities for which an M/WBE was available. We will analyze the results for the entire state and will explore trends by geography and service type, while also considering any qualitative data available on why the lead contractor or subcontractor was selected in each instance. We will quantify any disparity that exists between the availability and utilization of M/WBEs. When presenting the results, we will contextualize the findings of the analysis compared to other large organizations in the region that have recently-completed disparity studies (e.g., City of Boston, Commonwealth of Massachusetts Division of Capital Asset Management and Maintenance).

IMPLEMENTATION REVIEW

Budget: $120,000 - $160,000

Timeframe: Q2 2022 – Q3 2022

Format of Deliverable: Report including methodology and findings

SECTION 15: DEMAND REDUCTION STAGE 1 PLANS

15.1 C&I TARGETED DISPATCH

Study Name:	MA C&I ADR Summer 2023 Study
Study Champion:	Antonio Larson
Research Area:	Special & Cross Cutting
Type of Study:	Impact and Process
Study Lead:	N/A

Applicable Fuel: Electric
Underlying Program/ Initiative: Connected Solutions

BACKGROUND

The active demand reduction (ADR) programs in Massachusetts are growing in size, and in diversity of controls and dispatch strategies. The first state-wide impact and process study of the full-scale Connected Solutions program was conducted in 2019 and a follow-up impact study is planned for 2021. Based on stakeholder discussions during the SEP workshops, there is a desire to study these offerings every 2-3 years. This proposed study covers the impact and process evaluation of the Massachusetts ADR programs in 2023.

OVERALL STUDY GOAL

The primary objective of the impact evaluation is to provide verification of the proper baseline and impacts generated by the ADR programs for the 2023 summer season. For traditional curtailment projects, the team will use the symmetrically adjusted 10-of-10 baseline methodology, as agreed upon in the 2019 study. For battery storage projects, the team will provide verification of the demand reduction from direct measurement of the battery performance. Depending on the motivation for purchasing the battery, the evaluators will determine if the analysis would be confined to event-day performance or would include non-event day performance to determine the counterfactual baseline load. If other technologies are implemented that require different measurement and verification (M&V) methods, they will be studied using appropriate methodology in agreement with the relevant stakeholders.

The objectives of the process evaluation are to understand the customer and PA satisfaction, barriers to implementation and recruitment, and to follow up on recommendations that were made during the 2019 study.

VALUE OF STUDY

This study would provide updated realization rates, would provide input on success of newer technologies as they are deployed, and would enable the PAs to follow up on the findings and recommendations provided in prior studies. This study would also enable the PAs to keep a pulse on the customer satisfaction levels and uncover ways to improve satisfaction.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

Task 1: Construct Stage 3 work plan with guidance and approval from PAs and the EEAC. This Stage 1 plan will serve as the basis for a more detailed Stage 3 plan.

Task 2: Gather AMI data from PAs and battery measurement data from vendors. A data request will be issued to the PAs and battery vendors to acquire the event data needed to support the impact and process study. The budget range anticipates that each PA and vendor delivers complete datasets for all participants at the same time. These datasets will include event and consumption data, and if this data is split across several files, analysis will require identifiers/unique keys to merge variables so that all datasets can be combined. The scope assumes four participating PAs and up to 650 participating accounts.

Task 3: For traditional curtailment projects, the impact analysis will use utility AMI data to calculate symmetrically adjusted 10-of-10 baselines. For battery storage projects, the impact evaluation will use the direct measurement of the battery charging and discharging from the battery vendor's revenue grade meter readings to quantify demand reductions.

Task 4: Survey participants, interview vendors, and PAs. A brief online survey will be sent to all the program participants to assess customer experience and satisfaction. The vendors will be interviewed once each, and the PAs will be interviewed two times (once at the start and once at the end of the season).

Task 5: Perform process evaluation analysis. At the end of the season, the team will analyze the interview and survey data to identify key process findings and recommendations with an eye toward the evaluation research objectives.

Task 6: 2023 summer report writing and follow-up. The evaluation team will provide a written report containing all evaluation results and key findings at the end of the season.

IMPLEMENTATION REVIEW

Budget: $160,000 - $200,000

Timeline: June 2023 – January 2024

15.2 ENERGY EFFICIENCY AND DEMAND REDUCTION INTEGRATIONS LITERATURE REVIEW

Study Name:	Integrating Demand Reduction and Energy Efficiency Offerings
Study Champion:	Tony Larson
Research Area:	Demand Reduction
Type of Study:	Market Assessment
Study Lead:	Tony Larson
Applicable Fuel:	Electric
Underlying Program/ Initiative:	A2e - Residential Active Demand Reduction B1b - Income Eligible Active Demand Reduction C2c - C&I Active Demand Reduction

OVERALL STUDY GOAL

The aim of this study is to learn about how program administrators in other jurisdictions are approaching the integration of demand reduction (DR) and energy efficiency both from the implementation and cost-effectiveness perspectives.

VALUE OF STUDY

The learnings from this study will inform whether and how the Massachusetts PAs adjust their approach for the integration of DR and energy efficiency offerings in the state.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

This study will consist of the following tasks: literature review, interviews, and reporting.

Task 1 - Initial Literature Review. The team will conduct a staged literature review. In the first stage, the team will conduct a comprehensive search to identify the jurisdictions and program administrators that are integrating residential and non-residential DR and energy efficiency offerings in some way (e.g., coordinated marketing, administrative integration, fully combined offering). This step will involve a review of publicly available databases and reports, and a review of 20-25 program administrators' websites to assess how programs are marketed to customers. This research will inform the team's understanding of the state policies/regulations related to integrated DSM. The team will then discuss their findings with the

PAs and EEAC and select 4 jurisdictions and associated program administrators for the second stage of the literature review (Task 2) and to target for interviews (Task 3).

Task 2 - In-Depth Literature Review. In the second stage of the literature review, the team will conduct a detailed review of the jurisdictions and program administrators identified in the first stage to explore the extent to which the program administrators for these jurisdictions are performing this integration both from an implementation standpoint and a cost-effectiveness standpoint. The team will review annual and multi-year DSM planning filings and state-specific regulatory guidance for cost-effectiveness analysis. This review will inform the interviews the team will conduct (Task 3) and will be leveraged for the description of case studies (Task 4).

Task 3- Interviews. The team will conduct 8-10 interviews with staff associated with the 4 jurisdictions identified in Task 1. Targeted staff would include program managers, third-party implementers, and regulatory staff at program administrators or state agencies, as appropriate. Interviews with program managers and implementers will focus on understanding how these program administrators are approaching the integration of DR and energy efficiency from both an implementation and cost-effectiveness standpoint. Interviews with regulatory staff and representatives from state agencies will focus on understanding the rationale for current policies and gaining insights into future policies. Collectively, the interviews will inform how integration might best be approached in Massachusetts. The team will explore the following topics during the interviews:

- Policy drivers and motivations for pursuing an integrated approach to energy efficiency and DR offerings.
- How the integration of DR and energy efficiency is accomplished from an implementation perspective, what the challenges are, and how challenges have been overcome.
- How integration of DR and energy efficiency offerings changed engagement with customers, if at all.
- How the program administrators are assessing or plan to assess cost effectiveness of their integrated DR and energy efficiency offerings, and what the advantages and disadvantages are of “combining” DR and energy efficiency offerings for cost-effectiveness-related analyses.

Task 4 – Reporting. The team will prepare a draft memo to the PAs and EEAC for review. The memo will summarize the study approach, key findings from the initial literature review, four case studies based on the in-depth literature review and interviews, as well as the team’s recommendations related to how DR and energy efficiency integration might best be approached in Massachusetts based on this research. The team will incorporate feedback from the PAs and EEAC on the draft memo into the final memo deliverable.

IMPLEMENTATION REVIEW

Budget: $70,000 - $90,000

Timeline: January 2022 – April 2022

APPENDIX I: EVALUATION STUDY SUMMARIES

EVALUATION STUDY SUMMARIES

Study 1: Appliance Recycling Impact Evaluation

Type of Study: Impact Evaluation

Evaluation Conducted by: Guidehouse

Illume Advising

Date Evaluation Completed: 9/1/2021

Study Objective and Summary of Results:

This study assessed the gross savings impacts of the Program during 2019. The study was designed to achieve the following goals:

- Verify savings for each measure group (refrigerators, freezers, dehumidifiers)
- Describe the drivers of deviations from the 2018 evaluation results and considerations for future program planning
- Conduct additional analysis to understand the influence of control types and drain configurations on average UEC estimates for recycled dehumidifiers
- Provide limited process evaluation results through staff and stakeholder interviews

The key findings of this study are:

1. Evaluated 2019 values for refrigerators and freezers are very similar to 2018 results at 1,005 kWh and 753 kWh, respectively.
2. Survey results from 2019 participants show a 22% increase in the part-use factor for freezers over the previous year.
3. The overall UEC value for recycled dehumidifiers in 2019 is 1,050 kWh. When calculated separately, the appliance pick-up UEC is about 12% higher than the turn-in event UEC.
4. The PAs should adopt a different prospective savings value for dehumidifiers that reflects the new size eligibility requirements. The evaluation team calculated an overall prospective UEC value of 1,020 kWh.
5. The PA sponsors are very satisfied with the delivery of the Program.
6. Program staff successfully adjusted for the COVID-19 pandemic.
7. Appliance pick-up tracking data was straightforward to obtain, but dehumidifier turn-in event tracking data required additional iterations to receive information for the impact evaluation.
8. The drain configuration and control type of dehumidifiers does impact the UEC value.

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

- Residential
- Other
- Electric Only

Evaluation Recommendations:

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

Recommendation #1 – The evaluation team recommends the PAs adopt the UEC estimates listed in the key findings section.

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

The study updates the deemed savings amounts for refrigerators, freezers and dehumidifiers measures so that the deemed amounts reflect the typical efficiency levels of HPWH products that participants installed in 2019. The deemed savings values from this study represent similar electric savings compared to previous deemed savings values from 2018.

Overview of Study Method:

The evaluation team completed the following research tasks to meet the study objectives:

1. Staff and stakeholder interviews
2. Tracking data review
3. Participant surveys
4. Impact analysis of recycled appliances
5. Additional analysis of dehumidifier configuration

Application of Results: Prospectively

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

Study 2: Residential Wi-Fi and Programmable Thermostat Impacts

Type of Study: Impact Evaluation

Evaluation Conducted by: Guidehouse

Date Evaluation Completed: 9/29/2021

Study Objective and Summary of Results:

The objective of this study was to better understand and update the savings attributable to Wi-Fi communicating thermostats and programmable thermostats.

This study incorporated a large-scale survey of Wi-Fi thermostat adopters to derive demographic variables to help control for customer characteristics that are generally unknown in typical billing analysis. In addition to directly using survey-based variables in the analysis, the evaluation team relied on an early versus late adopter control strategy to mitigate potential selection bias. Specifically, the study group (2018 adopters) is similar to the comparison group (2019 adopters) in terms of propensity to adopt Wi-Fi thermostats because comparison customers are later observed to adopt Wi-Fi thermostats like the study group.

The study leveraged data from 10,800 gas customers to estimate savings from Wi-Fi communicating thermostats. The study did not update electric savings values due to insufficient data.

The key findings of this study are:

1. On average, Wi-Fi thermostats have gas savings of 2.79 MMBTU/device.
2. Wi-Fi thermostats replacing manual thermostats have gas savings of 4.51 MMBTU/device.
3. Wi-Fi thermostats replacing programmable thermostats have gas savings of 2.44 MMBTU/device.
4. On average, programmable thermostats have gas savings of 2.07 MMBTU/device.

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

- Residential
- Retail: Rebates & Upstream
- Existing Building Retrofits
- HVAC
- Weatherization
- Electric & Gas

Evaluation Recommendations:

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

Recommendation #1 - The evaluation team recommends using the following energy savings values (MMBTU per device) for Wi-Fi and programmable thermostats in the Residential sector.

Delivery Channel	Rebated Thermostat	Replaced Thermostat	Gas	Oil[2]	Other
Retail	Wi-Fi	All	2.79	2.78	2.78
Direct Install	Wi-Fi	Manual	4.51	4.50	4.49
Direct Install	Wi-Fi	Programmable	2.44	2.44	2.43
Direct Install	Wi-Fi	Wi-Fi	0.00	0.00	0.00
All	Programmable	All	2.07	2.07	2.06

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

The study updates the deemed savings amounts for Wi-Fi and programmable thermostats in the Residential sector. The deemed savings values from this study represent a decrease in the electric savings compared to previous deemed savings values, with the exception of Wi-Fi thermostats replacing manual devices.

Overview of Study Method:

The evaluation team conducted surveys with 2018 and 2019 Wi-Fi thermostat adopters in the PAs' retail programs. The study group comprises 2018 adopters, while the comparison group comprises 2019 adopters. This approach enables use of an early versus late adopter control strategy, which mitigates (but does not eliminate) the potential for selection bias related to the decision because customers in both the study and comparison groups eventually adopt a Wi-Fi thermostat. The potential for timing-based selection bias persists, however. To mitigate timing-based selection bias, we leveraged customer characteristics gathered via surveys to account for changes in household occupants, purchases of energy-related equipment such as electric vehicles (EVs) or solar PV, and other changes in the home expected to impact energy use such as a home remodel or addition. The early versus late adopter control strategy paired with survey data enables a thorough exploration of various matching approaches and regression model specifications.

The econometric approach used to estimate savings was an LDV regression model in which customers' usage in the pre-program period is an explanatory variable for usage in the post-program period. This approach controls for remaining differences in pre-period usage between the participant group and comparison group; when preceded by matching, it offers a double robustness for estimating an accurate counterfactual.

Regression model results are weather-normalized and adjusted for changes in participation levels for the Thermostat Optimization programs offered by Nest and ecobee.

Application of Results: Prospectively

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

Study 3: Residential New Construction Energy Optimization Cost Study

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 10/15/2021

Study Objective and Summary of Results:

The MA20R23 RNC Energy Optimization Cost study is designed to help estimate capital and ownership costs of various combinations of shell and mechanical systems for end-users, owners, and builders of new single-family and low-rise multifamily homes of three-stories or less. *Energy Optimization* (EO) refers to a philosophy of fuel-neutral energy reduction to maximize benefits relative to costs.

The study included Massachusetts-specific energy modeling that examined tens of thousands of combinations of home characteristics, such as building framing, insulation levels, windows, air tightness, HVAC equipment, and water heating equipment, to identify optimal packages of measures that can be included in a new home to achieve those various benefits.

The study provides the following key findings:

- Optimization yields flexibility of approach. Similar levels of home performance are possible across all types of construction and HVAC equipment
- By effectively prioritizing building practices to focus on lifetime cost-efficiencies, new homes in Massachusetts can be built to be more affordable, more energy efficient, and less carbon intensive than a typical home, regardless of heating equipment type.
- Builders can build more energy efficient homes that substantially increase bill savings without increasing construction costs.
- Certain practices were frequently selected in optimized homes, including studs spaced 24 inches apart, properly installed insulation, avoiding duct placement in unconditioned space, and insulating hot water pipes.
- Up to a point, decision makers should generally prioritize shell over HVAC upgrades.
- While natural gas homes have the lowest ownership costs, optimized electrically-heated homes can achieve greater site energy savings at similar levels of affordability.
- Heat pumps can serve envelope-optimized homes with minimal reliance on backup heat.
- The study includes a database of detailed cost and savings data for optimized packages across all prototypes.

The study had the following key limitations:

- Analysis relies on models and economic assumptions that would differ from any specific home.
- Analysis covers only energy-related costs of homes and assumes other costs such as countertops and flooring are constant across models.
- Analysis does not include onsite renewable generation.
- Analysis does not account for increasing shares of renewables on the electric grid.

- Future utility costs do not account for climate change's impacts on heating and cooling loads.

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

- Residential
- New Homes & Renovations
- Envelope & HVAC
- Electric & Gas

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

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

How the Study Affects Program Results and Its Significance:

As the Program Administrators look for new ways to achieve savings in the Residential New Construction market, this study provides research that can result in more efficient homes by informing the design process. Additionally, as the regulatory environment puts increasing emphasis on beneficial electrification and emissions reductions, this study, while fuel-neutral, serves as an early examination of how to cost-effectively support those goals.

Overview of Study Method:

NMR created prototype energy models of single-family and multifamily homes across Massachusetts using BEopt energy modeling software. Costs were calibrated to reflect Massachusetts-specific values using results from a literature review and a survey with contractors. NMR identified packages of home characteristics that achieved various goals such as, greatest energy savings with least additional construction costs, lowest ownership costs, and greatest possible site energy savings given model parameters.

Application of Results: Prospectively

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

Study 4: Residential Programs Net-to-Gross Research of RCD and Select Products Measures

Type of Study: Net-to-Gross Evaluation

Evaluation Conducted by: Guidehouse
Illume Advising
Cadeo Group

Date Evaluation Completed: 10/8/2021

Study Objective and Summary of Results:

The goals of this study were to:

- Develop net-to-gross (NTG) estimates at the measure group level, inclusive of participant free ridership and spillover, contractor free ridership (where the contractor is an influential market actor per program theory), and contractor spillover.
- Provide market-related or process-related insights to inform program design.
- Identify enhancements to the recently developed self-report methodology outlined within Massachusetts' Consistent Residential SRA methodology.
- Updating event type parameters to apply to the TRM.

Below are the recommended NTG ratios that the research team calculated as a part of this study by measure group.

Measure Group	Fuel Type	BCR Model NTG	Current Study NTG
From Current Single Family NTG Study			
Direct Install	All	100%	108%
Electric HVAC	Electric	78%	88%
Non-Electric HVAC	Electric	80%	80%
	Natural Gas	86%	76%
Thermostats	Electric	83%	99%
	Natural Gas	83%	87%
Water Heaters	Electric	81%	93%
	Natural Gas	79%	76%
Weatherization	Electric	123%	104%
	Natural Gas	126%	97%
From Energy Optimization Study**			

Measure Group	Fuel Type	BCR Model NTG	Current Study NTG
Heat Pumps, Fuel Switching	Electric	87%	91%
From Current Multifamily NTG Study* **			
All Measures	All	107%	86%

*BCR Model NTG is the average NTG of all measures falling within each measure group using the PAs' BCR Model NTG for 2021.
**Survey responses for fuel switching heat pumps were collected through the Energy Optimization study conducted by a separate Guidehouse/ILLUME research team.
*** Due to similarities between attached low-rise multifamily and single-family buildings, single-family NTG values should be used for attached low-rise buildings.

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

- Residential
- All End Uses
- Electric & Gas

Evaluation Recommendations:

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

Recommendation #1 – Apply the above NTG values to the TRM for the 2022-2024 Energy Efficiency Plan.

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

The study updates NTG values for selected residential measure groups. NTG values increased for some measures and decreased for others. The revised NTG values will be reflected in the amount of net savings claimed by the PAs.

Overview of Study Method:

The study used the self-report approach (SRA) to measure and report NTG, reflecting the important elements of the program theory and related points of influence (e.g., contractor and assessor influences). The approach follows the *Consistent Approach for Self-reported Residential NTG Measurement* report finalized May 28, 2020 (referred to herein as the Consistent Residential SRA).

There were three data collection efforts that informed the NTG measurement: a single-family RCD and retail participant survey, a multifamily RCD participant survey, and a participating contractor survey.

Activity	**Rationale**
Single-family participant survey	Gather data to estimate free ridership and spillover from RCD and retail participants who received measures through an assessment or an incentive for installation of select measures (HVAC, water heating, weatherization, and thermostats).
Multifamily participant survey	Gather data to estimate free ridership and spillover from property managers and owners whose buildings received measures installed through assessments or an incentive for installation measures as a result of their participation in RCD.
Participating contractor survey	Gather data to estimate contractor free ridership (to integrate with participant free ridership when responding customers indicate the contractor was influential in their decision-making process), as well as estimate contractor spillover.

Application of Results: Prospectively

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

Study 5: Heat Pump Water Heaters Costs and Savings Quick Hit

Type of Study: Impact Evaluation

Evaluation Conducted by: Guidehouse

Date Evaluation Completed: 8/31/2021

Study Objective and Summary of Results:

The objective of this quick hit study was to update the deemed energy savings and total installed costs for heat pump water heater (HPWH) measures to represent the HPWH products that customers typically install and to reflect current prices.

The current energy savings and cost values for HPWH measures are calculated at the minimum efficiency level that products must meet to qualify for the program – a uniform energy factor (UEF) of 2.0 UEF for HPWH products at 55 gallons or less or 2.7 UEF for HPWH products over 55 gallons. The evaluation team reviewed 1,769 participant records from program year 2020 and found that participants typically install HPWH products with efficiency ratings that greatly exceed these minimum qualifying efficiency levels.

The PAs previously examined water heater installation costs in 2018 during the *RES 19 Water Heating, Boiler, and Furnace Cost Study*. Since 2018, water heater installation costs have been affected by wage and price inflation and by changes in equipment prices due to increased costs of raw materials. To estimate present-day installation costs for water heaters, this study updated labor and supplies costs using index data from the Bureau of Labor Statistics and this study updated equipment costs using retail price webscraping.

The key findings of this study are:

1. For the HPWH at 55 gallons or less, the typical products rebated in 2020 (3.5 UEF) were 65% more efficient than the qualifying efficiency level (2.0 UEF) that was previously used to calculate deemed savings.
2. For the HPWH over 55 gallons, the typical products rebated in 2020 (3.4 UEF) were 26% more efficient than the qualifying efficiency level (2.7 UEF) that was previously used to calculate deemed savings.
3. Since 2018, labor costs for HPWH installations have increased by 8%, supplies costs have increased by 6%, and equipment costs have increased between 13% and 33%, depending on the water heater type.

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

- All Sectors
- HVAC
- Electric & Gas

Evaluation Recommendations:

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

Recommendation #1 - The evaluation team recommends using the following energy savings and cost vales for HPWH measures in the Residential and Income Eligible sectors.

Product Class	Energy Savings (not incl. heating fuel penalty)	Electric Demand Savings	Incremental Installed Cost (not incl. labor)	Incremental Labor Cost
Electric Storage --> HPWH, <55 gal	1,799 kWh	0.125 kW	$952	$137
Electric Storage --> HPWH, >55 gal	360 kWh	0.033 kW	$554	$98
Propane Storage WH --> HPWH, ≤55 gal	-831 kWh 17.1 MMBtu propane	-0.074 kW	$823	$32
Oil-fired WH (storage or indirect) --> HPWH, ≤55 gal	-1,138 kWh 18.1 MMBtu fuel oil	-0.102 kW	$146	-$82
Heating Fuel Penalty: For electric storage WH to HPWH ≤55 gallons: -0.50 MMBtu fuel oil, -0.10 MMBtu nat. gas, and -0.07 MMBtu propane For propane storage WH to HPWH ≤55 gallons: -0.67 MMBtu propane For oil-fired storage WH to HPWH ≤55 gallons: -0.67 MMBtu fuel oil For electric storage WH to HPWH >55 gallons: No fuel penalty				

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

The study updates the deemed savings amounts for HPWH measures so that the deemed amounts reflect the typical efficiency levels of HPWH products that participants installed in 2020. The deemed savings values from this study represent an increase in the electric savings and electric demand savings compared to previous deemed savings values.

Overview of Study Method:

The methodology was developed to update HPWH energy savings and installation costs:

Task 1 | HPWH Savings Updates

The evaluation team examined participant rebate data for program year 2020 to determine the representative size and efficiency of products that participants purchase. For each water heater measure, the team calculated energy savings as the difference between the baseline energy consumption and the efficient-level energy consumption. The team referenced baseline energy

consumption values from the MA Residential Baseline Study (for electric WH) and from the Energy Information Administration's Residential Energy Consumption Survey (EIA RECS). The team estimated energy consumption at the efficient level using engineering calculations.

Task 2 | Water Heater Cost Updates

The RES 19 cost study conducted in 2018 used a contractor survey, retail price webscraping, and program invoices to estimate the amount that contractors charge their customers for equipment, labor, supplies, and other costs at different efficiency levels. This study used publicly available data to estimate installation costs in 2021 based on the costs observed in 2018.

To account for changes in labor, supplies, and overhead costs, the team used producer price index and occupational wage index data from the US Bureau of Labor Statistics. To account for changes in equipment costs, the surveyed retail prices for a select set of water heater products in 2018 and then surveyed the same products again in 2021.

Task 3 | Memo and Presentation

The evaluation team summarized the methodology and findings of this study in a presentation delivered to the PAs on August 26, 2021 and a memo delivered to the PAs on August 31, 2021.

Application of Results: Retrospectively and Prospectively

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

Study 6: Energy Optimization Fuel Displacement Impact and Process Study

Type of Study: Impact Evaluation & Process Evaluation

Evaluation Conducted by: Guidehouse
Illume Advising
Cadeo Group

Date Evaluation Completed: 10/12/2021

Study Objective and Summary of Results:

The objectives of this study were as follows:

- Refine estimates of overall HVAC energy impacts for the Energy Optimization (EO) fuel displacement measures, including electric consumption increases and associated delivered fuel heating (fuel oil, propane) savings for the most prevalent EO fuel displacement measures.
- For partial displacement installations with integrated controls, understand how customers are controlling their existing delivered fuel-fired heating system and new heat pump (HP) systems, including programmed and field-verified switchover temperatures and other HVAC operation behavior; and identify opportunities for increased savings from improved control settings, installation practices, or customer or contractor education.
- Understand and offer insights into program processes, customer program satisfaction, potential barriers to participation, contractor and distributor program experience and engagement, and opportunities for improved program delivery.
- Understand customer motivations and decision-making around their energy optimization equipment purchase, including what the customer would have installed if they had not installed the retrofit equipment to determine baseline conditions, and if the customer primarily purchased the HP system(s) for heating, cooling, or both.

This is the first impact and process evaluation of the EO Fuel Displacement measure offerings, although the PAs previously estimated EO measure impacts through the *EO Optimization Model*, first developed in October 2018, with the latest update completed in March 2021. The MA PAs began offering the oil and propane to heat pump measures in 2019 and electric resistance to heat pump measure offerings in 2018.

As part of this evaluation, the team interviewed program staff, implementation staff, contractors, distributors, and a small sample of customers. The team also fielded a survey to participating customers. To round out the impact analysis, the team completed bill disaggregation, a metering study, and calibrated building simulation.

The key findings of this study are:

4. Most customers are satisfied with their new fuel displacement equipment—especially their HPs—and are more comfortable than they were before program participation. For the multifamily segment, interviewed building owners/operators were very happy with their program experience, the performance of the HPs installed at their properties, and the resulting energy cost reductions.

5. For partial displacement installations in 2019, customers who installed a central HP are largely relying on the integrated controls to auto-switch between their new heat pump and the previous delivered fuel-fired heating equipment (80% of installations in the 2019 program year). About half (40%-60%) of mini-split HP(s) installations are replying on the integrated controls to auto-switch, while the other half are manually operating their systems. Customers using manual operation are using either wall-mounted or app-based controls to operate their heat pumps and existing heating systems based on perceived outdoor air temperatures, or when they would prefer to run their various systems. This study found that customers who are manually operating their systems are largely switching system operation at close to desired temperatures, however, some mini-split HP owners are turning off the units entirely when they are not occupying the zone. These practices have the potential to reduce the efficiency benefits achieved.
6. The results from this study suggest that customers are not using standardized switchover temperatures for either oil or propane systems. For customers who do use an integrated control to auto-switch, they program a variety of switchover temperatures between approximately 5°F and 45°F.
7. Contractor and distributor interviews suggest that integrated controls may vary widely in functionality and features depending on the manufacturer. This is common for a developing market. However, this may cause some contractors to be overwhelmed or confused and decide to give up early on the technology. For example, contractors reported experiencing connectivity issues with different brands, and problems with mismatched zoning between the fossil fuel system and new mini-split HPs that may prompt customers to override the controls.
8. The program primarily leans on the contractors' relationship with customers to promote the rebate offering. However, many contractors – especially smaller contractors or contractors that have lower participation rates – require more training to be able to provide their customers with the necessary guidance and support so integrated control and HVAC systems operate as intended.
9. The prevalence of a no cooling baseline assignment is higher for customers who installed a mini-split HP (30% for fuel fired baseline heat, 37% for electric resistance baseline heat) relative to customers who installed a central HP (9%). This suggests that these customers who installed a mini-split HP through the program are motivated to add a cooling amenity to their space (which results in a net cooling energy increase) but are also spurred by the program to displace pre-existing delivered fuel-fired or electric resistance space heating with their new heat pump(s), as the program intended. Thirty-nine percent of customers who installed a central HP indicate that they would have installed a central AC if they did not install the HP they did (which does not provide a heating amenity). This further indicates that the program is having the intended effect: spurring customers to displace delivered fuel heating usage relative to their baseline purchasing decisions.

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

- Residential & Income-Eligible
- HVAC
- Electric Only

Evaluation Recommendations:

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

Recommendation #1 - Offer literature directly to customers (including online resources) that summarize the benefits of integrated controls and basic tips on how to operate new systems. Customize literature for central HP and mini-split HP owners. Helping customers build a greater understanding for their new equipment, how to operate it, and how not to operate it, may also increase customer satisfaction and reduce the number of customers switching between their heating systems manually. This will further help customers build a greater understanding for their new equipment, how to operate it, and how not to operate it, and may also increase customer satisfaction and reduce the number of customers manually switching between their heating systems. For example, mini-split HP literature could focus on the cost savings benefits and the ease of "setting and forgetting" with their integrated control. Instead of turning off heat pump when they are not in the room or are not home, they should turn back the boiler setpoint or choose the away setting on their thermostat.

Recommendation #2 - The Program Administrators should consider convening a study to gain additional understanding of the functionality and performance of different types of integrated controls, including distinctions between networked and hard-wired controls. Any future metering studies should include a large sample of both networked and hard-wired controls over an extended metering period to capture control and unit operation over a wide range of temperature and weather conditions (including heat pump performance at lower outdoor air temperatures). This type of study may help to further refine program requirements, along with the Qualified Products List (QPL).

Additionally, the study may assist the program in producing other guidance for contractors. For example, depending on the study's scope, a guide to accompany the QPL could be produced that identifies which controls are good for different customer types (e.g., tech-savvy customers, set-it and forget-it customers) and the features/functionality offered. As the market matures, controls may align in functionality and features, but until then some contractors may continue to be overwhelmed with the different options and features available.

Recommendation #3 - Provide contractors program support depending on how far along they are on the adoption curve for fuel displacement technologies. Take the following tactics to support the different contractor types:

- **Early Adopters:** Highlight their experiences and expertise in case studies or features that can be used to bring along other contractors. These contractors generally represent 20% of the population but perform 80% of the installations and require little to no technical assistance.

- **Majority:** Offer technical trainings or field support to increase this groups' capacity to resolve issues and become more confident with the technology. These contractors generally represent the second and third tiers down in project volume from the Early Adopters. They are motivated to offer their customers' the value of the rebate but are still somewhat skeptical of the technology.

- **Late Adopters:** Provide sales training and basic information about fuel displacement technologies and the program offering. These low volume EO contractors have little available time and are less likely to seek out resources on their own. The program could consider opportunities to perform additional one-on-one outreach to this group via phone or in-person, emphasizing the value proposition of integrated controls and how controls could benefit both them and their customers.

Recommendation #4 – The MA PAs should use the updated measure impact values developed through this study. Please reference the study's Executive Summary or Section 4.2 for the 2021 measure savings values, and Appendix A for the 2022-2024 planning values.

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

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

The PAs will adopt or have adopted recommendation 4 for both the 2021 annual report and the 2022-2024 three-year plan. The PAs are still reviewing and considering the other recommendations at this time.

How the Study Affects Program Results and Its Significance:

The study updates the deemed savings values for the EO Fuel Displacement measures, based on the data collection and analysis activities performed in the evaluation. The study also presents recommendations for further program improvement and highlights areas for further research to refine measure impact estimates.

Overview of Study Method:

The following methodology was used to provide process findings and recommendations and to update the EO fuel displacement measure impacts.

Task 1 | Program Records Review

The evaluation team performed a program records request and review for program year 2019 data. This dataset provided participant, measure, and contractor information to support evaluation tasks.

Task 2 | EO Fuel Displacement Staff, Implementers, Contractors, and Distributor

Interviews

The evaluation team completed six group interviews with the PA sponsors and program implementation staff to inform the study's research questions and evaluation tasks. Interviews explored goals and objectives of the fuel optimization offerings, how the participation process works, marketing and outreach efforts, successes, challenges, and potential improvements to the program going forward.

The evaluation team interviewed a total of 18 contractors over the phone to learn more about how contractors discussed HPs and integrated controls with their customers, the installation process for HPs and integrated controls, the program participation process for the contractor and customer, and barriers contractors faced with the fuel displacement technologies.

The evaluation team completed four phone interviews with HVAC distributors serving the MA residential market. These interviews explored market trends for HP systems and integrated controls, how distributors support contractors in the selling and installation of fuel displacement technologies, and potential market barriers.

Task 3 | Customer Survey and Interviews

The evaluation team surveyed customers who participated in the 2019 EO Fuel Displacement measure offerings to explore customer awareness and motivations, baseline heating and cooling equipment types, customer interactions with the equipment and integrated controls, and their experience with the program and their contractor.

Task 4 | Customer Bill Disaggregation and Billing Analysis

The team performed a bill disaggregation analysis on the pre-retrofit and post-retrofit period electric billing data to inform and calibrate building simulation models, including both HVAC and non-HVAC end uses.

Task 5 | Remote Temperature and Total Home Electric Usage Metering Analysis

The team performed a metering study to determine HVAC operation and integrated control switchover temperatures for a sample of heat pump installations with integrated controls. The results of this analysis were then applied to the calibrated building simulation impact analysis (Task 6).

Task 6 | Calibrated Building Simulation

The team used calibrated building simulation to estimate delivered fuels and electric consumption impacts for the primary building types and measure combinations rebated through the program. The model assumptions and parameters were informed through all other tasks in this study.

Task 7 | Report and Presentation

The evaluation team summarized the methodology and findings of this study in a presentation delivered to the PAs on June 10, 2021 and a report delivered to the PAs on October 13, 2021.

Application of Results: Retrospectively and Prospectively

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

Study 7: Residential Baseline Study - Phase 5 – ECM Impacts Study

Type of Study: Impact Evaluation

Evaluation Conducted by: Guidehouse

Date Evaluation Completed: 9/30/2021

Study Objective and Summary of Results:

The objective of this study was to update the deemed energy savings for the electrically commutated motor (ECM) boiler circulator pumps measure.

The deemed 'per unit' energy savings assumption that the program currently uses (142 kWh/year) is based on a small pilot study completed before the program administrators first offered the measure. This savings value exceeded the total consumption of boiler distribution systems (including all circulator pumps) for approximately half of the metered sample with boilers in the Residential Building Use and Equipment Characterization Study (formerly the Residential Baseline Study), indicating that the current deemed savings assumption may be overstated. The goal of this study was to update the current per-unit deemed savings value using more recent and robust data collection and analysis supported through the Residential Building Use and Equipment Characterization Study.

The key findings of this study are:

10. Average baseline (non-ECM) circulator pump wattage is 90W, as determined through field data collection on over 200 circulator pumps from the Residential Building Use and Equipment Characterization Study.
11. The evaluation team sources an efficient ECM circulator pump wattage from the Vermont Technical Reference Manual (14.4W). This value is supported by a robust data collection through onsite metering and captures both the efficient wattage of the ECM pump at maximum flow and savings at part load operation.
12. The study calculated an effective full load hours (EFLH) for boiler circulator pumps at 1,027 hours, using metered data collection for a sample of 19 boiler distributions systems.

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

- Residential & Income-Eligible
- HVAC
- Electric Only

Evaluation Recommendations:

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

Recommendation #1 - The evaluation team recommends using the following energy savings for the boiler ECM circulator pump measure in the Residential and Income Eligible sectors: **75.2 kWh per ECM pump.**

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

The study updates the deemed savings amounts for the ECM boiler circulator pump measure using field data collection from a large sample of Residential Building Use and Equipment Characterization Study participants. The study also references a reasonable efficient wattage from the Vermont Technical Reference Manual. The deemed savings value from this study represents a decrease in the electric savings compared to the previous deemed savings value.

Overview of Study Method:

The following methodology was used to update the ECM boiler circulator pump energy savings:

Task 1 | ECM Circulator Pump Analysis

The evaluation team used onsite data collected through the Residential Building Use and Equipment Characterization Study to support calculations of baseline circulator pump wattages and EFLH. The team took the average boiler circulator pump wattages for non-ECM pumps to develop the wattage baseline and analyzed metered data for a sample of circulator pumps to develop an EFLH assumption. The team sourced the efficient circulator pump wattage from the Vermont Technical Reference Manual and calculated an updated deemed savings value for the ECM boiler circulator pump measure.

Task 3 | Memo

The evaluation team summarized the methodology and findings of this study in a memo delivered to the PAs on September 30, 2021.

Application of Results: Retrospectively and Prospectively

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

Study 8: Residential Enhanced Incentives Study

Type of Study: Process Evaluation

Evaluation Conducted By: Guidehouse

Study Objective:

The 2019-2021 Three-Year Energy Efficiency Plan for Cape Light Compact (CLC) proposed several enhanced incentives targeting residential and C&I customers, all of which are continuations of enhancements offered by CLC during previous plan periods. In its Order on the 20196-2021 Plan, the Department of Public Utilities directed the Program Administrators to conduct an evaluation to determine if the enhanced incentives offered by CLC continue to be warranted and to understand if they should be more widely adopted by other PAs.

To comply with the Department's directive, the PAs are conducting the Residential Enhanced Incentives study to assess the effect of the weatherization-focused renter/landlord offer targeting 1-4 unit rental properties (where tenants pay the energy bills), focusing on 2019. The statewide renter/landlord offer was initiated in April of 2016, increasing insulation incentives for 1-4 unit rental properties to 90% of insulation costs up to $3,000. In 2017, the $3,000 cap was removed for this customer segment. As an exception, CLC has offered a 100% uncapped insulation incentive to landlords of 1-4 unit rental properties since 2010.

Note: The PAs have not filed a full summary for this study as final reporting has not yet been completed. A status report summarizing study tasks and completion status is included with this filing.

A copy of a status report for the study can be found in Appendix J, Study 8.

