APPENDIX B: STRATEGIC EVALUATION PLAN

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2022-2024

Massachusetts Statewide Energy Efficiency

Strategic Evaluation Plan

April Draft

Draft: April 16, 2021

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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. 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 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.

PA programs are adapting to focus more on other 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. EM&V is helping understand opportunities to increase participation and baselines for current equipment. 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. PAs are responding to stakeholder interest and policy directives to increase support for strategic electrification for heating, particularly in

[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/.

instances in which customer economics support a transition to electric heat pumps. EM&V is helping to quantify and document under what conditions heat pumps benefit customers and save energy. The PAs are also responding to the need to improve program equity by reducing barriers to participation and increasing investments in Environmental Justice communities. EM&V has identified the extent to which certain demographic groups, such as renters, moderate-income customers, and customers with limited English proficiency (LEP), have been less likely to participate in programs. 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 people who 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.

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.

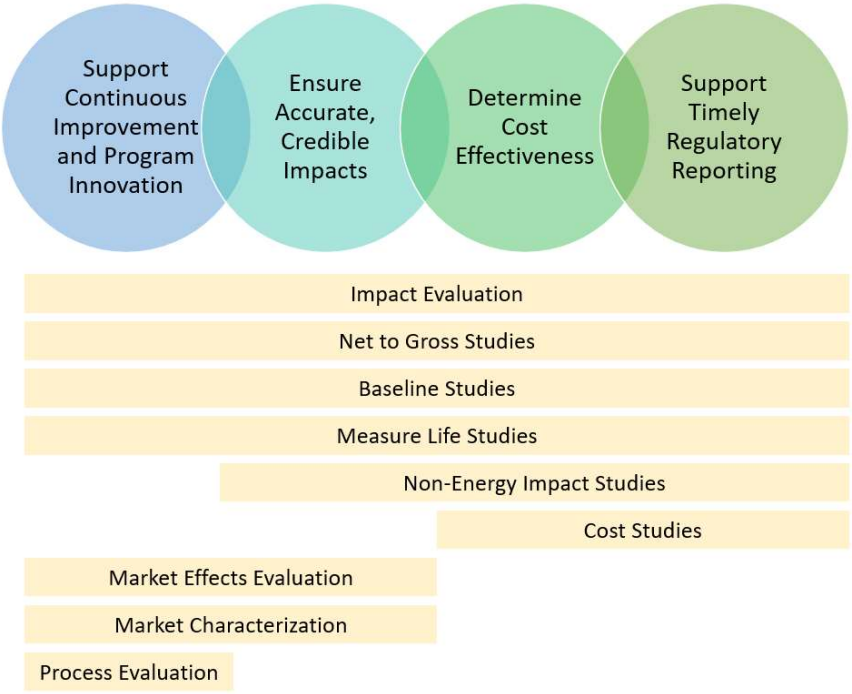
SECTION 3: PURPOSES OF EVALUATION

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: Purposes of Evaluation and Study Types

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:

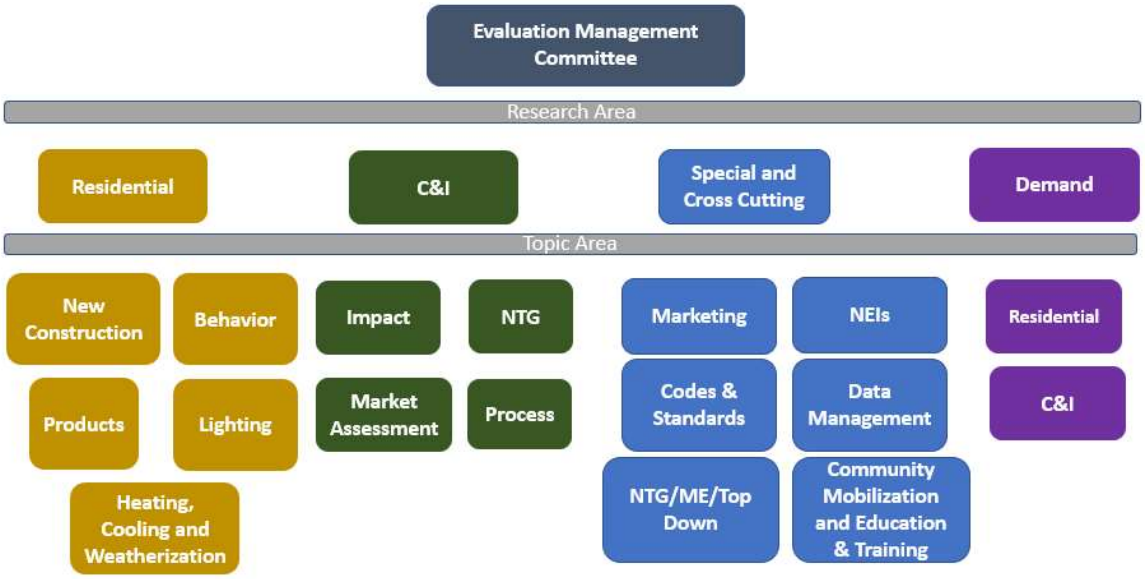
- Baseline equipment or practices.
- High-efficiency equipment or practices.
- Deemed savings or algorithms for calculating energy savings.
- Measure life.
- Other resource impacts, specifically water savings from energy efficiency measures.
- Impact factors, including:
    - In-service rate,
    - Savings 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. Historically, updates in the spring of each year have been incorporated into the Annual Report for the prior year (in other words, updates to savings calculations and impact factors have been applied retrospectively to the prior year). The exception is for NTG ratios, which have been applied prospectively to the next three-year term. The approach for applying evaluation factors during the 2022-2024 term is the subject of a DPU order (DPU 20-150) which opened an investigation to revise its energy efficiency guidelines, including whether results are applied prospectively or retrospectively, and whether NTG ratios may be updated on an annual basis. Once the investigation is complete and DPU directs the PAs on how to apply evaluation results, this section of the SEP will be updated.