Study 9: Massachusetts Non-Residential New Construction Market Characterization Study Report

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 6/21/2021

Study Objective and Summary of Results:

The purpose of this study was to assess and/or inform industry standard practices (ISPs) for Non-Residential New Construction (NRNC) where possible based on the data collection, including updating the interior lighting power density (LPD) adjustment factor developed through prior code compliance studies, and to assess energy code compliance for select code measures.

The primary finding from this study was that current standard practice is better than the energy code for many of the measures examined. Specifically, the study recommends the following ISP values:

- Interior lighting: 0.60. Applicable to the IECC 2015 values. Apply factor to code specified maximum LPD.
- Exterior lighting: 0.67. Applicable to the IECC 2015 values. Apply factor to code specified maximum LPD.
- Hot water boilers: 1.15. Apply factor to the code specified minimum efficiency.
- Warm air furnaces: 1.02. Apply factor to the code specified minimum efficiency.
- Heat pumps – heating: 1.06. Includes all heat pumps except packaged terminal heat pumps. Apply factor to the code specified minimum efficiency.
- Heat pumps – cooling: 1.03. Includes all heat pumps except packaged terminal heat pumps. Apply factor to the code specified minimum efficiency.
- Air conditioning: 1.00.
- Chillers: 1% better than code. This finding will be incorporated into the ISP Chiller Market Research Memo to determine the final recommended chiller code adjustment factor.

Core Initiatives to which the Results of the Study Apply:

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

Evaluation Recommendations:

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

Recommendation 1: We recommend adoption of the ISP values summarized above.

Recommendation 2: Determine a chiller code adjustment factor by combining the results of this study and the concurrent chiller ISP study. The chiller ISP study is collecting market actor estimates of equipment market share as a different approach to determining ISP. The final combined chiller code adjustment factor will be reported in the chiller ISP study.

Recommendation 3: Focus energy code training on targeting code provisions that are not readily complied with and/or require proper installation to capture energy benefits.

Recommendation 4: Account for new baselines. Other program, evaluation, and analysis methods should account for the baseline revisions, including attribution research and equipment costs used in benefit cost analysis.

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

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

How the Study Affects Program Results and Its Significance:

The new recommended values reflect the best available ISP data. The product of a code adjustment factor and the code specified minimum efficiency yields the ISP baseline efficiency to be used for calculating savings in lieu of the code specified value.

Overview of Study Method:

The study was conducted in two phases. Phase 1 included a literature review of prior compliance studies and PA programs and engaged the PAs, EEAC, and other stakeholders to achieve a consensus that the primary focus of this study should be on informing ISPs versus a full energy code compliance study. Phase 2 executed the recruitment, data collection, and analysis of site-level data from a representative sample of NRNC buildings permitted under IECC 2015 to assess NRNC ISPs. The DNV team recruited 38 municipal building departments to participate in the study and reviewed construction drawings for 55 sites permitted between January 1, 2017 and October 31, 2019, gathering building envelope, mechanical, and lighting details to assess ISPs and measure-level code compliance.

Application of Results: Prospectively

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

Study 10: Massachusetts C&I Customer On-Site Baseline Saturation Study

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 8/13/2021

Study Objective and Summary of Results:

The purpose of this study was to collect and update primary C&I market end-use equipment data for PA program planning and evaluation efforts. Other goals included the provision of data in support of technical potential studies and to provide inputs to the 2022-2024 planning cycle.

The study provides the following key findings:

Chillers

- Chillers installed in the last five years have efficiencies that are largely similar to or better than those assumed in the TRM for replace on failure/new construction events. These results suggest a potential need to re-examine those TRM assumptions, perhaps in combination with the current chiller baseline study also being performed for the PAs.
- We estimate only a third of chillers were manufactured before 2000, suggesting a measure lifetime shorter than in the TRM.
- Efficiencies of recent chiller installations observed in this study in combination with findings from the ongoing ISP study can be examined to assess appropriate baselines for chiller replacements.

Boilers

- Since the 2016 study, there appears to be a trend in the increase of natural gas-fueled boilers and decrease in the use of boilers using fuel oil.
- Approximately half of boilers with known capacity are estimated at <300 MBH and around 17% above 1,000, blurring the line in the market between small residential-style units and larger commercial sizes.
- 58% of installed boilers are estimated to be non-condensing units, presenting an opportunity for programs to install condensing boilers.
- The distribution of years of manufacture supports the recent change in eTRM lifetime assumption from 25 years to 20 years.
- Recent condensing boiler installations (in the last 5 years) have AFUE ratings above 95%, suggesting further research may be needed to ensure the current eTRM new construction/replace on failure baseline is appropriate, though we note that the number of participants in those recent installations is not known.

Furnaces

- Like boilers, most standalone furnaces are gas-fueled (76%), with most of the balance oil (16%) or propane (6%).

- Virtually all standalone furnaces are above the minimum standard of 78% AFUE/80% Et for units below 225 KBTUh, suggesting an increasingly obsolete federal standard.
- Most units observed in existing stock would qualify for program incentives (0.95 or 0.97 AFUE), as only a negligible number were above this threshold.

Packaged HVAC

- There remains strong technical potential for converting AC systems to heat pumps to supplement or displace gas heating.
- The majority of packaged systems are less than 5.4 tons (65 kBtuh) with a large portion of those being AC (cooling only). This suggests that opportunities exist for efficiency improvement and increasing heat pump technologies primarily for smaller units.
- Installations in the last five years indicate that over 50% of installed package units providing cooling have heat pump technology, and 79% of units providing heating are heat pump technology.
- Dual fuel packaged systems – units that are electric AC cooling and gas heating – were found more often in the market than heat pump systems used for both heating and cooling. Replacing the AC component of these dual fuel systems with a more efficient heat pump system presents an electrification and energy efficiency opportunity for programs. For supplemental heating, the gas heating element may be left in place.

DHW

- There appears to be a trend in the increase of natural gas consuming DHWs and a reduction in electric units compared to the 2016 study. The increase could be due to the change in sampling approach of this study from kWh to MMBtu in the current study, resulting in more dual fuel consuming establishments.
- There is a slight reduction in storage type DHWs from the previous study, but they are still the largest DHW system type in the state.
- Many DHW storage type installations in the last five years are non-condensing technology, suggesting a significant opportunity to capture savings via promotion and installation of condensing DHW storage type units.
- The assumed baseline efficiency for the eTRM commercial condensing water heater replace on failure installation event is 80% Et. We observed 84% of existing stock to have a higher efficiency than this assumption. To the extent we would expect the efficiency of a replace on failure scenario to exceed those observed in existing stock, these results suggest further research may be needed to ensure the current eTRM /replace on failure baseline is appropriate.

EMS

- EMS: 9% of establishments observed in this study have an EMS compared to 6% in 2016.
  Based on a comparison with the 2016 study, there is evidence that the use of pneumatic controls is decreasing. The 2016 study estimated 39% of units had pneumatic controls while the current study estimates 19%.

- HVAC is typically controlled by EMS systems observed. Additional control of lighting presents an opportunity that can be explored.

Refrigeration

- An estimated 16% of walk in/reach in refrigeration lighting is T8 or T12, presenting an opportunity for efficiency improvements.
- HFCs make up nearly three quarters of the refrigerants used in existing systems, presenting an opportunity for system upgrades as they are phased out.

General Study Findings

- The 2016 study provided a good basis from which to update data. The use of phone surveys with those customers was an effective way to gauge changes in the market. A panel approach might work well to establish and maintain an updated baseline over time.
- The use of photos and virtual visits to gather more detailed technical information on changes was a challenge, but under the right conditions worked reasonably well and can be incorporated into similar studies when appropriate. While engineer visits represent the highest rigor to gather information, requesting photos or using a virtual tool provided a useful alternative.

Core Initiatives to which the Results of the Study Apply:

- Commercial & Industrial
- All Initiatives
- Electric & Gas

Evaluation Recommendations:

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

Recommendation 1: We recommend the findings of this study be added to evidence from other sources and studies as part of ongoing program improvements, opportunity targeting, and TRM and ISP development. For example,

- Chiller installations in the last 5 years suggest that the current TRM replace on failure assumptions might be low. There is a chiller study being conducted for the PAs that can be considered with these results to more fully assess the need for revision and what new value might be appropriate.
- In addition, the data on installation years that directionally indicate different lifetimes than assumed in the TRM can be reviewed with the 2020 C&I measure life study and/or unitary EUL memo of 7/2018 to support TRM assumption revisions (e.g., chillers, boilers, packaged HVAC) as needed.

Recommendation 2: We also recommend that findings from this study be reviewed to identify areas of future research that might further examine promising program opportunities among the systems examined. To the extent that a set of results has poor precision, additional research may be conducted to confirm or disconfirm an opportunity for program improvement. For example,

- The PAs might consider supplementing the findings around furnace or boiler efficiencies installed over time to understand potential early replacement savings.

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

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

How the Study Affects Program Results and Its Significance:

This study was developed in anticipation of a need for more current information on the C&I marketplace, given rapid technological advances in equipment and a dynamic C&I market in Massachusetts. It established a set of data that can provide results used to support PA potential studies and key system saturation data.

Overview of Study Method:

Three primary data-gathering methods provided a final sample of 234 establishments:

- 60 on-site assessments, completed before March 2020
- 162 web and phone surveys with supplemental virtual visits with original baseline study participants
- 12 technical assistance studies (pre-program equipment characteristics)

The data from all sources were aggregated into a single database with system data from all 234 establishments. Iterative proportional fitting methods, also known as raking, were performed to develop weights with optimization based on sample and population characteristics (e.g., fuel, size, participation type, and building type). This was a critical step to improving the representation of the final sample, derived from multiple sources, back to the original population.

Application of Results: Prospectively

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

Study 11: Massachusetts Cannabis Cultivation ISP

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 6/10/2020

Study Objective and Summary of Results:

This study summary applies to the Massachusetts Cannabis Cultivation ISP study completed in June 2020. The purpose of this study was to define industry standard practice (ISP) in indoor cannabis cultivation in Massachusetts using high rigor methods. Subsequent research has been conducted since this study was completed per the recommendations of this study.

The study provides the following key findings:

- All licensed facilities must comply with Cannabis Control Commission (CCC) regulations, including ones that were designed and built before the regulations were passed. The regulations divide facilities into 11 tiers based on canopy square footage, with Tiers 1 and 2 being the smallest (1 to 10,000 square feet) and a maximum of 100,000 square feet.
- Horticultural lighting: Existing facilities have two ways to comply with the horticultural lighting power density (HLPD) requirements: retrofitting high-intensity fixtures with LED fixtures and reducing the percentage of cultivation area in active use. Tier 1 and 2 facilities have a maximum permitted HLPD of 50 watts per square foot, and Tiers 3 through 11 have a maximum HLPD of 36 watts per square foot.
- Environmental conditioning: Interviews indicated that CCC regulations had not impacted ISP for HVAC and dehumidification systems. For Tier 1 and 2 facilities, the space-cooling ISP is direct expansion (DX) type systems. For Tiers 3 through 11, chilled water systems are the ISP.
- Extraction equipment: The common processes to extract cannabinoids and terpenes for the manufacture of consumer products require energy-intensive air compressors and process chillers. Interviews found no ISPs at this time. These facilities need further study to quantify end use, productivity, and energy efficiency opportunities.

Core Initiatives to which the Results of the Study Apply:

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

Evaluation Recommendations:

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

Recommendation 1: Use identified ISP for baseline. ISPs identified in this study should be used by implementers as the baselines for projects and by evaluators when evaluating those projects. Where an ISP was not identified, use a site-specific baseline.

Recommendation 2: Conduct further research. The CCC regulations require annual reporting from licensed facilities on energy use, fuel use, production values, and lighting and HVAC systems. The PAs should revisit this study in 12 to 18 months to leverage the data the CCC will have accrued.

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

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

How the Study Affects Program Results and Its Significance:

The CCC enacted regulations in 2018 that dictate minimum standards for building envelopes, horticultural power density, and HVAC systems for cannabis cultivation facilities. PAs can no longer use a technology-based ISP but must align their baseline characterization with the CCC's regulations.

Overview of Study Method:

The team interviewed a random selection of service providers, including architects, engineers, builders, consultants, and equipment vendors. The combined respondents have worked on 13 of the 26 final licensed facilities in Massachusetts, and all are currently active with new projects in the state.

Application of Results: Retrospectively and Prospectively

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

Study 12: Cannabis ISP Update 1 – Horticultural Lighting Square Footage Definition Update

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 4/23/2021

Study Objective and Summary of Results:

The purpose of this study was to update the ISP recommendation for Horticultural Lighting Square Footage (HLSF) following revisions to MA regulations. On February 11, 2021 the Massachusetts Cannabis Control Commission (CCC) published revised regulations (935 CMR 500.000 and 935 CMR 501.000). The revised regulations change the definition of HLSF, which impacts the calculation of Horticultural Lighting Power Density (HLPD).

The study provides the following key findings:

- The previous version of 935 CMR 500 and 935 CMR 501 were published on November 1, 2019 and include the following definition for HLSF; "Horticulture Lighting Square Footage (HLSF) means Canopy." Canopy is then defined as,
  "Canopy means an area to be calculated in square feet and measured using clearly identifiable boundaries of all areas(s) that will contain mature plants at any point in time,…"
  The key words in the above definition of canopy are "mature plants". The Massachusetts seed-to-sale guide defines "mature" plants as those greater than 8" tall.
- 935 CMR 500 and 501 now define HLSF as: "Horticulture Lighting Square Footage (HLSF) means an area to be calculated in square feet and measured using clearly identifiable boundaries of all areas(s) that will contain plants at any point in time, at any stage of growth,…"
  The key revision in the above definition is the change from the inclusion of only "mature" plant canopy, to all plant canopy "at any stage of growth".

Core Initiatives to which the Results of the Study Apply:

- Commercial & Industrial
- New Buildings & Major Renovations
- Electric Only

Evaluation Recommendations:

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

Recommendation 1: For all projects, the HLPD calculation should reference the new definition of canopy which includes all stages of plant growth. This revised definition should be noted in the Baseline Repository and promulgated through technical assistance studies. This

revised definition should be noted in the Baseline Repository and promulgated through technical assistance studies, savings calculations and in the evaluation of projects

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

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

How the Study Affects Program Results and Its Significance:

The November 2019 and February 2021 versions of the regulations include the same equation for calculating HLPD;

$$HLPD = \frac{HLE}{HLSF}$$

where;

HLPD = Horticultural lighting power density, watts/sf

HLE = Horticultural lighting equipment, watts

HLSF = Horticultural lighting square footage, sf

HLE is defined in both versions of the regulations as,

> *"…any lighting equipment (e.g., fixtures, bulbs, ballasts, controls, etc.) that uses energy for the cultivation of plants, at any stage of growth (e.g., germination, cloning/Mother Plants, Propagation, Vegetation, Flowering, and harvest)."*

In the November 2019 regulations, there existed an apparent imbalance in the calculation of HLPD, where the connected wattage of the fixtures serving immature plants was to be included, but the canopy area of those immature plants was not to be included.

The February 2021 regulations correct this imbalance by including the HLE and HLSF of all cultivation areas, regardless of stage of growth or plant maturity.

Overview of Study Method:

DNV completed a review of the February 2021 updated regulations to make the recommendation noted above.

Application of Results: Retrospectively and Prospectively

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

Study 13a: ISP High Rigor Study Findings – HVAC Chillers

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 9/8/2021

Study Objective and Summary of Results:

The purpose of this study was to characterize the ISP in Massachusetts for HVAC chillers and their auxiliary equipment, including controls, pumps, and cooling tower fans.

The study provides the following key findings:

- A key finding of the primary research is that the installed chiller is dependent on whether a project is an end of life/replace on failure (ROF) scenario or a true new construction project
- New Construction chillers on average have rated efficiencies that are about 3% better than code
- ROF projects are largely driven by the equipment that was there before and the replacement equipment is expected to be at or slightly better than code.
- The study found that high efficiency chillers are not standard practice because they cost significantly more, and the program incentives do not overcome that cost gap. This is consistent with the relatively low penetration of the program in the market and the perception of vendors that the incentives have little impact.

Core Initiatives to which the Results of the Study Apply:

- Commercial & Industrial
- New Buildings & Major Renovations
- Electric Only

Evaluation Recommendations:

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

Recommendation 1: The evaluators recommend that the ISP standards presented in Tables 1a, 1b, 2, 2b and 3 of the main report be incorporated into the Baseline Repository roll-out upon finalization of these results. The ISP findings apply to applications approved in 2022 and going forward until such time that this study is revised or there are subsequent revisions to building code impacting chillers.

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

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

How the Study Affects Program Results and Its Significance:

The new recommended chiller baselines are slightly better than code. Application of these baseline findings will result in a small downward impact on chiller savings estimates.

While program design is not the study's primary objective, PAs and market experts shared information with the research team that can benefit program evolution. The program should consider researching the incremental costs of a high efficiency chiller compared to an ISP chiller with an eye to modifying future incentives if there is a desire to increase participation rates. The program should consider a streamlined and abridged application process for ROF efforts, and program designers should look at their process to figure out how to engage customers in chiller plant controls improvements as part of a ROF.

Overview of Study Method:

The high-rigor study included background research, a roundtable with PA representatives, interviews eight different market actors, and the integration of results from a recent non-residential new construction market characterization study. The determination of ISP was further refined during the NRNC study which confirmed that the intent of ISP is to reflect equipment choices if the program-eligible products were not available. In preparation for the primary research, the DNV team conducted secondary research and conducted a roundtable discussion with five PA representatives.

Application of Results: Prospectively

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

Study 13b: Energy and Heat Recovery Ventilators (ERV) ISP Memo

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 6/24/2021

Study Objective and Summary of Results:

The purpose of this study was to characterize the ISP in Massachusetts for energy recovery applications including Energy Recovery Ventilators (ERVs), Heat Recovery Ventilators (HRVs) and associated controls for non-cannabis HVAC purposes.

The study provides the following key findings:

Application	Industry Standard Practice (ISP)

New construction (NC) applications	• In HVAC applications where code does not require heat recovery, the baseline is no heat recovery.
	• Where code permits alternative paths in lieu of heat recovery, either the minimum requirements as defined by the alternative compliance path or the appropriate ISP equipment type can be selected as the baseline.
	Equipment Selection – when required by code
	• The equipment type is not dictated for medical and laboratory applications with a potential for cross-contamination or if there are other physical limitations to the installation.
	• The baseline equipment for all other HVAC applications is dictated by rated airflow as follows:
	  • Rated supply airflow rate <5,000 cfm: Plate exchanger
	  • Rated supply airflow rate >5,000 cfm and <60,000 cfm: Enthalpy wheel
	  • Larger airflow requirements require a site-specific baseline.
	Effectiveness
	• The baseline effectiveness varies by equipment type as rated under AHRI conditions:
	  • Enthalpy wheel: 65%
	  • Plate heat exchanger: 55%
	  • Run-around coil: 50% sensible[1]
	  • Heat pipe: 50%
	Controls:
	• Face-and-bypass damper controls

Replace on failure (ROF) applications	System type and effectiveness selected to match the existing unit connections, available space, and market availability without considering code.

[1] Generally, run around coils are only installed when the supply and exhaust cannot be located near each other, overall we expect this to be a small number of projects.

Core Initiatives to which the Results of the Study Apply:

- Commercial & Industrial
- C&I New & Replacement Equipment
- Electric & Gas

Evaluation Recommendations:

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

> **Recommendation 1:** It is recommended that the PAs adopt the baselines presented in the table above.

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

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

How the Study Affects Program Results and Its Significance:

While program design is not the study's primary objective, PAs and market experts shared information with the research team that can benefit program evolution.

Overview of Study Method:

This low-rigor study involved background research and two rounds of interviews. The first round was group discussions with program administrator (PA) representatives to establish a working understanding of the incentive programs as they currently exist. The second round of interviews involved individual discussions with a design firm specializing in the pharmaceutical and hospital sector, a manufacturer of low flow plate exchangers and enthalpy wheels, a manufacturer of enthalpy wheels and enthalpy wheel components, and an industry expert.

Application of Results: Prospectively

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

Study 14: Impact Evaluation of PY2018-2019 Custom Electric Installations

Type of Study: Impact Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 3/17/2021

Study Objective and Summary of Results:

The purpose of this study was to provide verification and re-estimation of energy and demand savings for a sample of statistically selected custom electric projects through site-specific verification, monitoring, and analysis of Program Year 2018/2019 installations.

The study provides the following key findings:

- For almost all energy and peak demand savings parameters, the three-year pooled realization rates improved over the previous two-year rolling results. Statewide, operational effects represents the largest discrepancy adjustment for lighting and baseline the largest for non-lighting.
- Custom non-lighting projects are generally more complex than lighting projects, so the realization rates (RRs) tend to have more variation. However, the programs could gain some ground in some areas. In particular, a large portion of the savings were reduced due to adjusted baselines—something the PAs are committed to improving upon.
- A handful of projects did not claim savings for some portions of the project, possibly to use more conservative tracking savings estimates. Since these have typically been quantified via measurement & verification (M&V), and to stay consistent with past studies, we included these only for sites with full M&V, which was not the case for many of the projects due to impacts of the COVID-19 pandemic on conducting full M&V.
- The lifetime savings adjustment factors (LSAF) reported in this memo represents evaluation changes made to measure event type and measure life selection and does not include the new lighting EUL and adjusted measure life (AML) values from the most recent MA Lighting Market Characterization study. The evaluation found that the claimed custom measure life was typically supported by the documentation provided in the project file.

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

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

Evaluation Recommendations:

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

Recommendation 1: Apply the results from the Interim Results Memo to the PY2020 tracking savings reported in the 2020 Plan Year Report filed in 2021.

Recommendation 2: Apply the LSAF to the PY2020 lifetime tracking savings reported in the 2020 Plan Year Report filed in 2021.

Recommendation 3: As the application files are not always complete, be diligent in gathering the technical assistance studies, spreadsheets, and models used to define and develop the project and include them in the electronic documentation.

Recommendation 4: Separate fixture replacement and lighting controls savings when calculating annual and lifetime savings estimates. If this isn't possible, a weighted measure life should be applied to better represent early replacement projects with both lighting fixture and control savings.

Recommendation 5: Adopt the recommendation made in the "Memorandum on Dual Baseline Calculation Practices and Assumptions, November 27, 2019" to maximize the accuracy of lifetime savings, and continue to evaluate lifetime savings impacts and calculate a lifetime adjustment factor to be applied to tracking lifetimes.

Recommendation 6: Develop a weighted measure life for multi-measure projects that fall in the same line of tracking data or isolate the individual measure savings into unique lines in the tracking data so that each measure claims an accurate measure life.

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

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

How the Study Affects Program Results and Its Significance:

The results from this study should be combined with the next round of custom electric impact evaluation, which is expected to be applied to the PY2021 tracking savings and reported in the 2021 Plan Year Report filed in spring 2022. This aligns with the MA impact evaluation framework by maintaining an annual rolling custom electric impact evaluation result.

Overview of Study Method:

Methods used for this year's evaluation were similar to last year's, except for modifications due to the COVID-19 pandemic. The key modifications were an increased scope of desk review tasks, including a more in-depth review of applicants' assumptions and calculation methodology; the use of virtual audits to verify technology, assess HVAC interaction, and validate measure installation; and realization rates based on verified non-operational parameters of the current and PY2016 and PY2017/18 samples, verified operational parameters of the current sample where available and

historical operation adjustments from the past two studies where not available and the pooling of this sample's results with PY2016 and PY2017/18 results.

Application of Results: Retrospectively and Prospectively

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

Study 15: Massachusetts Dual Baseline Cost and Lifetime Savings Methods Research

Type of Study: Process Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 4/9/2021

Study Objective and Summary of Results:

The purpose of this study was to develop a statewide solution to define and implement ex-post evaluation adjustments to reflect lifetime evaluation findings and develop methods for implementing cost adjustments associated with dual baseline measures. This study had five research objectives: to define the scope of the lifetime adjustment, to define the conceptual mechanism for applying evaluation results to lifetime savings, to recommend any necessary changes to sampling methodology, to recommend a method for implementing dual baseline cost adjustments, and to inventory support systems and tools.

The study provides the following key findings:

- Definition of and update process for Lifetime Savings Adjustment Factors (LSAF)
- Dual baseline cost methods and adjustments
- Common PA lifetime savings practices and exceptions thereto
- Potential LSAF modifications to the BC tool, and a short-term workaround

Core Initiatives to which the Results of the Study Apply:

- Commercial & Industrial
- C&I New & Replacement Equipment
- Electric & Gas

Evaluation Recommendations:

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

Recommendation 1: Add a lifetime savings adjustment factor (LSAF) to the BC Tool.

Recommendation 2: Continue to design samples for studies with annual savings as the precision target while also monitoring the LSAF precision to ensure it is being maintained at reasonable levels.

Recommendation 3: Update the dual baseline method currently incorporated in the CST to match the enhanced NEEP methodology.

Recommendation 4: Conduct an annual review of the CST and EUL and outyear factors.

Recommendation 5: Define protocols for measures without an EUL reference or where the CST has multiple EUL selections.

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

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

How the Study Affects Program Results and Its Significance:

While ultimately the PAs are responsible for accounting for the lifetime savings adjustment beginning with the term report filed in 2021 for PY2020 savings, this effort provides research, analysis, and facilitation to support the Working Group's development of a statewide solution to defining and implementing ex-post evaluation adjustments to reflect lifetime evaluation findings. The working group also examined methods for implementing cost adjustments associated with dual baseline measures.

Overview of Study Method:

The main study methods used were PA staff interviews, a review of PA tools, and five sessions of a Working Group comprising representatives from the Massachusetts PAs, the EEAC, and the team of evaluation consultants. The Working Group's responsibilities were to review and approve the approaches, findings, and draft recommendations that arose from the study.

Application of Results: Retrospectively and Prospectively

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

Study 16: Massachusetts C&I Adjusted Measure Lives for PY2021 and PY 2022

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 7/6/2021

Study Objective and Summary of Results:

The purpose of this study was to develop and present new adjusted measure life (AML) calculations for C&I lighting. The AML results are expected to be applied retrospectively to PY2021 and prospectively in PY2022.

The study provides the following key findings:

Application	Equipment Type	*PY2020*	2021	2022	PY2021-PY2022
Ambient Linear	LED Fixture	*8.8*	6.9	6.8	6.9
	TLED	*8.5*	6.7	6.6	6.7
High/Low Bay	LED Fixture	*8.6*	7.8	8.1	7.9
	TLED	*8.5*	7.7	8.1	7.9
	LED Lamp	*8.2*	7.5	7.9	7.7
Exterior/Outdoor	LED Fixture	*7.4*	6.0	6.2	6.1
	TLED	*7.4*	5.9	6.3	6.1
	LED Lamp	*6.9*	5.6	5.8	5.7
Screw-Based	A-Line	*3.5*	2.2	2.2	2.2
	Downlight	*6.0*	2.1	2.2	2.2
	Decorative	*3.0*	1.7	1.8	1.7

Core Initiatives to which the Results of the Study Apply:

- Commercial & Industrial
- All Initiatives (except New Construction)
- Electric Only

Evaluation Recommendations:

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

Recommendation 1: We recommend that the PAs adopt the PY2021 – PY2022 averaged AMLs for all early replacement and replace-on-failure measures reflected in the table above for upstream, prescriptive, and custom lighting program installations. New construction and major renovations measures should continue using the full rated lifetimes for LED measures

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

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

How the Study Affects Program Results and Its Significance:

Gross lifetime savings for the PAs C&I lighting programs are assessed as a product of the first-year annualized savings and the AML. Changes to the AML results in changes to the lifetime savings for lighting measures. Since lighting measures are subject to dual baseline savings methods, the AML is used to account for both replace-on-failure and early replacement.

Overview of Study Method:

The updated results rely on the same market model forecasts (extended through 2030) as were used to calculate the PY2020 values to estimate future baselines. The only change in the methodology from previous efforts was driven by the need to account for two-period lifetime savings estimates in the ROF component of the calculations. In addition to this change, we also used more reflective data to support the first-period baseline in the ER component of the calculations rather than a proxy value. There was no primary data collection or re-calibration of the model market share forecasts; however, the model forecasts were extended to address the need to estimate future baselines beyond the prior forecast period.

Application of Results: Retrospectively and Prospectively

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

Study 17: Massachusetts C&I Upstream Lighting Net-to-Gross Study 2022-2024 Report

Type of Study: Net-to-Gross Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 7/1/2021

Study Objective and Summary of Results:

The purpose of this study was to develop net-to-gross (NTG) ratios for C&I LED technologies offered in the Massachusetts Upstream Lighting initiative. Research objectives were to estimate spillover and free-ridership associated with the kinds of LEDs supported by the PY2019 Upstream Lighting Program using both customer-reported information and market actor interviews, provide a retrospective PY2019 ratio associated with the Upstream Lighting Program, and estimate a prospective NTG for the PY2022-2024 three-year plan.

The study provides the following key findings:

	Retrospective	Prospective		
LED Category	PY2019	PY2022	PY2023	PY2024
Screw-In	0.56	0.45	0.40	0.35
TLEDs	0.40	0.26	0.20	0.14
Fixtures	0.37	0.27	0.22	0.17
Fixtures with Controls	0.53	0.58	0.56	0.53
High or Low Bay	0.61	0.49	0.44	0.38
Exterior	0.27	0.17	0.12	0.07

Core Initiatives to which the Results of the Study Apply:

- Commercial & Industrial
- C&I New & Replacement Equipment
- Electric Only
- Upstream Lighting

Evaluation Recommendations:

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

Recommendation 1: We recommend the PAs adopt the PY2022-2024 prospective NTG ratio estimates developed by the Massachusetts EEAC, PA representatives, and evaluators. In previous three-year program cycles, estimates were locked in and could not be revised.

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

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

How the Study Affects Program Results and Its Significance:

Overall, the upstream LED C&I market continues to experience a downward trend in NTG ratios as the program continues. The integration of the distributors' LED NTG ratio added an additional layer to the customer NTG calculation that resulted in a better understanding of LED market dynamics.

Overview of Study Method:

The team collaborated with the data collection efforts from other concurrent lighting studies to conduct CATI surveys with PY2019 Upstream Lighting participants. The objective of the CATI surveys was to collect information on participant free-ridership and spillover and to conduct onsite lighting inventories. Through a consensus process, three groups representing the Program Administrators, the EEAC, and the evaluators independently developed prospective NTG ratio estimates. Averages across all three groups were presented, discussed, and accepted as the prospective NTG estimates.

Application of Results: Retrospectively and Prospectively

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

Study 18: C&I Lighting Controls Savings Factors for PY2021 and PY2022

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 9/21/2021

Study Objective and Summary of Results:

The purpose of this study was to develop and recommend commercial and industrial (C&I) lighting controls savings factors (LCSFs), to be applied retrospectively to PY2021 and prospectively to PY2022.

The study provides the following key findings:

Controls Technology	Savings Factor	Source
Networked Lighting Controls (NLC)	49%	DLC and NEEA, 2020
Luminaire-Level Lighting Controls (LLLC)	49%	DLC and NEEA, 2020
Dual Occupancy and Daylight Sensors	38%	Williams, et al., 2012
Combination of High-End Trim and Daylight Dimming	35%	Calculated based on High-End Trim and Daylight Dimming savings factors from Williams, et al., 2012
Combination of High-End Trim and Occupancy Sensors	33%	Calculated based on High-End Trim and Occupancy Sensor savings factors from Williams, et al., 2012
High-End Trim	27%	DLC and NEEA, 2020
Daylight Dimming	28%	Williams, et al., 2012
Occupancy Sensors	24%	Williams, et al., 2012

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

- Commercial & Industrial
- C&I New & Replacement Equipment
- Lighting
- Electric Only

Evaluation Recommendations:

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

- **Recommendation 1**: The Massachusetts PAs should adopt the controls savings factors presented in the table below identified by the literature review for retrospective application (2021) and prospective application (2022).

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

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

How the Study Affects Program Results and Its Significance:

While the work to assemble these recommendations was conducted under MA19C06-E-UPLGHT: Upstream Lighting Impact Evaluation (MA19C06-E-UPLGHT), the LCSFs should be applied to all controls measures across upstream, prescriptive, and custom program installations except where additional information is available to inform site-specific estimates. Results are intended to be applied both retrospectively and prospectively.

Overview of Study Method:

Due to complications surrounding fieldwork during the COVID-19 pandemic, the DNV team had a small sample of upstream participant sites metered with fixtures with integrated controls (n=5). Because of this limited data, the DNV team leveraged results from a literature review completed by DNV as part of Connecticut X1931-4 New Measure Advanced Lighting Controls Study on behalf of the Connecticut Energy Efficiency Board (EEB) Evaluation Consultant Team. The EEAC Consultants and the PAs agreed that results from this literature review are applicable to savings from lighting controls across all programs, beyond just LED fixtures with integrated controls sold through the Upstream Initiative. In addition, DNV compiled data from the five upstream participant sites as well as the two most recent Massachusetts custom electric studies (P80 and P88) to provide additional evidence to support the LCSF.

Application of Results: Retrospectively and Prospectively

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

Study 19: 2020 C&I Lighting Controls Market Study

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 6/30/2021

Study Objective and Summary of Results:

The purpose of this study was to characterize the C&I lighting controls market in order to understand lighting controls opportunities, including drivers of and barriers to realizing market potential, and whether and to what extent recent installations of LEDs without controls may impede the adoption of advanced lighting controls.

The study provides the following key findings:

- Customer adoption and saturation are low.
- Overall awareness of advanced controls is increasing.
- Cost is not as significant a barrier as other factors, such as lack of awareness, space type, and lack of training.
- Manufacturers are expanding their lighting product portfolios to include advanced lighting controls products, seeing this as a growth area.
- Manufacturers and distributors see multiple paths for program intervention.
- Market actors and customers see controls as having positive impacts on their facilities beyond energy savings.
- The team anticipates that lighting controls products will continue to improve and further enable adoption of advanced controls strategies, lighting load engagement in demand response and/or grid-interactive building-type programs, and the provision of key non-energy impacts such as security, cybersecurity, and remote diagnostics.

Core Initiatives to which the Results of the Study Apply:

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

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

Consideration 1: The PAs should consider using targeted marketing and bundled lighting packages to speed adoption.

Consideration 2: Providing case studies or simplified workbooks for contractors to show customers the ROI and non-energy benefits associated with lighting controls could help overcome barriers to adoption.

Consideration 3: The PAs should consider contractor training workshops and/or materials.

Consideration 4: The PAs should consider conducting further research into customer motivation to shed light on what customers are interested in and how to meet their needs.

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

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

How the Study Affects Program Results and Its Significance:

The PAs have conducted extensive research over the past several years on the market for lamps and fixtures in C&I buildings. This study builds on that research to study the market more explicitly for C&I lighting controls in Massachusetts as the PAs look to understand the opportunities and challenges of this market.

Overview of Study Method:

The study explored key topics in three research areas: customer characterization, supply side market characterization, and product assessment and trajectory. The project team collected data in coordination with concurrent lighting studies and utilized existing data from previous evaluation efforts and from research conducted in jurisdictions beyond Massachusetts. The primary data collection efforts included customer saturation phone surveys, a contractor web survey, and manufacturer and distributor in-depth interviews.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 19.

Study 20: Vendor Pipe and Fixture Insulation Savings Calculator Review Report

Type of Study: Technology Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 8/24/2021

Study Objective and Summary of Results:

The purpose of this study was to review vendor insulation gas savings calculators and past site-specific evaluation reports and provide recommendations for how the Massachusetts PAs should proceed with future insulation savings calculations.

The study provides the following key findings:

- Differences related to bare surface temperatures of the insulated components between evaluation and tracking are the most significant sources of low realization rates.
- Three of the tools reviewed were built referencing ASTM Standard C680, which is a standard describing the established methodology to calculate heat loss values for bare and insulated surfaces. These three tools were found to result in heat loss values that matched the empirical data more closely than the tool that was not built in reference to ASTM C680.
- One of the tools, Methodology D, developed by National Grid, which references ASTM C680, diverges somewhat from the other two tools that reference ASTM C680 where simple corrections will bring the tool back into alignment.
- Vendor feedback about the programs offered in Massachusetts for insulation measures was very favorable.
- When evaluators convert horizontal pipes to the "Tank Shell – Horizontal" geometry within 3EPlus, the evaluators are underestimating the true impacts from these projects.

Core Initiatives to which the Results of the Study Apply:

- Commercial & Industrial
- C&I New & Replacement Equipment
- Gas Only

Evaluation Recommendations:

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

Recommendation 1: The study team recommends an effort to engage with the key vendors who develop insulation projects in Massachusetts, and together create an agreed-upon procedure for collecting key variables, namely surface temperature measurements.

Recommendation 2: The study team recommends that the Massachusetts PAs require insulation project ex-ante savings be based on tools that reference the ASTM C680 standard,

rather than tools that use other methods, such as the default heat transfer coefficient previously used by Vendor 2.

Recommendation 3: The study team recommends that the divergences from ASTM C680 found in Methodology D, the tool developed for National Grid be corrected as outlined in Section 5.2.

Recommendation 4: The study team recommends that the Massachusetts PAs continue to communicate with key stakeholders, namely vendors who actively participate in the program, before making any significant changes to program delivery or requirements, and that the programs should continue to solicit and incorporate feedback from these key vendors.

Recommendation 5: The study team recommends that the evaluators no longer convert linear feet of pipe to the "Tank Shell – Horizontal" geometry within 3EPlus.

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

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

How the Study Affects Program Results and Its Significance:

The recently completed 2017 and 2018 MA Custom Gas Impact Evaluation Reports found that vendors use a variety of savings calculation approaches. There are also multiple savings calculators across Massachusetts, resulting in different outputs for a given set of inputs. A review of vendor insulation savings calculators allows us to present recommendations on whether the Massachusetts PAs should adopt a standard approach around calculating gas savings from pipe and fixture insulation measures.

Overview of Study Method:

The team reviewed 25 recent impact evaluation site reports completed on pipe/fitting insulation projects installed in Massachusetts between 2016 and 2018, the four calculators used by various vendors to estimate ex-ante energy savings, and the process they use to collect data. Part of this work also involved asking questions of the vendors to get feedback from them about ways to improve the program, especially increasing the accuracy of savings estimates, while considering implications that potential program changes could have on customers and vendors.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 20.

Study 21: Air Infiltration Savings Calculator Review Final Memo

Type of Study: Technology Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 4/19/2021

Study Objective and Summary of Results:

The purpose of this study was to research and discuss the viability of a vendor infiltration savings calculation tool that can run large numbers of building simulation models consistent with NIST suggested modifications and generate a simple spreadsheet analysis model for PAs.