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 $53.63 million to EM&V studies.[6] This budget includes funding for independent third-party evaluators to conduct research managed by the EMC. The budget was developed based on an estimate of evaluation study spending in 2019 and 2020, and anticipated spending through the end of 2021, which collectively totals $53.63 million. The actual spend amount was slightly higher than the budgeted amount for the 2019-2021 term, which was $52 million. The increase in costs was largely due to higher-than-expected spending on C&I evaluations, including baseline and impact evaluations. In the last term, EM&V study budgets represented just less than 2 percent of total budgets for the electric and natural gas programs. This level of spending is appropriate, given that many jurisdictions spend between 2-3 percent of program budgets on EM&V, and Massachusetts has large program budgets that have been subject to evaluation for many years, so it is reasonable to expect that budgets would be at the bottom end of that range.

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.

[6] 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	$ 53.63	100%
Research Area Budgets		
Commercial and Industrial	$ 19.84	37%
Residential	$ 11.26	21%
Income Eligible	$ 5.63	10%
Special and Cross Cutting	$ 14.43	27%
Demand Response	$ 2.68	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%	53%
Residential	47%	37%
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:[7]

- C&I Impact and NTG evaluations.
- C&I Market Assessment.
- C&I Process Evaluation.

[7] 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 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 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.[8]

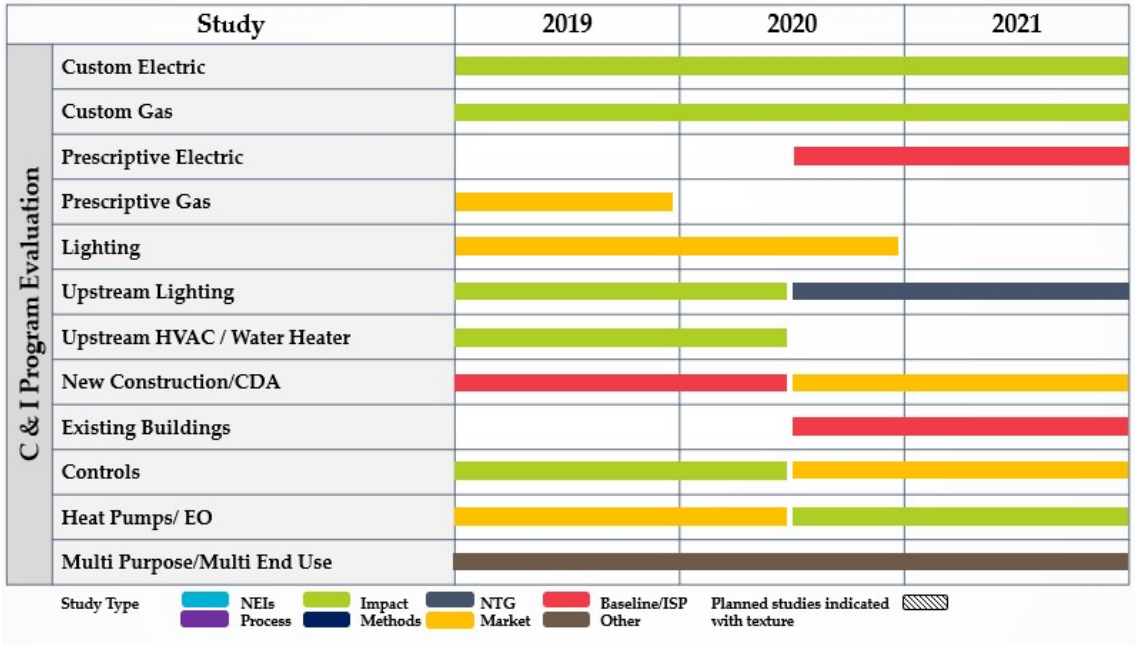
7.1 LESSONS LEARNED FROM 2019-2021 TERM

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 offers, 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

[8] 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 is 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 the2022-2024 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 comprised of 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 seems 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.

- **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 lower 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 ensuring that savings calculations are up to date. *Planned Start: 2022. Stage 1: Included in Appendix.*
- **Combined Heat and Power (CHP) Research.** While some CHP research has been done over the last 10 years, it needs to be updated. Based on recent stakeholder discussions, it is likely that the EMC will prioritize conducting a CHP impact evaluation, followed by (possibly) market research and a focused NTG study geared at understanding the nuances of NTG for different project/event types (e.g., retrofit vs. new construction vs. replace on failure). The impact evaluation may use the rolling structure mentioned earlier and/or embedded evaluation, wherein evaluators are engaged in the project from the outset. The evaluation may assess the performance of typical CHP systems as well as a recently introduced micro-CHP offering. The CHP offering is somewhat unique as only a handful of projects are supported each year, which allows for consideration of alternative evaluation models like embedded evaluation. *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.*
- **Lighting Market Research.** Given the speed at which the lighting market is evolving, continued research is warranted in the near term to ensure effective program design through 2023. However, as savings decrease over the 2022-2024 term due to increasing light-emitting diode (LED) market share/saturation and declining NTG rates, less evaluation activity may be required in the latter part of the plan period. Consequently, research in this space is expected to be conducted in the early part of the 2022-2024 term. *Planned Start: 2022-23. Stage 1s: Included in Appendix.*

- **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 (EIMS) 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.** A deeper dive into the impact of the COVID-19 pandemic on C&I customer operations may be justified to inform stakeholder policies around customer baselines and operational characteristics. At this point it is unclear if business characteristics will ultimately revert to pre-pandemic norms or a "new normal" will be established which programs will need to reflect in program assumptions. *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. Research priorities for the 2022-2024 term are likely to encompass tracking participation in Environmental Justice communities for small and microbusinesses. Additionally, further assessment of participation barriers for small 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/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. Low-income 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. **Error! Reference source not found.**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