The study provides the following key findings:

- Weather induced infiltration impacts are real and significant. The preferred modeling software the MA PAs use (eQuest) does not have the ability to determine the infiltration-related impact on building energy consumption.
- The vendor model has been tested for multiple building types to determine weather impacts, identifying which building types can implement infiltration measures.
- Vendor model results replicated NIST findings and can update the models as NIST comes up with new findings.
- Vendor tool has ability to perform extensive runs and post run analytics. This will help determine the significant building characteristic variables that affect the infiltration rate.

Core Initiatives to which the Results of the Study Apply:

- Commercial & Industrial
- New Buildings & Major Renovations
- Gas Only

Evaluation Recommendations:

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

Recommendation 1: The EEAC recommended the PAs move away from eQuest and instead use an updated modeling tool: OpenStudio. Using OpenStudio would also diminish any potential interactive effects and to kickstart the transition, recommended training new construction program vendors with OpenStudio.

Recommendation 2: Develop validation protocols to ensure they are acceptable to evaluation for the proposed air infiltration program in the form of a checklist.

Recommendation 3: Leverage the tool (if acceptable) for existing buildings as well as new construction.

Recommendation 4: If the measure is not cost-effective utilizing code as the baseline, determine if the measure merits more research to identify if standard practice is below code. This activity is also recommended for the measure if it is cost effective as the review could glean additional savings.

Recommendation 5: If model is accurate, propose a small evaluation of several small projects to compare the evaluation results against the modeled results. Document how any differences

can be addressed through updated model assumptions to ensure ongoing improvements in accuracy of the model.

Recommendation 6: Although it was found that the NIST model was better than available alternatives, it has not been validated for infiltration analysis. As a result, the EEAC believes that to deploy this solution in Massachusetts would require empirical testing as part of the deployment of a future proposed program.

Recommendation 7: The EEAC recommended a discussion with a panel of building commissioning experts to better understand air infiltration impacts.

Recommendation 8: Work with the vendor to establish a Massachusetts specific baseline based on EUI and end-use.

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

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

How the Study Affects Program Results and Its Significance:

Improvement in building infiltration load reduction, which can reduce natural gas consumption for commercial buildings in the Mass Save program, is a savings opportunity that has gone largely untapped in current offerings because the current new construction incentive does not have a defined approach for estimating infiltration savings. One major reason is the limitations of the current building simulation software (eQuest) commonly used for new construction projects savings estimates.

Overview of Study Method:

Through a series of working group meetings consisting of members of DNV; the MA PAs, including implementers; and the Energy Efficiency Advisory Council (EEAC), the team shared key insights gathered from their research and discussed the viability of the infiltration tool and path forward. Working group members conducted background research, a deep dive into NIST research papers, a deep dive into the vendor tool, and an assessment of vendor tool usability.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 21.

Study 22: Upstream HVAC and Water Heating Process Evaluation Report

Type of Study: Process Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 8/30/2021

Study Objective and Summary of Results:

The purpose of this study was to:

- Identify obstacles to participating in the Initiatives
- Assess opportunities to increase Initiative participation and related energy savings

The study provides the following key findings:

- **Overall satisfaction with the Massachusetts Initiatives was high, and satisfaction with certain aspects of the Initiatives was also high.** Participating distributors and contractors were satisfied with the Initiatives overall. Using a scale of 1 to 5, where 1 is very dissatisfied and 5 is very satisfied, the average rating from both sets of participants was 4.6. In addition, participating distributors were satisfied with staff responsiveness (average rating of 4.7) and the reimbursement application process (4.6). Participating contractors were satisfied with eligible equipment (4.6) and equipment performance (4.6).
- **Future Initiative marketing should emphasize contractors and also end-use customers.** Initiative staff and some contractors suggested boosting marketing and outreach to foster greater demand from contractors and also end users. Initiative staff seek to foster demand "pull" for higher-efficiency equipment to complement the supply "push" from the distributors. In addition, five of the ten inactive distributors interviewed suggested that the Initiatives should conduct direct outreach with contractors and potential end-use customers. Lastly, some inactive distributors chose not to participate in the Initiatives due to lack of demand for eligible equipment.
- **Further outreach from the implementation contractor may broaden participation.** Seven of ten inactive distributors believed that more outreach or support from the PA's implementation vendor would help their company participate. The main reasons they cite for their lack of participation include the loss of a key water heater product line and a lack of clarity about the Initiatives. However, five of the ten distributors primarily sell boilers, which are not eligible for the Initiatives.
- **Peer Program Administrators avoid offering the same equipment via midstream and downstream programs.** The peer programs strive to avoid offering overlapping measures in their midstream and downstream channels, with exceptions for low-income programs and during the transition period after a midstream program launch. In addition, some peer midstream programs require pre-approval for larger purchases (similar to Massachusetts) and some peer PAs offer equivalent incentives for any overlapping measures to discourage shopping across their midstream and downstream programs. It appears that water heaters, which are eligible for residential programs, are the primary source of measure overlap in the multi-family sector in Massachusetts.

- **The Massachusetts pre-approval process for larger sales is an obstacle for participating distributors.** Initiative staff and almost one-half of the participating distributors cited the pre-approval process required for larger sales[2] as the main obstacle to participation. In addition, distributors were less satisfied with the pre-approval process than with other aspects of the Initiatives, assigning it their lowest average rating (3.8). Lastly, some participating distributors and a few contractors cited improving the pre-approval process as a strategy to advance the Initiatives. These distributors are concerned about the pre-approval disrupting the purchasing process and not being reimbursed if their pre-approval is rejected.

- **The Massachusetts incentive amounts appear to be on the low side and may be limiting participation and possibly program influence.** One initiative staff member and a few participating distributors cited the incentive amount as an obstacle to participation. In addition, distributors were less satisfied with the distributor incentive amount (average rating of 3.9) and buyer incentive amounts (4.3) than with most other aspects of the Initiatives. Lastly, a few participating distributors and some contractors recommended increasing the incentive amount as a strategy to improve the Initiatives. While participants requesting to increase incentive amounts is not unusual, the Massachusetts customer incentive amounts are generally lower than those offered by peer programs for similar measures, in particular for AC systems, heat pumps, and water heaters. The 2017 process evaluation study of the Upstream HVAC initiative also found low incentive levels. While most peer programs also employ the Total Resource Cost test, only one other peer program applies an ISP baseline. ISP is applied for water heaters in Massachusetts, which reduces the savings and may also limit the incentive amount.

- **Boilers appear to be a significant gap in Massachusetts Initiative offerings.** While the measures eligible for the Massachusetts initiatives are generally similar to those of the peer programs, boilers are commonly eligible for the peer programs. In addition, initiative staff and some participating distributors recommended adding boilers. Lastly, five of ten inactive distributors interviewed primarily sell boilers, which is likely a driving reason for their lack of participation. However, the baseline assumption for boilers less than 2,000 MBH in size has transitioned to a mid-efficiency model in Massachusetts.[3] In addition, the companion MA20X08-B-HVACNTG study estimated low NTG results for upstream measures.
- **Chillers, advanced controls, heat pump water heaters, and furnaces represent additional new measure opportunities.** Initiative staff and some participating distributors

[2] The Initiatives require pre-approval for larger-volume upstream purchases of 10+ units or $8,000+ in incentives to avoid upstream equipment also receiving downstream incentives.
[3] *Gas Boiler Market Characterization Study Phase II - Final Report*. March 1, 2017. Prepared for: Massachusetts Program Administrators and Energy Efficiency Advisory Council. Prepared by: DNV GL and NMR Group.

recommended adding chillers and advanced controls. Several peer midstream programs are considering adding chillers and advanced controls as well. In addition, heat pump water heaters are commonly eligible for peer programs. Boilers and furnaces (both gas and oil) are also eligible in a few peer programs.

Core Initiatives to which the Results of the Study Apply:

- Commercial & Industrial
- C&I New & Replacement Equipment
- Electric & Gas
- Upstream HVAC and Water Heating

Evaluation Recommendations:

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

Recommendation 1: Identify strategies to speed up the pre-approval process. Develop a more streamlined process that more quickly yields decisions about pre-approval requests. In particular, this streamlined process should seek to avert the need for the implementation contractor to check with individual PAs to determine whether specific midstream projects are already participating in a downstream initiative.

Recommendation 2: Increase incentive levels where feasible. Initiative staff, distributors, and contractors reported that incentive levels are low, which is supported by the comparison to peer program customer incentives. Increasing incentive levels – for distributors, customers or both – should boost both participation and savings. In addition, it should influence equipment sales to a greater degree and therefore increase NTG ratios. However, the ISP baseline for water heaters may limit the extent to which these incentives can be increased.

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

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

How the Study Affects Program Results and Its Significance:

Over the past few years, the Massachusetts C&I HVAC and Heat Pump Initiative and C&I Water Heating Initiative have not met annual savings goals. This study identified several key barriers to participation, in particular the pre-approval process and low incentive levels. In addition, the study identified several new measures to consider adding to the program, including boilers and heat pump water heaters, that could improve both participations and savings. The study also offered several considerations to minimize issues for overlapping measures that are eligible for both midstream and downstream programs.

Overview of Study Method:

The study included the following data collection tasks:

- **Implementation Staff Interviews.** NMR conducted telephone interviews with implementation staff involved in overseeing and delivering the Initiatives. These interviews covered Initiative design, delivery, changes, participation, obstacles, and opportunities.
- **Participating Distributor Interviews.** NMR coordinated with the companion Upstream HVAC NTG study to add process questions to the NTG interview guide used with participating distributors. These questions sought to understand these distributors' awareness of the Initiatives, application of the incentive, listing of incentive on invoice, satisfaction with various aspects of the Initiatives, and suggestions for improvement. The study teams completed telephone interviews with 22 active distributors (out of a sample frame of 50) in December 2020.
- **Inactive Distributor Interviews**. In January and February 2021, NMR completed telephone interviews with ten distributors who were not participating in the Initiatives to better understand why they did not participate. NMR selected these distributors from a sample frame of 34 inactive distributors who had either never participated or who had not recently participated in the Midstream Initiatives. The goal of these interviews was to obtain feedback regarding Initiative awareness, interest in participating, obstacles to participating, and suggestions to facilitate future participation.
- **Contractor Surveys**. NMR coordinated with the companion Upstream HVAC NTG study to add process questions to the NTG surveys with participating contractors. These questions sought to understand the contractors' awareness of the incentive, the extent to which they saw the incentive listed on their invoices or passed it through to end users, their satisfaction with various aspects of the Initiatives, and suggestions for improvement. The study teams completed CATI surveys with 65 participating contractors (out of a sample frame of 500) in January-February 2021.
- **Peer Program Review**. NMR reviewed and compiled publicly available information, including websites, plans, and reports, about the design and delivery of eight peer midstream C&I HVAC and water heating programs. Next, NMR completed six in-depth telephone interviews with implementation managers of these peer programs in February and March 2021. We asked questions about the rationale behind their program design and delivery; distributor engagement strategies; marketing strategies; and other internal processes.

Application of Results: Prospectively

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

Study 23: EMS ISP Study Report

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 6/20/2021

Study Objective and Summary of Results:

The purpose of this study was to identify ISPs for Energy Management Systems (EMS) in existing buildings and use this information to recommend criteria for distinguishing a measure event type as either replace-on-failure (ROF) or early replacement (ER), ISPs for EMS systems in ROF scenarios, areas for further EMS research, and evidentiary standards for defining EMS systems as having failed.

The study provides the following key findings:

- This study supports assertions from the July 2020 Energy Management System C&I Implementation Group (EMS-IWG) memo that there are energy savings opportunities with existing EMS/BAS systems.
- Challenges remain in being able to characterize the baseline operating conditions of the existing systems to support savings claims.
- Energy saving opportunities for EMS/BAS systems in new construction scenarios are limited.

Core Initiatives to which the Results of the Study Apply:

- Commercial & Industrial
- C&I New & Replacement Equipment
- Electric & Gas

Evaluation Recommendations:

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

Recommendation 1: Increase customer and vendor education and support concerning ASHRAE guideline 36. This new guideline: High-Performance Sequences of Operation for HVAC Systems, provides uniform sequences of operation for HVAC systems that are designed to reduce energy consumption, cost, and system downtime with more resilient systems, control sequence compliance, and diagnostic software. The guideline also promotes communication between specifiers, contractors, and operators by creating a language of common terms. However, this study found that only 27% of the vendors and only 8% of the end users were familiar with this guideline. In addition, when the team asked the end users: "Are you interested in implementing sequences from Guideline 36 if they can help reduce energy use?", 88% of the end users said they were interested with 12% saying they were unsure. Besides this customer and vendor education, the program can further support the wider adoption of

ASHRAE guideline 36 by supporting projects which use this guideline and documenting the level of energy savings these projects achieve.

Recommendation 2: Do more marketing of the EMS incentive program. This was one of the top two vendor recommendations for improving the current program. One vendor identified managers of buildings with low-income housing as being good candidates for this customer education.

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

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

How the Study Affects Program Results and Its Significance:

The findings from this study can assist in determining whether current Mass Save eligibility guidelines for EMS incentives are reasonable based on current standard practices, and allowing the evaluation team to test the feasibility of identifying the age, condition, and operating parameters of an EMS system through both virtual and in-person site visits.

Overview of Study Method:

The information from this study came from a mix of primary and secondary sources, including:

• In-depth interviews with Massachusetts EMS and Retrocommissioning (RCx) providers.

• In-depth interviews and virtual site visits with Massachusetts end use customers with EMS/BAS systems.

• Review of Massachusetts building codes.

• Review of recent EMS impact evaluations.

Application of Results: Prospectively

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

Study 24: Commercial & Industrial Enhanced Incentives Study

Type of Study: Process Evaluation

Evaluation Conducted By: Guidehouse

Study Objective:

The 2019-2021 Three-Year Energy Efficiency Plan for Cape Light Compact (CLC) proposed several enhanced incentives targeting residential and C&I customers, all of which are continuations of enhancements offered by CLC during previous plan periods. In its Order on the 20196-2021 Plan, the Department of Public Utilities directed the Program Administrators to conduct an evaluation to determine if the enhanced incentives offered by CLC continue to be warranted and to understand if they should be more widely adopted by other PAs.

To comply with Department's directive, the PAs are conducting the C&I Enhanced Incentives study. This study explores incentives offered through the turnkey initiative to small businesses, microbusiness tenants, and small non-profits for electric and gas measures (excluding Instant Savings Measures (ISMs) incentivized at 100% across PAs – aerators, showerheads, spray valves, and pipe insulation). Additionally, the study explores incentives offered to municipal customers.

Note: The PAs have not filed a full summary for this study as final reporting has not yet been completed. A status report summarizing study tasks and completion status is included with this filing.

A copy of a status report for the study can be found in Appendix J, Study 24.

Study 25: Non-Residential New Construction ISP Prescriptive Deemed Savings Memo

Type of Study: Impact Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 9/3/2021

Study Objective and Summary of Results:

The purpose of this study was to apply the results of MA19C08-B-NRNCMKT to four prescriptive measures currently offered by PAs and to calculate the lifetime impacts of the new MA efficiency standards on three prescriptive hot water measures.

The study provides the following key findings:

- For TRM measure COM-HVAC-HEC: HVAC - High Efficiency Chiller, DNV applied the weighted average baseline of 0.6% better than 2018 IECC to the TRM baseline efficiency table. The recommended prescriptive chiller baselines are:

Equipment Type	Size Category	Path A FL	Path A IPLV	Path B FL	Path B IPLV
		kW/ton	kW/ton	kW/ton	kW/ton
Water-cooled, Non-centrifugal	< 75 tons	0.746	0.596	0.775	0.497
	≥ 75 tons and < 150 tons	0.716	0.557	0.746	0.487
	≥ 150 tons and < 300 tons	0.656	0.537	0.676	0.437
	≥ 300 tons and < 600 tons	0.606	0.517	0.621	0.408
	≥ 600 tons	0.557	0.497	0.581	0.378
Water-cooled, Centrifugal	< 150 tons	0.606	0.547	0.691	0.437
	≥ 150 tons and < 300 tons	0.606	0.547	0.631	0.398
	≥ 300 tons and < 400 tons	0.557	0.517	0.591	0.388
	≥ 400 tons and < 600 tons	0.557	0.497	0.581	0.378
	> 600 tons	0.557	0.497	0.581	0.378
		EER	EER	EER	EER
Air-cooled	< 150 tons	10.16	13.78	9.76	15.89
	≥ 150 tons	10.16	14.08	9.76	16.20

- For TRM measure COM-HVAC-F: HVAC - Furnace, Gas, DNV calculated the deemed natural gas savings. The deemed savings are 6.7 MMBtu for the 95% furnace measure and 7.7 MMBtu for the 97% furnace measure.

Measure Name	NC MMBtu Savings	ROF MMbtu Savings	ER MMBtu Savings	Weighted MMBtu Savings
Furnace, 95%	7.9	5.7	6.2	6.7
Furnace 97%	8.8	6.7	7.2	7.7

- For TRM measure COM-HVAC-B: HVAC - Condensing Boiler, DNV calculated the deemed natural gas savings. The deemed savings are:

Measure Name	Weighted MMBtu Savings
Heating System, Condensing Boiler, Gas ≤ 300 mbh (.95 TE)	13.8
Heating System, Condensing Boiler, Gas ≤ 300 mbh (.90 TE)	11.4
Heating System, Condensing Boiler, Gas 301-499 mbh (.90 TE)	21.8
Heating System, Condensing Boiler, Gas 500-999 mbh (.90 TE)	39.9
Heating System, Condensing Boiler, Gas 1000-1700 mbh (.90 TE)	73.4
Heating System, Condensing Boiler, Gas 1701+ mbh (.90 TE), Gas	128.5

- For TRM measure COM-HVAC-HPS: HVAC – Heat Pump System, DNV calculated the weighted average cooling baseline is 2.7% better than 2018 IECC and the average heating baseline is 5.4% better than 2018 IECC. The recommended heat pump baseline efficiency values are:

Equipment Type	Size Category	Heating Section Type	Cooling Subcategory or Rating Condition	Cooling Efficiency	Heating Subcategory or Rating Condition	Heating Efficiency
Air cooled	< 65 kBtuh (< 5.4 Tons)	All	Split System	14.4 SEER	Split System	8.6 HSPF
			Single Package System	14.4 SEER	Single Package System	8.4 HSPF
Through-the-wall, air cooled	≤ 30 kBtuh (≤ 2.5 Tons)	All	All	12.3 SEER	All	7.8 HSPF
Single-duct high-velocity air cooled	< 65 kBtuh (< 5.4 Tons)	All	Split System	11.3 SEER	Split System	7.2 HSPF
Air cooled	≥ 65 kBtuh and < 135 kBtuh (≥ 5.4 Tons and < 11.3 Tons)	Electric Resistance (or None)	All	11.3 EER 12.3 IEER	47°F db/43°F wb outdoor air 17°F db/15°F wb outdoor air	3.5 COP 2.4 COP
		All other	All	11.1 EER 12.1 IEER	47°F db/43°F wb outdoor air 17°F db/15°F wb outdoor air	3.5 COP 2.4 COP
	≥ 135 kBtuh and < 240 kBtuh (≥ 11.3 Tons and < 20 Tons)	Electric Resistance (or None)	All	10.9 EER 11.9 IEER	47°F db/43°F wb outdoor air	3.4 COP
					17°F db/15°F wb outdoor air	2.2 COP
		All other	All	10.7 EER 11.7 IEER	47°F db/43°F wb outdoor air	3.4 COP
					17°F db/15°F wb outdoor air	2.2 COP
	≥ 240 kBtuh (≥ 20 Tons)	Electric Resistance (or None)	All	9.8 EER 10.9 IEER	47°F db/43°F wb outdoor air	3.4 COP
					17°F db/15°F wb outdoor air	2.2 COP

Equipment Type	Size Category	Heating Section Type	Cooling Subcategory or Rating Condition	Cooling Efficiency	Heating Subcategory or Rating Condition	Heating Efficiency
		All other	All	9.6 EER 9.7 IEER	47°F db/43°F wb outdoor air	3.4 COP
					17°F db/15°F wb outdoor air	2.2 COP
Water to Air: Water Loop	< 17 kBtuh (< 1.4 Tons)	All	86°F entering water	12.5 EER	68°F entering water	4.5 COP
	≥ 17 kBtuh and < 65 kBtuh (≥ 1.4 Tons and < 5.4 Tons)	All	86°F entering water	13.4 EER		
Water to Air: Ground Water	< 135 kBtuh (< 11.3 Tons)	All	59°F entering water	18.5 EER	50°F entering water	3.9 COP
Brine to Air: Ground Loop	< 135 kBtuh (< 11.3 Tons)	All	77°F entering water	14.5 EER	32°F entering fluid	3.4 COP
Water to Water: Water Loop	< 135 kBtuh (< 11.3 Tons)	All	86°F entering water	10.9 EER	68°F entering water	3.9 COP
Water to Water: Ground Water	< 135 kBtuh (< 11.3 Tons)	All	59°F entering water	16.7 EER	50°F entering water	3.3 COP
Brine to Water: Ground Loop	< 135 kBtuh (< 11.3 Tons)	All	77°F entering water	12.4 EER	32°F entering fluid	2.6 COP

- DNV calculated new adjusted measure lives (AML) for each of the showerhead, faucet aerator, and pre-rinse spray valve measures.

Equipment Type	Showerheads	Faucet Aerators	Spray Valves
Adjusted Measure Life (AML)	7	3	3

Core Initiatives to which the Results of the Study Apply:

- Commercial & Industrial
- C&I New & Replacement Equipment
- Electric & Gas

Evaluation Recommendations:

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

Recommendation 1: DNV recommends the PAs adopt the new baseline efficiencies for the following prescriptive measures:

- COM-HVAC-HEC: HVAC - High Efficiency Chiller
- COM-HVAC-HPS: HVAC – Heat Pump System

Recommendation 2: DNV recommends the PAs adopt the new deemed savings estimates for the following prescriptive measures:

- COM-HVAC-F: HVAC - Furnace, Gas
- COM-HVAC-B: HVAC - Condensing Boiler

Recommendation 3: DNV recommends the PAs adopt the new AMLs for the following prescriptive measures:

- COM-WH-PRSV – Hot Water – Pre-Rinse Spray Valve
- COM-WH-FA – Hot Water – Faucet Aerator
- COM-WH-LFSH – Hot Water – Low-Flow Showerhead

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

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

How the Study Affects Program Results and Its Significance:

The NRNC study recommended the current industry standard practice (ISP) for new construction projects be adjusted. This adjustment impacts the baseline used to calculate energy impacts the prescriptive measures identified in this study.

The new MA standards for water fixtures also required an adjustment to the lifetime impacts of the prescriptive hot water measures identified in this study.

Overview of Study Method:

DNV leveraged information gathered as part of studies including the Non-Residential New Construction Market Characterization Study, ISP research for commercial chillers, and the C&I Early Replacement Study to calculate and weight new prescriptive baselines and deemed savings values for chillers, furnaces, boilers, and heat pumps. DNV produced weighted savings factors based on the percent split of new construction, replace on failure, and early replacement projects going through the prescriptive track.

For the hot water measures impacted by the new MA standards, including pre-rinse spray valves, faucet aerators, and low-flow showerheads, DNV calculated new AMLs according to the following approach:

Equipment Type	Showerheads	Faucet Aerators	Spray Valves
TRM Baseline (TRM_{BASE}) Flowrate (GPM)	2.5	2.2	Existing
TRM High Eff (TRM_{HE}) Flowrate (GPM)	1.5	1.5	1.6

New MA Standard (MA_{NEW}) Flowrate (GPM)	2	1.5	1.5
TRM Equivalent Useful Life (EUL)	10	10	8
Out Year Factor (OYF) $OYF = (MA_{NEW}-TRM_{HE})/(TRM_{BASE}-TRM_{HE})$	0.5	0	0
Adjusted Measure Life (AML) EUL x (1/3 + (2/3 x OYF))	7	3	3

Application of Results: Prospectively

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

Study 26: Residential Products Net-to-Gross Study

Type of Study: Net-to-Gross Evaluation
Impact Evaluation

Evaluation Conducted by: NMR Group
DNV GL

Date Evaluation Completed: 6/8/2021

Study Objective and Summary of Results:

The study goals were to establish retrospective net-to-gross ratios (NTGRs) and in-service rates (ISRs) for 2019 and develop prospective NTGRs and ISRs for 2022 to 2024 for eight products that are supported through the Residential Retail and Residential Coordinated Delivery initiatives.

The studied methods included the following:

- a literature review to examine recent ISR and NTGR findings from other jurisdictions for all eight products
- a participant survey of households that had purchased or received advanced power strips (APSs) or dehumidifiers through the residential initiatives
- consensus process to review the results, estimate retrospective 2019 ISRs and NTGRs, and recommend prospective ISRs and NTGRs for 2022 to 2024

Because the consensus process yielded the same ISRs for 2019 as for 2022 to 2024, the study also suggests applying the ISRs to 2020 and 2021.

The table below presents the consensus derived ISRs and NTGRs.

Table 1: Consensus Derived ISRs and NTGRs

Product	BCR IDs	Delivery Methods	Consensus Derived Values			
			ISR	NTGR		
			2019, 2022 to 2024	2022	2023	2024
APSs	E19A2c073 E19A2c0744	Online Upstream	83%	91%	90%	88%
APSs	E19A2a008	Leave Behind	Addressed in MA20R26-B-VHEA	95%	95%	93%
APSs	E19A2a008[3]	Mailed Kits	Addressed in MA20R26-B-VHEA	93%	92%	91%
Clothes Dryers	E19A2c077	Rebate Form	99%	53%	52%	52%
Dehumidifiers	E19A2c075	Online Rebate Form In-store Rebate	99%	49%	47%	45%
Pool Pumps[4]	E19A2a001 E19A2a002	Midstream	100%	89%	87%	84%
Room Air Cleaners	E19A2c072	In-store Rebate	97%	63%	61%	60%
Room Air Cleaners	E19A2c072[3]	Online Rebate Form	97%	70%	68%	66%
Room Air Conditioners	E19A2c086	Online Rebate Form In-store Rebate	100%	56%	54%	52%
TSVs and Low-flow Showerheads with TSVs	E19A2c082 though E19A2c085	Online Upstream	78%	97%	96%	96%

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

- Residential
- Residential Retail
- Residenital Coordinated Delivery
- Other
- Electric Only

Evaluation Recommendations:

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

- **Recommendation 1:** The Program Administrators (PAs) should use the ISRs and NTGRs in Table 1 to inform planning for the 2022 to 2024 program cycle.
- **Recommendation 2:** The PAs should apply the ISRs in Table 1 starting in 2020 and use them until future research or information suggests updates to the estimates.
- **Recommendation 3:** The PAs should apply the NTGRs in Table 1 starting in 2022 and use them until future research or information suggests updates to the estimates.

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

The recommended ISRs will lead to retrospective adjustments to 2020 and 2021 savings estimates. The recommended ISRs and NTGRs will be used to inform 2022 to 2024 program planning and to estimate gross and net savings until future research or information suggests updates to these inputs.

Overview of Study Method:

The study relied on three methods.

First, the study team conducted a literature review of NTGRs and ISRs from studies completed between 2016 and 2020. The literature provided insights into recent ISRs and NTGRs from Massachusetts and other jurisdictions. The study team reviewed 173 reports; 38 of them included findings on ISRs, NTGRs, or both.

Second, the study team fielded a participant survey with 44 customers who received leave-behind APSs through the RCD program, 72 customers who bought APSs through the PAs' online store, and 70 customers who bought dehumidifiers using a program rebate form. The survey included questions designed to estimate ISRs and NTGRs. For NTGRs, the survey followed the guidance of the Consistent Methodology for Self-Reported Residential Net-to-Gross Measurement (MA19X03-B-RSRNTG). The survey also included questions to understand how customers use their APSs and whether program participants would recommend the program to others.

Third, the study team convened a panel comprising representatives of the PAs, Energy Efficiency Advisory Council (EEAC), and evaluators. This panel reviewed the results of the literature review and the participant surveys as well as additional market information provided by the study team. The panel then engaged in a consensus process to decide on ISRs and NTGRs to inform the 2022 to 2024 program planning process and, for ISRs, to apply retrospectively to savings estimates.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix J, Study 26.

Study 27: Low-Income Multifamily Health- and Safety-Related NEIs Study

Type of Study: Impact Evaluation

Evaluation Conducted by: NMR Group

Three Cubed

Date Evaluation Completed: 8/12/2021

Study Objective and Summary of Results:

The purpose of this study was to quantify and monetize the health- and safety-related non-energy impacts (NEIs) attributable to improvements in the energy efficiency of multifamily buildings served through the Mass Save income-eligible coordinated delivery initiative.

This study explored and attempted to monetize a total of 13 NEIs. It also attempted to identify which, if any, of the NEIs yielded strong enough results from statistical analysis or other supporting evidence to warrant recommending that the Massachusetts Program Administrators (PAs) claim them when screening programs for cost-effectiveness.

The study provides the following key findings:

- Four of the thirteen NEIs this study explored – Arthritis, Thermal Stress (Cold), Home Productivity, and Reduced Fire Risk – met the adoption criteria that were set in advance. These criteria were that the NEI: (1) accrues at the household level; (2) is not derived from energy bill savings and so does not risk double-counting; (3) when it relies on primary data, both the unadjusted and regression-adjusted estimates are statistically significant at p-value <.10 for the outcome of interest; and (4) when it relies on secondary data only, there is sufficient incidence rate and risk factor data from secondary sources to monetize the NEI from these sources.
- The total annual value of these four NEIs per weatherized housing unit, excluding societal benefits and including the Value of a Statistical Life (VSL), is $1,537. The annual value of each individual NEI is Arthritis, $49; Thermal Stress (Cold), $1,426; Home Productivity, $49; and Reduced Fire Risk, $13.

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

- Income-Eligible

Evaluation Recommendations:

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

Recommendation 1: The Arthritis, Thermal Stress (Cold), Home Productivity, and Reduced Fire Risk NEIs meet all NEI adoption criteria. The PAs should adopt the monetized value of these four low-income multifamily health-and-safety-related NEIs. The annual values for each NEI are Arthritis, $49; Thermal Stress (Cold), $1,426; Home Productivity, $49; and Reduced Fire Risk, $13. The total annual value of the recommended household NEI values per unit,

excluding societal benefits and including VSL, is $1,537. The value of the recommended NEIs should be allocated across three measures, as follows: Air sealing, 24%; Insulation, 24%; Heating system upgrades: 52%.

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

This study placed values the on the impacts of weatherization services on program recipients by calculating money saved, or the dollar value of costs avoided, due to changes to resident health and safety, and reductions in participating households' costs other than energy, that result directly or indirectly from weatherization. By adopting the recommended values presented in this study, the cost-effectiveness of the PAs' income-eligible weatherization measures is expected to improve in 2022 and beyond.

Overview of Study Method:

This study collected data from weatherization program participants and non-participants in Massachusetts. The research was conducted in conjunction with a multistate evaluation that was funded through a grant awarded by the JPB Foundation (the "JPB study"). The JPB study collected similar data from program participants and non-participants in Illinois, New Hampshire, New York, Pennsylvania, Rhode Island, Vermont, and Wisconsin. Both this and the JPB study took a quasi-experimental approach to estimate the causal non-energy impacts of weatherization on low-income households without random assignment. Using a pretest-posttest design, the two studies administered the same set of survey instruments to three groups of residents of affordable multifamily buildings before and after a subset of the buildings was weatherized. The studies supplemented these surveys with information about the mechanical and ventilation systems in the buildings before weatherization and the measures installed during weatherization, as reported by participating partners. This study leveraged the data collected by the JPB study to increase the statistical power and precision of the Massachusetts results at no additional cost to the Massachusetts PAs. The evaluation team fielded the surveys for this study from January 2018 through May 2019 (pre-weatherization) and from July 2019 through March 2020 (post-weatherization).

Both studies recruited research participants from among residents of affordable multifamily buildings that fell into the three groups: a Treatment group, with pre- and post-testing; a Comparison-with-Treatment group, which received its treatment prior to the start of the project; and a Control group. Statistically significant differences in demographic characteristics were found between groups. Two approaches were used to estimate the change in rate of incidence of the NEI indicators due to weatherization. First, the evaluation team produced unadjusted estimates by running simple difference in means tests using a quasi-experimental study design approach. For those NEI indicators that met the threshold for statistical significance, the evaluation team then

produced regression-adjusted estimates using a regression analysis to control for differences in the observable characteristics between the study groups and to test the statistical rigor of the estimate.

The evaluation team created composite variables in order to calculate the percent attribution of the total NEI value by measure.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 27.

Study 28: Residential Appliance Recycling Net-to-Gross Study

Type of Study: Net-to-Gross Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 7/23/2021

Study Objective and Summary of Results:

The study goals were to establish retrospective net-to-gross ratios (NTGRs) for 2019 and to use these to inform the development of prospective NTGRs for 2022 to 2024 for appliance recycling measures that are supported through the Mass Save® Residential Consumer Products Core Initiative.

The study objectives included the following:

- Estimate retrospective and prospective net-to-gross ratios (NTGRs) for dehumidifiers, freezers, and refrigerators recycled through the Appliance Recycling Program to inform planning for the 2022 to 2024 program cycle.
- Explore possible effects of synergies created by the availability of incentives for both recycling dehumidifiers and purchasing new ENERGY STAR®-qualified dehumidifiers on NTGRs, including whether the Program Administrators (PAs) should adopt separate early retirement and replace on failure dehumidifier NTGRs.

Participant responses to a web-survey and applied to an algorithm developed by the *Uniform Methods Project (UMP)*[4] yielded the retrospective 2019 NTGRs listed in Table 1. The study recommends that the PAs apply these NTGRs prospectively starting in 2022 and continue using the same NTGRs until results of future research or other information suggest changing them.

The study also found evidence that the availability of rebates for recycling old and buying new dehumidifiers induced about 4% of dehumidifier recyclers to retire their unit early. The study concluded that this percentage was too small to warrant an adjustment to the dehumidifier NTGR to account for early retirement.

[4] Keeling, J.; Bruchs, D. 2017. "Chapter 7: Refrigerator Recycling Evaluation Protocol." *The Uniform Methods Project: Methods for Determining Energy-Efficiency Savings for Specific Measures.* Golden, CO; National Renewable Energy Laboratory. NREL/SR-7A40-68563. http://www.nrel.gov/docs/fy17osti/68563.pdf.

Table 2: Appliance Recycling Retrospective and Prospective Recommended NTGRs

Savings Type	BCR IDs	Retrospective 2019 NTGR[1]	Prospective Recommended NTGR
Refrigerator	E19A2c066	46% (38%, 54%)	46%
Freezers	E19A2c052	50% (41%, 59%)	50%
Dehumidifier	E19A2c076	41% (35%, 47%)	41%

[1] Confidence interval in parentheses.

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

- Residential
- Residential Retail
- Electric Only

Evaluation Recommendations:

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

- The PAs should use the retrospective 2019 NTGRs to plan for the 2022 to 2024 program cycle.
- The PAs should adopt the same NTGRs prospectively starting in 2022 and continue using them until results of future research or other information suggest changing them.

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

The recommended NTGRs will be used to inform 2022 to 2024 program planning until future research or information suggests updates to these inputs.

Overview of Study Method:

The study team conducted a web-based survey of 345 participants in the Appliance Recycling Program: 96 refrigerator recyclers, 75 freezer recyclers, and 174 dehumidifier recyclers. Respondents answered questions designed to determine what they believe they would have done with the recycled appliances had they not taken part in the program. The study team applied these survey responses to an approach adapted from the UMP to estimate retrospective net energy savings and NTGRs for appliances recycled by the program in 2019. The UMP approach

assigns a portion of adjusted gross savings to each unit recycled by the program by accounting for free-ridership (the units would have been removed from service), transferred use (someone other than the participant or their acquaintance would have used the unit), and non-free-ridership (the participant would have kept the unit or given it to an acquaintance). The NTGR equals the average net savings divided by the average adjusted gross savings.

The survey also asked participants about their likelihood of recommending the program, and about the influence of incentives for both recycling dehumidifiers and purchasing new ENERGY STAR-qualified dehumidifiers on participation decisions.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 28.

Study 29: Low-Rise Residential New Construction NTG

Type of Study: Net-to-Gross Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 7/27/2021

Study Objective and Summary of Results:

The purpose of this study was to estimate net savings and net-to-gross (NTG) ratios for the Program Administrators' (PAs') efforts in the Residential New Construction (RNC) market for the 2022-2024 program period. The RNC efforts examined included the RNC program, the Codes and Standards Compliance and Support initiative, the Passive House program, and Code Promulgation. The study covered the single-family and low-rise multifamily markets. It estimated retrospective NTG ratios for homes permitted in 2017 through 2019, prospective NTG ratios for homes permitted in 2022 through 2024, and net savings for homes split by program participations status and building code. The study incorporates new information from the 2019 Residential New Construction Baseline/Compliance Study and improves on the previous RNC NTG evaluation (the Residential New Construction and CCSI Attribution Assessment, study TXC48) by estimating separate NTG ratios for the single-family and low-rise multifamily markets

The study provides the following key findings:

- The overall NTG ratios are 0.49 for 2022, 0.43 for 2023, and 0.38 for 2024.
- The single-family NTG ratios are 0.30 for 2022, 0.29 for 2023, and 0.27 for 2024.
- The multifamily NTG ratios are 1.02 for 2022, 0.84 for 2023, and 0.71 for 2024.
- Single-family NTG has decreased since the previous NTG study due to high program penetration, reducing the population for spillover. Multifamily NTG is higher than single-family NTG because there is much lower program penetration in the multifamily market.
- The PAs' RNC efforts had the greatest impact on duct leakage, air leakage, foundation walls, and electric water heaters.
- The overall impact of the RNC efforts decreased across most measures since the previous NTG study. Lighting, duct leakage, and air leakage impacts decreased the most. However, duct and air leakage are still the top two measures most impacted by the RNC efforts.
- "Electric storage water heaters" was the only measure for which the RNC efforts' impacts increased, as estimated by the Delphi panel. Panelists said the RNC program increased heat pump water heater adoption by 15%.
- Panelists indicated that the RNC efforts had substantial impact on insulation Grade (i.e., installation quality).