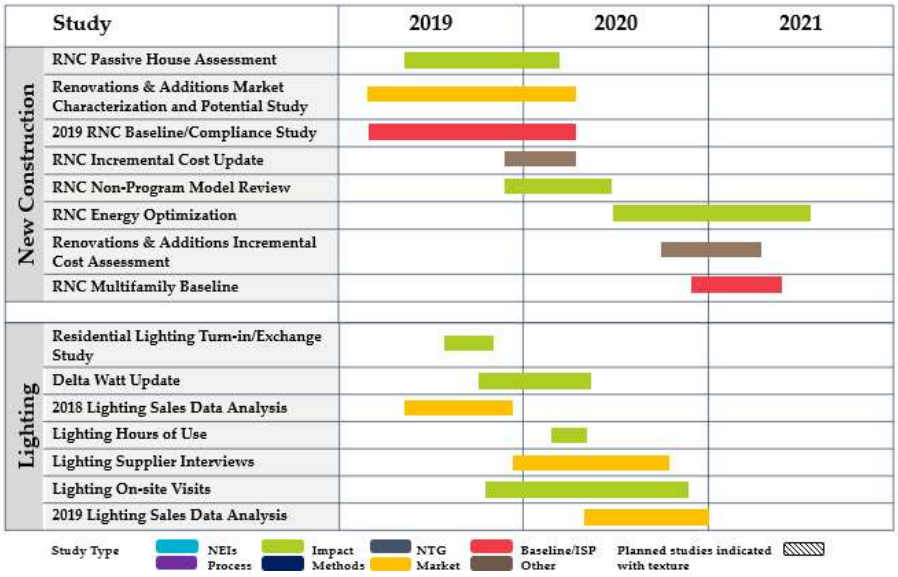
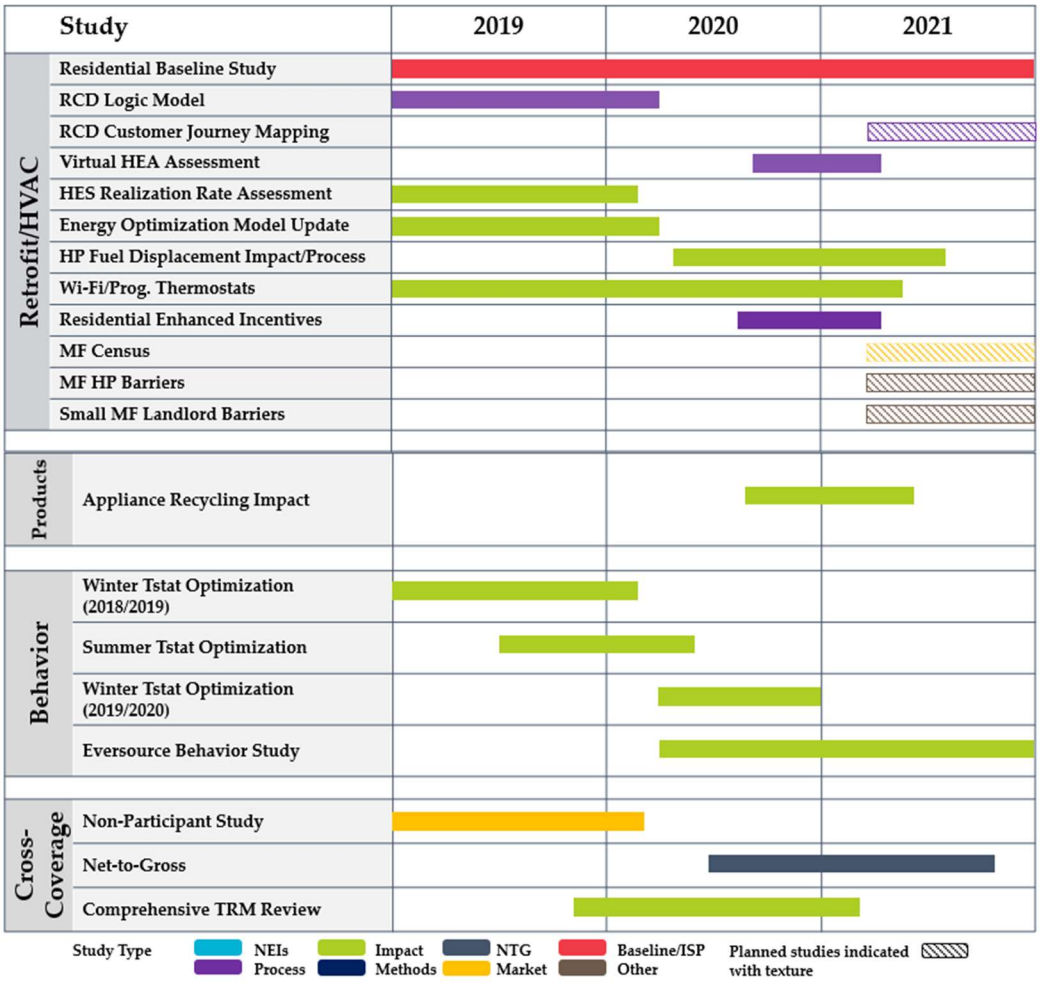


Figure 8: Residential HVAC, Products, Behavior & Cross Coverage Evaluation Activity in 2019-2021



The Residential Sector research area had a robust research agenda over the 2019-2021term 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, contrary to popular belief, non-financial barriers are more prevalent than financial barriers.
- **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 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. 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 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 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[9] (low- and moderate-income customers, renters, and LEP 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

[9] Participation of small and microbusinesses is discussed in Section 7.2, C&I Research Priorities for the 2022-2024 term, under the header “Equity”.

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 LEP customers and will likely 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 (for both residential and small/microbusiness) and consider using energy burden as a metric for tracking progress. Evaluation will conduct research to help implementers identify potential community-based organization/municipal partners at the local level, what specific populations they serve, and how they could help increase participation.[10] *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.