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

- Residential
- New Homes & Renovations
- Envelope & HVAC
- Electric & Gas

Evaluation Recommendations:

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

Recommendation 1: The PAs should explore new ways to generate savings in the RNC market.

Recommendation 2: The PAs should claim net savings from the code promulgation efforts separately from other RNC efforts examined in this study using the framework and 90% attribution factor from the Code Promulgation Attribution Study (MA19X07-B-CDPROMATT).

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

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

The study's prospective results assumed a business-as-usual scenario without major changes to the program design. However, due to the low NTG ratios estimated by the study, the PAs are considering significant program design changes. Currently, the evaluation team, PAs, and the Energy Efficiency Advisory Council are conducting follow-up research and deliberations to consider adopting altered NTG values that account for program changes that were not known at the time of this study.

How the Study Affects Program Results and Its Significance:

This study determined the NTG ratios that should be applied to gross-savings estimates resulting from the PAs' RNC single-family and low-rise multifamily efforts – assuming a business-as-usual scenario. The NTG values that should be applied are 0.49 for 2022, 0.43 for 2023, and 0.38 for 2024.

Overview of Study Method:

NMR recruited 14 experts in the RNC industry to serve on a multi-round Delphi panel. The Delphi panel estimated counterfactual measure-level efficiencies for homes built between 2017 and 2019, with the counterfactual scenario being had the PAs' RNC initiatives ceased operation on January 1, 2017. NMR used the panelists' estimates to adjust 200 energy models of homes built between 2017 and 2019 and compared the resulting counterfactual consumption estimates with actual consumption to determine net savings. NMR then developed prospective net savings and NTG

ratios for the years 2022-2024 by leveraging the retrospective net savings and panelist-estimated forecasts of RNC activity.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 29.

Study 30: Renovations and Additions Net-to-Gross Study

Type of Study: Net-to-Gross Evaluation

Impact Evaluation

Evaluation Conducted by: NMR Group

Date Evaluation Completed: 7/30/2021

Study Objective and Summary of Results:

The purpose of this study was to establish a retrospective net-to-gross ratio (NTGR) for 2019 and develop a prospective NTGR for the 2022 to 2024 period for the Renovations and Additions sub-offering. The study accounted for programmatic changes in baseline in estimating prospective NTGR. The study also sought to provide insights into topics such as program experience, NEIs and program satisfaction, COVID-19 impacts, and barriers to participation. This sub-offer is part of the Residential New Construction (RNC) Initiative.

The study provides the following key findings:

- The study found retrospective (2019) Free-ridership of 34%, Participant Spillover of 2%, Non-participant Spillover of 17%, and overall NTG of 85%.
- The study found prospective (2022 to 2024) Free-ridership of 22%, Participant Spillover of 2%, Non-participant Spillover of 12%, and overall NTG of 92%.

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

- Residential
- New Homes & Renovations
- Envelope
- Electric & Gas

Evaluation Recommendations:

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

- **Recommendation 1:** The PAs should adopt the 92% NTGR prospectively starting in 2022 and continue using it until results of future research suggest changing it.
- **Recommendation 2:** To avoid the possibility of introducing unknown bias into the sample frame in the future, going forward, the PAs should require the implementation contractor to track contact information for both the homeowner and the primary contractor associated with the project, regardless of which one applies for the incentive.

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

The recommended NTGRs will be used to inform 2022 to 2024 program planning until future research or information suggests updates to these inputs.

Overview of Study Method:

The study team first conducted a web-based survey of 120 homeowners and 31 contractors who participated in the Renovations and Additions Program in 2019 and the first quarter of 2020. The study team designed and fielded homeowner and contractor web surveys following the survey development guidance in the Consistent Methodology for Residential Self-Report Net-to-Gross Measurement.

Homeowner respondents answered questions designed to determine what they believe they would have done with their renovations and additions project had they not taken part in the program. The homeowner survey also asked participants about their program satisfaction and about the influence of incentives in the homeowners' decision to participate in the program.

Contractor respondents answered questions customized to reflect their actual program practices to obtain the most accurate assessment of the particular measure they would have installed in the absence of the program. The contractor survey also asked about non-energy impacts (NEIs) experienced by homeowners, NEIs emphasized by contractors to homeowners, and opportunities and barriers to program participation.

The study team worked with representatives of the PAs, EEAC, and evaluators in a consensus group process to set prospective NTGRs for 2022 to 2024, leveraging the 2019 NTGR developed as part of this study, survey and program data, and expectations about the future R&A market.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 30.

Study 31: C&I Prescriptive and Custom Net-to-Gross Omnibus Study

Type of Study: Net-to-Gross Evaluation

Evaluation Conducted by: Tetra Tech**,** DNV GL, NMR Group

Date Evaluation Completed: 9/13/2021

Study Objective and Summary of Results:

The purpose of this study was to produce net-to-gross ratios (NTGRs) for the 2022-2024 program cycle for the Massachusetts Program Administrators' Commercial and Industrial (C&I) programs. This study presents prospective (2022-2024) and retrospective (2019) net-to-gross (NTG) ratios and related research findings for electric and natural gas downstream programs. These programs include custom and prescriptive approaches for new and replacement, retrofit, and small retrofit projects.

The study provides the following key findings:

- Program offerings were influential in customers' decisions to install energy-efficient equipment.
- Customer purchasing decisions have not significantly changed since March 2020.
- Vendor recommendations have not changed since March 2020.
- Alternative models found current reporting aggregation levels reflect the key factors associated with differences in NTGR.

The prospective NTGRs are as follows:

Table 3: Statewide C&I Electric Prospective NTG Results

Initiative	Program Type	Measure Type	2022 NTG Ratio	2023 NTG Ratio	2024 NTG Ratio
New and Replacement	Custom	Other	64.2%	64.2%	64.2%
	Prescriptive	Other	83.7%	83.7%	83.7%
Retrofit	Custom	Lighting	65.8%	61.9%	58.3%
		Other	102.0%	102.0%	102.0%
	Prescriptive	Lighting	78.5%	74.6%	71.1%
		Other	87.8%	87.8%	87.8%
Small Retrofit	Custom	Lighting	80.0%	76.5%	73.3%
		Non-lighting	94.0%	94.0%	94.0%
	Prescriptive	Lighting	86.6%	82.9%	79.5%
		Non-lighting	94.0%	94.0%	94.0%

Table 4: Statewide C&I Gas Prospective NTG Results

Initiative	Program Type	Measure Type	2022 NTG Ratio	2023 NTG Ratio	2024 NTG Ratio

New and Replacement	Custom	Other	61.1%	61.1%	61.1%
	Prescriptive	Other	84.4%	84.4%	84.4%
Retrofit	Custom	Building Shell	54.1%	54.1%	54.1%
		Hot Water	70.9%	70.9%	70.9%
		Other	92.1%	92.1%	92.1%
	Prescriptive	Other	66.3%	66.3%	66.3%
Small Retrofit	Custom	Non-lighting	98.3%	98.3%	98.3%
	Prescriptive	Non-lighting	71.5%	71.5%	71.5%

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

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

Evaluation Recommendations:

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

Recommendation 1: The PAs should adopt the prospective NTG values in Table 1 and Table 2 for 2022 and 2023 and 2024 if the PAs do not measure NTG again before then. Table 1 and Table 2 show the 2022-2024 NTGRs at the statewide Initiative, Program-type, and Measure-type levels for electric and gas measures, respectively. These values are based on the 2019 NTG estimates developed in this study, adjusted to meet precision and sample size requirements, as appropriate.

Recommendation 2: Record customer contact information associated with installed equipment. Having contact information allows the evaluation team to conduct study calling more efficiently. Over 50% of the participant sample records in the tracking system were missing customer phone numbers or address information. The missing data points varied across initiatives and program types.

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

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

How the Study Affects Program Results and Its Significance:

The prospective NTGRs from this study more accurately reflect the expected effects of C&I programs on the adoption of prescriptive and custom measures than the previous NTGRs. The results have been taken into consideration in the design of affected programs for the 2022-2024 program cycle.

Overview of Study Method:

The team used a multi-pronged approach to collect data with which to estimate NTG. This approach consisted of a telephone survey of 2019 participating customers (646 completes, 14% response rate), a survey of influential vendors (46 completes, 30% response rate), and a survey of vendors to estimate nonparticipant spillover (143 surveys, 29% response rate). The study also used a consensus group approach to setting prospective NTGRs for 2022 to 2024, leveraging the 2019 NTGRs developed as part of this study, survey and program data, and expectations about the future markets for various types of C&I equipment. The consensus group comprised PA and EEAC representatives and expert evaluators.

The team aggregated results from the electric and natural gas C&I downstream programs at the core initiative level. The core initiatives included the C&I Existing Building Retrofit and C&I New & Replacement Equipment initiatives. If the sub-offering was Turnkey within retrofit, the team recategorized the measures as Small Retrofit following the same process as the previous study. The evaluation team further classified measures by program type (custom and prescriptive) and measure category based on tracking data from the PAs.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 31.

Study 32: C&I Upstream HVAC & Gas Water Heating NTG Study

Type of Study: Net-to-Gross Evaluation

Evaluation Conducted by: DNV GL

NMR Group

Date Evaluation Completed: 9/10/2021

Study Objective and Summary of Results:

The objectives of this study were to estimate prospective (2020-2022) NTG ratios (NTGRs) for six electric HVAC, heat pump, and gas water heating technologies supported by the C&I Upstream Initiative; collect information in support of the process evaluation that was conducted in conjunction with this study; and provide insights to increase Initiative participation in future years.

The study provides the following key findings:

Table 1 presents the NTG values estimated via this study. These values are meant to be used for 2022, and for 2023 and 2024 if the PAs choose not to re-measure NTG for these upstream measures before then.

Table 1: Retrospective (2019) & Prospective (2022-2024) NTGRs

Upstream Technologies	Finalized Distributor/Contractor Non-Nested NTGRs
Volume Water Heater	44%
Instantaneous Water Heater	38%
Variable Refrigerant Flow Heat Pump (VRF)	30%
Package (Air Conditioner, Water-Cooled Heat Pump [WCHP])	55%
Storage Water Heater	29%
Indirect Water Heater	36%

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

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

Evaluation Recommendations:

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

Recommendation 1: In future NTG studies of HVAC, heat pump, and water heating equipment supported by the Upstream Initiative, continue to have the implementation vendor

introduce interviewers from the evaluation team to distributors. This will help maximize the distributor response rate.

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

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

How the Study Affects Program Results and Its Significance:
The 2019 retrospective NTG results will be leveraged prospectively by the PAs' for 2022 planning, and for 2023 and 2024 if the PAs choose not to re-measure NTG for these upstream measures before then.

Overview of Study Method:

The evaluation used self-reported data obtained through interviews with participating distributors (22), contractors (83), and end-users (6). The purpose of the interviews was to obtain insight into the impact of the C&I Upstream Initiative on the sales- and purchase-related decisions of these groups. As part of the evaluation the evaluation team also conducted a market review based on participating distributor interview responses and tracking data, and provided data in support of a process evaluation of the Upstream Initiative (study number MA20C12-B-HVACPROC).

The team identified participants by reviewing 2019 Initiative tracking data. The evaluation used a consensus process to come to agreement on retrospective NTGRs for 2019 and prospective NTGRs.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 32.

Study 33: Non-Residential New Construction Net-to-Gross Study

Type of Study: Net-to-Gross Evaluation

Evaluation Conducted by: NMR Group

DNV

The Cadmus Group

Date Evaluation Completed: 9/30/2021

Study Objective and Summary of Results:

The purpose of this study was to establish retrospective Net-to-Gross Ratios (NTGRs) for 2019 for the Commercial New Buildings and Major Renovations Program (the NRNC program) and the Multifamily High-Rise New Construction program (the MFHR program) and prospective NTGRs for 2022 for the NRNC program, the MFHR program, and the Multifamily Passive House (PH) offering. To address the significant NRNC Program redesign that launched in 2020, four prospective NTGRs were developed for 2022:

1. Paths 1 (Deep Energy Savings/Zero Net Energy (ZNE)) and 2 (Whole Building EUI Reduction) of the NRNC program (the new pathways)
2. Paths 3 (Whole Building Streamlined) and 4 (Systems) of the NRNC program ('traditional' pathways)
3. The multifamily Passive House offering
4. The multifamily high-rise (MFHR) new construction program

The study provides the following key findings:

Table 1 provides the 2019 retrospective NTGRs developed by the study team and the recommended 2022 NTGRS developed through a Consensus Group process. Below, **Table 2** presents the individual free-ridership (FR) and spillover (SO) values developed for the retrospective NTG calculations and the prospective FR and SO values for Paths 3 and 4 of the NRNC Program based on Consensus Group voting.

Table 6: 2019 Retrospective and Recommended 2022 NTGRs

Time Period	Final Net-to-Gross Ratios			
2019 Retrospective	**NRNC Program**		**MFHR Program**	
	58%		75%	
2022 Recommended	**NRNC Paths 1 & 2**	**NRNC Paths 3 & 4**	**MFHR**	**Multifamily Passive House**
	73%	**64%**	**83%**	**90%**

Table 7: Free-Ridership and Spillover Findings[5]

Initiative	FR	SO
NRNC Program (Retrospective, low net savings)[a]	61%	19%
NRNC Program (Retrospective, high net savings)[a]	54%	31%
NRNC Program (Prospective for Paths 3 & 4, Consensus)[b]	**58%**	**23%**
MFHR Program	54%	29%

[a]Two net savings values were calculated, one with building energy consumption outliers included and one with outliers removed. Outliers increased overall net savings in the "high net savings" scenario.
[b]This final prospective value is an average of votes from the three consensus group parties (Program administrators, EEAC, and evaluation), and is derived from the retrospective values in the table.

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

- Commercial & Industrial
- New Buildings and Major Renovations
- Residential
- Residential High-Rise New Construction
- Multifamily Passive House Offering

Evaluation Recommendations:

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

Recommendation 1: The PAs should apply the recommended 2022 NTGRs for the four program offerings detailed in **Table 1**.

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

The PAs plan to adopt the recommendations.

How the Study Affects Program Results and Its Significance:

This study established a market-level prospective NTGR for the PAs' non-residential new construction program activities, including the New Buildings and Major Renovations Initiative and the Commercial Codes and Standards Compliance Support Initiative (CSCS). It also provided the first dedicated NTG measurements for the PAs' Residential MFHR and Multifamily PH

[5] The component FR and SO values in this table are rounded. Using rounded values can cause discrepancies when recreating NTG calculations. For NTG calculations, and where these numbered are included in the Technical Reference Manual (TRM), values with one decimal place are used.

Offerings. In addressing all of these initiatives together, the study sought to avoid any double counting or undercounting of savings caused by overlapping Program impacts and influences.

Overview of Study Method:

This study measured NTG using a Delphi approach to estimate the counterfactual energy consumption of Massachusetts C&I buildings constructed in 2019. Counterfactual energy consumption represents the estimated change in building energy consumption among participating and non-participating new construction projects completed in 2019 in a counterfactual scenario in which the PAs' NRNC and MFHR programs left the market at the beginning of 2019. The Delphi panel in this evaluation was a collection of experts in non-residential new construction building practices and in commercial energy-efficiency program evaluation with a mix of local and national experience.

Delphi counterfactual estimates were applied to actual energy consumption data from Massachusetts new construction projects to develop counterfactual energy consumption values and, subsequently, an estimate of the net energy savings achieved by the program. Four net savings values were calculated, covering participating and non-participating NRNC and multifamily projects

The team used the Massachusetts EUI values and Massachusetts new construction square footage estimates from the Construction Market Data (CMD) Group to create population-level energy consumption estimates. Applying the Delphi counterfactual estimates to the EUI data yielded population-level counterfactual energy use. The difference between actual and counterfactual consumption represents the program net savings.

The team used 2019 NRNC savings data published on the Mass Save data portal to generate gross savings values for each program. These savings values and the net savings estimates above were used to calculate free-ridership, spillover, and retrospective NTGRs for the previous NRNC program design and the MFHR program.

The team used feedback from the Delphi panel to create prospective NTG adjustment factors to reflect the impact of the NRNC program redesign and the new PH offering. The team applied the adjustment factors to the retrospective NTGRs and generated prospective NTGRs for the NRNC program, the MFHR program, and the PH offering. Because of the uncertainty introduced through conducting the evaluation shortly after the new program designs launched, the team provided these NTGRs to a consensus group, who worked through the data and findings over the course of four meetings and vote on the final 2022 NTGRs.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 33.

Study 34: Commercial and Industrial O&M and Non-O&M NEI Study

Type of Study: Impact Evaluation

Evaluation Conducted by: DNV

NMR

Three Cubed

Date Evaluation Completed: 9/24/2021

Study Objective and Summary of Results:

The purpose of this study was to identify and quantify Non-Energy Impacts (NEI) attributable to the Massachusetts energy-efficiency Program Administrators' (PAs') commercial and industrial (C&I) program measures. The primary objective was to develop Operations and Maintenance (O&M) NEI values broadly across all C&I measures and programs, and non-O&M NEI values (excluding health and safety (H&S) NEIs) with a focus on energy-efficiency measures common to small businesses programs (though application of these NEIs would not be limited to small business programs). An additional objective was to collect qualitative data to inform future research to monetize H&S NEIs.

The study provides the following key findings and results:

- O&M NEIs by measure category, fuel type, and event type
- Non-O&M NEIs by measure category and fuel type
- Natural gas non-O&M NEIs by measure category
- Preliminary findings related to H&S NEIs

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

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

Evaluation Recommendations:

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

Recommendation 1: Maintain separate O&M, Non-O&M, and H&S values, with a calculated overall value as the sum of these.

Recommendation 2: Use the O&M NEI values appearing in the Selected NEI Value column of Table 1 of the report.

Recommendation 3: Use the non-O&M NEI values appearing in the Final Adjusted Non-O&M columns in Table 2 and Table 3 of the report.

Recommendation 4: Use the measure-level O&M and non-O&M values as laid out in the BCR matching workbook (provided to the PAs as a separate deliverable).

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

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

How the Study Affects Program Results and Its Significance:

Results from this study will inform measure BCR testing and could also be used by program staff to help end-use customers understand the full impact of participation.

Overview of Study Method:

To calculate O&M NEIs, the evaluation team reviewed manufacturer O&M manuals and published data to identify any new NEIs or cost information and collected primary data from in-depth interviews (IDIs) with Massachusetts vendors of energy-efficient equipment. The team used cost parameters available from third-party costing tools to develop baseline cost parameters, vetted these with the equipment vendors, and calculated life-cycle O&M costs for the efficient and baseline cases using the results. The team completed 53 interviews with equipment vendors.

To calculate non-O&M NEIs, the evaluation team conducted IDIs, mostly with small business customer end-users, to capture information on the incidence of non-O&M NEIs, the direction of the impacts, and metrics to quantify the impacts. For each measure the customer was asked about, the interviewer inquired whether their organization had experienced positive or negative NEIs related to the higher efficiency of the new equipment. For those that had, the interviewer attempted to collect quantitative information to support monetizing the NEI value. The evaluation team completed 54 interviews plus 16 partial interviews.

Monetizing H&S was beyond the scope of this study, but the team did ask equipment vendors to rank the impact of installing energy-efficient measures on H&S NEIs. It also asked small business end users whether they collect data (e.g., OSHA violations, employee absences, etc.) that would be useful for monetizing H&S NEIs.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix J, Study 34.

Study 35: RNC NEI Quick Hit Assessment

Type of Study: Impact Evaluation

Evaluation Conducted by: NMR Group

Three Cubed

Date Evaluation Completed: 10/1/2021

Study Objective and Summary of Results:

The primary purpose of this study was to use secondary data to identify and propose updates to the monetized NEI values associated with the PAs' Residential New Homes and Renovations initiative. A secondary objective was to identify other potential NEIs that the PAs do not currently claim, and either use academic research and secondary data to monetize them where possible, or develop approaches for conducting primary research to monetize them.

The study provides the following key findings:

- In a literature review comprising 41 NEI studies, the evaluation team found very few studies that monetized NEIs from general high-efficiency residential new construction. As a short-term solution, the team adjusted for inflation the NEIs that the RNC program currently claims. The adjustment increased the thermal comfort and noise reduction NEIs from a total value of $117 to $139 per home per year.
- Two studies from the literature review met the team's criteria for developing monetization algorithms. Based on these, the team monetized additional NEIs totaling $3.30. The additional monetized NEIs accounted for impacts associated with removing gas stoves on asthma ($3.28 per home per year) and for the impact of reduced formaldehyde due to mechanical ventilation with heat or energy recovery (ERV or HRV) on asthma-related emergency room visits ($0.02 per home per year). The additional monetized NEI values can be recalculated on an annual basis if there is a change in the program saturation compared to baseline saturations of homes with gas stoves and homes with ERVs or HRVs.
- In the literature reviewed, the evaluation team found potential NEIs for future research, such as reduced sick building syndrome, lower operations and maintenance costs, and increased productivity. The team used the potential NEIs found in the literature to inform considerations for future research priorities.

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

- Residential
- New Homes & Renovations
- Envelope
- HVAC
- Electric & Gas

Evaluation Recommendations:

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

Recommendation 1: Apply to the RNC program the NEI values presented in the table below. The recommended NEI values include the update to the NEIs the program currently claims (thermal comfort and noise) and the new NEIs that were monetized as part of this study.

Table 8: Summary of Recommended NEI values for RNC Program

Measure	Non-Energy Impact	Recommended Value
Thermal comfort	Inflation-based update of 2011 value	$91.50 per household per year
Noise	Inflation-based update of 2011 value	$47.53 per household per year
Electric Stoves (elimination of exposure to gas stoves combustion by-products)	Childhood asthma prevention, occupant lifetime	$0.65 per household per year
	Adult asthma symptom reduction	$2.21per household per year
	Childhood asthma symptom reduction	$0.42 per household per year
ERV/HRV[1] (formaldehyde)	Reduced asthma ED visits	$0.02 per household per year
Total Recommended NEIs		**$142.30 per household per year**

[1] Energy Recovery Ventilator/Heat Recovery Ventilator.

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

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

How the Study Affects Program Results and Its Significance:

The research on which the current NEI valuation used by the RNC program is ten or more years old. One study occurred in 2009, when the program leveraged ENERGY STAR home requirements, and the RNC program NEI values were finalized in a 2011 NEI evaluation. Since 2009, the RNC has changed in a variety of ways, including by incentivizing Passive House design and construction practices in multifamily buildings. Also since this time, building and energy codes have increased in stringency and baseline construction practices have improved. This study updates the NEI values for the RNC program to better reflect the non-energy impacts of the program on the current RNC market and program participants.

Overview of Study Method:

This study included reviewing the RNC NEI literature produced since 2009, conducting a scan of NEIs claimed by jurisdictions other than Massachusetts, updating NEIs for inflation, monetizing new asthma-related NEIs using information from the literature review and other secondary data, and identifying future RNC NEI research needs.

The evaluation team conducted a broad review of RNC NEI literature, comprising 41 studies. The purpose of the review was to identify potential secondary data sources with which to update NEI

values, monetize additional NEIs, and identify potential new NEIs related to residential new construction.

The team also scanned ten jurisdictions outside Massachusetts, reviewing 14 public planning documents, Technical Reference Manuals (TRMs), cost-effectiveness testing documents, and other public documents to obtain details on how the jurisdictions claim NEIs attributed to RNC programs.

The evaluation team was unable to find sufficient relevant data from the literature review with which to update the values of the thermal comfort and noise reduction NEIs that the PAs currently claim for the RNC program. As a result, the team updated these NEIs for inflation instead. The team relied primarily on the academic research from the literature review to identify new NEIs that the PAs could potentially claim as outcomes from the RNC program. Several of the NEIs the team identified could be monetized without collecting primary data. The selection criteria for NEIs that could be monetized without collecting primary data was the level of evidence in the literature, the availability of additional information with which to monetize the impacts, and the ability to link the impacts to the RNC program. The evaluation team focused on monetizing additional NEIs that met the following conditions:

1. Studies presented data that provided evidence of an NEI attributable to components, equipment, and design commonly found in energy-efficient new construction (such as exposure to gas stoves, inclusion of ERV / HRV systems).
2. The measured data had strong evidence of association with a monetizable health outcome.

The evaluation team used findings from the literature review to identify NEIs that could potentially result from the RNC program activities and be monetized. Focusing on NEIs for which there is a greater amount of evidence in the secondary literature, the team scoped the data collection needs and valuation methodology for each proposed NEI.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 35.

Study 36: 2018-2019 Residential Customer Profile Study Results Brief

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted By: DNV

Date Evaluation Completed: 8/20/2021

Study Objective and Summary of Results:

The overall goals of the Residential Customer Profile Study Results Brief are to provide a high-level summary of the MA energy landscape and customer population from the 2018-2019 Residential Customer Profile Study (RCPS) report. It conveys critical data elements identified by the PAs and EEAC Consultants in a graphical format to serve a wide (including non-technical) audience.

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

- Residential
- All Program Paths
- All End Uses
- Electric & Gas

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

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

How the Study Affects Program Results and Its Significance:

This graphical brief provides a high-level overview of key performance metrics for the PAs' energy efficiency programs and a broad view of the PA customer population that can be used by stakeholders looking for quick and accessible information.

Overview of Study Method:

DNV cleans and standardizes the PAs' customer energy usage and energy efficiency program participation data. Prepared data is loaded with historical data to the MA data warehouse. Using geoprocessing and analytics tools, we then combine it with third-party data sources including data from the MA tax assessors office and the US census.

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix J, Study 36.

Study 37: 2013-2019 Residential Customer Profile Study

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted By: DNV

Date Evaluation Completed: 10/12/2021

Study Objective and Summary of Results:

The overall goals of the 2013-2019 Residential Customer Profile Study are to characterize the Massachusetts residential energy efficiency market by analyzing the usage, savings, and program participation data of all residential gas and electric customers served by the Massachusetts Program Administrators (PAs). The primary objective of the study is to identify historical trends in participation metrics, their potential drivers, and their future implications for PA customer populations. Other objectives are to integrate this study with the Residential Customer Profile Study Dashboard and identify possible areas of further research to inform the future direction of the PAs' programs.

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

- Residential
- All Program Paths
- All End Uses
- Electric & Gas

Evaluation Recommendations:

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

- **Recommendation 1**: Most lighting will become ineligible for program funding in the next few years. When this occurs, the PAs will find it increasingly difficult to achieve overall program savings goals and pass cost-effectiveness tests. The PAs should plan for another measure or program approach to replace the savings from lighting. Lighting accounts for most electric savings, and it has one of the highest benefits-cost ratios of all electric measures.
- **Recommendation 2:** The PAs should continue focusing on renters for targeted program marketing. For both gas and electric programs, the PAs should specifically increase targeting 5-9 unit buildings. These buildings had the lowest participation rates and savings rates across the different categories considered.
- **Recommendation 3**: The PAs should investigate ways to increase depth of savings for moderate-income customers and customers with limited English proficiency. Areas with high concentrations of these characteristics had a lower depth of savings.

- **Recommendation 4**: The PAs should continue using the readily available block group-level demographic results for program targeting and other implementation purposes. With the ability to produce individual-level variables for building size, ownership, and building age based only on PA and tax assessor data, evaluators should continue to consider both the block group and individual-level analyses for investigation, recommendations, and confirmation of block group-level analyses.

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

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

How the Study Affects Program Results and Its Significance:

The RCPS identifies historical trends in participation metrics, their potential drivers, and their future implications for PA customer populations. Other objectives are to integrate this study with the Residential Customer Profile Study Dashboard and identify possible areas of further research to inform the future direction of the PAs' programs.

Overview of Study Method:

The RCPS uses the PAs' 2013-2019 billing and tracking data after it has been through the extract, transform, and load (ETL) process under the 2019 Residential Data Intake project and signed off by the PAs via a Summary of Data Completeness (SDC) documents. Data is prepared for analysis by linking the 2019 tracking and billing data to the historical data. DNV supplements the PA billing and participant tracking data with several third-party datasets including the US Census American Community Survey data, The Emergency 911geographic data, and MA Level 3 tax assessment data**.** This data is then used in the following sets of analysis:

- Detailed summaries of participation, savings, and energy consumption for the PA customer population
- Analysis of savings and spending across multiple end-use categories
- Geographic market analysis of consumption weighted spending
- Identification of renters and multifamily location using algorithms developed under the study
- Individual and block group level modeling to identify key demographic traits associated with participation or non-participation

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix J, Study 37.

Study 38: 2019 Commercial and Industrial Customer Profile Study Results Brief

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted by: DNV

Date Evaluation Completed: 10/12/2021

Study Objective and Summary of Results:

The overall goals of the 2019 Commercial & Industrial Customer Profile Study (CCPS) are to analyze, summarize, and report on the energy efficiency program tracking data and billed usage data for all C&I gas and electric customers served by the PAs. Since 2012, DNV has worked with the PAs and Energy Efficiency Advisory Council (EEAC) Consultants to produce the annual CCPS report. The report characterizes the Massachusetts C&I energy efficiency market by analyzing customer usage, savings, and program participation data using charts, tables, and geographic outputs. The project identifies historical trends, their potential drivers, and their future implications for PA customer populations. The project also identifies possible areas of further research to inform the future direction of the PAs' programs.

In place of a full CCPS analysis of the 2019 data, DNV developed a 2019 CCPS Results Brief that improves on the former CCPS stakeholder summaries by tailoring it to a broader and less technical audience, reducing its text, and automating its analytics, which allows for more efficient updates of future reports as new data gets loaded to the data warehouse. The results brief provides readers with summary statistics on 2019 program performance and guides them to the dashboard for additional analytics of 2019 data.

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

- Commercial & Industrial
- All Program Paths
- All End Uses
- Electric & Gas

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

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

How the Study Affects Program Results and Its Significance:

The analysis and reporting of the statewide data allow the PAs and the Energy Efficiency Advisory Council (EEAC) Consultants to accurately quantify and report on trends and time series evolution in the Massachusetts C&I landscape. The CCPS report allows the PAs to evaluate how their

standardized data compares to other PAs' standardized data, and compares to the state, while always maintaining PAs' customer and IT system confidentiality.

Overview of Study Method:

The 2019 CCPS Results Brief uses PAs' 2019 billing and tracking that has been verified and signed off by each PA via the Summary of Data Completeness (SDC) process. This data underwent a standard extract, transform, and load (ETL) process as a part of the 2019 data intake effort. The results brief also uses the most recent 6 years of historical billing and tracking data along with third-party tax assessor data. Data back to 2011 is available to users via the dashboard.

Data is prepared for analysis by linking the 2019 tracking and billing data to the historical data, weather-normalizing extrapolated consumption for 2019 accounts that did not provide a full year's worth of consumption, adjusting consumption for 2019 new construction projects, and performing data retention for the consumption bin analysis.

This study characterized the state's energy efficiency customers according to metrics such as customer usage, savings, and program participation across all PAs. The following statistics for various analysis lenses were included in the results brief:

- Account participation rate
- Location participation rate
- Population savings achieved
- Participant savings achieved
- 6-year penetration rate
- Savings achieved over time

Findings are presented at different analysis grains including the account level and location level. DNV provided summary statistics for the broad groupings of:

1. Statewide by fuel
2. PA and fuel
3. Energy consumption range
4. Geographic region
5. Industry segment
6. End use

Application of Results: Retrospectively and Prospectively

A copy of the complete study can be found in Appendix J, Study 38.

Study 39: 2021 Cost-Effectiveness of Active Demand Response for Residential End-Uses Study

Type of Study: Market Characterization or Assessment Evaluation

Evaluation Conducted By: Guidehouse

Date Evaluation Completed: 7/19/2021

Study Objective and Summary of Results:

To inform the direction of the Massachusetts Program Administrators' residential electric active demand reduction (ADR) programs, Guidehouse estimated relative potential and cost-effectiveness of ADR for DR-enabled appliances. For each combination of appliance, enabling device, and DR strategy listed in Table 1, this study provides estimates of:

1) Potential savings per unit during the summer peak period;
2) Current and forecasted market saturation data;
3) Approximate incremental costs for summer DR;
4) Measure-level benefit-cost ratios.

This report considers a range of residential appliances and multiple enablement strategies for each appliance type. The previous Cost-Effectiveness of DR for Residential End-Uses Study, conducted during 2018 and finalized in 2019, was conducted for National Grid alone and covered a broader range of residential end-uses.[6] For this 2021 update, with input from the MA PAs and Massachusetts Energy Efficiency Advisory Council (EEAC), Guidehouse included a subset of measures included in the 2019 report.

This study also provides updated literature review findings related to proven and potential DR enablement technologies, and the program designs of relevant utility programs, along with challenges encountered (as available).

The study provides the following key findings:

For each appliance, enabling technology, and DR strategy combination, Table 1 contains potential unit impact estimates, potential DR program size in 2022 and 2024 (the start year and end year of this study's benefit-cost analysis), and BCRs reflecting the total resource cost (TRC) test over the 2022 to 2024 period (meaning, BCRs reflect the benefits and costs incurred during the 3-year period associated with those who are enrolled during that period). Benefits from each DR program option analyzed represent the avoided costs associated with avoided generation capacity, avoided transmission and distribution capacity, and reliability benefits. Costs included in the benefit-cost analysis are measure-level costs—in other words, costs that depend on the number of enrolled devices. From the analysis, Guidehouse excludes DR portfolio/program-wide costs from the benefit-cost analysis—or costs that would be shared with other DR initiatives, such as program setup costs, annual DR management system (DRMS) license fees, administration costs, and

[6] Navigant Consulting, Inc. "Cost-Effectiveness of Electric Demand Response for Residential End-Uses." April 19, 2019 (https://ma-eeac.org/wp-content/uploads/Cost-Effectiveness-of-DR-for-Residential-End-Uses-Final-Report-2019-04-18.pdf)

marketing costs. This means the BCRs at the measure-level in this report are overestimates for how they may contribute to a complete program BCR.

As shown in the table, room air conditioners, dehumidifiers and water heaters were not determined to be cost effective for any enabling technology and DR strategy combination considered in this study. The BCR values for these appliances range from a low of 0.2 associated with smart plug/switch options for room ACs, electric resistance water heaters, and heat pump water heaters to 0.8 for smart electric resistance water heaters (with built-in Wi-Fi).

Pool pumps were found to have the greatest per-unit impact of the appliances considered in this study (0.65 kW). As a result, DR will likely be cost-effective for programs featuring smart pool pumps (i.e., pool pumps with Wi-Fi built-in) and simple mechanical switches. The BCR for the Wi-Fi switch option was estimated to be just under 1 (0.9). One advantage of DR for pool pumps is that it is assumed to be less of an inconvenience to participants – in contrast to some other end-uses – and, therefore, the rate of opt-out is assumed to be low. However, the low penetration of smart/built-in pool pumps in MA (the option with the highest BCR) shows that the MW benefit in 2024 remains modest at 8 MW. This lower benefit may not be able to support the upfront cost IS/IT, administration, and marketing cost to set up a pool pump program targeting smart pool pumps alone. These upfront costs are not included in the BCR estimates.

Table 9. Potential Unit Impacts[7], Program Size, and Benefit-Costs (TRC, 2022-2024)

Appliance	Enabling Device	DR Strategy	Estimated Unit Impacts[8] (kW)	Potential Units Enrolled in MA Statewide (2022)	Potential Units Enrolled in MA Statewide (2024)	BCR w/ Customer Incentives Included (TRC, 2022-2024)[9]
Room Air Conditioner	Smart appliance	Temperature setback	0.13	17,880	78,300	0.7
	Simple plug	DLC	0.09	150,286	594,984	0.5
	Smart plug	Temperature setback	0.09	150,286	594,984	0.2
Dehumidifier	Smart appliance	DLC	0.15	10,362	45,378	0.7
	Simple plug	DLC	0.08	69,323	229,880	0.6
	Smart plug	DLC	0.10	69,323	229,880	0.3
Heat Pump Water Heater	Smart appliance	DLC	0.10	406	1,780	0.5
	Simple switch	DLC	0.10	2,719	9,015	0.2
	Smart switch	DLC	0.10	2,719	9,015	0.1
Electric Resistance Water Heater	Smart appliance	DLC	0.16	3,454	15,126	0.8
	Simple switch	DLC	0.16	23,108	76,627	0.3
	Smart switch	DLC	0.16	23,108	76,627	0.2
Pool Pump	Smart appliance	DLC	0.65	2,709	11,864	3.2
	Simple switch	DLC	0.65	21,748	72,119	1.4
	Smart switch	DLC	0.65	21,748	72,119	0.9

The BCR estimates are at the measure-level only as they do not include administration and marketing costs, among other program-level costs. This means the BCRs at the measure-level in this report are overestimates for how they may contribute to a complete program BCR.
Source: Guidehouse analysis based on multiple data sources, reference footnotes.

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

- Residential
- Residential Behavior
- Room Air Conditioners, Dehumidifiers, Water Heating, Pool Pumps
- Electric Only
- Wi-Fi-Based Direct Load Control

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

[7] Net of derating factors associated with event participation, Wi-Fi connectivity, DR enablement strategy, and first-year in-service rate.
[8] Potential impacts used for calculating BCRs are based on end-use metering for the hottest 2017-2019 summer days; i.e., all non-holiday weekdays in the summers of 2017 - 2019 for which Boston, Massachusetts had a maximum temperature of equal to or greater than 90°F.
[9] Some costs were not included in the BCR calculation such as program administration, setup costs, and software costs. Inclusion of these costs would reduce BCRs.

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

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

How the Study Affects Program Results and Its Significance:

This study identified that Room Air Conditioners, Dehumidifiers, and Electric Water Heaters are not a stand-alone cost-effective demand response opportunity at this time. The study also identified that pool pumps could potentially be a viable opportunity using the current avoided cost. This study did not account for other expenses such as overhead cost for running the Demand Response offering.

Overview of Study Method:

The key elements of the study method include the following:

DR Context: Guidehouse conducted a literature review to provide an overview of DR enablement technologies on the market and the vendors providing them, as well as the DR programs across the country, and in other countries, that have tested the technologies.

Potential Impact Per Device: Guidehouse constructed average daily load shapes for each appliance type using end-use metering data from the MA Residential Baseline Study for the 2017-2019 summer periods. For each appliance type, Guidehouse reports the average load coincident with peak hours of 2 p.m. to 5 p.m. for all non-holiday weekdays in the summers of 2017 - 2019 for which Boston, Massachusetts had a maximum temperature of equal to or greater than 90°F.