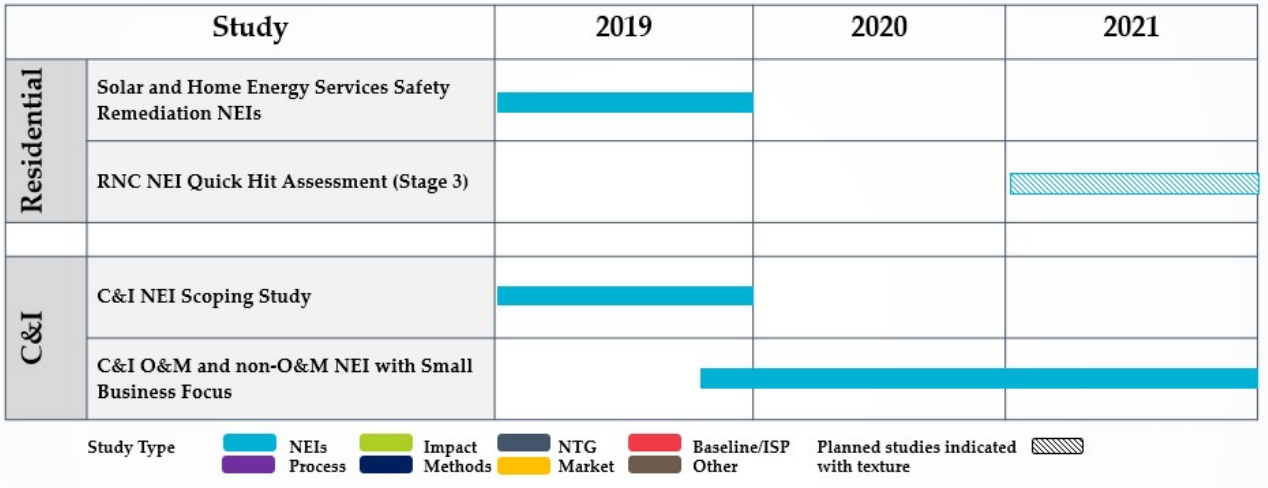
9.1.1 LIFE LESSONS LEARNED FROM RESEARCH COMPLETED IN THE 2019-2021 TERM

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

[10] 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.

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.

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, as 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.

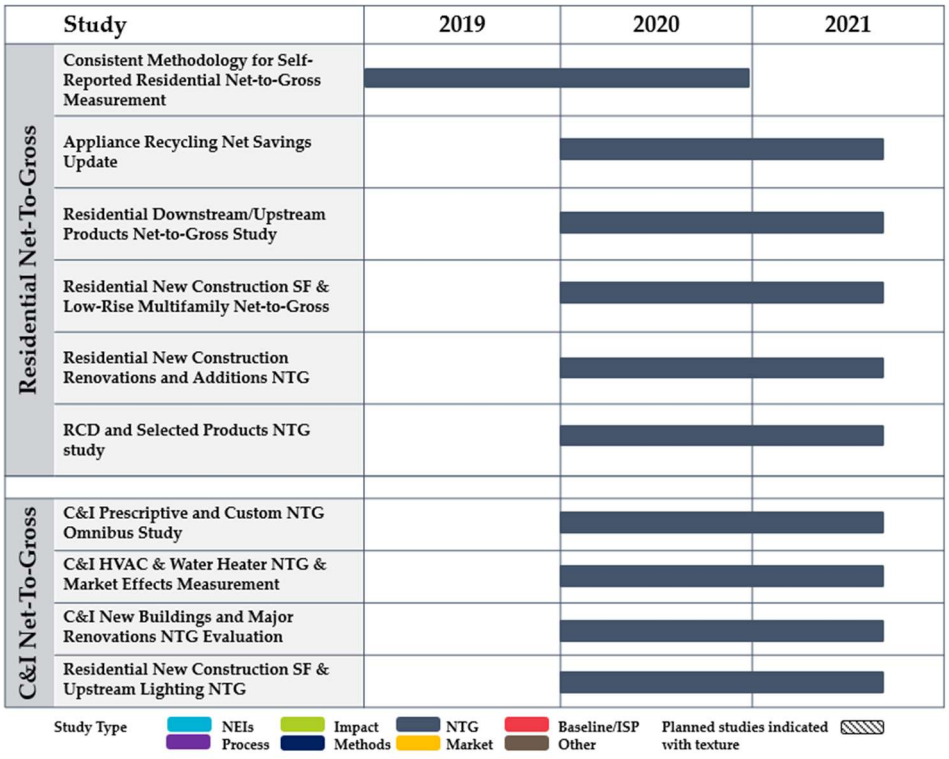
9.2.1 LESSONS LEARNED FROM RESEARCH COMPLETED IN THE 2019-2021 TERM

The NTG topic area has been very active over the 2019-2021 term, particularly in 2020. Given that under the current policy framework, the NTG values are 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. 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



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 draft guidelines which would allow NTG values to be updated up to once per year, instead of once per term. If these guidelines are approved there will be 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 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 avoids stacking all the studies to 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.