Total Achievable Impact: Guidehouse used the MA Residential Baseline Study Saturation Survey for 2019, as well as the above-mentioned literature review, to develop estimates current statewide saturation of the end-uses considered in this study as well as forecasted enrollment in DR programs for these end-uses.

Benefit-Cost Analysis: Combining research on achievable unit impacts and program costs, Guidehouse performed a measure-level benefit-cost analysis, using the MA Total Resource Cost (TRC) Test, for each appliance and DR-enabling device combination. For these analyses, Guidehouse calculated the net-present value of annual benefits and costs for the period from 2022 to 2024.

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 39.

Study 40: 2019-2021 Electric Vehicle Supply Equipment Direct Load Control Demonstration Evaluation

Type of Study: Pilot Evaluation and Demonstration Projects

Evaluation Conducted by: Guidehouse

Date Evaluation Completed: 9/21/2021

Study Objective and Summary of Results:

The primary objectives of this evaluation were to verify that the Electric Vehicle Supply Equipment (EVSE) Direct Load Control (DLC) demonstration successfully enables demand reductions (and, if so, by how much) and to assess customer acceptance of the solution. Additionally, the evaluation sought to understand how customers use and interact with their EVSEs on event and non-event days across the year.

Select key evaluation findings are included below:

Customer Experience Research –

- 88 of 150 respondents (59%) who had purchased a new charger around the time of enrolling in the program became aware of the program before purchasing the new charger. Of these respondents, 84% reported being at least partially influenced by the program to buy the new charger.
- Those who used their EV on a regular schedule (e.g., work commuting) during summer months declined from approximately 80% to 40% between the 2019 post-summer and 2020 post-summer surveys.
- One-quarter of respondents to the 2021 post-winter survey indicated that the program influenced their charging schedule, with some choosing to charge during off-peak hours on a regular basis to align with program goals.
- Nearly all of respondents who recalled at least one event said the events had no impact on their charging or driving behavior. Satisfaction with the program is very high, with 96% of respondents reporting that they are likely to continue participating in the future.

Assessment of Charging Profiles –

- Peak charging occurred between 5 p.m. and 9 p.m. on weekdays and the maximum peak charging observed was 19% (in 2019). An average of 16%-19% of EVSEs were simultaneously charging during this period from August 2019–February 2020. The percentage of EVSEs charging during these hours dropped to 8%-9% from March 2020–September 2020 and increased to 11%-13% from October 2020–March 2021. The decreased number of EVs charging on average during evening hours led to fewer potential participants in the two impact analysis periods that occurred during the pandemic.

- 60% of all charging sessions were complete within 2 hours and 89% were complete within 4 hours. Longer event windows will likely have a negligible impact on the ability for vehicles to finish charging overnight.
- 29% of customers used scheduled charging in some capacity from August 2019–March 2021, with most scheduled charging sessions starting at 11 p.m.

Assessment of Event Participation -

- In all periods and for all events, most devices were unplugged during the event and did not participate. In all periods, less than 30% of devices on average were fully or partially participating.
- Events did not prevent participants from reaching a full state of charge. On non-event weekdays, devices fully charged in slightly over 85% of sessions, compared to 85% of sessions on event days.

Impact Analysis –

- Variety in event timing and participation makes it difficult to isolate factors contributing to differences in impacts between impact analysis periods. In addition, there were changes in max observed power draw of participants, non-event day charging behavior, and participation rates during events.
- Period-average demand impacts for all devices ranged from 0.11 kW to 0.26 kW across the three analysis periods.[10] Period-average demand impacts for *participating devices* ranged from 0.92 kW to 1.38 kW.
- Average impacts among participating devices were highest in the most recent impact analysis period (October 2020–March 2021). This was in part due to higher maximum observed power draw in the population. The earliest impact analysis period had no participating EVSEs with maximum observed power draw greater than 8 kW, whereas the most recent had five devices.
- Impacts for simulated events decrease after February 2020 because of changes in charging behavior, assumed to be due primarily to the COVID-19 pandemic. Months with data before and during the pandemic had an average 32% decrease of theoretical impacts year-over-year for events simulated from 5 p.m.–7 p.m.

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

- Residential
- Active Demand Reductions

[10] Impacts calculated with the engineering method are highlighted in the key findings section because they are unaffected by non-event day charging, which changed across impact analysis periods due to the COVID-19 pandemic.

- Electric Only

Evaluation Recommendations:

No formal recommendations were made in this evaluation.

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

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

How the Study Affects Program Results and Its Significance:
The key findings provided in this demonstration evaluation will be used to inform the design and implementation of EV-focused Demand Response programs that Eversource may deploy in the future.

Overview of Study Method:

The evaluation methodology included participant surveys, EVSE data QA/QC and dashboarding, an assessment of charging profiles, an assessment of event participation, the analysis of impacts, an assessment of simulated events, and a literature review. Refer to the final report for a more detailed description of evaluation methods.

Table 2 displays the data periods included in the assessment of charging behavior and impact analyses. The assessment of charging profiles on non-event days includes breakouts into three time periods to distinguish changes in behavior that were likely caused by the COVID-19 pandemic. Each of these time periods includes one of the three impact analysis periods.

Table 10. Data Periods Included in Analysis

Analysis	2019					2020											2021		
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Charging Profiles Analysis	Aug 2019 – Feb 2020							Mar 2020 – Sep 2020							Oct 2020 – Mar 2021					
Event Behavior & Impact Analysis	1										2				3					

Source: Guidehouse

Application of Results: Prospectively

A copy of the complete study can be found in Appendix J, Study 40.

APPENDIX J: EVALUATION STUDIES

Please see the separate file for Appendix J.

APPENDIX K: 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 innovate 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 activity[1]. 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.

APPENDIX L: COUNCIL'S RESOLUTION OF JULY 28, 2021

FINAL

Massachusetts Energy Efficiency Advisory Council Resolution Regarding the April 30th Draft of the 2022-2024 Energy Efficiency Plan

Adopted July 28, 2021

1. Introduction

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, 2021.[1] Having reviewed the Draft Plan, the Council provides the following comments to the PAs. The Council commends the PAs on their past energy efficiency achievements and specifically acknowledges the PAs' efforts to maintain Mass Save® Program activity during the COVID-19 pandemic, while implementing health and safety protocols for the protection of customers and contractors. The Council looks forward to building on the historic success of the Mass Save programs in the next plan. The Council is committed to supporting a transformational plan that meets the challenge of the greenhouse gas (GHG) emission reductions needed in the Commonwealth to combat the effects of climate change, and addresses historical inequitable program participation through significant changes in approach to planning, program design, and implementation.

In its March 24, 2021 Resolution (March Resolution), the Council put forth its priorities and recommendations for the 2022-2024 plan which were developed through an extensive stakeholder engagement process including nine public comment sessions, six Council workshops, and establishment of an Equity Working Group, convened to specifically address issues of equity in the delivery of energy efficiency programs. The March Resolution set an expectation of an innovative and forward-looking plan, with a focus on alignment with GHG emission reduction and electrification goals, equitable program delivery and participation, and workforce development investment. On March 26, 2021, Governor Baker signed legislation that codified the administration's commitment to achieve net zero emissions in 2050 and furthered the Commonwealth's nation-leading efforts to combat climate change and protect vulnerable communities. Chapter 8 of the Acts of 2021 - *An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy* (the Climate Act) establishes new mandates for economy-wide emissions reductions by 2030 and 2040, and significantly increases protections for Environmental Justice communities across Massachusetts. The Climate Act also directs the Secretary of Energy and Environmental Affairs (EEA) to set a GHG emissions-reduction goal for the Three-Year Energy Efficiency Plans, requires the social value of greenhouse gas emissions to be included in the cost-effectiveness calculations for all measures excluding fossil fuel heating and hot water systems, allows a mechanism to prioritize projects that reduce greenhouse gas emissions, expands the mandate of the Department of Public Utilities (Department) to prioritize equity and greenhouse gas emission reductions in its decisions, and directs the Program Administrators to transfer $12 million annually to MassCEC for a clean energy equity workforce and market development program.

The Council's priorities for the 2022-2024 Energy Efficiency Plan are underscored by the provisions of the Climate Act. The Council is pleased that the PAs have adopted these priorities as pillars of the April Draft Plan. While the Draft Plan generally adopts these priorities, there is insufficient detail on program design to assess whether the programs will achieve these priorities. Further, the Council does not see all of these priorities reflected in the proposed budgets, savings goals, and measure-mix in the benefit-cost models. In general, savings goals are below the potential identified by the PA's potential studies, and

[1] G.L. c. 25, §21(c).

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significant incentives remain focused on fossil fuel equipment. Detailed budgets and metrics supporting equity priorities were not included, except for moderate income.

The Council looks forward to continuing collaboration and exchange of information among the PAs, the EEAC, its Consultants, and interested stakeholders throughout the summer and fall. The Council respectfully requests the PAs to continue to 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 requests a Revised Plan with benefit-cost models no later than September 1st, leading to the Final Plan to be filed with the Department in October. In the spirit of collaboration, the Council provides the following comments on the Draft Plan in its role in shaping a Final Plan that merits the support of the EEAC.

Benefits, energy savings, greenhouse gas emissions reductions, equity targets, budgets

The Council expects the savings goals, benefits and budgets in the Final Plan to adequately reflect the opportunity that exists as Massachusetts pivots to the future of energy efficiency programs through electrification, existing building retrofits and decarbonization, weatherization, workforce development and enhancing support for historically underserved communities and customers. The Council appreciates that the Draft Plan adopts the strategic priorities recommended by the Council in its March Resolution for the next term. In order to fully reflect the Council priorities and meet the requirements of the Green Communities Act and the Climate Act, the Final Plan must include updated benefits, savings goals, and budgets. The updates should be designed to achieve aggressive goals for equitable program outcomes and deliver cost-effective energy savings that align with the Commonwealth's GHG goals and comply with the GHG reduction goal set by Energy and Environmental Affairs (EEA) Secretary Theoharides on July 15th, 2021[2].

The Council expects the Final Plan to reflect the following:

- GHG reduction goals that comply with that set by EEA Secretary Theoharides including details on how the Plan will achieve the statewide goals and sector-specific breakdown set forth in the Secretary's letter and the table below. The EEAC expects the Final Plan to include specific commitments for greenhouse gas reductions attributable to low and moderate income.

	Electric Program 2030 Cumulative Annual Emissions Reduction (metric tons of CO2e)	**Gas Program 2030 Cumulative Annual Emissions Reduction (metric tons of CO2e)**
Residential (excluding Moderate Income)	296,000	142,000
Income Eligible & Moderate Income	55,000	49,000
Commercial & Industrial	153,000	150,000

- Specific, measurable targets to increase investments in and benefits delivered to historically underserved customer groups, including moderate income, renters, English-isolated customers, small businesses, and Environmental Justice communities.

[2] https://www.mass.gov/doc/greenhouse-gas-emissions-reduction-goal-for-mass-save/download

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- A minimum of 120,000 cold-climate heat pumps installed in the 2022-2024 Plan, including retrofit and new construction. This should include at least 50,000 fuel switching heat pumps and 7,000 heat pumps for low income customers, and increasing targets year over year for whole-building conversions.
- Specific details and commitments of the PAs' to invest and transform the market for heat pump technologies.
- Reductions in fossil-fuel heating and hot water budgets included in the April Draft, including an estimated $15 million shift of income-eligible fossil-fuel equipment budget to electrification, to support heat pump equipment where such equipment is technically feasible, will not cause a material increase to a customer's energy burden, and electrification for end-of-life gas equipment.
- A minimum of 4,100,000 MMBtu of delivered fuel displacement from C&I heat pumps, with at least 1,400 small C&I customer participants.
- Budget increases to support greater electrification efforts for space heating and hot water, including an additional $150 million for the Residential sector and $50 million for Income Eligible.
- 240 MW (150 MW from the C&I sector, 80 MW from Residential, and 10 MW from Income Eligible) of energy storage capacity enrolled in active demand management offerings and specific goals in the Final Plan for income-eligible storage by 2024.
- Increase investments in Commercial & Industrial electric and gas programs at or above the 2019-2021 plan levels, with a correlated increase in benefits. Re-allocate no less than 50% of the proposed C&I lighting spending (~$133M of incentives) to longer-lived and more GHG impactful measures such as HVAC, envelope and fuel switching as identified in the PAs market potential studies.

Stakeholder Support

Throughout the 2022-2024 Plan process to date, the Council has prioritized stakeholder feedback and suggestions through nine public comment sessions and on-going opportunity to submit written comments.[3] Public comments were carefully considered when developing the Council priorities for the 2022-2024 Plan. Additional stakeholder feedback regarding the Draft Plan has been incorporated into the Council's feedback in each topic area below. The public is calling for a transformative plan that addresses the need for substantial GHG emission reductions, while also targeting program offerings to better serve historically underserved populations.

The Council urges the PAs to incorporate stakeholder feedback into the Final Plan and particularly the public comment regarding the Council's priorities: Alignment with Massachusetts GHG reduction goals, Workforce Development and Equitable Program Delivery.[4]

2. Council Response to Priorities

In its March Resolution, the Council set specific priorities for the 2022-2024 Plan that support continued robust energy efficiency, while ensuring that goals are met equitably and cost effectively.[5] The Council urged the PAs to develop a plan that includes aggressive GHG emission reductions to support the

[3] To date, the Council has received over 300 written public comments.
[4] https://ma-eeac.org/public-comment/
[5] https://ma-eeac.org/wp-content/uploads/FINAL-EEAC-Priorities-Resolution_Adopted-3.24.2021.pdf

Commonwealth's goals through a strong focus on weatherization and electrification, with significant expansion of heat pump targets and an investment in market transformation and workforce development. The Council also indicated that the Final Plan should include a strong commitment and investment in equitable program delivery by increasing participation from renters/landlords, moderate income customers, language-isolated customers, Environmental Justice communities, and small businesses. To support the Final Plan, the Council requests that both the narrative and data support the three foundational principles of GHG emission-reductions, equitable program-delivery, and workforce development. The Council provides the following expectations on how these priorities must be addressed in the Final Plan:

Greenhouse Gas Emissions Reductions

Meeting the Climate Act's 2050 Net Zero limit and 2030 limit of at least 50% reduction from 1990 will require a significant increase in the scope and scale of building retrofits, through a focus on envelope improvements and efficient electrification. The Council expects that the 2022-2024 Plan will include a phase out of lighting and fossil fuel incentives as set forth in the March Resolution and below, and increased investments in insulation, electrification of existing buildings, all-electric new construction, and deeper custom building retrofits. As mandated by the Climate Act, the Council expects the Final Plan to maintain the current social value of GHG emissions reductions for all measures, and remove the social cost from calculations of cost effectiveness for conversions from fossil fuel heating and cooling to fossil fuel heating and cooling.

Equity

The 2022-2024 Plan must address equity in a deliberate and inclusive manner which addresses the historical under-participation of underserved customer groups. The PAs have proposed some solutions, and the Council urges the PAs to develop new innovative approaches that better serve customers, including substantial support for complementary efforts such as workforce development and partnerships. The Council expects the PAs to address equity in all areas of program design, implementation and evaluation. To ensure success, the Council expects that the Final Plan will incorporate details for targets and metrics that will be used to measure progress towards equity goals. This includes commitments to detailed tracking and frequent reporting of data related to equity goals.

The Council also expects that renters/landlords, moderate-income customers, and English-isolated customers, are included equitably in GHG reduction efforts in the 2022-2024 Plan. The Equity Working Group has reviewed the Draft Plan and provides its detailed comments on the Plan in Attachment A. The Council adopts the Equity Working Group comments in full and thanks the Equity Working Group for its ongoing commitment to ensuring program equity in the Final Plan.

Workforce Development

To achieve the transformative climate and equity goals in the 2022-2024 Plan, the Commonwealth will need an expanded and skilled workforce. The Council acknowledges and appreciates the increased Workforce Development budget and commitment to the Clean Energy Pathways program in the Draft Plan. In the Final Plan, the Council expects the following:

- Increased detail on how the planned budget will be utilized, including a detailed workforce development plan and budget needed to meet the state's electrification goals.
- More information, including tracking and reporting, on efforts to improve Disadvantaged Business Enterprise (DBE) participation in PA procurements.

- Ensure that workforce efforts align with Equity Working Group and Consultant recommendations provided in the March Resolution.
- More detail on the PA's plan to collaborate with the Massachusetts Clean Energy Center on its implementation of workforce programs pursuant to the Climate Act.

3. Topic Areas

Residential Sector

The Council requests that the Final Plan addresses all of the Residential Sector recommendations listed in Appendix A to the March Resolution. The Draft Plan shows progress in addressing the Council's priorities, particularly in emphasizing electrification and weatherization, but levels of investment in electrification are still insufficient to achieve the Commonwealth's GHG goals and the details regarding implementation strategies do not give the Council confidence its priorities will be achieved.

In order for the Council to support a Final Plan, the Council requests the following:

- Significant increases in the numerical goals for both space and water-heating heat pump installations to align with the Consultants' Assessment of Potential, with a ramp-up over the three-year term. The Council expects that existing electric, oil and propane space and water heating systems will be replaced with heat pumps wherever technically feasible. Customers should be supported with long-term planning considerations including the option to switch from gas to heat pumps at the end of equipment life. At a minimum, more robust incentives should be offered and marketed for cost-effective gas to heat pump measures.
- A framework for successful achievement of the heat pump numerical goals in the form of a comprehensive market transformation plan that includes customer education and support, long term planning to convert from fossil fuel systems, encompassing all levels of the supply chain and focusing strongly on education and customer cost management.
- Phase-out of incentives for fossil fuel equipment per the Council's March Resolution.
- Increase in the numerical goals for number of residences and businesses to be weatherized, to ensure that homes are "heat-pump ready" and to support the growing opportunity and need for electrification.
- Develop a whole-home, performance-based retrofit program modeled after DOER's Home MVP pilot, that goes beyond enhanced incentives to encourage an integrated program to deliver weatherization and heat pumps for space and water heating, as well as supporting customer entry through both the Residential Coordinated Delivery (RCD) and Retail Initiatives.
- Integration of home energy scorecards into home energy assessments and effectively leverage them to inform customers about potential impacts of fuel conversions.
- A fully formed all-electric new construction offer for the 1-4 unit market segment and commitment to cease incentives for fossil fuel heating or hot water in new construction by January 1, 2022.
- Dedicated reporting of multifamily participation, savings, and budgets within the RCD Initiative to provide enhanced access to service to this important segment.
- Seamless integration of Active Demand Management (ADM). Facilitate comprehensive electrification for residential customers including co-delivery of electric vehicle charging, storage, and Solar Photo Voltaic incentives.

- Building on the success of the Passive House offering introduced in the current Plan, develop a framework to facilitate deep retrofits at multifamily buildings (including affordable housing) utilizing a flexible, predictable approach that supports leveraging of outside resources and includes non-measure-specific incentives.

Income Eligible

The Council requests that the Final Plan respond to all of the Income Eligible recommendations listed in Appendix A to the March Resolution. To ensure that these priorities are met, and to prevent income-eligible residents from being "left behind" in the transition to a clean energy future, the Final Plan must demonstrate a significantly increased investment in electrification, weatherization/envelope measures, and technologies to support active demand management. This will require an increase in the income-eligible budget overall, and/or a re-allocation of resources to ensure funding consistent with the Council recommendations below. The Final Plan must also demonstrate an increased focus on multifamily buildings, including effective service to buildings with mixed-income residents, increased flexibility to support deep energy retrofits of subsidized housing, and targeting of smaller multifamily buildings, especially naturally occurring affordable housing. In addition, to ensure continually improving equitable and effective delivery of resources and services, the Final Plan must show a strengthened commitment to transparent and modernized data collection and reporting.

In order for the Council to support a Final Plan, the Council requests the following:

- A budget increase for the Income Eligible Sector to support a more costly measure mix that includes increased electrification, weatherization, and active demand measures as well as anticipated increases in the numbers of income eligible households served.
- Significantly increase the goals for heat pump installations for both space and water heating and ensure that such goals reflect a ramp-up over the Plan term.
    - The Council expects that existing space and water heating systems will be replaced with heat pumps wherever technically feasible and where energy burdens will not be increased. Weatherization measures should be implemented to enable electrification without causing a material increase to energy burden. Note that this will require an increase in the budget allocated to heat pumps and envelope. As a result, planned fossil fuel equipment numbers will be lower in the Final Plan, with associated budget funds reallocated to heat pumps and weatherization.
    - The Council also expects the Final Plan to include resources and strategies to remove or mitigate barriers to participation and installation, and to ensure customer awareness of, and satisfaction with, heat pump technologies. Such strategies include customer, contractor, and operator education, as well as other strategies outlined in the March Resolution.
- Increase the goals for weatherization and ensure co-delivery of heat pumps with weatherization.
- Significantly increase the goals for installation of wi-fi thermostats or other technologies to support active demand participation, and ensure that such goals reflect a ramp-up over the Plan term.
- Increase the budget for multifamily buildings to support an increase in installations of heat pumps (particularly for small multi-family buildings), envelope measures (including masonry

weatherization where appropriate), and wi-fi thermostats. Note that this may include a re-allocation of the lighting budget toward these measures, and/or a re-allocation of the single family budget toward multifamily.

- A clear strategy for phasing out lighting incentives by 2024. The Council expects that the lighting budget in the Final Plan will decrease for each year of the Plan to reflect a ramp-down of lighting installations overall.
- Include a strong commitment to metrics and reporting designed to increase transparency and accountability regarding planned investment and work performed in single family vs. multifamily buildings, and across PA and CAP agency territories.
- Include a commitment to develop and implement a statewide computerized audit tool by the date specified in the recommendations set forth in the March Resolution.
- Develop and implement strategies to increase participation of income-eligible renters living in "naturally occurring" or non-institutionally-assisted housing, including implementation of a mixed-income protocol that provides a streamlined, efficient process for customers.
- Capitalize on all opportunities to support electrification and deep energy retrofits, in the affordable housing sector by including programming and budget that provides flexible, non-measure-specific incentives modeled and incentivized at the building or project level delivered through an approach that supports bringing outside funding to projects.
- Include the Cape and Vineyard Electrification Offering (CVEO) recognizing its innovative approach to serving low- and moderate-income residents with a package of clean energy technologies to reduce GHG emissions through electrification.
- Seamless integration of Active Demand Management (ADM). Facilitate comprehensive electrification for residential customers including co-delivery of electric vehicle charging, storage, and Solar Photo Voltaic incentives.

Commercial & Industrial

The Council requests that the Final Plan respond to all the Commercial and Industrial (C&I) recommendations listed in Appendix A to the March Resolution. This is imperative as the Draft Plan's goals are less than half of the electric savings identified in the PAs' market potential studies. The Council expects significant increases in budget, savings goals, and benefits for the C&I programs to meet the statutory mandate of all cost-effective energy efficiency. Having successfully transformed the commercial lighting market to high-efficiency LED technologies, C&I programs must now shift to a more holistic treatment of total building energy use and specifically target heating, cooling, ventilation, and process loads. Strategies used to deliver significant lighting savings will be less applicable to more complex and interrelated end-uses, and the programs must adapt to help customers capture these substantial but more difficult opportunities. This will require an increase in the C&I budget overall, and a re-allocation of resources as described below.

To support a Final Plan, the Council requests the following:

- Create a dedicated stakeholder working group that includes C&I program participants to identify concrete ways to improve programmatic offerings and reduce barriers to participation.
- Develop a consistent definition of "small business" in order to better serve the sector.

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- Invest in more engineering staff and/or technical assistance vendors to identify, develop, and review complex custom project scopes of work in a consistent and expedient manner.
- Launch a Deep Energy Retrofit program offering in 2022 that seeks to dramatically reduce C&I building loads and associated GHG emissions holistically.
- Increase spending and savings goals for commercial envelope measures and apply lessons learned from ongoing small commercial weatherization pilots.
- Reduce reliance on point-of-sale rebates for complex measures and end-uses such as HVAC systems and process, and instead prioritize custom retrofit measures that utilize existing conditions baselines.
- Significantly increase investment in commercial electrification and prioritize envelope measures that reduce overall thermal loads to begin with.
- Focus all remaining indoor lighting opportunities on controllable technologies. Starting in January 2022, cease incentives for all TLEDs through the midstream pathway. For the small business turnkey pathway, prioritize LED fixtures with controls and only install TLEDs paired with controls.
- Demonstrate strategy to convert remaining streetlights to LEDs within first 12-18 months of the Plan, incorporating wireless controls at the time of conversion.
- Develop and implement a dedicated downstream program for public buildings by start of 2023 that emphasizes HVAC and building envelope measures with enhanced incentives, using lessons from effective Cape Light Compact program.

Equity

The Council requests that the Final Plan commit to implement, through identifiable metrics, distinct budgets, and detailed descriptions of strategies, all of the Equity recommendations listed in Appendix B to the March Resolution. As noted above, the Council also adopts the EWG's comments in response to the April Draft (attachment A). The Council emphasizes the EWG's comments and expects a Final Plan to include specific equity targets, designated budget levels for identified customer types and environmental justice communities, more detailed and frequent data reporting, and specifics on programmatic enhancements and changes. The Council expects that the equity budgets, targets, and programs will be intentionally designed and calculated to redress past under-participation and enable underserved customer groups to realize savings and benefits and participate equitably in the transition to a low-carbon future.

Active Demand Management

The Council requests the Final Plan to respond to all the Active Demand Management (ADM) recommendations listed in Appendix A to the March Resolution. While the Program Administrators' Draft Plan demonstrates an expansion of core active demand offerings such as Residential Direct Load Control Wifi Thermostats and C&I Curtailment, it falls short of capturing all cost-effective potential demand savings identified in the PAs' potential studies. This is especially true for Residential Direct Load Control Wifi Thermostats where less than 5% of total Massachusetts households with central cooling are currently enrolled in the program as of 2020. The EEAC Consultant's Assessment of Potential also recommend significantly more active demand storage than proposed in the April draft plan. As noted in ACEEE's 2019 paper: *Integrated Energy Efficiency and Demand Response Programs*[6] – Massachusetts'

[6] https://www.aceee.org/sites/default/files/publications/researchreports/u1906.pdf

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Connected Solutions program is only at Tier 2, Cross-Promotion, out of four levels. The Council recommends the PAs work to achieve Tier 4, Fully Integrated Programs, by integrating efficiency and demand savings offerings and incentives rather than just cross-promoting them. In addition, the Council expects more transparency and reporting on various active demand offerings.

In order to support a Final Plan, the Council requests the following:

- Increase the goals for Residential Direct Load Control Wifi Thermostats to reach at least 20% of centrally cooled homes in the Commonwealth by 2024.
- Further integrate ADM savings measures for control-based measures by offering higher energy efficiency incentives for demand response enabled technologies.
    - Example – provide a higher tier Energy Management System incentive for those that build load shedding protocols into their programming at the time of commissioning.
- Set specific numerical goals for Income-Eligible and Small Commercial Direct Load Control Wifi thermostats, and report these figures going forward in all regular ADM reporting.
- Phase out support for fossil fuel generator participation in active demand programs and report the amount of C&I demand savings from generators versus load curtailment until said phase out is complete.
- Expand goals for energy storage ADM in residential, commercial, and income eligible sectors.
- Transition EV charging pilot to a program offering by January 1, 2022.
- Provide more clarity on the long-term incentive levels for energy storage systems to give developers and customers the necessary information they need to finance storage projects.
- Strive to meet the vision of the U.S. Department of Energy's Grid Interactive Efficient Buildings[7] concept in all new construction projects across all sectors.

4. Performance Incentive

As stated above, the Council emphasizes that the 2022-2024 Plan is a transformational plan which must meet the challenge of aggressive GHG emission reductions required by the Climate Act to combat the effects of climate change while also equitably serving Massachusetts ratepayers. The priorities of GHG emissions reduction and equitable program delivery must be considered in tandem to ensure that historically underserved communities are able to realize benefits from emissions reduction efforts. The Council expects the 2022-2024 Performance Incentive (PI) Mechanism to transition in support of these priorities. Specifically, the PI mechanism must be designed to incentivize the PAs to pursue benefits and energy savings in communities that have been historically underserved by the programs. The PI mechanism must also be foundationally based on rewarding the PAs for reaching the GHG reduction goal set by EEA Secretary Theoharides, through increasing implementation of measures and developing programs that will support the achievement and align with the Commonwealth's interim and long-term climate goals while also ensuring that underserved communities are prioritized. The Council expects the PI mechanism to be a change from past plans in order to achieve these outcomes.

[7] https://www.energy.gov/eere/buildings/grid-interactive-efficient-buildings

Energy Efficiency Advisory Council's Equity Working Group's Comments on April Draft Plan 2022-2024

July 23, 2021

1. Introduction

The Energy Efficiency Advisory Council's Equity Working Group recognizes and commends the Mass Save® Program Administrators (PAs) for their work to include equity as a priority focus in the April Draft Plan.[1] The EWG reiterates support for the full list of recommendations[2] provided to the Council and Mass Save® PAs and included as a part of the EEAC resolution approved on March 24, 2021. The focus of the EWG's comments here are on the priorities and details the EWG deems most important for inclusion in the Final Plan submitted in October of this year.

The April Draft Plan presents a shift from prior statewide electric and gas energy efficiency plans. However, the EWG believes that the Final 2022-2024 Plan must go further than currently proposed in the April Draft Plan to ensure that transformative change happens. The April Draft Plan provides qualitative goals within its sections on strategic initiatives, and accompanying these goals are descriptions of barriers, example tactics, applicable incentives, and simplified timelines for implementation. Improving equitable outcomes in the statewide energy efficiency programs will take significant investments of time, effort, and resources in communities and customers that have been historically underserved. Achieving success with equity initiatives will also require investments in complementary initiatives such as partnerships and workforce development. The details included in the April Draft Plan provide important qualitative descriptions of initiatives that the PAs will undertake, but they do not provide the quantitative targets necessary to measure progress towards equity goals and lack some tactical detail necessary to assess whether program changes align with EWG recommendations from March 2021.

2. Focus on Equity - the Priorities

The PAs define equity in the context of energy efficiency as, "… the process of establishing more equal access to and participation in energy efficiency programs, particularly among those groups who have historically participated at lower rates, including renters/landlords, moderate-income customers, and English-isolated families."[3] While access to and participation in energy efficiency programs is of primary importance, it is not the sole definition of equity and cannot be achieved without a broader view of and approach to equity.

Program participation provides one set of energy efficiency benefits. Other benefits that need to be more equitably distributed include 1) the geographic distribution of program investments and benefits

[1] Massachusetts Joint Statewide Electric and Gas Three-Year Energy Efficiency Plan, (April 30, 2021), https://ma-eeac.org/wp-content/uploads/Mass.-Statewide-Energy-Efficiency-Plan-Submitted-April-30-2021.pdf
[2] Council Approved Equity Recommendations, (February 24, 2021) https://ma-eeac.org/wp-content/uploads/FINAL-Equity-Recommendations-APPROVED-2.24.21.pdf
[3] Massachusetts Joint Statewide Electric and Gas Three-Year Energy Efficiency Plan at 58, (April 30, 2021), https://ma-eeac.org/wp-content/uploads/Mass.-Statewide-Energy-Efficiency-Plan-Submitted-April-30-2021.pdf

and 2) the availability of and access to employment and procurement opportunities for individuals and businesses that are underrepresented in the clean energy economy. Furthermore, the Massachusetts legislature has explicitly called for equitable distribution of energy and environmental benefits and environmental burdens.[4] The EWG feels strongly that the PAs continue developing and enhancing initiatives focused on equitable distribution of benefits.

The Commonwealth has established a goal of net-zero GHG emissions by 2050 and aims to do so equitably. In the April Draft Plan the PAs identified equity and electrification as two of their top priorities. The EWG firmly believes that any and all prioritization of electrification should be viewed with an equity lens as well. The EWG urges the PAs to ensure that the 2022-2024 Plan proactively paves the way to a just and clean energy transition. Over the next several years, hundreds of thousands of residences and businesses will need to be electrified to meet statewide GHG emissions reductions goals. The statewide energy efficiency programs present a significant opportunity to meet those goals equitably by centering equity and environmental justice in electrification policies from the start. This means that low- and moderate-income customers cannot be left behind in the clean energy transition. Designing policies and programs that do not actively promote electrification where economically feasible would force low- and moderate income customers to bear the financial burden of supporting fossil fuel infrastructure as the state transitions away from fossil fuels. The PAs and the Low-Income Energy Affordability Network (LEAN) should actively pursue electrification for low- and moderate-income customers using delivered fuels or inefficient electric heat, where energy burden will be reduced by converting to efficient electric heat pumps. While it may not be economically feasible for gas customers to convert now, the PAs and LEAN should have plans in place such that additional customers can be quickly and efficiently transitioned in the future.

With deliberate and inclusive actions, we can create a diverse set of solutions that bring us closer toward the Commonwealth's climate goals and at the same time further reduce social inequities related to energy.

3. Budgets, Benefits, and Participation

With increased focus on equity issues and equitable delivery of energy efficiency services, it is necessary to enhance transparency and understanding regarding the magnitude of PA financial investments and impacts in the 2022-2024 Plan. The EWG supports the increased investment that has been allocated for moderate-income customers. However, additional information is needed to adequately assess whether investments for the other equity priority areas are acceptably robust. Much of the information regarding equity-related budgets has been delivered to the EWG via its regular meetings; therefore the EWG strongly recommends that the PAs include a detailed budget for equity initiatives in the 2022-2024 Plan. These detailed budgets should include investment, planned number of participants served, and net lifetime MMBtu broken down by environmental justice communities, workforce development,

[4] An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy (2021)

partnerships, moderate-income (including pre-wx barrier mitigation), renters and landlords (including income-eligible), language-isolated populations, and small business.[5]

4. Stakeholder Inclusion

Over the last year and a half the EEAC has implemented changes and process improvements to provide opportunities for more meaningful involvement in Three Year Planning. Much of the meaningful involvement has come through process improvements in the planning process, such as including stakeholder representatives as members of the Equity Working Group, inviting stakeholders to provide input during EWG hosted focus groups, and hosting virtual meetings and listening sessions which allowed for greater participation.

The EWG would like to highlight some of the key takeaways from comments received from stakeholders following the publication of the April 30th Draft Plan. In their comments, stakeholders have stressed the need for the following to be included in the final version of the 2022-2024 Plan.

- Additional quantitative and qualitative details, clarity, and transparency are needed throughout the plan to ease concerns about the achievability of the equity goals specified in the plan.
- Numerical targets and metrics are essential to assess progress on equity priorities throughout the plan. Relying on EM&V studies that are completed years later is insufficient for measuring progress in real time.
- Budgets should be clearly articulated for equity initiatives and commensurate with the needs of underserved customer groups such as moderate-income customers, renters and landlords, language-isolated populations, and small businesses.
- Enhanced communications are needed to ensure that customers, contractors, municipalities, and more are aware of the program offerings available and are able to effectively communicate those offerings to their peers.
- The climate benefits of electrification should be more accessible to all residences and businesses interested in participated in Mass Save®. This includes educating Mass Save® partners on electrification technologies and encouraging them to promote electrification opportunities among customers.

In effort to maintain informative stakeholder connections, the EWG recommends that the DOER, EEAC, and PAs continue with the successful stakeholder engagement practices identified during this planning process and that plans for maintaining continued engagement be included in the next version of the Plan.

5. Equity Targets and Metrics

The EWG firmly believes that committing to and making progress towards equity goals requires establishing targets and metrics. Without clearly defined numerical targets and metrics and timelines for

[5] The PAs should indicate where there is overlap between priority areas (e.g. a moderate-income renter). For priority areas where the PAs cannot provide granular data, approximations should be made and detailed assumptions regarding those approximations should be shared as well.

implementation, the Council will be limited in its ability to track where progress has been made and where additional support is needed. In consultation with the PAs, the EWG has begun developing a framework for measuring equity in the areas of environmental justice communities,[6] workforce development, partnerships, renters, moderate-income customers, language isolated populations, and small businesses. The framework uses metrics such as participation, benefits, and investment as means to track progress towards more equitable outcomes. Metrics are being carefully chosen based on available baseline data and feasibility for collecting new data. In addition, reporting requirements, including the frequency of reporting for each metric, are still under discussion. Examples of targets the EWG has discussed include, but are not limited to, the following:

- Environmental Justice Communities: Increase number of participants by PA in designated EJ communities Plan over Plan in selected EJ municipalities by a percent to be set for each PA individually.
- Workforce Development: At least 120 people will complete training and be placed in relevant industry positions through Clean Energy Pathways, with at least 75% being Women, Black, Indigenous, or People of Color, fluent in language(s) other than English, and/or from EJ block group at time of enrollment. PAs will report on 12-month retention, with a target of [XX] % of placed trainees retained.
- Moderate-Income: Increase the number of moderate-income weatherization jobs by [XX]% year over year (baseline to be established using 2021 actual data).

The EWG has been clear through this process that the framework is a first step in a longer journey, and that the targets and metrics framework will continue to be updated as needed. The EWG expects that the PAs will continue to work with the EWG to develop an Equity Targets Framework including details around reporting frequency and bring the framework to the Council for review in August 2021.

6. Data, Tracking, and Reporting Toward Equity Targets

The EWG views data, tracking, and reporting as a core component of making progress towards improved equity in the Mass Save® programs. The EWG recognizes the significant upgrades that have been made to increase access to Mass Save® Data including developing interactive data mapping tools and Customer Profile Dashboards for the Residential and Commercial and Industrial sectors.[7] These new tools provide enhanced access that formal and informal Mass Save® partners can access to help develop targeted outreach strategies that will hopefully direct program resources to customers who need them most and customers that have been historically underserved. The EWG expects the PAs to continue to host outreach sessions on these new tools to increase awareness among interested stakeholders, improve these data tools and resources over time, and expand these tools to additional municipalities.

[6] As defined by the Executive Office of Energy and Environmental Affairs *Environmental Justice Policy* (June 24, 2021) https://www.mass.gov/doc/environmental-justice-policy6242021-update/download

[7] The Massachusetts Energy Efficiency Database, https://www.masssavedata.com/public/home, (last visited June 28, 2021)

In the recommendations provided to the Council earlier this year, the EWG recommended several reporting criteria for the PAs to consider.[8] The EWG views reporting towards equity targets to be critical. More frequent and granular reporting of participation by underserved customer groups is necessary to ensure progress. By providing data more frequently, the EEAC and the PAs will be better equipped to review and act with necessary urgency, rather than waiting years for comprehensive evaluation studies to be completed. Furthermore, more detailed reporting would allow the EEAC and the PAs to understand how certain priority areas and customer segments within a sector are making progress towards equitable outcomes and reassess if there are changes that should be made to improve outcomes. The EWG understands that this process will take time and that it will require a serious overhaul of data tracking and reporting systems for some of the newer metrics. The EWG encourages the PAs to view this as a long-term investment in equity as reaching a more just and equitable future will require more time than the next plan term. The EWG recommends that all reporting systems for equity targets should be in place by the end of the second quarter of 2022.

7. Programmatic Priorities

The Three Year Plan and accompanying documents typically have been strategic —rather than tactical— documents. The EWG strongly suggests that additional tactical detail is needed to address adequately issues of inequity. There are two reasons : 1) to ensure that the extensive work that the EWG and stakeholders have made is utilized to implement the EEAC's equity recommendations and 2) to see implementation strategies in sufficient detail to have confidence that equity targets will be met. In this next section, the EWG provides more detailed comments regarding areas where the EWG supports the PAs plans, where the EWG believes additional detail is needed to make a fair assessment, and changes the EWG expects to see in the Final Plan. In each of the below areas addressed in the Three-Year Plan, the EWG recommends that the PAs define critical points of review to ensure that new strategies and tactics are bringing about the desired results. Such review should include stakeholder participation for input and problem solving. Building into the Plan review and recalibration of programs will ensure the strong forward momentum on goals that the EWG, PAs, and stakeholders want to see in these areas.

Table 1. Equity Working Group Programmatic Priorities

	The EWG Supports…	***More Information Needed on…***	***Areas Where Changes Are Needed…***
Partnerships	• Option for multi-year partnerships • Increased focus on EJ communities for Municipal Partnership Program • Municipal Partnership funding structure that is more guaranteed and predictable	• Budget for Municipal Partnership Program and partnerships more broadly • Metrics that will be used to evaluate partnership performance	• Increase in the number of partnerships, including how those partnerships will be distributed throughout the Commonwealth • Definition of partnerships

[8] Council Approved Equity Recommendations, (February 24, 2021) https://ma-eeac.org/wp-content/uploads/FINAL-Equity-Recommendations-APPROVED-2.24.21.pdf

Workforce Development	• Increase in budget for WFD efforts • Creation of the Clean Energy Pathways program	• PAs' plan to collaborate with MassCEC on $12 million/year for energy efficiency workforce development • Workforce development investments outside of the Hard To Measure budget • Efforts to improve Diverse Business Enterprise participation in PA procurements	• Additional workforce efforts beyond Clean Energy Pathways in residential, income eligible, and C&I sectors
Moderate-Income	• Increase in funding for barrier mitigation and HVAC incentives which can be tracked at the measure-level • Commitment to improving and simplifying the income verification process	• Implementation strategy for serving moderate income customers such as streamlining the income verification process and timeline for implementation • Barrier mitigation budget and tracking and reporting of barriers	• Increase the value of HVAC incentives for heat pumps • Differentiate incentives for electric and fossil fuel heating systems such that heat pumps are competitive up-front • If Wx is included as a requirement for enhanced HVAC incentives, the PAs must develop a coordinated and streamlined delivery model that reduces the number of contacts for a customer
Renters and Landlords	• Continuation of enhanced inventive for residential 1-4 unit and attached low-rise individually metered buildings	• Implementation strategies for directly engaging with residential and commercial landlords • Details on the Mixed-Income Protocol, including framework and timeline for implementation	• Include more innovative approaches for reaching landlords • Develop participation goals by building size, particularly for smaller multifamily buildings with 3-9 units • Develop plans for serving rental C&I properties, particularly small- and micro-business • Include plans for integrated service delivery and one point of contact for landlords
Language Isolated Populations	• Commitment to improving access for	• Details on how language assistance will be provided across PAs	• Provide an implementation timeline for Language Access Plan, which should

	Spanish and Portuguese-speaking households • Commitment to developing a Language Access Plan	• Details describing how comprehensive language access will be fully integrated through all aspects of the PA portfolio, including outreach, intake, assessment, installation, and quality assurance for residential, income eligible, and commercial and industrial customers • Details for how the PAs will serve small businesses where English is not the primary language spoken by the business owner	include details for language access for households with a primary language other than Spanish or Portuguese
Small Business	• Allowing eligible customers to sign up online for turnkey small business audits	• Details on outreach strategies for small business in addition to the Main Streets Program • Provide details on how Wx and HVAC installations are being scaled up from current levels • Address how the PAs will reach different industries within the small business sector such as non-profits	• Define small business or adopt definition used in the C&I non-participant study • Develop participation goals for upstream and downstream initiatives specifically for Wx, HVAC, and non-lighting measures

8. Conclusion

The EWG is grateful for the opportunity to collaborate closely with the PAs on equity. It is the EWG's goal to continue this close collaboration moving forward. Creating a Three Year Plan that not only prioritizes equity but leads to equitable outcomes is the ultimate goal of the working group. The non-participant studies and stakeholder feedback has shown that statewide energy efficiency programs have left customers underserved. This plan signals a change and a commitment to investing in those communities. Ensuring that underserved communities have equitable access to program benefits will require us to try and try again when we don't succeed, but the goal will remain the same: to ensure more just and equitable access and outcomes.

APPENDIX M: AGREEMENT ON CERTAIN TERMS BETWEEN ATTORNEY GENERAL, DOER, AND PROGRAM ADMINISTRATORS

Final Approved Version
October 25, 2021

Term Sheet

Massachusetts Joint Statewide Electric and Gas Three-Year Energy Efficiency Plan for 2022-2024

Delivering Savings and Transition Toward Climate and Equity Imperatives

I. Green Communities Act Context.

Pursuant to G.L. c. 25, §§ 19, 21, on April 30, 2021, the Program Administrators ("PAs") filed their initial "Massachusetts Joint Statewide Electric and Gas Three-Year Energy Efficiency Plan for 2022-2024" ("2022-2024 Plan") with the Energy Efficiency Advisory Council ("EEAC" or "Council"), along with detailed supporting data including benefit cost ratio ("BCR") models and detailed energy efficiency data tables. Since the PAs' April 30 filing, there have been seven Council meetings, three additional public comment listening sessions, extensive work with the Equity Working Group ("EWG"), multiple informal stakeholder engagements, and extensive work with the Council and its technical consultants. On July 28, 2021, the Council adopted its detailed Resolution regarding the April 30 draft of the 2022-2024 Plan. On September 15, the PAs filed a next iteration of data updating the 2022-2024 Plan, along with a narrative summary. On October 6, 2021, the PAs filed a detailed 249-page update of the narrative for the 2022-2024 Plan, along with a comparison to the April 30 draft showing the changes made to the original draft based upon stakeholder feedback, the Council's July 28 Resolution, and further planning work. In this Term Sheet, the PAs, the Department of Energy Resources ("DOER"), and the Office of the Attorney General ("AGO") (together, the "Parties") set forth the key terms to be included in the final 2022-2024 Plan.

II. Climate Act Context.

On March 26, 2021, Governor Baker signed bold new legislation adopted by the General Court that codified the General Court's and the Administration's commitment to achieve net-zero emissions in 2050 and furthered the Commonwealth's nation-leading efforts to combat climate change and protect vulnerable communities. Chapter 8 of the Acts of 2021 - *An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy* ("Climate Act") establishes new mandates for economy-wide emissions reductions by 2030 and 2040, and significantly increases protections for Environmental Justice communities across Massachusetts. The Climate Act also directs the Secretary of Energy and Environmental Affairs ("EEA") to set a greenhouse gas ("GHG") emissions-reduction goal for the Three-Year Energy Efficiency Plans, requires the social value of GHG emissions to be included in the cost-effectiveness calculations for all measures excluding fossil fuel heating and hot water systems, allows the PAs to propose and the Council to approve a mechanism that prioritizes projects that reduce GHG emissions, and expands the mandate of the Department of Public Utilities ("Department") to prioritize equity and greenhouse gas emissions reductions in its decisions, in addition to safety, reliability, and affordability. The provisions of the Climate Act underscore the Council's recommendations set forth in its March Resolution, setting its three strategic priorities for the 2022-2024 Statewide Efficiency Plans – 1)

alignment with the Commonwealth's GHG emission reduction limits, 2) equitable program delivery and participation, and 3) workforce development. With this context, the 2022-2024 Plan represents a transformational plan to meet the challenge of the GHG emission reductions needed in the Commonwealth to combat the effects of climate change, and to address historical unequal program participation through significant changes in its approach to planning, program design, and implementation.

III. Overall High Level 2022-2024 Goals.

The Parties each will support 2022-2024 energy efficiency statewide savings goals for electric and gas PAs, along with MW savings, MMBtu savings, budgets, benefits, GHG reductions, and performance incentives as set forth in Attachment A.[1] The summary information in Attachment A is provided at both a three-year rolled-up statewide level, along with individual sets of PA-specific information. This Term Sheet agreement is contingent upon the PAs providing updated sets of PA-specific and statewide rolled-up energy efficiency data tables and benefit-cost models in advance of the final 2022-2024 Plan that are consistent with this Term Sheet. This framework is designed with an expectation of a review of the final 2022-2024 Three-Year Plan, but all Parties support each of the overall terms set forth herein. DOER and the AGO will review the final Plan data tables and BCR models and work collaboratively with the PAs to resolve any concerns or inconsistencies identified in the BCR models and detailed data tables prior to the final 2022-2024 Plan filing with the Department on November 1, 2021.

With respect to electrification budgets, the PAs anticipate that there will be additional, material costs associated with the electrification efforts contemplated in 2022-2024 beyond those included in the energy efficiency programs. The Parties understand and agree that the provision of additional outside funding will be an essential tool in 2022-2024 to offset costs to electric and gas customers. DOER and the AGO will work collaboratively with the PAs to identify sources of additional funding that can be used to reduce and offset energy efficiency and related infrastructure costs during the 2022-2024 term.

As set forth in Attachment A, the 2022-2024 Plan represents a $3.94 Billion investment in energy efficiency, with a focus on aligning with the Commonwealth's climate change goals, more equitable participation, and enhanced workforce development. It is the largest investment and most ambitious plan to be undertaken by the PAs since the enactment of the Green Communities Act in 2008. This investment is projected to result in $12.9 Billion in benefits to ratepayers.

IV. Climate: Alignment with Commonwealth's Greenhouse Gas Emissions Goals and Statutory Limits

The 2022-2024 Plan is designed to carry out the applicable goals of the GCA and the Climate Act. The 2022-2024 Plan is designed to achieve total GHG reductions of 845,000 metric tons of CO2e in 2030. The Parties support the allocation of this aggregate amount as follows: 474,000 metric tons of CO2e for the electric programs, 341,000 metric tons of CO2e for the gas programs, and

[1] As a public entity, the Cape Light Compact JPE is not eligible for performance incentives. Additionally, Cape Light Compact JPE, by direction of its governing board, is not offering incentives for fossil fuel heating systems in market rate programs in 2022-2024. It will offer such incentives for income-eligible customers.

30,000 metric tons from gas to electric fuel switching projects. For the 2022-2024 Plan, DOER and the AGO agree that up to 30,000 metric tons of CO2e emissions from gas to electric programs may count towards the GHG reduction goal originally set forth in the Secretary of EEA's letter of July 15, 2021). The 30,000 metric tons of CO2e must be derived from projects involving gas to electric fuel switching projects, with all savings from such projects being eligible for inclusion. For the avoidance of doubt, savings related to efficient natural gas equipment incentives and savings related to measures that are not part of an electrification project shall not be included in the 30,000 metric tons of CO2e emissions reductions to be reallocated to gas programs and may only be credited toward the Secretary of EEA's original July 15, 2021 allocation of GHG goals to gas PAs.

Summary tables for 2022-2024 follow:

Electric Portfolio

Sector	Year	Total Spend	Lifetime MMBTU	Total Benefits	Active Demand Response (MW)	2030 Avoided CO2e (Metric Tons)
Residential	2022	$316,910,221	17,984,186	$1,133,296,004	72	72,865
	2023	$384,919,374	21,534,061	$1,432,337,775	96	99,568
	2024	$487,322,959	25,877,976	$1,819,630,384	122	139,949
Income Eligible	2022	$107,085,862	3,811,356	$291,878,418	1	12,240
	2023	$112,661,185	4,028,757	$310,257,945	1	13,482
	2024	$121,550,610	4,286,014	$333,190,912	1	15,248
C&I	2022	$315,855,888	15,411,253	$1,154,918,694	120	23,030
	2023	$371,993,941	16,667,733	$1,170,526,142	137	35,836
	2024	$512,917,486	18,331,766	$1,406,526,752	155	61,785
Portfolio	2022	$739,851,971	37,206,795	$2,580,093,116	193	108,135
	2023	$869,574,500	42,230,551	$2,913,121,862	234	148,886
	2024	$1,121,791,055	48,495,757	$3,559,348,049	278	216,982

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Gas Portfolio

Sector	Year	Total Spend	Lifetime Therms	Lifetime MMBTU	Total Benefits	2030 Avoided CO2e (Metric Tons)
Residential	2022	$204,737,648	171,298,462	17,199,784	$557,362,597	50,443
	2023	$219,183,203	182,110,923	18,205,070	$591,780,206	52,983
	2024	$237,716,599	189,929,275	18,871,827	$623,100,203	55,120
Income Eligible	2022	$75,353,791	55,232,840	5,675,922	$243,166,493	14,203
	2023	$82,704,427	58,698,470	6,029,902	$253,811,623	15,072
	2024	$91,174,734	61,937,260	6,364,831	$268,633,725	15,924
C&I	2022	$82,344,595	135,509,293	12,785,016	$395,381,284	50,598
	2023	$99,656,031	147,355,487	13,411,997	$425,244,187	55,157
	2024	$114,615,753	156,050,140	13,795,030	$449,738,614	61,546
Portfolio	2022	$362,436,034	362,040,595	35,660,722	$1,195,910,374	115,243
	2023	$401,543,661	388,164,880	37,646,969	$1,270,836,016	123,212
	2024	$443,507,086	407,916,676	39,031,688	$1,341,472,542	132,589

Given the essential role of the PAs' three-year plans in meeting the Climate Act's 2050 Net Zero limit and 2030 limit of at least 50% reduction in GHG emissions from 1990, the 2022-2024 Plan reflects a significant increase in the scope and scale of building retrofits, with a focus on envelope improvements and efficient electrification. The 2022-2024 investments aggressively prioritize measures that support the 2030 GHG emission reduction goal and are consistent with the Commonwealth's long-term 2050 net-zero limit. Toward this end, the 2022-2024 Plan includes the following key elements.

A. An intensive focus on strategic electrification.

The 2022-2024 Plan includes the following volumes of residential cold climate heat pump installations and high efficiency C&I heat pump installations, as well as an extensive focus on market transformation through work with manufacturers, distributors, contractors, and customers as described in the Plan narrative.

Heat Pump Goals

Residential-Electric

	2022	2023	2024	Term
RNC	1,720	3,012	2,883	7,615
Full Displacement	1,294	2,202	4,221	7,717
Partial Displacement	6,206	9,891	15,856	31,953
Electric Resistance	2,298	2,454	2,612	7,364
HPWH	912	1,490	2,149	4,551

Income Eligible-Electric

	2022	2023	2024	Term
Full Displacement	480	520	580	1,580
Partial Displacement	1,036	1,170	1,392	3,598
Electric Resistance	460	474	484	1,418
HPWH	325	336	339	1,000

Residential-Gas

	2022	2023	2024	Term
Full Displacement	204	248	313	765
Partial Displacement	206	339	494	1,039
HPWH	30	40	50	120

Commercial & Industrial – Fuel Switching

	Electric	Gas
Net Annual Fossil Fuel MMBTU	1,025,095	502,233
Net Lifetime Fossil Fuel MMBTU	15,566,609	7,638,841
Square Footage	34,102,738	18,527,073

1) Investment of over $800 million to achieve the goals set forth above which is expected to result in a total of 43,370 "household equivalent" electric heated homes (17,677 full displacement homes and 36,590 partial displacement homes).
2) Implementation of all-electric new construction offerings for residential and commercial buildings in 2022.
3) Commitment to work with customers, contractors, and manufacturers to drive market transformation and generate customer demand. Specific key performance indicators/measures of success and milestones are set forth in the narrative.
4) Discontinue new non-heat pump central air conditioning residential incentives starting in January 2022.

B. Reduced support of lighting measures in accordance with the following principles:
1) Residential Market Rate: based on study information from evaluation, all retail lighting measures phased out by December 2021; no market rate lighting incentives to be offered in 2022-2024, with the exception of flexibility for PAs to offer lighting measures to renters and moderate income customers, understanding that DOER advocates the phase out of these lighting measures.
2) Commercial and Industrial: Indoor lighting opportunities will be limited to controllable technologies in accordance with Design Lights Consortium 5.1. PAs will prioritize LED fixtures with controls for the 2022-2024 Plan.
3) Since the September 15 PA filing of data, the 2022-2024 Plan will reduce planned lighting incentives by more than $21 million for C&I and more than $4 million in income-eligible.
4) The PAs will work with the DOER, the Council, and LEAN on phase out strategies for lighting in the income eligible and commercial industrial sectors based upon evaluation study results and any Department direction. Such strategies, including applicable details and proposed timelines, shall be developed by no later than June 30, 2023.
5) If the PAs offer lighting measures for moderate income or renters in 2022–2024, the related benefits, participation, and investments do not count toward the achievement of the equity targets set forth in Attachment B. Similarly, with respect to performance incentives, as set forth in more detail in Attachment E, those lighting measures will count toward the standard benefits component, and not the equity component in which lighting was removed from the baseline.

C. Limited and reduced support of fossil fuel heating and hot water equipment in accordance with the following:
   1) The Plan eliminates residential incentives for all oil-fired boilers in 2022-2024. For all other residential fossil fuel heating systems, the PAs will only offer incentives to customers who have non-condensing heating systems and are converting to condensing heating systems. There may be exceptions to these principles in limited income eligible applications.
   2) The 2022-2024 Plan phases out natural gas combined heat and power ("CHP") incentives. No new natural gas CHP projects will be incentivized in 2022-2024 except for agreed upon, already committed CHP projects specified outside this Term Sheet. Any additional applications of CHP will only be established consistent with Commonwealth policies and if parameters are agreed upon in advance by DOER.
   3) The 2022-2024 Plan phases out support for fossil fuel generators. Starting in 2022, fossil fuel generators will not be eligible to participate in Active Demand Reduction offerings, including Daily Dispatch or Targeted Dispatch, in 2022-2024. The PAs may provide a transition period of up to one year for existing Targeted Dispatch participants. This will result in the reduction of 82 MW of planned generator active demand participation in the Daily Dispatch offering and the Targeted Dispatch offering relative to the PAs' September 15, 2021 data.

D. Social Cost of Carbon ("SCC"). As mandated in the Climate Act, the 2022-2024 Plan incorporates the social value of GHG emissions reductions of $393 per short ton for all measures, as recommended by Synapse. SCC will not be applied to any new fossil fuel process heating, space heating, or water heating equipment regardless of the customer's prior heating source.

E. New Offerings. The PAs will implement the following new offerings in 2022-2024:
   1. Commercial Deep Energy Retrofit – the PAs will develop a detailed deep energy retrofit ("DER") offering by the first half of 2022 consistent with the high-level design set forth in the October 6 draft 2022-2024 Plan. The PAs will implement this DER offering during the 2022 program year and will report on spending, as well as savings (by measure or end use) and participation.
   2. Pairing electrification with weatherization – the October 6 draft Plan sets forth strategies for pairing electrification with weatherization. The PAs will engage with DOER with respect to the potential for an integrated delivery approach, pairing electrification with weatherization and consider a performance-based incentive approach.
   3. C&I working group – the PAs and DOER will finalize direction for and convene a C&I working group, which shall meet four times a year during 2022-2024 and be co-led by the PAs and the DOER. The key focus of this group will be direct engagement with customers and contractors with experience with the programs. The charter of the C&I working group will be developed jointly by DOER and the PAs, with input from the working group. The charter will contemplate conducting detailed surveys and the sharing of survey results providing independent feedback and input from a sufficiently sized and diverse spectrum of C&I stakeholders, especially contractors and customers. Information to be gathered should be representative of the diversity – e.g., customer

size and industry segment, contractor end-use/focus, etc. – of the stakeholder population. The working group will share and discuss how PAs have considered and incorporated that input into their program design and implementation activities. Additional stakeholders will be EEAC councilors with C&I expertise and other expert stakeholders who will identify the C&I customers and contractors they are authorized to represent. The size of the working group will be sufficiently limited in order to facilitate candid exchange and to foster administrative efficiency.

4. Affordable multi-family decarbonization/deep energy retrofit offering - the Plan will set forth a strategy for a customized approach for income-eligible/affordable multi-family buildings going beyond a typical retrofit. This offering will provide flexible, non-measure specific incentives and be launched in 2022.
5. Gas demand response - National Grid will work with DOER on exploring options for differentiated gas demand response demonstrations (localized benefits or price response) in 2022.

F. Emphasis on weatherization – The 2022-2024 Plan materially increases the number of homes and businesses weatherized throughout the Commonwealth. Insulation, air sealing, and tightening are essential to optimizing energy use, preparing buildings for electrification, and achieving long-term climate goals.

G. Refrigerants – the 2022–2024 Plan will not include GHG reductions from the disposal of GHG emitting refrigerants in the measures as was proposed by the PAs in the October 6 draft narrative. The PAs claimed GHG emissions in the final 2022-2024 Plan will be adjusted accordingly.

V. Equity: A Commitment to Programmatic and Implementation Strategies and Workforce Development to increase the Equitable Delivery of Energy Efficiency to the Commonwealth's Most Vulnerable Customers

The 2022-2024 Plan will address equity and workforce matters aggressively. This Term Sheet agreement incorporates key performance indicators/measures of success and milestones for achieving equity and applicable workforce goals set forth in Attachment B, with gratitude to the EEAC EWG for review and input. A budget summary of equity related investments is included as Attachment C.

As highlights, the 2022-2024 Plan includes the following key elements, each with specific tailored measures of success and milestones:

A. Income Eligible: An investment of $589 million to serve income-eligible customers, including over 6,650 heat pump installations over the three years. PAs will implement a mixed-income protocol that provides a streamlined, efficient process for customers by Q2 2022.

B. Moderate Income: An investment of $136 million to serve moderate-income (61%-80% of the state median income) customers, including a moderate-income offer of 100% incentive for weatherization and enhanced incentives for heating systems for customers who income qualify, with higher incentives for efficient electric heating compared to fossil fuel equipment, and introduction of new incentives for pre-weatherization barrier mitigation. PAs will develop processes to provide a streamlined and integrated experience

to customers for the installation of weatherization and heating system upgrades. Commitment to update and streamline the income qualification process by June 2022.

C. Renters/Landlords: Increased investments to serve renters and landlords, including an increase in renter units served in attached low-rise buildings and 100% weatherization incentive for individually-metered rental units. A commitment to targeting residential, income eligible, and commercial landlords of residential properties and serving whole buildings. PAs will prepare a strategic plan, with a draft by Q2 2022 and a final by Q3 2022, that includes detailed examples of how the PAs will increase service to renters, including additional strategies to increase landlord participation.

D. Workforce Development: An investment of over $49 million (inclusive of funds to MassCEC) to train a more diverse and field-ready workforce, including the Program Administrators' innovative "Clean Energy Pathways" internship program and a commitment to work with the MassCEC, which has a leadership role in workforce development under the Climate Act. A commitment to explore workforce development pathways to two-year and four-year degrees related to energy efficiency for disadvantaged students seeking clean energy related higher education.

E. Partnerships: An investment of over $6 million for participants in the Municipal and Community Partnership Program. A commitment to partner with at least 20 qualified Community-Based Organization ("CBO") teams across at least 30 municipalities to harness their expertise and knowledge of their communities. A commitment to engage with community organizations and community leaders in the program design to ensure programs meet community-specific needs. Investment of up to $1.5 million in 2022-2024 in a new "Open Doors" offering to work with CBOs on residential education efforts for school-age children.

F. Language Isolated Communities: An investment of $9 million. Expand language abilities, including through program materials, vendor requirements, and workforce development. A commitment to developing and implementing a Language Access Plan by 2023 and by 2024 offering HEAs in five (5) of the most commonly spoken languages.

G. Small Businesses: An investment of $185 million. Robust program offerings, including attractive incentives for weatherization for small businesses and microbusinesses, throughout the Commonwealth with a particular focus on businesses located in Environmental Justice Communities.

H. Environmental Justice Communities: Increased plan over plan investment and participation in specified Environmental Justice Communities. A commitment through workforce development efforts to prioritizing recruitment, hiring, and retention strategies targeted at workers from Environmental Justice Communities and minority and women owned business enterprises ("M/WBEs").

VI. Evaluation

The Parties agree to address certain evaluation policy issues related to the transformative nature of this 2022–2024 plan as set forth in an Evaluation Policy Memorandum of even date and attached as Attachment D.

VII. Reporting

The PAs will continue to submit monthly data dashboards, quarterly reports, plan-year reports and a three-year term report for 2022–2024. In addition, the PAs will continue to report each of the six key performance indicators ("KPIs") currently reported for the 2019-2021 term with mutually agreed adjustments. The PAs will expand current heat pump KPI reporting to track the measures (by measure and by fuel source) included in this 2022-2024 Plan with mutually agreed adjustments. In addition, the PAs will present the equity related KPIs as set forth in Attachment B and C. Further, consistent with the Department's May 3, 2021, Order Updating Energy Efficiency Guidelines (page 12, footnote 9), the PAs will finalize with the EEAC a formal process for how data requests from the Council will be made and satisfied during 2022-2024. There will be a new income-eligible KPI for income-eligible matters as mutually agreed, including with LEAN. The PAs will report twice a year on benefits and costs by performance incentive component by PAs.

VIII. Performance Incentives

The Parties agree to the performance incentives approach for 2022-2024 set forth in further detail in Attachment E. Highlights of this approach include:

1. Use of a three-component structure, with a focus on electrification, equity, and energy efficiency benefits in a manner designed to address Department precedent and design principles articulated in the Department's Energy Efficiency Guidelines. Development of this three-component approach has required flexibility, innovation, and collaboration and seeks to address essential priorities while honoring regulatory guidance.
2. Overall performance incentive pool of $170 million of which $131.8 million is dedicated to electric and $38.2 million is dedicated to gas.
3. The performance incentive approach set forth in attachment E includes tailored thresholds for each component that are designed to be aggressive and achievable with effort.
4. In all events, there is an overall cap of 125% of the incentive pool applicable to any given PA.
5. For purposes of calculating benefits eligible in performance incentive calculations, the benefits set forth in the avoided energy supplied cost study for the marginal abatement costs ("MAC") related to fossil fuel heating and hot water measures shall not be included. Such MAC benefits shall be included for cost-effective determinations.

NOTES

- **Confirmation**. All savings and budget figures are subject to confirmation and quality control checks as the PAs develop detailed tables consistent with this Term Sheet. Final PA-specific savings and budget numbers may be slightly higher or lower than these values, but all within a reasonable, non-material bandwidth that does not reduce the overall statewide savings target or increase overall statewide budget.
- **Aggressive Goals.** The PAs have utilized an integrated, statewide approach to commit to the aggressive statewide savings levels set forth in this term sheet at costs that reflect the increased challenges of achieving savings. The individual PA savings levels and costs set forth in Attachment A are appropriate for the 2022-2024 Plan.
- **Effect of Future Legislation, Regulations, or Department Orders**. The PAs may be required to offer new approaches in the future based upon new legislation, regulation, or Department Orders. In the event that material impacts occur from a new or potential municipal aggregator energy efficiency program, new regulations or guidelines, or any other new legislation or directives issued prior to or during the three-year plan term, any affected PA shall have the opportunity to make appropriate adjustments to its costs and savings goals (and related performance incentives) based upon the nature of the impacts, subject to the Council review under G.L. c. 25, § 21(c) and the approval of the Department of Public Utilities.
- **The Commonwealth's Unique Role.** As the largest landlord in the Commonwealth, DOER and the AGO recognize that the Commonwealth has a special role to play in achieving the goals set forth in the 2022-2024 Plan. DOER and the AGO will be strong advocates for state and municipal building participation in the PAs' programs during 2022-2024 and for leadership by example.
- **A Successful Collaborative Process and Reservations of Rights.** The provisions, data, and terms reflected in this Term Sheet reflect collaboration and compromises by each of the Parties, all with the overarching goal of developing, and ultimately implementing, the most ambitious energy efficiency and GHG reduction plan undertaken in the Commonwealth. While each of the Parties will support each of the terms of this Term Sheet for the 2022-2024 Plan, such support does not in any way prejudice or prevent their taking of other positions in other proceedings outside this 2022-2024 Plan. Accordingly, this Term Sheet is only used for the purposes of the 2022-2024 Plan and its implementation and is entered without prejudice in any other proceeding. Each of the Parties respects and appreciates the diligent efforts of their counterparts, as well as the members of the Council and the multiple stakeholders who have engaged in this process and who have helped to enhance this 2022-2024 Plan and address areas of key concern more effectively and equitably.

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Attachment A

2022-2024 Core Data

ELECTRIC

National Grid

Sector	Year	Total Spend	Lifetime MMBTU	Total Benefits	Active Demand Response (MW)	2030 Avoided CO2e (Metric Tons)
Residential	2022	$151,597,991	9,856,642	$609,706,254	31	41,799
	2023	$179,803,771	11,721,409	$762,136,411	40	55,209
	2024	$211,289,612	13,226,144	$897,534,547	49	68,703
Income Eligible	2022	$46,212,982	1,669,237	$122,170,747		5,144
	2023	$49,988,267	1,847,842	$135,642,281		6,046
	2024	$57,025,824	2,051,991	$152,451,443		7,377
C&I	2022	$150,149,449	7,863,372	$541,869,564	67	12,646
	2023	$195,641,523	7,655,961	$590,539,816	69	21,801
	2024	$237,492,296	7,674,399	$637,621,843	71	29,403
Portfolio	2022	$347,960,421	19,389,252	1,273,746,565	98	59,588
	2023	$425,433,562	21,225,213	1,488,318,508	109	83,057
	2024	$505,807,731	22,952,534	1,687,607,833	120	105,483

Eversource

Sector	Year	Total Spend	Lifetime MMBTU	Total Benefits	Active Demand Response (MW)	2030 Avoided CO2e (Metric Tons)
Residential	2022	$119,426,000	5,734,125	375,463,167	38.80	21,776
	2023	$157,603,000	7,339,309	512,997,685	53.40	34,185
	2024	$220,428,000	10,129,972	756,938,902	69.75	59,995
Income Eligible	2022	$52,383,000	1,905,107	151,003,383	0.65	6,515
	2023	$53,614,500	1,935,057	155,204,654	0.98	6,822
	2024	$54,846,000	1,980,812	160,624,414	1.30	7,206
C&I	2022	$144,613,000	6,851,984	567,662,606	49.91	9,103
	2023	$153,913,000	8,249,542	529,431,670	63.67	12,476
	2024	$252,914,000	9,806,307	711,387,703	78.36	30,512
Portfolio	2022	$316,422,000	14,491,216	1,094,129,156	89.36	37,394
	2023	$365,130,500	17,523,908	1,197,634,010	118.04	53,483
	2024	$528,188,000	21,917,092	1,628,951,018	149.41	97,713

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Cape Light Compact

Sector	Year	Total Spend	Lifetime MMBTU	Total Benefits	Active Demand Response (MW)	2030 Avoided CO2e (Metric Tons)
Residential	2022	$43,152,364	2,264,218	$139,933,398	2.15	8,675
	2023	$44,535,521	2,333,599	$148,088,728	2.72	9,479
	2024	$52,282,982	2,375,157	$155,272,036	3.32	10,472
Income Eligible	2022	$7,296,812	207,924	$16,340,245	0.02	509
	2023	$7,837,815	216,289	$16,974,550	0.03	536
	2024	$8,381,929	222,569	$17,561,513	0.03	575
C&I	2022	$18,063,156	515,278	$34,091,720	2.31	991
	2023	$19,363,486	596,714	$39,798,104	2.86	1,233
	2024	$19,161,940	691,079	$46,606,695	3.76	1,497
Portfolio	2022	$68,512,332	2,987,420	$190,365,363	4.48	10,175
	2023	$71,736,822	3,146,602	$204,861,382	5.61	11,248
	2024	$79,826,851	3,288,805	$219,440,244	7.11	12,544

Unitil

Sector	Year	Total Spend	Lifetime MMBTU	Total Benefits	Active Demand Response (MW)	2030 Avoided CO2e (Metric Tons)
Residential	2022	$2,733,866	129,200	8,193,186	0.086	615
	2023	$2,977,082	139,743	9,114,950	0.095	695
	2024	$3,322,365	146,703	9,884,899	0.105	780
Income Eligible	2022	$1,193,068	29,088	2,364,043		72
	2023	$1,220,603	29,569	2,436,460		78
	2024	$1,296,857	30,641	2,553,542		90
C&I	2022	$3,030,283	180,619	11,294,804	1.091	291
	2023	$3,075,931	165,516	10,756,551	1.200	326
	2024	$3,349,250	159,981	10,910,512	1.320	373
Portfolio	2022	$6,957,217	338,907	21,852,032	1.177	979
	2023	$7,273,616	334,828	22,307,962	1.295	1,099
	2024	$7,968,472	337,326	23,348,953	1.425	1,242

GAS

National Grid

Sector	Year	Total Spend	Lifetime Therms	Lifetime MMBTU	Total Benefits	2030 Avoided CO2e (Metric Tons)
Residential	2022	$113,538,460	96,145,573	9,671,308	$311,005,602	29,052
	2023	$123,918,360	102,708,848	10,258,168	$328,137,688	30,761
	2024	$136,190,150	106,249,257	10,511,878	$338,784,638	31,971
Income Eligible	2022	$40,073,658	32,081,942	3,277,419	$137,263,224	8,374
	2023	$44,803,444	31,969,952	3,269,770	$138,175,854	8,352
	2024	$49,800,774	33,339,616	3,412,422	$144,896,674	8,725
C&I	2022	$44,215,697	75,047,886	7,005,711	220,121,909	27,997
	2023	$51,878,660	79,083,989	7,170,124	230,929,044	29,359
	2024	$59,336,037	81,680,463	7,197,194	240,399,340	31,604
Portfolio	2022	$197,827,814	203,275,400	19,954,438	$668,390,735	65,423
	2023	$220,600,464	213,762,789	20,698,062	$697,242,585	68,472
	2024	$245,326,961	221,269,336	21,121,494	$724,080,652	72,300

Eversource – NSTAR

Sector	Year	Total Spend	Lifetime Therms	Lifetime MMBTU	Total Benefits	2030 Avoided CO2e (Metric Tons)
Residential	2022	$39,030,000	33,615,356	3,351,332	111,744,762	9,754
	2023	$41,100,000	35,884,152	3,571,443	120,120,719	10,218
	2024	$43,940,000	37,727,668	3,740,163	128,732,973	10,626
Income Eligible	2022	$15,110,000	10,878,353	1,123,253	48,385,339	2,722
	2023	$16,720,000	12,808,007	1,317,840	53,375,549	3,204
	2024	$18,525,000	13,694,635	1,408,685	56,903,403	3,426
C&I	2022	$17,550,000	26,803,337	2,561,474	88,264,326	10,335
	2023	$22,815,000	30,901,173	2,797,213	98,347,755	12,021
	2024	$26,035,000	33,953,579	2,989,904	106,146,041	14,251
Portfolio	2022	$71,690,000	71,297,046	7,036,058	248,394,427	22,811
	2023	$80,635,000	79,593,332	7,686,496	271,844,023	25,443
	2024	$88,500,000	85,375,882	8,138,752	291,782,417	28,303

Eversource - EGMA

Sector	Year	Total Spend	Lifetime Therms	Lifetime MMBTU	Total Benefits	2030 Avoided CO2e (Metric Tons)
Residential	2022	$43,860,000	36,076,491	3,620,501	117,212,183	9,976
	2023	$45,905,000	38,155,748	3,829,559	126,065,545	10,394
	2024	$48,890,000	40,680,725	4,083,258	138,037,923	10,943
Income Eligible	2022	$16,505,000	10,133,292	1,052,564	46,170,040	2,559
	2023	$17,405,000	11,676,724	1,208,443	50,199,029	2,941
	2024	$18,775,000	12,535,936	1,296,807	53,921,839	3,164
C&I	2022	$17,580,000	29,329,384	2,784,858	72,643,050	10,361
	2023	$21,960,000	32,663,953	2,973,855	80,886,855	11,646
	2024	$26,110,000	35,553,054	3,121,455	87,777,254	13,340
Portfolio	2022	$77,945,000	75,539,167	7,457,923	236,025,273	22,897
	2023	$85,270,000	82,496,424	8,011,857	257,151,429	24,981
	2024	$93,775,000	88,769,714	8,501,520	279,737,016	27,447

Unitil

Sector	Year	Total Spend	Lifetime Therms	Lifetime MMBTU	Total Benefits	2030 Avoided CO2e (Metric Tons)
Residential	2022	$1,227,917	687,713.26	70,405	$2,168,340	215
	2023	$1,251,444	748,318.58	75,870	$2,358,188	230
	2024	$1,359,696	750,486.92	75,796	$2,387,648	232
Income Eligible	2022	$566,493	317,541.00	32,984	$1,720,248	84
	2023	$591,550	328,591.00	34,181	$1,788,364	87
	2024	$631,577	345,166.00	35,980	$1,893,537	92
C&I	2022	$523,806	780,159.37	78,089	$2,415,707	452
	2023	$578,316	915,508.11	91,630	$2,746,484	527
	2024	$658,268	952,095.88	95,295	$2,794,229	555
Portfolio	2022	$2,318,216	1,785,414	181,478	$6,304,295	752
	2023	$2,421,311	1,992,418	201,681	$6,893,036	844
	2024	$2,649,541	2,047,749	207,070	$7,075,414	879

Liberty

Sector	Year	Total Spend	Lifetime Therms	Lifetime MMBTU	Total Benefits	2030 Avoided CO2e (Metric Tons)
Residential	2022	$3,961,190	2,502,539	255,252	$8,216,897	783
	2023	$4,057,660	2,439,693	249,052	$8,177,232	753
	2024	$4,395,818	2,430,007	248,161	$8,201,542	753
Income Eligible	2022	$1,564,824	901,391	95,288	$4,821,221	232
	2023	$1,696,262	996,122	105,300	$5,424,450	257
	2024	$1,937,273	1,091,783	115,385	$6,106,726	283
C&I	2022	$1,151,873	1,696,138	169,614	$4,918,861	734
	2023	$1,185,086	1,829,721	183,030	$5,337,323	812
	2024	$1,231,425	1,955,568	195,614	$5,973,327	908
Portfolio	2022	$6,677,887	5,100,068	520,154	$17,956,979	1,749
	2023	$6,939,008	5,265,536	537,382	$18,939,005	1,822
	2024	$7,564,516	5,477,358	559,160	$20,281,595	1,944

Berkshire

Sector	Year	Total Spend	Lifetime Therms	Lifetime MMBTU	Total Benefits	2030 Avoided CO2e (Metric Tons)
Residential	2022	$3,120,082	2,270,791	230,986	$7,014,812	662
	2023	$2,950,739	2,174,163	220,978	$6,920,834	627
	2024	$2,940,935	2,091,131	212,571	$6,955,479	596
Income Eligible	2022	$1,533,816	920,321	94,414	$4,806,421	232
	2023	$1,488,170	919,075	94,368	$4,848,377	231
	2024	$1,505,111	930,125	95,552	$4,911,545	234
C&I	2022	$1,323,219	1,852,389	185,269	$7,017,431	719
	2023	$1,238,969	1,961,142	196,144	$6,996,727	792
	2024	$1,245,022	1,955,380	195,568	$6,648,423	887
Portfolio	2022	$5,977,117	5,043,500	510,669	$18,838,664	1,612
	2023	$5,677,878	5,054,380	511,491	$18,765,938	1,650
	2024	$5,691,068	4,976,636	503,691	$18,515,448	1,717

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Attachment B

Equity Framework and Targets

MA EEAC Equity Working Group
Equity Targets for 2022-2024 Three-Year Plan

The Massachusetts Energy Efficiency Advisory Council (EEAC) and Program Administrators (PAs) are committed to improving the equitable delivery of energy efficiency programs. In 2020, the EEAC established the Equity Working Group (EWG) to focus attention on customer groups identified through analysis of nonparticipants. Based on this evaluation research, the EEAC identified underservice to moderate-income customers, renters and landlords, households with a primary language other than English, and small businesses when compared to other program participants. The EWG agrees that it should be priority of the Mass Save® programs to remedy past underservice in order to ensure program equity moving forward. The EWG also recognizes that equitable decarbonization also prevents customers and communities historically underserved from being further left behind.