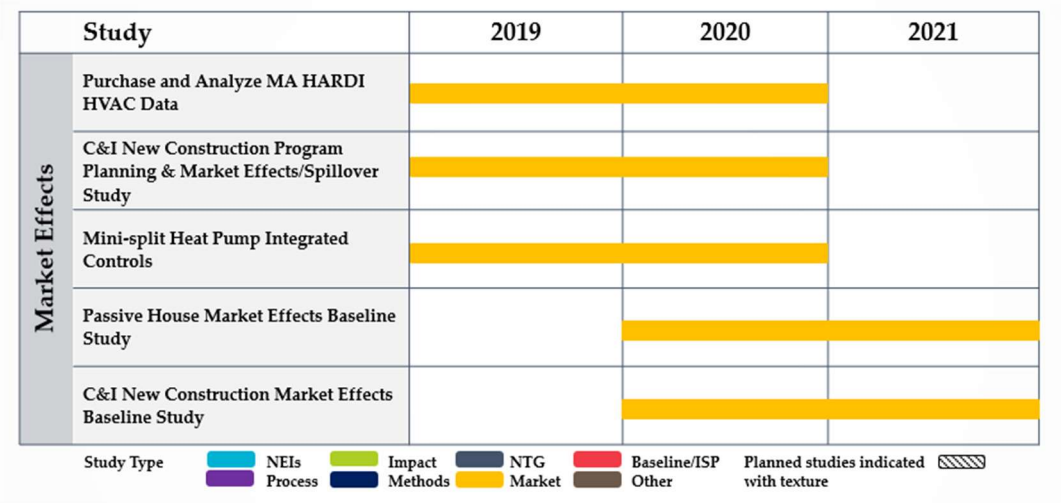
9.3 MARKET EFFECTS

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.

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:

- **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 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 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 customers with LEP). 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

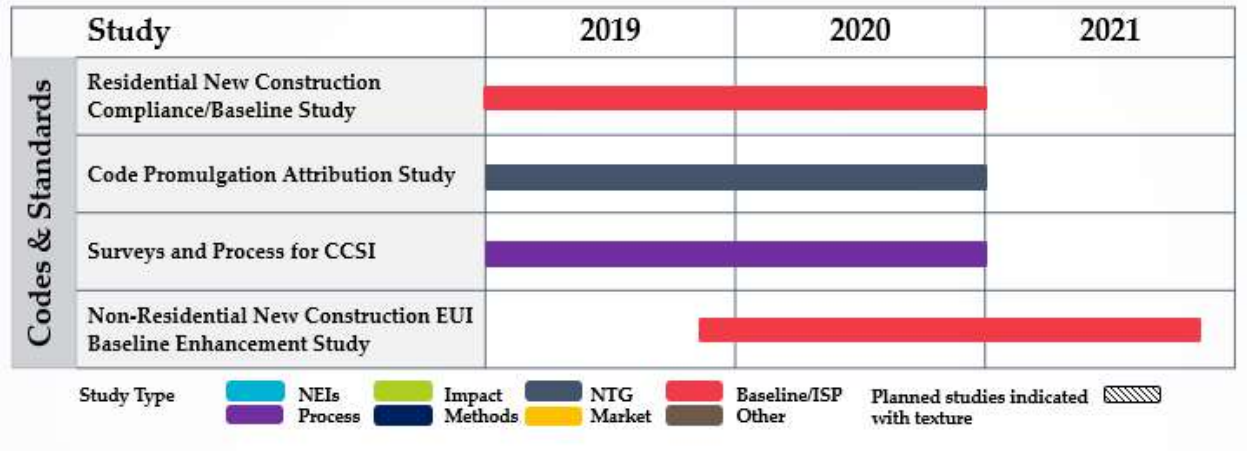
Codes and Standards (C&S) evaluation work is designed to measure net savings attributable to PA C&S activities through measuring aspects such as baseline practices, code compliance, and attribution.

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, 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 LEP 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 Work Force Development Program Evaluation

The EMC expects to support an initial evaluation of the new statewide workforce development program, which may include, for example, establishing theories of change and a program logic model, confirming key performance indicators, and conducting baseline measurement. *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.
- **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, the study will help identify key partners, and strategic engagement pathways for municipalities.

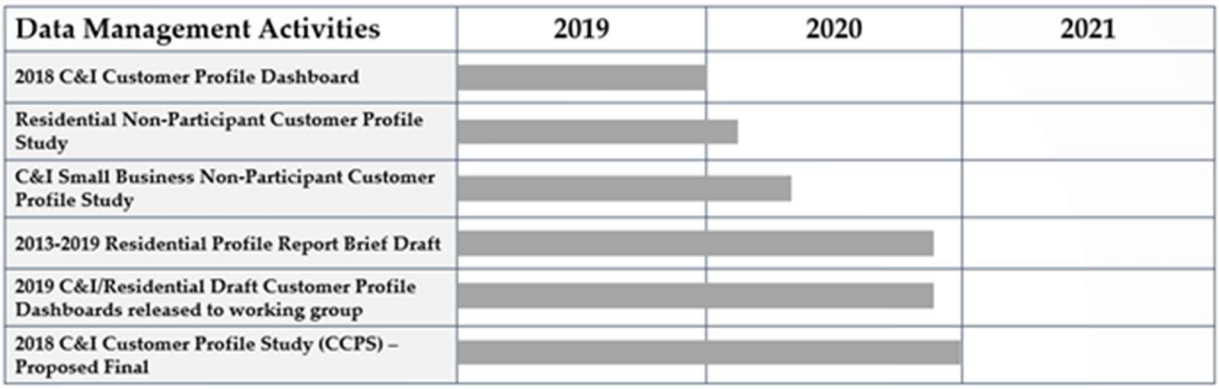
9.7 DATA MANAGEMENT

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, most of these program offerings 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[11], depending on the type and scale of offering. As this is a relatively new research area, PAs may independently implement and evaluate smaller demonstration