The EWG is comprised of voting EEAC Councilors, representatives of the PAs and the Low-Income Energy Affordability Network (LEAN), representatives of environmental justice organizations, and the EEAC Consultants. (Appendix A provides the EWG membership with affiliations.) The EWG has worked collaboratively with stakeholders and other members of the public who have called for more equitable delivery of services over the years.

The EWG has developed the following targets for the consideration of the full EEAC in order to guide investments in equity and assess performance in the 2022-2024 Energy Efficiency Plan. The EWG understands that the framework that is crafted today, at the beginning of this important journey for a new three-year plan, is a starting point. As the EEAC learns throughout the implementation process, it may find that metrics will need to change over time. All members of the EWG have agreed, through a consensus-based discussion, to these targets.

Principles

- Targets are results-oriented and time-bound.
- Targets are established statewide except for EJ Communities, which are established individually for each PA.
- PAs will report on equity efforts in quarterly report narratives.
- Targets are year-over-year unless otherwise stated. When performance in an early year exceeds a percent increase goal, baseline will not change, and overage can count toward later year targets.
- Participants can and should be counted in as many customer segments as appropriate (e.g., a moderate-income renter household will show up in participant counts for both moderate-income and renter).
- “Environmental Justice Municipalities” will be defined for the purposes of this framework as: [PA-served communities where (1) greater than 33% of the population resides in an environmental justice block group and the municipality (as a whole) meets the EJ municipality’s income criteria and at least one additional criterion (e.g., minority or English isolation) (based on 2020 data posted at state website); and (2) consumption weighted participation rate from the Residential Non-Participant Customer Profile Study does not exceed 30%]. The list of Environmental Justice Municipalities is set forth at Appendix B.

EJ Municipalities

- Increase Plan over Plan investment[1] by each PA in Environmental Justice Municipalities. Percent increases will be established for each PA and each sector separately.[2]
- Increase number of participants in Environmental Justice Municipalities Plan over Plan by a percent to be set for each PA individually.
- Baselines to be established using 2019-2021 actual data normalized with the 2022-2024 BCR model with lighting removed from the baseline and actuals.
- Data to be reported annually in the Q4 report.

Workforce

- Conduct EM&V study and share initial results in 2022 to analyze whether and to what extent substantial disparities exist between the availability and PA utilization of state-certified minority and woman-owned business enterprises (M/WBE) in procurement for lead vendors and subcontractors by the PAs (statewide and individually) related to energy efficiency programs and services, including actionable recommendations for how to increase both the availability and PA utilization.
- Over the three-year term, at least 120 people will complete training and be placed in relevant industry positions through Clean Energy Pathways, with at least 90 people being Women, Black, Indigenous, or People of Color, fluent in language(s) other than English, and/or from EJ block groups at time of enrollment. PAs will emphasize the value of retention to the measurable success of Clean Energy Pathways and will study success in achieving retention in both training and job placement in the evaluation of the program.
- PAs will track and report annually on the number of M/WBEs contracts and spend for contracts that are directly between PAs and vendors that are M/WBEs and also report total number and spend of all direct contracts.
- PAs will hold at least two workshops per year for contractors to provide education on PA programs in order to increase ability of new M/WBE vendors to participate; PAs to target advertising for the workshop to likely M/WBE contractors.
- At least once per year, the PAs will perform direct targeted outreach to all Massachusetts-certified M/WBEs listed in the Massachusetts Supplier Diversity Office's Directory of Certified Businesses with a Description of Services that indicates that they provide services or equipment that are likely eligible for Mass Save contracts, subcontracts, or incentives. A description of the outreach methods and number and types of businesses contacted will be reported annually in the Q4 report.

Partnerships

- Partnerships with municipalities, community organizations, or business associations will be established in at least 75% of Environmental Justice Municipalities. These partnerships may be

[1] "Plan over Plan" is 2019-2021 compared to 2022-2024. "Investment" is defined as incentives and money spent for Clean Energy Pathways internships, Municipal Partners, targeted marketing, and other direct/geographically targeted investments.

[2] PAs will gather and report data on 2019-2021 EJ investment by PA and by sector by the end of Q1 in 2022. Percent increases will be established by the EEAC and PAs by the end of Q2 in 2022.

formal "Municipal and Community Partnership" arrangements or other partnerships[3] outside of that program that aim to improve service to one or more of the identified underserved customer groups.

- Track and report annually the number of customer accounts participating and units served in the PA programs in the established Municipal and Community Partnerships municipalities, broken out and reported by sector and by renters, moderate-income qualified, English-isolated customers, and small business turnkey.
- Track and report annually the number of outreach activities (marketing campaigns, events, community engagements, etc.) initiated and completed by Municipal and Community Partner for each underserved customer segment focused on by each Partner (renter, moderate-income, English-isolated, and small/microbusiness).
- Track and report annually the level of program investment (award amount) for each Partnership Team and which segments each Partnership Team is focusing their efforts on.

Renters

- Increase renter unit participation by 24% from 2021 to 2024, achieved as an increase of 7% in 2022, 7.5% in 2023, and 8% in 2023 in RCD (baseline to be established using 2021 actual data normalized with the 2022-2024 BCR model). PAs will prepare a strategic plan with detailed examples of how the PAs will serve renters, with a draft by the end of Q2 2022, and a final by the end of Q3 2022.
- Increase number of renter units served in attached low-rise buildings by at least 16% from 2022 to 2024, achieved as an increase of 8% year over year for both Residential RCD and Income Eligible Coordinated Delivery, which shall be reported separately (2022 to be baseline year). Report separately the number of attached low-rise projects that are 25+ units.
- Data to be reported twice each year.

Moderate Income

- Increase number of moderate-income weatherization jobs by 700% from baseline to 2024, achieved as an increase of 100% year over year (baseline to be established using 2019 actual data).
- Increase number of moderate-income heating systems replaced by 56% from 2022 to 2024, achieved as an increase of 25% year over year (2022 to be baseline year).
- Data to be reported quarterly.

English Isolated[4]

- Increase number of participants who receive a Home Energy Assessment (HEA) in Residential Coordinated Delivery or online assessment, or energy assessment in Income Eligible Coordinated Delivery, in Spanish or Portuguese by 21% from 2022 to 2024, achieved as an

[3] Partnerships may include municipalities or regional or community-based organizations with which the PAs have established cooperative agreements to collaborate, including through memorandums of understanding and/or memorandums of agreement. Partnerships are also intended to focus on increasing energy efficiency services, including K-12 and vocational education, electrification, and energy burden reduction, as identified by and targeted toward historically underserved populations.

[4] Defined as households in which no one 14 and over speaks English only or speaks a language other than English at home and speaks English very well.

increase of 10% year over year in Residential and Income Eligible sectors, which sectors shall be reported separately (2022 to be baseline year). Data to be reported twice each year.

- Increase by 10% from 2022 to 2024, achieved as an increase of 5% year over year the number of participants who receive weatherization after receiving an HEA in Residential Coordinated Delivery or energy assessment in Income Eligible Coordinated Delivery in Spanish or Portuguese (2022 to be baseline year). Data to be reported twice each year.
- A Mass Save Language Access Plan will be developed, with analysis completed in 2022 for Residential Coordinated Delivery and Income Eligible Coordinated Delivery, and implementation commencing by the end of the second quarter of 2023. The full Language Access Plan will be completed by the end of Q1 2024. The Plan will address how customers are to be served in their preferred language, and will coordinate PA language resources to allow PAs, lead vendors, contractors, and suppliers to access needed translation and interpretation services.
- By the end of 2024, the PAs will be able to offer Home Energy Assessments (either performed by a fluent contractor or with an interpreter) in five languages other than English, which are currently expected to be Spanish, Portuguese, Mandarin, Cantonese, and Haitian Creole.

Small Business

- Complete 600 small business weatherization projects in 2022, 700 in 2023, and 800 in 2024.
- By 2024, complete a repeat of the C&I 2020 nonparticipant study to analyze participation rates of small and microbusinesses (including small nonprofit organizations) and study barriers to participation. Comparing results of the 2020 and the 2024 studies, increase the percentage of population savings achieved (combined for electric and gas) for non-lighting end uses among microbusinesses by 5%.

Appendix A: MA EEAC Equity Working Group Members, with Affiliations

Name	Position
Maggie McCarey	DOER
Alexis Washburn	DOER
Cindy Arcate	Representing Massachusetts Non-Profits
Charlie Harak	Representing Organized Labor
Cammy Peterson (Chair)	Representing Commonwealth Cities & Towns
Mary Wambui (Chair)	Representing Residential Consumers
Jo Ann Bodemer	AGO
Amanda Formica	National Grid
Ruth Georges	Eversource
Stephanie Terach	Liberty Utilities
Margaret Downey	Cape Light Compact
Brian Beote	Action Inc.
James Collins	ABCD
Elizabeth Chant	EEAC Consultant
Margie Lynch	EEAC Consultant
Crystal Johnson	EEAC Consultant
Eugenia Gibbons	Healthcare Without Harm/Green Justice Coalition
Caitlin Peale Sloan	Conservation Law Foundation
Andrew Yarrows	Conservation Law Foundation
Cindy Luppi	Clean Water Action/Green Justice Coalition

Appendix B: Environmental Justice Municipalities

- Attleboro
- Boston (select zip codes, see below)
    - Allston 02134
    - Brighton 02135
    - Dorchester 02121
    - Dorchester 02122
    - Dorchester 02124
    - Dorchester 02125
    - East Boston 02128
    - Fenway/Longwood 02115
    - Mattapan 02126
    - Mission Hill 02120
    - Roxbury 02119
- Brockton
- Chelsea
- Chicopee
- Eastham
- Everett
- Fall River
- Fitchburg
- Gardner
- Gloucester
- Great Barrington
- Haverhill
- Holbrook
- Lawrence
- Lowell
- Lynn
- Malden
- Methuen
- Montague
- New Bedford
- North Adams
- Northampton
- Palmer
- Peabody
- Pittsfield
- Quincy
- Randolph
- Revere
- Southbridge
- Springfield
- Stoughton
- Taunton
- Wareham
- Webster
- West Springfield
- Williamstown
- Worcester

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Attachment C

Equity Budget Summary

Equity Investments 2022-2024 10/4/2021			
Metric	Investments**	Net Lifetime MMBtu Savings	Participants
Moderate Income*	$ 136,074,730	8,769,488	19,085.00
Renters and Landlords*	$ 44,306,061	4,016,133	27,412.00
Income Eligible Renters & Landlords	$ 208,238,560	11,221,235	87,351.38
Language Isolated Customers***	$ 9,141,743	N/A	N/A
Small Businesses	$ 185,108,288	10,722,738	17,574.00
Pre-weatherization barriers, MR	$ 22,965,893	N/A	N/A
Pre-weatherization barriers, IE	$ 6,331,445	N/A	N/A
Partnerships	$ 6,300,000	N/A	20+ teams across 30+ municipalities
Workforce Development	$ 49,585,533	N/A	N/A
Total	$ 668,052,254	34,729,594	151,422

* There will be some overlap of Moderate Income and renter/landlord and Pre-Wx incentives.

** Investments above are Incentive spending except for Partnerships and WFD.

*** Includes projected marketing spend, language access plan, and costs associated with interpretation services for customers

**** Includes 20 teams across 30+ municipalities.

Attachment D

Evaluation Policy Memorandum

EM&V Policy Memo 10-21-21

The following items memorialize the understanding between DOER, the Attorney General, the PAs, and EEAC Consultants (hereafter, "the parties") regarding evaluation policy issues as part of term sheet negotiations for the 2022-2024 plan.

1. Market Effects

i. To account for the planned substantial investment in heat pump market transformation in the 2022-2024 term, the Plan includes a 22% market effects factor, which is based on an evaluated spillover value from heat pump fuel displacement, for all market rate residential electrification measures in both electric and gas programs. This includes:
   1. Minisplit heat pumps
   2. Central heat pumps
   3. Air to water heat pumps
   4. Ground source heat pumps

ii. The market effects factor for income-eligible will include a 10% market effects factor, which is based on the evaluated contractor spillover value from evaluation research,

iii. In addition, the Plan also includes a 22% market effects factor for C&I prescriptive electrification installing small C&I heat pumps, specifically ducted and ductless heat pumps <5.4 tons replacing oil and propane heating and water heating equipment.

iv. For C&I prescriptive electrification installing large heat pumps (≥5.4 tons) as well as C&I custom electrification, including VRF measures, the Plan includes a 10% market effects factor, which is based on the evaluated contractor spillover value from evaluation research.

v. The market effects factor would only be counted if at least 50% of the agreed-upon annual goals as described in the term sheet are met (the 50% volume thresholds for residential and income-eligible, and 50% threshold for C&I based on MMBtu.) The PAs would claim the market effect savings in each Annual Report, with a "true up" at the end of the term, based upon aggregate performance over the combined three years of the 2022-2024 Plan term. For example, if the PAs do not meet the 50% threshold in one year, but far exceeded it in other years, so that the 50% threshold is met for the term, then no adjustment would be needed in the Term Report. If the PAs meet the threshold in one year, but not the other two, such that they do not meet the 50% threshold for the term, then the PAs would give back the savings for the one year they met the threshold.

vi. The market effects factor alone (no free ridership) would be counted for the purpose of GHG because market effects from PA efforts in 2022–2024 are expected to result in the adoption of heat pumps outside of the PA programs that contribute to gross GHG goals and would not be accounted for elsewhere. For the purpose of performance incentives, spillover and free ridership would be included as part of the typical net savings calculations.

vii. The PAs will evaluate market effects this term, and those evaluation findings will be used to claim market effects savings starting in 2025. This rigorous evaluation of market effects that accrue over the long term will include:
   1. Studying barriers to heat pump adoption.
   2. Establishing and documenting a program theory for the PA's market transformation efforts, including key indicators that would be expected to change as the market transforms.

3. Gathering baseline information for key indicators of market transformation starting in 2022 and measuring them over time to understand the extent of market transformation the PAs are generating.
4. Adapting program strategies to address evaluation findings during the term PAs.

The PAs will include an initial market transformation plan and brief description of their initial program theory in the planned narrative submitted on November 1, 2021.

2. Fuel switching baselines

2A. Baselines for fuel switching in existing buildings (i.e., custom retrofit fuel switching)

For custom retrofit projects, the parties agree that the baseline fuel should be the preexisting fuel.

With regard to the type of equipment assumed to be the baseline for custom retrofit projects, the parties agree that fossil fuel to electric heat pump switching occurring under the C&I Existing Building Retrofit initiative and supplanting all or part of both existing heating and cooling services to the affected loads will use the existing heating and cooling system types in establishing baseline energy use. This applies to both end of life and early retirement measures. Evaluation will assess system baselines for heat pump impacts covered by this agreement, and relevant evaluation findings will be used to inform baseline assumptions for future plans. C&I heat pump baselines not explicitly covered by this agreement will be determined using existing EM&V frameworks and practices and applied to the following program year as with other impact parameters.

Regarding assumptions for the efficiency of baseline equipment, the parties agree that custom fuel switching retrofit projects will use a single existing efficiency baseline *if* PAs confirm that the replaced equipment was operational at the time of replacement and an independent agency (e.g., a TA vendor) provides qualitative statement about the operation/condition of the equipment which supports the claim that the customer would have continued to use this equipment for the foreseeable future. This statement would be based on a site visit and discussion with facilities personnel, visual inspection of equipment, and maintenance logs (if available).

2B. Baselines for fuel switching in C&I new construction

The parties agree to use following guidelines for fuel switching C&I new construction projects[1]:

a) Use a gas baseline for customers with gas service available, and a delivered fuel (propane) baseline for customers who do not have gas service available. In this case, the PAs propose defining gas service as being "available" for a new building if the nearest neighboring building has gas service (or within 100 feet of property line).
b) Agree that evaluation will not overturn the fuel type of a baseline in the future.
c) Apply a NTG value to fuel switching savings in the model to account for those customers who would have installed a heat pump on their own, without program influence. These customers exist and must be accounted for in the savings claimed by PAs. Since there isn't currently an evaluated value for C&I electrification NTG, the parties agree to use a negotiated value for 2022,

[1] This proposal is not intended to waive any PA argument presented to and pending before the Department of Public Utilities in D.P.U. 16-169.

and conduct a study during that year to arrive at a researched NTG value or values for the remainder of the Plan term.

3. BERDO and other Local Energy Initiatives

As cities and towns have increasingly adopted more stringent energy polices, a primary driver of adoption of these policies is access to EE incentives and, more generally, PA program support of these municipalities and customers in these jurisdictions. Municipalities depend on PA incentives to help customers meet the higher efficiency levels they strive for. Stakeholders expect customers subject to the Boston Building Energy Reporting and Disclosure Ordinance (BERDO) and other local energy initiatives would continue to have access to Mass Save technical assistance, vendors, incentives, etc., as a path to complying with these standards.

Given this context, the parties agree that the PAs should be able to serve customers in areas with BERDO and the parties agree to apply this concept to other similar municipal ordinances. The parties also agree to work together to determine how to apply this concept in practice.

Issue 4: Application of C&I new construction industry standard practice (ISP) baselines

The parties agree that new construction whole building projects be evaluated against the baselines that were in effect at the time of project initiation. Project initiation is defined as the earliest of the following milestones that could occur, depending on the project and PA: 1) Memorandum of Understanding date; 2) Engineering Service Agreement date; 3) Signing of any application; 4) Signing of a registration form. Under this policy, all new projects would incorporate the most up-to-date ISP baselines available at the time of project initiation. Those baselines will be considered locked at project initiation from an evaluation perspective. Therefore, realization rates will account for errors in baseline choice or discrepancies/errors in savings assumptions, but they will not retrospectively apply impacts from new ISP baselines to older projects. Instead, the programs will ensure on the front end that all new projects use the most updated baselines available. For projects that were initiated under a retrospective framework (prior to 2022) but close under a prospective framework (2022 and later), the PAs propose using the same prospective evaluation treatment and holding these projects accountable in evaluation to the baselines that were in place at the time of project initiation.

Final Approved Version
October 25, 2021

Attachment E

Performance Incentives for 2022-2024

mass save

MASSACHUSETTS JOINT STATEWIDE ELECTRIC & GAS

2022-24 Performance Incentive Discussion

October 24, 2021

WE ARE MASS SAVE®:

BERKSHIRE GAS An AVANGRID Company

Cape Light Compact

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Summary of PI Mechanism

- Mechanism includes three components based on benefits and is aligned with the priorities set forth in the 2022-2024 Plan:
  - 1) Equity Component
  - 2) Electrification Component
  - 3) Standard Component
- Each component has its own, distinct threshold and design levels
- Equity & Electrification components are not capped, subject to total/portfolio PI capped at 125% of planned
- Standard component achievement > 125% cannot contribute to portfolio max until Equity & Electrification thresholds met
- Equity & Electrification payout rates higher than Standard payout rate
- Discontinuation of Value Component and Targeted Active Demand Savings Component from 2019-2021 PI Mechanism
- $170m statewide pool ($131.8m electric, $38.2m gas)

Summary of PI Components

Component	What's Included	Threshold	Design	Cap
Equity	Benefits achieved in specific EJ communities and selected Boston zip codes (not including large C&I) and for moderate income customers statewide, including from electrification Equity benefits for Res/IE to be at least 25% of Res/IE portfolio benefits for electric and 45% for gas by 2024	85%	100%	N/A
Electrification	Benefits from electrification measures that are not in EJ communities or not for moderate income customers statewide	60%	100%	N/A
Standard	Benefits achieved in the rest of the service territories that are not counted in the two benefits components above	75% threshold of standard component or meeting weighted average portfolio threshold	100%	125% of standard EE until equity & electrification thresholds are met
Portfolio	All program benefits, with the exception of MAC benefits from fossil fuel systems, are eligible to earn PI in one (and only one) of the above PI components	Weighted Avg Threshold of 73% elec / 77% for gas *	100%	125%

There may be slight shifts in these percentages as numbers are updated to reflect final agreement/term sheet

Components - Detailed

- **Equity Component**
  - 85% threshold, tied to proposed growth rates to ensure that threshold represents increase over baseline benefits
  - Based on activity 1) occurring in agreed upon subset of agreed on EJ communities & Boston zip codes and 2) through the moderate income offering
  - Includes C&I Turnkey, Residential End Use, Midstream measures – excludes other C&I
  - Includes electrification measures in EJ communities & for moderate income participants
  - Includes fossil fuel measures in EJ communities & moderate income participants
  - Excludes any lighting delivered to renters & moderate income participants
  - Excludes benefits associated with the MAC on fossil fuel systems
  - Enhanced payout rate relative to Standard component

- **Electrification Component**
  - 60% threshold
  - All electrification measures less those that occur in the designated EJ communities and moderate income participants
  - Enhanced payout rate relative to Standard component

- **Standard Component**
  - 75% threshold of standard component **or** meeting weighted average portfolio threshold
  - All other residential and income eligible measures not already counted in the Equity or Electrification components
  - All C&I measures not already counted in the Equity or Electrification Components
  - Excludes benefits associated with the MAC on fossil fuel systems

- **Summary**
  - All program benefits, with the exception of MAC benefits from fossil fuel systems, are eligible to earn PI in one (and only one) of the above PI components

Payout Rates

ELECTRIC PI 2022-2024*					
Component	**Statewide Benefits (No CLC)**	**% of Total**	**Statewide PI Pool**	**PI as % of Pool**	**Payout Rates**
Equity	$1.4B	16.2%	$23.7m	17.9%	$0.0172
Electrification	$2.2B	25.9%	$37.8m	28.7%	$0.0172
Standard	$4.9B	57.8%	$70.38m	53.3%	$0.0143
Total	$8.5B		$131.8m		

GAS PI 2022-2024*					
Component	**Statewide Benefits**	**% of Total**	**Statewide PI Pool**	**PI as % of Pool**	**Payout Rates**
Equity	$1.1B	28.8%	$14.1m	36.9%	$0.0126
Electrification**	$0.3B	8.7%	$4.2m	11.1%	$0.0126
Standard	$2.4B	62.5%	$19.8m	51.9%	$0.0081
Total	$3.9B		$38.2m		

*There may be slight shifts in these totals and payout rates as numbers are updated to reflect final agreement/term sheet
**PAs are specifically looking into gas electrification to QC; current estimates look too high

Sample Electric Scenarios

	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	100%	$	17.67	equity threshold met
Electrification	100%	$	27.76	electrification threshold met
Standard	100%	$	54.57	standard threshold met
Portfolio	100%	$	100.00	hitting 100% of total benefits yields 100% PI
	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	85%	$	15.02	equity threshold met
Electrification	60%	$	16.66	electrification threshold met
Standard	125%	$	68.21	standard threshold met
Portfolio	102%	$	99.89	hitting 102% of total benefits yields 100% PI
	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	85%	$	15.02	equity threshold met
Electrification	60%	$	16.66	electrification threshold met
Standard	171%	$	93.32	standard threshold met
Portfolio	130%	$	125.00	hitting 130% of total benefits yields 125% PI
	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	130%	$	22.98	equity threshold met; no cap applied on equity
Electrification	60%	$	16.66	electrification threshold met
Standard	70%	$	38.20	standard threshold not met, but portfolio threshold met
Portfolio	77%	$	77.83	hitting 77% of total benefits yields 78% PI

Sample Electric Scenarios

	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	75%	$	-	equity threshold not met
Electrification	65%	$	18.04	electrification threshold met
Standard	130%	$	68.21	standard component capped at 125% since equity threshold not met
Portfolio	105%	$	86.25	hitting 105% of total benefits yields 86% PI
	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	75%	$	-	equity threshold not met
Electrification	55%	$	-	electrification threshold not met
Standard	130%	$	68.21	standard component capped at 125% since equity threshold not met
Portfolio	102%	$	68.21	hitting 100% of total benefits yields 68% PI
	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	75%	$	-	equity threshold not met
Electrification	80%	$	22.21	electrification threshold met
Standard	70%	$	38.20	standard component not met, portfolio threshold met
Portfolio	73%	$	60.40	hitting 73% of total benefits yields 60% PI

Sample Gas Scenarios

	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	100%	$	33.24	equity threshold met
Electrification	100%	$	6.16	electrification threshold met
Standard	100%	$	60.60	standard threshold met
Portfolio	100%	$	100.00	hitting 100% of total benefits yields 100% PI
	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	85%	$	28.25	equity threshold met
Electrification	60%	$	3.69	electrification threshold met
Standard	125%	$	75.75	standard threshold met
Portfolio	110%	$	107.70	hitting 110% of total benefits yields 108% PI
	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	85%	$	28.25	equity threshold met
Electrification	60%	$	3.69	electrification threshold met
Standard	155%	$	93.67	standard threshold met
Portfolio	129%	$	125.62	hitting 129% of total benefits yields 126% PI
	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	130%	$	43.21	equity threshold met; no cap applied on equity
Electrification	60%	$	3.69	electrification threshold met
Standard	70%	$	42.42	standard threshold not met, but portfolio threshold met
Portfolio	87%	$	89.33	hitting 87% of total benefits yields 89% PI

Sample Gas Scenarios

	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	75%	$	-	equity threshold not met
Electrification	65%	$	4.00	electrification threshold met
Standard	130%	$	75.75	standard component capped at 125% since equity threshold not met
Portfolio	110%	$	79.76	hitting 110% of total benefits yields 80% PI
	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	75%	$	-	equity threshold not met
Electrification	45%	$	-	electrification threshold not met
Standard	130%	$	75.75	standard component capped at 125% since equity threshold not met
Portfolio	109%	$	75.75	hitting 109% of total benefits yields 76% PI
	% of benefits achieved	PI earned (illustrative design pool of $100)		
Equity	80%	$	-	equity threshold not met
Electrification	100%	$	6.16	electrification threshold met
Standard	73%	$	44.24	standard component not met, portfolio threshold met
Portfolio	77%	$	50.40	hitting 77% of total benefits yields 50% PI

Thank you

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APPENDIX N: COUNCIL'S RESOLUTION OF OCTOBER 27, 2021

Massachusetts Energy Efficiency Advisory Council
Resolution Regarding the 2022-2024 Massachusetts Joint Statewide Three-Year Electric and Gas Energy Efficiency Investment Plans

October 27, 2021

BE IT RESOLVED THAT:

Pursuant to G.L. c 25, §21, the Energy Efficiency Advisory Council (Council or EEAC) presents the following comments to the Department of Public Utilities (DPU) regarding the 2022-2024 Massachusetts Joint Statewide Three-Year Electric and Gas Energy Efficiency Investment Plans. The Green Communities Act, as set forth in G.L. c 25, §21, directs the Council to review the draft 2022-2024 Massachusetts Joint Statewide Three-Year Electric and Gas Energy Efficiency Plans (Statewide Plans) submitted to the Council on April 30th by the Program Administrators (PAs) (April Draft Plan). The PAs are then directed to incorporate any changes or revisions to reflect the input of the Council into their submittal of the Statewide Plans to the DPU on or before October 31, 2021.

On March 26, 2021, Governor Charlie Baker signed into law *An Act Creating a Next-Generation Roadmap For Massachusetts Climate Policy* (the Climate Act) which codified the Baker-Polito Administration's commitment to achieve Net Zero emissions by 2050 and furthers the Commonwealth's nation-leading efforts to combat climate change and protect vulnerable communities. The Climate Act made significant changes to the Green Communities Act and the Global Warming Solutions Act (the GWSA) including requiring the Secretary of Energy and Environmental Affairs (EEA) to set a goal, expressed in tons of carbon dioxide equivalent, every three years for the succeeding Statewide Plans' necessary contribution to meeting each statewide greenhouse gas (GHG) limit and sublimit adopted under the GWSA. On July 15, 2021, EEA Secretary Kathleen Theoharides submitted a letter to the PAs detailing the GHG reduction goals for the 2022-2024 Statewide Plans.[1] Since these new GHG reduction goals were issued after the April Draft Plan, the PAs revised the Statewide Plans to meet these new GHG reduction goals (October Draft Plan).

In developing its input on the 2022-2024 Statewide Plans, the Council undertook a comprehensive stakeholder engagement process, starting with six planning workshops as well as six public comment sessions between October 7, 2020 and January 20, 2021. The planning workshops featured in-depth discussion between the Council, PAs and the EEAC Consultants. In addition, the public comment sessions highlighted stakeholder priorities for the 2022-2024 Statewide Plans. The Council also established an Equity Working Group in early 2020, specifically to address issues of equity in the delivery of energy efficiency programs. The workshops and public comment sessions informed the Council's March 24, 2021 resolution[2] that set forth Council priorities and recommendations for the Statewide Plans, with the highest priorities being electrification and GHG reductions, equity, and workforce development. Lastly, three additional public comment sessions were held in June 2021 to receive stakeholder feedback on the April Draft Plan.

The Council detailed its comments, including the Equity Working Group recommendations, on the April Draft Plan in its July 28, 2021 EEAC resolution to the PAs.[3] The Council was pleased the PAs adopted electrification, equity, and workforce development as key priorities and themes of the narrative. However, the Council noted, in part, that the April Draft Plan lacked detail on program design and evidence of the Council priorities reflected in the proposed budgets, savings goals and benefit cost models. With regard to

[1] https://ma-eeac.org/wp-content/uploads/2021-07-15-Mass-Save-GHG-Goal.pdf
[2] https://ma-eeac.org/wp-content/uploads/FINAL-EEAC-Priorities-Resolution_Adopted-3.24.2021.pdf
[3] https://ma-eeac.org/wp-content/uploads/FINAL-July-Resolution_Adopted-7.28.21.pdf

equity, the Council noted that the April Draft Plan lacked necessary programmatic details and specific budget commitments. [4]

On September 17, 2021 the PAs submitted updated data tables and a presentation of program enhancements that reflected changes to the April Draft Plan, and on October 6, 2021, the PAs submitted an updated Plan narrative (collectively, October Draft Plan). The Council offers its comments based on the October Draft Plan, with the expectation that the PAs will file final Statewide Plans with DPU on November 1, 2021 that are fully consistent with the content of these materials provided to the Council throughout October:

1. Draft joint statewide plans dated October 6, 2021;
2. Term Sheet dated October 25, 2021; and
3. Revised data tables dated October 25, 2021

Overall Plan Comments

The Council recognizes and appreciates the significant contributions of PA staff, the Council consultant team, the Equity Working Group, Councilors, the Low-Income Energy Affordability Network (LEAN) and stakeholders in preparing the energy efficiency plans. The development of the 2022-2024 Statewide Plans represents a transformation of energy efficiency programs in Massachusetts to better align with the Commonwealth's greenhouse gas and environmental justice goals. The Council commends the prioritization of electrification, deeper building retrofits, increased weatherization goals and incentives, workforce development and enhancing support for historically underserved communities and customers. The Council also commends the PAs on their efforts between the April Draft and the October Draft Plan to reorient and expand the Plans to achieve EEA Secretary Theoharides' GHG emissions reduction goals for the 2022-2024 term. The development of the 2022-2024 Statewide Plans reflects significant collaboration across PAs and among members of the Council, DOER, the AGO, and stakeholders. These comments of the Council are based on its review of the October Draft Plan:

- The Council supports the proposed $3.94 Billion investment to deliver $13 Billion in benefits to ratepayers.
- The Council supports the greenhouse gas and energy savings goals in alignment with the Term Sheet. This includes achieving the aggregate electric and gas combined goals, with at least 94% of the Secretary's electric goal. The remaining 6% of the electric goal will be met through overachieving on the gas goal and, specifically through conversions of natural gas equipment to highly efficient electric equipment.
- The Council commends the PAs on their collaboration with the EWG throughout the planning process and supports the equity goals set forth in the October Draft Plan as a first step in the equitable delivery of energy efficiency in the Commonwealth. The Council looks forward to regular updates and reporting on the PA commitments to increase investments in EJ municipalities and more equitably serve historically underserved populations. The Council expects the PAs to continue to engage with the EWG during development of new initiatives and design and implementation of EWG recommendations as well as Plan implementation, with a focus in 2022 on strategic and innovative renter/landlord engagement and moderate-income program design.
- The Council acknowledges the PAs proposed increase in workforce development investments for the 2022-2024 Plan term and emphasizes the importance of equitably growing the workforce to achieve the Commonwealth's climate goals, continuing to increase the PAs' equitable workforce development investments, and coordinating with the Massachusetts Clean Energy Center to maximize our collective interests.

[4] https://ma-eeac.org/wp-content/uploads/FINAL-July-Resolution_Adopted-7.28.21.pdf

- Additional, non-ratepayer funding will be an essential tool in 2022-2024 to reduce or offset costs to electric and gas customers. The Council agrees to support the PAs in identifying and seeking out those additional funding sources.
- The Council expects that the individual PA Plans will remain fully consistent with the October Draft Plan.
- The Council recognizes that performance incentives are an integral part of the planning and implementation of the energy efficiency programs. The Council accepts, consistent with the DPU's Energy Efficiency Guidelines at Section 3.6, the performance incentives set forth in the October Draft Plan. The new performance incentive mechanism includes components and individual thresholds for core energy efficiency, energy efficiency and electrification for EJ municipalities, and electrification. The Council also accepts the removal of the value component in the 2022-2024 Plan Term to ensure the PI mechanism is fully aligned with the EEAC's equity, electrification, and workforce development priorities.
- The Council, Council consultants, and PAs will continue to work collaboratively and transparently throughout the three-year roll-out of the individual Plans, in accordance with the GCA, through continued quarterly reports, monthly data dashboards, and specific updates at Council meetings that focus on topics requested by the Council. We expect the PAs to consistently engage with the Council and its consultants proactively to analyze new lessons learned (especially around equity, workforce development and electrification), develop adjustments, and put them into practice. The Council also looks forward to engagement and updates on the newly formed Commercial and Industrial Customer Working Group starting in 2022.

Council Comment on Priorities

In its March Resolution, the Council set specific priorities for the 2022-2024 Plan that support continued robust energy efficiency and GHG mitigation, while ensuring that goals are met equitably and cost-effectively.[5] The Council urged the PAs to develop a plan that includes aggressive GHG emissions reductions to support the Commonwealth's goals, through a strong focus on weatherization and electrification, with significant expansion of heat pump targets, and investments in market transformation and workforce development. The Council also indicated that the Final Plan should include a strong commitment and investment in equitable program delivery by increasing participation from renters/landlords, moderate-income customers, language-isolated customers, Environmental Justice (EJ) municipalities, and small businesses. The Council requested that the Final Plans, both narrative and data, support these three foundational principles of GHG emissions reductions, equitable program delivery, and workforce development. The Council provides its comments on these priorities below.

Greenhouse Gas Emissions Reductions

Throughout the 2022-2024 Three-Year planning process, including ambitious GHG emissions reductions has been a top priority of the Council. Specifically, the Council urged the PAs to align the Plan with the Commonwealth's GHG reduction goals through a strong focus on weatherization and electrification, with a significant expansion of the heat pump targets, focus on deep retrofits, reduction in incentives for fossil fuel equipment, and an investment in market transformation and workforce development. This priority was underscored by the Climate Act and formalized by Secretary Theoharides' letter setting GHG reduction goals for the 2022-2024 Plan.

The Council acknowledges and appreciates the PAs' efforts to meet the Secretary's GHG goal to ensure 2022-2024 investments are aligned with the Commonwealth's GHG goals. The Council also recognizes the increased commitment to electrification and weatherization in the October Draft Plan. Based on the

[5] https://ma-eeac.org/wp-content/uploads/FINAL-EEAC-Priorities-Resolution_Adopted-3.24.2021.pdf

October data, and in alignment with the Term Sheet, the Council supports the PAs GHG goals and commends the following commitments:

- Commitment to heat pump installations with:
  - Electric Plan: Approximately 54,000 planned in the Residential sector, 6,650 in the Income Eligible sector and 34.1 million square feet in Commercial & Industrial (C&I) sector.
  - Gas Plan: Approximately 1,700 planned in the residential sector and 18.5 million square feet in the C&I sector.
- Increase commitment to weatherization.
  - Residential Electric: $257,216,800
  - Income Eligible Electric: $39,816,337
  - Residential Gas: $275,596,773
  - Income Eligible Gas: $66,684,898
- Addition of an affordable housing multi-family decarbonization retrofit program and C&I deep energy retrofit offering to be launched in 2022.
- Commitment to adding all-electric new construction offerings in both residential and C&I sectors.