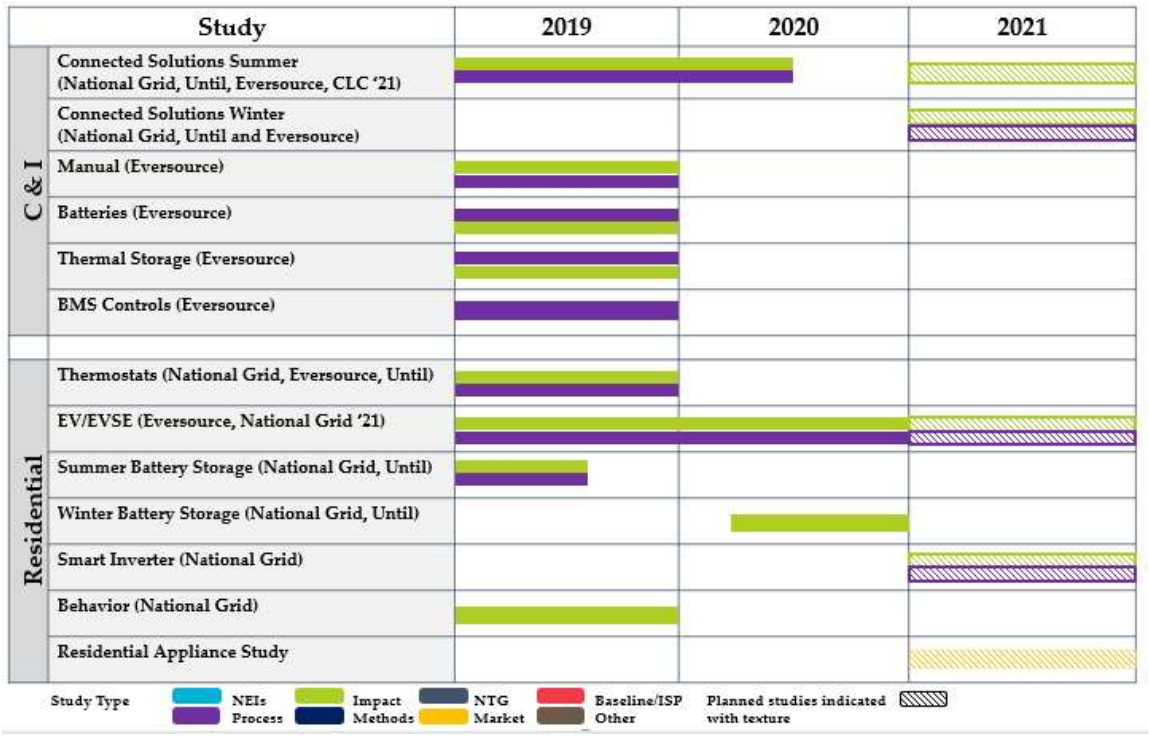
[11] PA-specific studies are generally performed by the relevant statewide contractor team.

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 are currently working on five evaluation studies 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. 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 the demand response evaluation area 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 been valuable not only 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 increases in the 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 from demonstration to statewide program.
- **Program Growth.** The studies have also continued to show that the programs are growing, and 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, 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. 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 offering 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 Dispatch.** One of the exceptions to reduction in frequency of evaluating existing offerings is for C&I targeted 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 Stage 1 Plans that will be included in the subsequent draft of the SEP.

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 Market Model Recalibration	Continuation of lighting market model updates on annual basis
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	CHP Impact Evaluation	Impact evaluation of CHP using rolling or embedded evaluation.
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	Workforce Development and Training	An initial evaluation of the new statewide workforce development program, which may include, for example, establishing theories of change/a program logic model, confirming key performance indicators, and conducting baseline measurement
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	R&A MEs	This research will identify market effects indicators for Renovations and Additions within the RNC program
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
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 MARKET MODEL RECALIBRATION

Study Name: Ongoing Updates to LED Market Model
Study Champion: TBD
Research Area: C&I Markets
Type of Study: Market Characterization
Study Lead: DNV
Applicable Fuel: Electric
Underlying Program/Initiative: Custom, Prescriptive, and Small Business Electric

BACKGROUND

Over the last several years, the non-residential lighting market in Massachusetts has been experiencing a rapid transition from fluorescent technology to LEDs. This began with the transition to screw-based LEDs and TLEDs but is now being fueled by conversion to LED integrated fixtures. Because of this rapid transition, it is important to closely monitor the market to accurately forecast at what point the market becomes completely transformed to LED technology.

OVERALL STUDY GOAL

This effort will continue to leverage all the available research on the rapidly changing C&I lighting market and include targeted data collection to enhance our understanding of this market. This information will continue to inform the LED Market Model forecasts, which not only capture the remaining opportunities for lighting programs but are also used to calculate the adjusted measure lives (AMLs) for upstream, prescriptive, and custom lighting program installations. Gross lifetime savings for the Massachusetts PAs' C&I lighting programs are assessed as a product of the first-year annualized savings and the AML. Since early replacement measures are subject to dual baseline savings methods, the AML is used to account for both replace-on-failure and early replacement.

VALUE OF STUDY

The value of this study is to assess the remaining potential for lighting programs to continue to transform the market. Any additional data collected integrated with the market model forecasts will project the point at which the natural adoption of LEDs meets or exceeds the adoption of LEDs with program influence. Understanding the trajectory of the AMLs will help implementers to plan for the impacts on gross lifetime savings due to the dual baseline framework.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

The study approach will likely focus more on targeted data collection on key parameters or submarkets rather than a comprehensive market assessment. The goal will be to identify where key inputs can be researched to enhance the certainty of the market model forecasts.

- **Task 1: Work plan development.** As part of the work plan process, the study team will hold a working group meeting with the PAs and EEAC to discuss where there are questions or uncertainties in our understanding of the market. Prior to this meeting, the team will conduct a sensitivity analysis on the LED Market Model to present areas of focus that would have the largest impact on the model forecasts. At the working group meeting, the study team, the PAs, and EEAC will decide what updates to pursue in this scope of work. The study team will then develop a work plan describing those updates.
- **Task 2: Data collection and model calibration.** Under this task, the study team will study key market indicators and update market parameters, as determined during the working group meeting. These indicators and updates could include:
    - Estimated market share and LED sales volume forecasts from key trade allies including lighting manufacturers, distributors, and contractors.
    - Existing saturation rates of LEDs across submarkets or within targeted submarkets or customer segments.
    - Product availability, price, and efficacy through of distributor and manufacturer web-scraping.
    - Measure lifetime, retrofit/turnover rates (the annual percent of operating lamps expected to be replaced early), and application-specific hours of use to improve stock turnover forecasts in replace on failure and retrofit events.
    - Jurisdictional comparisons and expert panel review of Massachusetts forecasts.
- **Task 3: Lighting coordination and future research priorities.** this task will include coordination across all impact and non-impact lighting research efforts.
- **Task 4: Report writing.** this task will include all reporting requirements to meet PA and EEAC needs. Impact parameters, like AMLs, will be finalized in time for the annual reporting filing deadline.