Equity

Since the early stages of the planning process for the 2019-2021 term, it has been a priority of the Council to increase participation by, and savings from, historically underserved populations. The Council chose equity as a priority in an effort to respond to stakeholders and results of the non-participant study completed in 2019. Two non-participant studies completed in 2020 analyzed existing data and collected new data to evaluate participation levels and potential unaddressed barriers for residential customers.[6] This effort was part of a special focus on renters, moderate income, and English-isolated customers. The studies confirmed that certain identifiable populations participate at lower rates compared to other populations. For the last year and a half, the EWG has worked to receive feedback and develop solutions to the unique barriers that hinder moderate-income customers, renters and landlords, English-isolated populations, and small businesses from fully participating in programs and accessing all program benefits.[7]

Through its efforts, the EWG has worked collaboratively with the PAs and stakeholders representing Environmental Justice (EJ) communities to develop comprehensive recommendations that seek to address lower than average participation from these key customer groups. The EWG commends the progress that the PAs have made since their April Draft Plan to include more of these recommendations. The EWG would also like to recognize the effort the PAs have made to provide more detailed commitments regarding the equity-specific investments they will be making over the next three years. Undergirding these investments is the creation of a new performance incentive mechanism that focuses on accruing greater program benefits in 38 cities and towns which have higher numbers of EJ populations and lower energy efficiency program participation. With this new performance incentive mechanism, the PAs will be incentivized to significantly increase investments in EJ municipalities and underserved populations. The EWG expects investments in EJ municipalities to increase at a minimum 30% over current baselines. The EWG agrees that greater benefits delivered to these communities and residents are necessary not only to better reach those who have been historically underserved, but also to address inequities accrued over many years. To track progress towards these goals and as further described below, the EWG has collaborated with the PAs to develop equity-specific targets, with metrics for each of the underserved

[6] https://ma-eeac.org/wp-content/uploads/MA19R04-A-NP-Nonpart-MarketBarriersStudy_Final.pdf and https://ma-eeac.org/wp-content/uploads/MA19X06-B-RESNONPART_Report_FINAL_v20200228.pdf

[7] Separately a C&I non-participant study was conducted in 2020, which identified small businesses and micro-businesses as participating at lower than average rates compared to larger C&I customers (https://ma-eeac.org/wp-content/uploads/Final-MA19X11_B_SBNONPART-Report-20200415-1.pdf).

populations in addition to specific metrics focused on EJ Municipalities,[8] community partnerships, and workforce development.

While the EWG supports many of the changes to date, the EWG expects that the PAs will continue to work cooperatively and proactively with the EWG throughout the implementation of the plan.

- The Council supports the PAs' commitment to community partnerships, including $6 million dedicated to the Municipal and Community Partnerships program through which the PAs commit to partner with at least 20 qualified Community-Based Organization ("CBO") teams across at least 30 municipalities to harness their expertise and knowledge of their communities. The Council expects the PAs to engage with community organizations and community leaders in the program design to ensure programs meet community-specific needs.
    - The Council appreciates the PAs additional commitment of $1.5 million new "Open Doors" offering to work with CBOs on residential education efforts for school-age children. However, the Council and EWG expect these partnerships to be additional to the partnership commitment above.
- The Council supports the PAs' commitment to workforce development including their comprehensive Clean Energy Pathways Program, designed to train and deploy a more diverse workforce. While this effort is impressive, the Council would like to see this program focus on the future of the industry, by training candidates primarily for electrification roles and emphasize job retention and placement in the internship program, especially for people historically underrepresented in the industry. The Council would also like to see a significant increase in minority and women owned contractors in Mass Save programming. The Council recognizes that the PAs will be collaborating extensively with the Massachusetts Clean Energy Center (MassCEC) on other workforce development efforts and expects that the PAs will commit to full transparency on these efforts including regular opportunities for input and updates to the Council.
- The Council expects a more robust and detailed strategy for serving renters and landlords, as well as significantly higher levels of investment. The October Draft Plan lacks the detail and specific, new strategies that will be deployed to engage landlords and retrofit rental units. The Council appreciates the PAs' commitment to develop a more detailed strategy for serving rental units. Furthermore, the Council expects the PAs to coordinate and collaborate with the EWG and pilot, starting in 2022, multiple renter-specific recommendations provided earlier this year by the EWG and its stakeholders including, but not limited to, referrals, openers and closers, and other innovative ideas.
- The Council commends the PAs' $136 million investment in and enhanced incentives for moderate income customers.[9] To ensure these ambitious increases in program participation are met, the Council expects the PAs to work earnestly to reduce barriers to participation for moderate-income customers.
    - More specifically the Council insists that the PAs commit to streamlining and simplifying income verification. The PAs should actively and transparently involve the EWG in the development and implementation of this process.
    - The Council expects the PAs to coordinate with the EWG during program delivery design and implementation including sharing a draft program design of the

[8] Communities selected for EJ Initiatives and the Equity Component of the Performance Incentive meet the following criteria. At least one census block group meets the income criteria and at least one additional criterion (e.g., minority or English isolation); Greater than 33% of the population resides in an environmental justice block group; Consumption weighted location participation rate from the Residential Non-Participant Customer Profile Study does not exceed 32%; Median household income is less than 100% of state median household income; and Municipalities not served by PAs for either electric or gas are excluded.

[9] The PAs note that there will be some overlap of moderate-income, renter and landlord, and pre-weatherization incentives.

comprehensive delivery model and implementing as soon as possible and no later than the end of Q2 2022. In addition, the Council expects the comprehensive delivery model to be in place prior to imposing the weatherization requirement for moderate-income customers to access enhanced heating incentives. Simplified access to the new moderate-income offerings is needed not only to address equity issues, but to also meet the ambitious goals of the Plan.

  - A comprehensive delivery model can ensure that moderate-income customers are not burdened with the additional responsibility of coordinating with multiple contractors to complete weatherization prior to HVAC installation, which is a requirement not placed on other residential customers. The EWG recognizes the benefits of a comprehensive delivery model and urges the PAs to develop one, so that customers can benefit from appropriately sized HVAC equipment.
  - Moreover, the Council requests that the PAs continue to work with the EWG to refine incentives for HVAC equipment. The moderate-income incentives should be designed to provide a greater upfront economic advantage to advance electrification over fossil fuel equipment.

- The Council supports the PAs' commitment to addressing customer language barriers by developing a Language Access Plan as expediently as possible. The Council encourages the PAs' to continue developing language access supports for language-isolated populations that do not speak the most commonly spoken non-English languages in Massachusetts—beyond Spanish, Portuguese, and Mandarin.
- The Council commends the PAs' commitment to 2,100 small business weatherization projects throughout the Plan term. The Council requests that the PAs continue to work with the EWG on implementation details to support streamlined participation by small businesses. The Council also supports the PAs' targeted efforts to host Main Streets events in Environmental Justice neighborhoods.

Workforce Development

The Council recognizes the need for workforce development efforts to focus on cultivating a diverse and highly skilled workforce to meet aggressive energy savings goals in the upcoming three-year term. The PAs' initiatives are primarily focused on recruiting and training diverse new entrants to the field, while also facilitating upskilling opportunities for existing workers. In addition to their own initiatives through Mass Save®, the PAs will allocate an annual investment of $12 million to the Massachusetts Clean Energy Center (MassCEC) for their own workforce development initiatives as required by the Climate Act. More specifically the Council supports the PA's commitment to the following:

- Developing the Clean Energy Pathways (CEP) internship program which focuses on attracting, training, and placing in clean energy jobs young adults who have been historically underrepresented in the energy efficiency field including women, people of color, multi-lingual speakers, and residents residing in EJ neighborhoods.
- Diversifying the PA pool of business partners through commitments to increasing contracting and subcontracting opportunities with minority-owned businesses, women-owned businesses, and veteran-owned businesses (collectively referred to as diverse business enterprises).
- Building electrification market capacity by developing heat pump specific trainings for HVAC contractors and recruiting contractors to participate in a heat pump installer network.
- Ongoing collaboration with MassCEC on workforce development efforts.

- Funding efforts that grow the field of qualified building automation system technicians and commissioning specialists, and train customer building operators to ensure that investments made in controls technologies in large, complex buildings deliver on their full savings potential.

To achieve the transformative climate and equity goals in the 2022-2024 Plan, the Council requests that the PAs commit to the following over the coming term:

- Emphasize retention through ongoing support and mentorship and track retention of participating individuals and contractors in the CEP program.
- Evaluate the performance of the CEP internship program and use the findings to help scale the program over time to train and place more individuals through the program.
- Continue to establish robust workforce development efforts, with commensurate investment, outside of the CEP internship program.
- Provide details regarding ongoing collaboration efforts and strategies with MassCEC to avoid gaps and overlap in implementation of workforce programs.
- Grow commercial weatherization in the turnkey small business program, by providing contractor training for qualified residential contractors to work on C&I buildings.
- Increase funding for Income-Eligible Sector-specific trainings to a level that is proportional to the program investment in the Income-Eligible Sector.
- Set targets, measure progress, and evaluate the success of cross-sector workforce priorities.

Topic Areas

Residential Sector

The October Draft Plan shows significant progress from April Draft Plan in addressing the Council's priorities, particularly in emphasizing electrification and weatherization in the residential sector and will help achieve the Commonwealth's GHG goals. To ensure that these ambitious and important goals are met, the Council requests that the PAs focus on the following programmatic and implementation strategies over the 2022-2024 Term:

- Develop a framework for successful achievement of the heat pump numerical goals, in the form of a comprehensive market transformation plan that includes ground-source, cold-climate air source and water heating heat pumps, customer education and support, near- and long-term planning to convert from fossil fuel systems, encompassing all levels of the supply chain and focusing strongly on education and customer cost management.
- As part of the expansion in weatherization, coordinate with contractors and update the Council on insulation contractor pricing in light of variations in materials and labor costs.
- Implement additional methods for co-delivery of weatherization and heat pumps, including creating a whole-home, performance-based retrofit program modeled after DOER's Home MVP pilot, that goes beyond enhanced incentives to encourage an integrated program to deliver weatherization and heat pumps for space and water heating, as well as supporting customer entry through both the Residential Coordinated Delivery and Retail Initiatives.
- Integrate home energy scorecards into home energy assessments and effectively leverage them to inform customers about potential impacts of fuel conversions.

- Implement a fully formed all-electric new construction offer for the 1-4 unit market segment, with aggressive unit goals to capture higher share of new homes that would otherwise use fossil fuels.
- Build on the PAs' success in 2019-2021 and maintain a robust incentive, technical support and training infrastructure to promote the continued growth of Passivehouse in multi-family new construction.
- Include the Cape Light Compact's enhanced incentives for income-eligible and moderate-income new construction, recognizing that the incentives will support equitable service to low-and moderate-income new construction projects on the Cape & Vineyard and promote strategic electrification in new construction for these customers and serve to reduce greenhouse gas emissions.

Income Eligible

The Council strongly supports improvements that have been made in several key areas since the April Draft Plan, including: 1) increases in the heat pump budget and installation goals for heat pumps (for both space and water heating), wi-fi thermostats, and envelope measures; 2) reduction in the lighting budget and installations; and 3) the PAs and LEAN commitments to developing a customized, flexible offering for Affordable Multi-Family Deep-Energy Retrofits. The Council supports the Cape and Vineyard Electrification Offering (CVEO) recognizing its innovate approach to serving low- and moderate-income residents with a package of clean energy technologies to reduce GHG emissions through electrification. The Council expects the Final Plan to ensure equitable decarbonization such that low-income residents are not left behind, but rather supported, in the transition to electrification. Over the 2022-2024 term, the Council expects the PAs and LEAN to prioritize electrification over fossil fuel systems and to limit delivered fuel heating systems, commit to a timeline for phase out lighting incentives, support uptake of active demand management measures in addition to wi-fi thermostats, and improve reporting to provide greater transparency around electrification, comprehensiveness, and equity. More specifically, the Council expects the PAs and LEAN to:

- Prioritize installation of heat pumps over fossil fuel HVAC and hot water systems, and to develop and implement supporting strategies, including for heat pump water heaters. For example, heat pump water heater installation guidelines should identify opportunities and achieve successful outcomes, provide enhanced workforce training, and prepare and launch customer education strategies.
- Prioritize installation of envelope measures in the gas program and reduce reliance on achieving savings through installation of gas HVAC equipment.
- Integrate active demand strategies into the Income Eligible program. Increase participation of income eligible customers in active demand offerings including increased battery storage and EV charging.
- Provide more detail to the Council on the enhanced strategy for serving small multi-family buildings, including "naturally occurring" low-income housing.
- Provide the Council with details and implement a mixed income protocol for multi-unit buildings, as well as other strategies to ensure that customers living in small multifamily buildings are equally and comprehensively served.
- Include a commitment to a new KPI that improves transparency by providing information on comprehensiveness of service broken out by existing fuel and by CAP agency such that progress can be easily monitored and to facilitate program improvements, such as consistent service across CAP agency territories.
- Develop and implement a statewide computerized audit tool by the third quarter of 2022 that can provide regular, timely, and consistent information to support identification of best practices and

needed continuous improvement as well as reporting to the Council and providing data for EM&V.

Commercial and Industrial

The Council supports the increased budget and GHG emissions reductions for the C&I sector from the April Draft Plan. The Council commends the inclusion of an outline for a deep energy retrofit program and commitment to launch in 2022. The Council emphasizes the need for a C&I stakeholder and customer working group as the commercial programs transition and expand and is pleased to see commitment by DOER and the PAs to co-lead a C&I stakeholder working group beginning in 2022. The Council looks forward to regular updates on progress of the working group, feedback received, and solutions implemented. The Council appreciates the reduction in the lighting budget since the April draft plan and emphasizes the importance of phasing out support for these measures in 2022-2024.

The Council expects to continue working with the PAs in the following areas of the C&I programs:

- Coordinate closely with the Council and the C&I Working Group to provide greater detail on implementation including strategy, budgets and incentives to achieve energy efficiency and electrification goals, and opportunities to achieve goals at a lower cost. The Council expects DOER and the PAs to consult with the Working Group once established to determine if meeting more than once per quarter will be needed to ensure productive outcomes.
- Increase savings delivered through electric HVAC efficiency including retro-commissioning and integrated controls as these are effective measures that result in significant savings for existing buildings.
- Reduce fossil-fuel equipment incentives.
- Implement dedicated strategies for municipal building participation in deep energy retrofit offering with an appropriate setting of a baseline since these buildings have unique uses and are frequently repurposed.
- Include the Cape Light Compact's ("Compact") C&I enhancements of up to 100% for target markets such as municipalities, non-profits, renters and small businesses (including microbusinesses), recognizing that: (a) the Compact has offered these enhanced incentives as part of its past program design as a municipal aggregator, which have been deemed reasonable and appropriate by the DPU for the 2019-2021 Plan; and (b) a statewide evaluation is nearing completion to provide additional analysis as to whether these incentive levels continue to be warranted and whether they should be more widely adopted.

Active Demand Management

The Council supports continuation of the successful Active Demand Management (ADM) programs while increasing overall demand savings. The Council supports continued increase of storage incentives, increased participation of direct load control programs, and is pleased to see the commitment to a statewide offering for electric vehicle charging in Connected Solutions. The Council also expects the following:

- Increase participation and reporting of low income ADM offerings.
- Co-deliver ADM with traditional energy efficiency programs to increase demand savings.
- Increase participation in direct load control and load curtailment offerings.
- The Council expects current electric-vehicle charging offerings to continue until the programs shift to statewide offerings in 2022.
- PAs should work with ADM vendors on ongoing program changes, soliciting feedback from industry prior to implementation changes.
- PAs should significantly increase enrollment of storage including continuation of the guaranteed 5-year performance term.

Reporting

Transparency and reporting are critical components to assess progress toward the transformational objectives of the 2022-2024 Plan. The Council supports and appreciates the reporting commitments in the Term Sheet, including reporting on Equity Targets and Budgets (Term Sheet Attachments B and C) and Bi-annual reporting on the performance incentive components. The Council looks forward to quarterly updates on electrification market transformation including heat pump installations by sector, existing fuel type, and installed system type and may seek additional reporting frequency and heat pump performance metrics as necessary to ensure alignment with the goals of the Plan. The Council looks forward to continuing to receive quarterly reporting on Key Performance Indicators ("KPIs") and bi-annual reporting metrics. Additionally, the Council supports and looks forward to coordinating on development of an income-eligible specific KPI to begin reporting in Q1 2022.

Throughout the planning process, the importance of data transparency has been discussed by the Council and stakeholders. The Council looks forward to coordinating with the PAs to track achievement throughout the 2022-2024 Plan term and request regular updates on multi-family savings, participation, and spending, and regular updates on new initiatives such as the residential and commercial deep energy retrofit offerings.

Council Decision on Draft Plan

Based on its review described above, the Energy Efficiency Advisory Council respectfully requests the Department of Public Utilities approve the 2022-2024 Massachusetts Joint Statewide Three-Year Electric and Gas Energy Efficiency Investment Plans and the individual plans of the Program Administrators, to the degree that the final filed plans are fully consistent with the Statewide Plans and to the degree that the final filed plans are fully consistent with the information available to the Council at this time. We further request that the DPU embrace and reflect the comments above.

APPENDIX O: TECHNICAL REFERENCE MANUAL

Please see the separate file for Appendix O.

APPENDIX P: PARTICIPANT DEFINITIONS

PROGRAM/CORE INITIATIVE	PARTICIPANT DEFINITION
A - Residential	
A1 - Residential New Buildings	
A1a - Residential New Homes & Renovations	Dwelling unit with any measure
A2 - Residential Existing Buildings	
A2a - Residential Coordinated Delivery	Dwelling unit with any measure
A2b - Residential Conservation Services (RCS)	[no participants; not a separate initiative]
A2c - Residential Retail	Number of widgets *Assumption for Upstream* : 1 measure per participant, except 2 measures for smartstrips and thermostats
A2d - Residential Behavior	Unique account number
A2e - Residential Active Demand Reduction	Unique account number
B - Income Eligible	
B1 - Income Eligible Existing Buildings	
B1a - Income Eligible Coordinated Delivery	Dwelling unit with any measure
B1b - Income Eligible Active Demand Reduction	Unique account number
C - Commercial & Industrial	
C1 - C&I New Buildings	
C1a - C&I New Buildings & Major Renovations	Unique account number or equivalent
C2 - C&I Existing Buildings	
C2a - C&I Existing Building Retrofit	Unique account number
C2b - C&I New & Replacement Equipment	Unique account number
C2c - C&I Active Demand Reduction	Unique account number

APPENDIX Q: AVOIDED ENERGY SUPPLY COMPONENTS IN NEW ENGLAND: 2021 REPORT AND SUPPLEMENTS

Please see the separate file for Appendix Q.

APPENDIX R: 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)

APPENDIX S: PERFORMANCE INCENTIVE MODELS

A. Performance Incentives (PI) Calculation

The 2022-2024 Statewide Electric PI pool includes a standard savings component, a component for benefits generated by measures that are installed in selected Environmental Justice Communities and selected Boston zip codes ("equity"), and a component for benefits generated by strategic electrification measures.

1	Statewide Electric 2022 - 2024 Total Design Level PI (In 2022$)	$	131,800,000	
	REMAINING PORTFOLIO ("STANDARD") SAVINGS COMPONENT			
2	Statewide Electric Standard Benefits	$	4,886,317,047	*Excluding CLC and Benefits associated with Marginal Abatement Costs*
3	Electric PI Allocated to Savings Component	$	70,407,501	
4	Electric Standard Savings Payout Rate	$	0.0144	*Line 3/Line 2*
5	Standard Savings Component Threshold Level		75%	
	EQUITY SAVINGS COMPONENT			
6	Statewide Electric Equity Benefits	$	1,375,191,475	*Excluding CLC and Benefits associated with Marginal Abatement Costs*
7	Electric PI Allocated to Equity Savings Component	$	23,778,350	
8	Electric Equity Savings Payout Rate	$	0.0173	*Line 7/Line 6*
9	Equity Savings Component Threshold Level		85%	
	ELECTRIFICATION SAVINGS COMPONENT			
10	Statewide Electric Electrification Benefits	$	2,175,367,856	*Excluding CLC*
11	Electric PI Allocated to Electrification Savings Component	$	37,614,149	
12	Electric Electrification Savings Payout Rate	$	0.0173	*Line 11/Line 10*
13	Electrification Savings Component Threshold Level		60%	
14	**Statewide Electric 2022 - 2024 Design Level Performance Incentives**	**$**	**131,800,000**	*Line 3 + Line 7 + Line 11*
15	**Statewide Total Benefits**	**$**	**8,436,876,378**	*Line 2 + Line 6 + line 10*
16	**Statewide Weighted Portfolio Threshold**		**73%**	*((Line 2 * Line 5) + (Line 6*Line 9) + (Line 10*Line 13))/Line 15*
	Additional Calculations			
17	Total Residential & Income Eligible Equity Benefits in 2024	$	494,013,934	
18	Total Residential & Income Elgible Portfolio Benefits in 2024	$	1,974,665,952	
19	% Residential & Income Eligible Equity Benefits of total Residential & Income Eligit		25.0%	*Line 17/Line 18*
20	Target		25.0%	*Target agreed to by PAs & DOER, AGO, Council*

National Grid
Performance Incentives (In 2022 Dollars)

	REMAINING PORTFOLIO ("STANDARD") SAVINGS COMPONENT			
1	National Grid Standard Benefits	$	2,463,872,274	Excluding Benefits associated with Marginal Abatement Costs
2	Gas Standard Savings Payout Rate	$	0.0144	From Statewide PI Model
3	National Grid Gas PI Allocated to Savings Component	$	35,502,217	
	EQUITY SAVINGS COMPONENT			
4	National Grid Equity Benefits	$	642,147,424	
5	Gas Equity Savings Payout Rate	$	0.0173	From Statewide PI Model
6	National Grid PI Allocated to Equity Savings Component	$	11,103,331	
	ELECTRIFICATION SAVINGS COMPONENT			
7	National Grid Electrification Benefits	$	1,341,367,143	
8	Gas Electrification Savings Payout Rate	$	0.0173	From Statewide PI Model
9	National Grid PI Allocated to Electrification Savings Component	$	23,193,495	
10	**National Grid 2022 - 2024 Design Level Performance Incentives**	**$**	**69,799,043**	*Line 3 + Line 6 + Line 9*

Eversource
Performance Incentives (In 2022 Dollars)

	REMAINING PORTFOLIO ("STANDARD") SAVINGS COMPONENT			
1	Eversource Standard Benefits	$	2,380,306,788	Excluding Benefits associated with Marginal Abatement Costs
2	Gas Standard Savings Payout Rate	$	0.0144	From Statewide PI Model
3	Eversource Gas PI Allocated to Savings Component	$	34,298,113	
	EQUITY SAVINGS COMPONENT			
4	Eversource Equity Benefits	$	716,784,119	
5	Gas Equity Savings Payout Rate	$	0.0173	From Statewide PI Model
6	Eversource PI Allocated to Equity Savings Component	$	12,393,869	
	ELECTRIFICATION SAVINGS COMPONENT			
7	Eversource Electrification Benefits	$	825,019,018	
8	Gas Electrification Savings Payout Rate	$	0.0173	From Statewide PI Model
9	Eversource PI Allocated to Electrification Savings Component	$	14,265,352	
10	**Eversource 2022 - 2024 Design Level Performance Incentives**	**$**	**60,957,334**	*Line 3 + Line 6 + Line 9*

Unitil
Performance Incentives (In 2022 Dollars)

	REMAINING PORTFOLIO ("STANDARD") SAVINGS COMPONENT			
1	Unitil Standard Benefits	$	42,137,984	Excluding Benefits associated with Marginal Abatement Costs
2	Gas Standard Savings Payout Rate	$	0.0144	From Statewide PI Model
3	Unitil Gas PI Allocated to Savings Component	$	607,171	
	EQUITY SAVINGS COMPONENT			
4	Unitil Equity Benefits	$	16,259,932	
5	Gas Equity Savings Payout Rate	$	0.0173	From Statewide PI Model
6	Unitil PI Allocated to Equity Savings Component	$	281,149	
	ELECTRIFICATION SAVINGS COMPONENT			
7	Unitil Electrification Benefits	$	8,981,695	
8	Gas Electrification Savings Payout Rate	$	0.0173	From Statewide PI Model
9	Unitil PI Allocated to Electrification Savings Component	$	155,302	
10	**Unitil 2022 - 2024 Design Level Performance Incentives**	**$**	**1,043,622**	*Line 3 + Line 6 + Line 9*

A. Performance Incentives (PI) Calculation

The 2022-2024 Statewide Gas PI pool includes a standard savings component, a component for benefits generated by measures that are installed in selected Environmental Justice Communities and selected Boston zip codes ("equity"), and a component for benefits generated by strategic electrification measures.

1	Statewide Gas 2022 - 2024 Total Design Level PI (In 2022 dollars)	$	38,200,000	
	REMAINING PORTFOLIO ("STANDARD") SAVINGS COMPONENT			
2	Statewide Gas Standard Benefits	$	2,328,762,405	*Excluding Benefits associated with Marginal Abatement Costs*
3	Gas PI Allocated to Standard Savings Component	$	20,373,012	
4	Gas Standard Savings Payout Rate	$	0.0087	*Line 3/Line 2*
5	Standard Savings Component Threshold Level		75%	
	EQUITY SAVINGS COMPONENT			
6	Statewide Gas Equity Benefits	$	1,109,063,653	*Excluding Benefits associated with Marginal Abatement Costs*
7	Gas PI Allocated to Equity Savings Component	$	15,038,975	
8	Gas Equity Savings Payout Rate	$	0.0136	*Line 7/Line 6*
9	Equity Savings Component Threshold Level		85%	
	ELECTRIFICATION SAVINGS COMPONENT			
10	Statewide Gas Electrification Benefits	$	205,604,704	
11	Gas PI Allocated to Electrification Savings Component	$	2,788,013	
12	Gas Electrification Savings Payout Rate	$	0.0136	*Line 11/Line 10*
13	Electrification Savings Component Threshold Level		60%	
14	**Statewide Gas 2022 - 2024 Design Level Performance Incentives**	**$**	**38,200,000**	*Line 3 + Line 7 + Line 11*
15	**Statewide Total Benefits**	**$**	**3,643,430,762**	*Line 2 + Line 6 + line 10*
16	**Statewide Weighted Portfolio Threshold**		**77%**	*((Line 2 * Line 5) + (Line 6*Line 9) + (Line 10*Line 13))/Line 15*
	Additional Calculations			
17	Total Residential & Income Eligible Equity Benefits in 2024	$	395,500,530	
18	Total Residential & Income Elgible Portfolio Benefits in 2024	$	856,037,519	
19	% Residential & Income Eligible Equity Benefits of total Residential & Income Elig		46.2%	*Line 17/Line 18*
20	Target		45.0%	*Target agreed to by PAs & DOER, AGO, Council*

National Grid
Performance Incentives (In 2022 Dollars)

	REMAINING PORTFOLIO ("STANDARD") SAVINGS COMPONENT			
1	National Grid Standard Benefits	$	1,250,784,109	Excluding Benefits associated with Marginal Abatement Costs
2	Gas Standard Savings Payout Rate	$	0.0087	From Statewide PI Model
3	National Grid Gas PI Allocated to Savings Component	$	10,942,396	
	EQUITY SAVINGS COMPONENT			
4	National Grid Equity Benefits	$	585,142,064	Excluding Benefits associated with Marginal Abatement Costs
5	Gas Equity Savings Payout Rate	$	0.0136	From Statewide PI Model
6	National Grid PI Allocated to Equity Savings Component	$	7,934,564	
	ELECTRIFICATION SAVINGS COMPONENT			
7	National Grid Electrification Benefits	$	127,978,930	
8	Gas Electrification Savings Payout Rate	$	0.0136	From Statewide PI Model
9	National Grid PI Allocated to Electrification Savings Component	$	1,735,403	
10	**National Grid 2022 - 2024 Design Level Performance Incentives**	**$**	**20,612,362**	*Line 3 + Line 6 + Line 9*

Eversource (NSTAR Gas)
Performance Incentives (In 2022 Dollars)

	REMAINING PORTFOLIO ("STANDARD") SAVINGS COMPONENT			
1	Eversource (NSTAR Gas) Standard Benefits	$	551,445,254	Excluding Benefits associated with Marginal Abatement Costs
2	Gas Standard Savings Payout Rate	$	0.0087	From Statewide PI Model
3	Eversource (NSTAR Gas) Gas PI Allocated to Savings Component	$	4,824,280	
	EQUITY SAVINGS COMPONENT			
4	Eversource (NSTAR Gas) Equity Benefits	$	191,318,429	Excluding Benefits associated with Marginal Abatement Costs
5	Gas Equity Savings Payout Rate	$	0.0136	From Statewide PI Model
6	Eversource (NSTAR Gas) PI Allocated to Equity Savings Component	$	2,594,290	
	ELECTRIFICATION SAVINGS COMPONENT			
7	Eversource (NSTAR Gas) Electrification Benefits	$	37,949,188	
8	Gas Electrification Savings Payout Rate	$	0.0136	From Statewide PI Model
9	Eversource (NSTAR Gas) PI Allocated to Electrification Savings Component	$	514,593	
10	**Eversource (NSTAR Gas) 2022 - 2024 Design Level Performance Incentives**	**$**	**7,933,163**	*Line 3 + Line 6 + Line 9*

Eversource (EGMA)
Performance Incentives (In 2022 Dollars)

	REMAINING PORTFOLIO ("STANDARD") SAVINGS COMPONENT			
1	Eversource (EGMA) Standard Benefits	$	450,053,373	Excluding Benefits associated with Marginal Abatement Costs
2	Gas Standard Savings Payout Rate	$	0.0087	From Statewide PI Model
3	Eversource (EGMA) Gas PI Allocated to Savings Component	$	3,937,260	
	EQUITY SAVINGS COMPONENT			
4	Eversource (EGMA) Equity Benefits	$	283,370,997	Excluding Benefits associated with Marginal Abatement Costs
5	Gas Equity Savings Payout Rate	$	0.0136	From Statewide PI Model
6	Eversource (EGMA) PI Allocated to Equity Savings Component	$	3,842,529	
	ELECTRIFICATION SAVINGS COMPONENT			
7	Eversource (EGMA) Electrification Benefits	$	39,489,348	
8	Gas Electrification Savings Payout Rate	$	0.0136	From Statewide PI Model
9	Eversource (EGMA) PI Allocated to Electrification Savings Component	$	535,478	
10	**Eversource (EGMA) 2022 - 2024 Design Level Performance Incentives**	**$**	**8,315,267**	*Line 3 + Line 6 + Line 9*

Liberty
Performance Incentives (In 2022 Dollars)

	REMAINING PORTFOLIO ("STANDARD") SAVINGS COMPONENT			
1	Liberty Standard Benefits	$	31,644,774	Excluding Benefits associated with Marginal Abatement Costs
2	Gas Standard Savings Payout Rate	$	0.0087	From Statewide PI Model
3	Liberty Gas PI Allocated to Savings Component	$	276,842	
	EQUITY SAVINGS COMPONENT			
4	Liberty Equity Benefits	$	22,413,128	Excluding Benefits associated with Marginal Abatement Costs
5	Gas Equity Savings Payout Rate	$	0.0136	From Statewide PI Model
6	Liberty PI Allocated to Equity Savings Component	$	303,923	
	ELECTRIFICATION SAVINGS COMPONENT			
7	Liberty Electrification Benefits	$	95,593	
8	Gas Electrification Savings Payout Rate	$	0.0136	From Statewide PI Model
9	Liberty PI Allocated to Electrification Savings Component	$	1,296	
10	**Liberty 2022 - 2024 Design Level Performance Incentives**	**$**	**582,062**	*Line 3 + Line 6 + Line 9*

Berkshire
Performance Incentives (In 2022 Dollars)

	REMAINING PORTFOLIO ("STANDARD") SAVINGS COMPONENT			
1	Berkshire Standard Benefits	$	35,087,532	Excluding Benefits associated with Marginal Abatement Costs
2	Gas Standard Savings Payout Rate	$	0.0087	From Statewide PI Model
3	Berkshire Gas PI Allocated to Savings Component	$	306,961	
	EQUITY SAVINGS COMPONENT			
4	Berkshire Equity Benefits	$	17,607,254	Excluding Benefits associated with Marginal Abatement Costs
5	Gas Equity Savings Payout Rate	$	0.0136	From Statewide PI Model
6	Berkshire PI Allocated to Equity Savings Component	$	238,756	
	ELECTRIFICATION SAVINGS COMPONENT			
7	Berkshire Electrification Benefits	$	59,939	
8	Gas Electrification Savings Payout Rate	$	0.0136	From Statewide PI Model
9	Berkshire PI Allocated to Electrification Savings Component	$	813	
10	**Berkshire 2022 - 2024 Design Level Performance Incentives**	**$**	**546,529**	*Line 3 + Line 6 + Line 9*

Unitil
Performance Incentives (In 2022 Dollars)

	REMAINING PORTFOLIO ("STANDARD") SAVINGS COMPONENT			
1	Unitil Standard Benefits	$	9,747,364	Excluding Benefits associated with Marginal Abatement Costs
2	Gas Standard Savings Payout Rate	$	0.0087	From Statewide PI Model
3	Unitil Gas PI Allocated to Savings Component	$	85,274	
	EQUITY SAVINGS COMPONENT			
4	Unitil Equity Benefits	$	9,211,781	Excluding Benefits associated with Marginal Abatement Costs
5	Gas Equity Savings Payout Rate	$	0.0136	From Statewide PI Model
6	Unitil PI Allocated to Equity Savings Component	$	124,912	
	ELECTRIFICATION SAVINGS COMPONENT			
7	Unitil Electrification Benefits	$	31,706	
8	Gas Electrification Savings Payout Rate	$	0.0136	From Statewide PI Model
9	Unitil PI Allocated to Electrification Savings Component	$	430	
10	**Unitil 2022 - 2024 Design Level Performance Incentives**	**$**	**210,616**	*Line 3 + Line 6 + Line 9*

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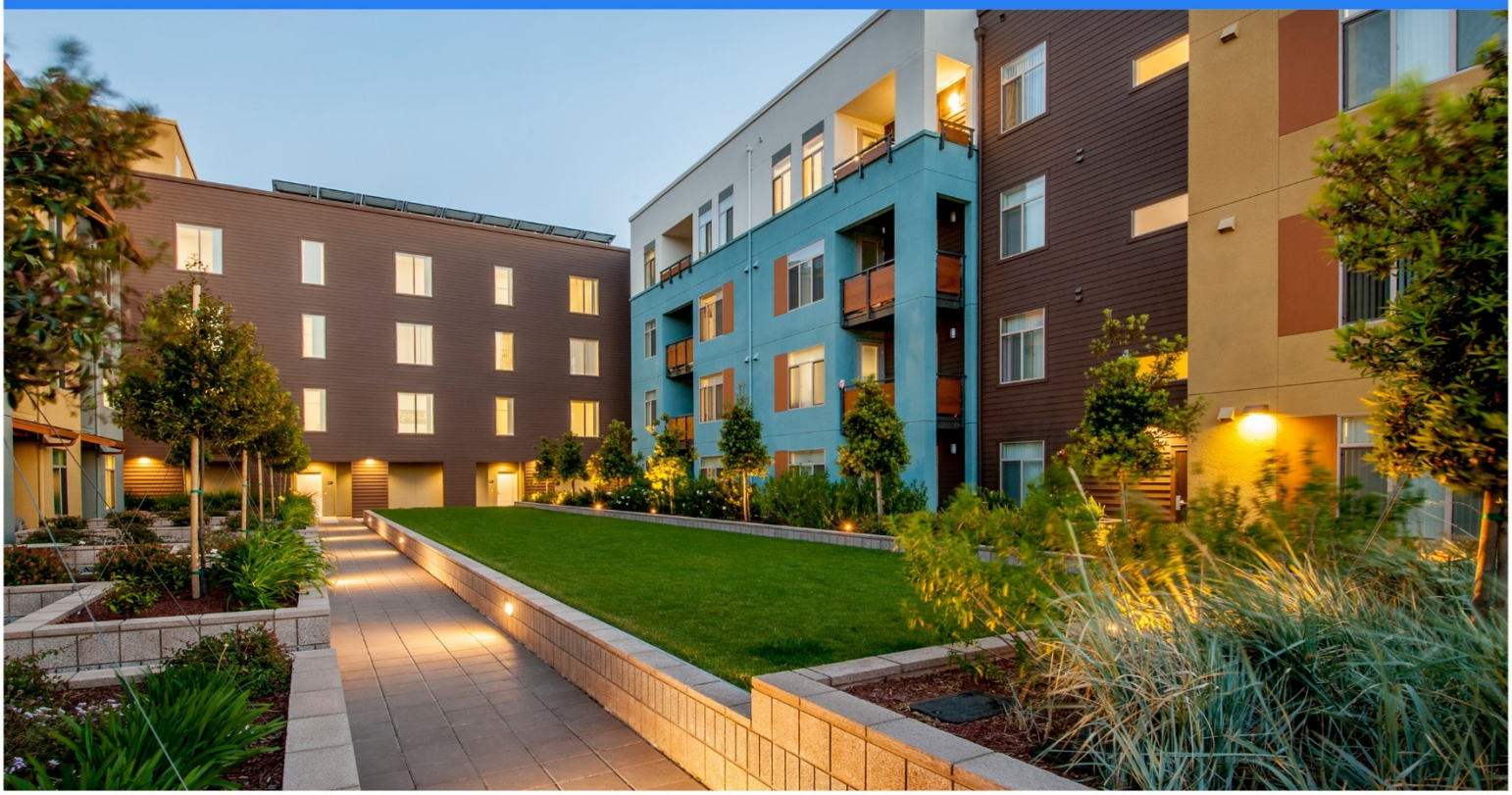

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