IMPLEMENTATION REVIEW

Budget: $150,000 - $400,000

Timeline: Q2 2022 to Q3 2023

12.5 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

12.6 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)

12.7 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)

12.8 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

12.9 CHP IMPACT EVALUATION

Study Name: CHP Impact Evaluation

Study Champion: TBD
Research Area: C&I Impact/NTG
Type of Study: Impact Evaluation
Study Lead: DNV
Applicable Fuel: Electric and Natural Gas
Underlying Program/Initiative: Custom

BACKGROUND

About a dozen CHP (including fuel cells, internal combustion engines, and turbine designs) are installed each year in Massachusetts with savings in the order of 75 GWh per year. The most recent CHP studies were published in 2011 and 2012 and based on PY2010 participants. Some of the key findings included realization rates of 93 percent for electric generation and 101 percent for thermal recovery. The studies recommended the PAs establish modeling protocols and a commissioning process which includes a shakedown period and a determination of 'normal operations.' Currently, systems are approved in three phases with the last phase lasting about a year with the purpose of confirming the final ex ante savings and embedded metering is installed on most if not all systems. Verification follows the Alternate Portfolio Standard (APS) protocols, and many systems qualify for a monthly non-energy efficiency revenue stream based on monthly metered data submissions.

OVERALL STUDY GOAL

The goal of this study is to evaluate recent claims for CHP (including fuel cell) electric energy savings, natural gas consumption, and heat recovery and winter and summer peak demand impacts. The study should also consider whether CHP measures should be rolled into the normal custom impact evaluation, potentially in a separate stratum. A secondary goal is to examine the persistence of CHP systems in Massachusetts.

VALUE OF STUDY

Study findings will update realization rates and potential EULs. Outcomes will indicate practices associated with high-performance systems and early indications of fuel cell efficacy.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

Unlike other measures, CHP impacts are directly measurable and do not require a counterfactual. In addition, metering is almost always installed as part of a CHP system and the data streams are usually captured. PAs are capturing metering performance as part of commissioning and the MA DOER is capturing CHP performance from APS participating sites. There is, however, uncertainty on the availability of metered data for individual sites.

In developing the workplan, the data status of each site in the study population will be determined and may include sites with readily available data, sites requiring data purchase (from a third-party aggregator, for example) and sites with no data. Acquired data will be analyzed for quality and completeness.

Impact findings will be based on a census of sites with data meeting quality criteria and a sample of the balance of the sites. Potentially, on-sites will not be required. Outcomes will include first year impacts (electricity generation, natural gas consumption, natural gas offset via heat recovery) and peak demand impacts. The results will be examined for trends in performance to identify high-performance systems and characteristic performance of CHP types (turbine, microturbine, ICE, and fuel cell).

Research in California indicated high rates of system failure/abandonment for CHP systems installed under its Self-generation Efficiency Program. The Massachusetts program has set in place mechanism to ensure longer life including improved feasibility assessments and requirements for O&M requirements. The success of the MA model will be tested by conducting surveys of all incentivized CHP systems installed since the beginning of the program in 2010.

IMPLEMENTATION REVIEW

Total Budget Range: $250,000 - $400,000

Timeline: 12-15 months

12.10 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

[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))

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 LEP 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 (LEP 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 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 LEP, 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., LEP customers).

- **Task 4: Customer Interviews and Journey Mapping (LEP-focused).** The PAs and EEAC identified the need to better understand IES Program interactions with LEP 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 LEP 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 LEP 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 LEP 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 LEP customers.** For various reasons, including trust barriers, the research could have been strengthened by better representing LEP customers. Leveraging relationships established with community and other organizations, it may be worthwhile more deeply investigating these LEP 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 MassSave 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 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

[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.

[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.

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 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

[16] The 2017 base code refers to the 2015 IECC with Massachusetts amendments.

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

[17] National Renewable Energy Lab, website: https://remdb.nrel.gov/.

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

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.

Total Budget Range: $75K-$125K

Timeline: Q1 2022-Q3 2022

SECTION 14: SCC STAGE 1 PLANS

14.1 WORKFORCE DEVELOPMENT AND TRAINING

Study Name: Embedded Statewide Training and Workforce Development Program Evaluation
Study Champion: TBD
Research Area: Training/Workforce Development
Type of Study: Process/Impact/Market Baseline and Characterization/Market Effects
Study Lead: Ellen Steiner, Ph.D., Opinion Dynamics
Applicable Fuel: Electric/Natural Gas
Underlying Program/ Initiative: Statewide Workforce Development and Training Program

BACKGROUND

The United States is at the perfect tipping point for workforce, education, and training to play a pivotal role in driving COVID-19 economic recovery while at the same time ensuring a diverse workforce with the necessary knowledge, skills, and abilities to transition to a clean energy economy. The education and training landscape is complex, spanning a multitude of industries, end-use roles, skill levels, high-potential markets, and delivery channels. The significant changes occurring within the electric industry coupled with the COVID-19 pandemic, require effective workforce, education, and training interventions to support Massachusetts energy and climate goals.

OVERALL STUDY GOAL

The objective of this portfolio of studies is to ensure a rigorous and systematic evaluation of the new statewide workforce and training program. As this new program is just launching, the first year is important to establish appropriate theories of change and frameworks for engagement and measurement. Research objectives may include:

- Conduct evaluability assessment and establish program theory, logic model, and key performance indicators for new statewide program.
- Develop frameworks for engagement and measurement.

VALUE OF STUDY

This portfolio of studies will support the new statewide program design, implementation, and evaluation of outcomes, providing key data to drive continuous improvement. Given that this program is just launching, now is a key time to ensure the evaluability of this program for years to come. Investments now will drive rigorous and defendable evaluations moving forward, limiting challenges with developing retrospective baselines and incomplete data collection, as well as identifying opportunities to leverage the key workforce and training stakeholders across the state.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

The Stage One research plan is intentionally open-ended, as program designs and research needs are in the process of being established. To ensure the greatest value, it is important that the evaluation team conducts an embedded, holistic, ongoing evaluation given the number of variables and moving parts in training programs, especially during the formative years of a new statewide effort. Research activities may include:

- Host kick-off meetings and conduct planning to determine critical research objectives, activities, and timelines.
- Develop workplans for key studies to support new statewide program.
- Create or critically review existing theories of change for plausibility and evaluability.
- Develop or critically review logic models to document program design against program theory.
- Establish key performance indicators.

IMPLEMENTATION REVIEW

Budget: $100,000

Total Budget Range: $90,000-$150,000

Timeline: Planned start 2022

14.2 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)

14.3 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.

14.4 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

14.5 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 GOA:

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

14.6 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

14.7 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

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

[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 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.

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.

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 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

14.8 R&A MES

Study Name: Residential Renovations & Additions Market Effects Baseline
Study Champion: TBD
Research Area: RNC
Type of Study: Market Effects Baseline
Study Lead: Jared Powell, NMR
Applicable Fuel: Electric, Natural Gas, Oil, Propane
Underlying Program/ Initiative: Renovations and Additions offering within the Residential New Home and Renovations Initiative

BACKGROUND

As part of the *RLPNC 18-12 Renovations and Additions Market Characterization and Potential Savings Study*, NMR developed a PTLM for the Renovations and Additions (R&A) pathway of the Residential New Homes & Renovations Initiative. The initiative provides financial incentives, education, training, and technical support to builders and homeowners to help residential new construction and renovation projects meet the highest energy performance standards. The R&A pathway is expected to increase market actors' demand for and knowledge about energy-efficient practices, affecting the broader residential renovations market and contributing to the transformation of the market for single-family home renovation to higher-efficiency building practices and equipment. The logic model identified short-, mid-, and long-term outcomes in the market expected from the program (i.e., market effects) and identified possible indicators to track progress toward these outcomes.

OVERALL STUDY GOAL

The goals of this study are to operationalize the market effects indicators for the R&A pathway's implementation, establish or update baseline values for the indicators as needed, and develop a research approach for quantifying the savings from market effects resulting from the R&A pathway at a future date using the indicators and other data.

VALUE OF STUDY

This plan recognizes that the PAs have invested in previous studies to characterize the R&A market and aid in initiative design. This study will leverage previous studies to (1) identify and compile existing data that could be used to establish baselines of market effects indicators for the R&A pathway of the Residential New Homes Initiative and document the results, (2) identify any market effects indicators that require measurement, and measure them as appropriate, and (3) produce an actionable methodological approach to quantify market effects savings in the future leveraging these data.

HIGH-LEVEL DESCRIPTION OF APPROACH/METHODOLOGY

This study will rely on multiple methods to explore, understand, operationalize, and measure the market effects indicators. The methods include a secondary data review; program data analysis; in-depth interviews (IDIs) with PAs, implementation staff, and market actors; and a web survey of market actors. Additional discrete research tasks may be included based on the availability of program data or IDIs with PA staff. A key aspect of these tasks will be to identify other market forces and activities that could affect the adoption of efficient building practices in the R&A market, and to identify the possible effects of other program administrator offerings on this market.

The secondary data review will include a review of the previous studies to identify relevant research results that could inform or serve as indicators for market effects. This effort will identify which of these indicators require remeasurement as part of this study.

The study team will conduct up to three IDIs with PA staff and implementation staff. One outcome of those interviews will be a program data and material request. The PA and implementation staff interviews and program materials and data will be used to measure indicators of program outputs and outcomes related to program marketing and education materials, program participation, and modeled energy savings.

The study will then conduct approximately ten IDIs with participant and ten IDIs with non-participant market actors to gain their perspectives on the selected baseline market effects indicators and to aid in the development of the market actor web survey. The web survey will target 50 completes with participant market actors and 50 completes with non-participant market actors. Market actors may include, but are not limited to, homeowners, general contractors, architects, and energy raters that operate in the R&A market. The web survey will gather information to measure market effects indicators that can be generalized to the target population for the R&A pathway (builders and market-rate-customer owners of single-family homes). The study will offer incentives for both the IDIs (ranging from $50-$100) and the web survey ($10-$50). The value of the incentives will depend on the length of the final instruments.

Informed by the results of this research, and following the guidance outlined in the 2019 "Action Plan for Measuring Market Effects" and the 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, taking into account the effects of other forces in the market, as well as the possible joint effects of the PAs' R&A offering and other program administrator efforts.

Deliverables for this study will include a Stage 3 work plan, a memo that summarizes the results of the secondary data review and the indicators that will be operationalized and measured in the web survey, draft and final instruments for the IDIs and web survey, and draft and final reports.

IMPLEMENTATION REVIEW

Total Budget Range: $150,000 - $200,000

Timeline: Summer 2021 – Spring 2022

14.9 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

14.10 BASELINE & CODE COMPLIANCE STUDY

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 PAs 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 Sector 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 (commercial) 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 Program Administrators and the Massachusetts Energy Efficiency Advisory Council to ensure that the follow-up instruments cover issues the Program Administrators and Energy Efficiency Advisory Council 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 several months after they attended 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 to it. 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 we reach the anticipated survey completion quota of at least 60% 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

14.11 MARKETING AND OUTREACH AWARENESS STUDY

Study Name: MA Statewide Marketing and Awareness Survey
Study Champion: Phil Moffit, Adam Wirshafter
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.

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