C&I New Construction Program Planning & Market Effects/Spillover Study

(MA19CX01-B-NCPLANME)

Final Report

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SUBMITTED TO:
Massachusetts Program Administrators

SUBMITTED BY:
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C&I New Construction Program Planning & Market Effects/Spillover Study

The Massachusetts C&I New Construction Program Planning and Market Effects/Spillover Study is intended to help the Massachusetts Program Administrators (PAs) redesign their Non-Residential New Construction (NRNC) Program and position themselves to claim market effects. The purpose of the redesign is due to (1) diminishing savings due to rising energy codes, municipal mandates, and industry standard practices; (2) low program realization rates; and (3) a strategic three-year goal to explore further-reaching design innovations.

Next Steps

Plans for Redesign

The PAs will commission a study to estimate EUI baselines for NRNC that consider building type, fuel type, and other factors.

Recommendation

Promptly conduct surveys with market actors and conduct other research to document market indicator baselines.

Considerations

Determine if program should be evaluated alone or holistically with whole NRNC sector. Track policy discussions to determine how/when to measure market effects.

Approach

Methodology

- 4 charrettes with program stakeholders
- 18 interviews with implementers, market actors, and industry experts
- 2 focus groups with 11 program participants
- Best practices review
- Development of market effects framework with stakeholders

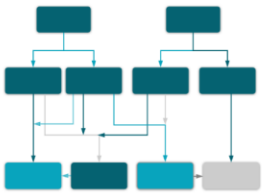
Proposed Market Effects Research Phases

1. Establish a market effects framework by which to carry out the following two research phases. ✓
2. Establish baselines of market effects indicators.
3. Measure changes in indicators and quantify effects after indicators suggest market effects may be measurable.

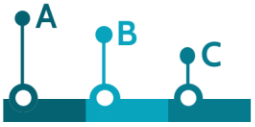
Market Effects Framework

The evaluation team and program stakeholders took the following steps towards establishing a market effects framework:

Developed a program theory and logic model (PTLM).



Identified indicators to measure progress toward outcomes.



Proposed data sources to measure the indicators (surveys, databases, etc.).

PAs' Proposed Program Design (to date)

- Organize into four paths; two paths focused on building optimization.
- Emphasize low EUI, enhanced technical assistance, and early engagement.
- Offer EUI-based incentives and optional pay-for-performance incentives.
- Allow opportunity for bonuses for Zero-Net Energy and Passive House certifications.

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Acronyms

Acronym	Definition
AIA	American Institute of Architects
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BCR	Benefit-Cost Ratio
BPD	Building Performance Database
CBECS	Commercial Buildings Energy Consumption Survey
CCSI	Code Compliance Support Initiative
CDA	Comprehensive Design Assistance
CEP	Clean Energy Program
C&I	Commercial & Industrial
ComEd	Commonwealth Edison
DD	Design Development
DOE	Department of Energy
DOER	Department of Energy Resources
ECM	Energy Conservation Measures
EDA	Energy Design Assistance
EIA	Energy Information Administration
EEAC	Energy Efficiency Advisory Council
EMIS	Energy Management Information System
EUI	Energy Usage Intensity
IDAP	Integrated Design Assistance Program
IDI	In-depth Interview
ILFI	International Living Future Institute
ISP	Industry Standard Practice
LEED	Leadership in Energy and Environmental Design
LPD	Lighting Power Density
MBCx	Monitoring-Based Commissioning
MEETS	Metered Energy Efficiency Transaction Structure
NBI	New Buildings Institute
NC	New Construction
NEI	Non-Energy Impact
NOMAD	Naturally Occurring Market Adoption
NRNC	Non-Residential New Construction
NTG	Net-to-Gross
OPM	Owner Project Managers
PA	Program Administrators
PEUI	Predicted EUI
PG&E	Pacific Gas and Electric
PH	Passive House
PHIUS	Passive House Institute U.S.
PPA	Power Purchase Agreement
PTLM	Program Theory and Logic Model
PTNZ	Path to Net Zero
P4P	Pay for Performance

RNC	Residential New Construction
ROF	Replace on Failure
SD	Schematic Design
TA vendor	Technical Assistance Vendor
USGBC	U.S. Green Building Council's
ZNE	Zero Net Energy

Executive Summary

From late 2018 through early 2020, NMR Group, Inc., and its subcontractor EMI Consulting (the NMR team), conducted the *MA19CX01-B-PLANME Commercial & Industrial (C&I) New Construction Program Planning & Market Effects/Spillover* study for the Massachusetts Program Administrators (PAs). The study is a combination of two topic areas related to the PAs' Non-Residential New Construction (NRNC)[1] program, which are under two unique contracts: program planning research (MA19C01-B-NCPLAN) under the *C&I Process Evaluation* contract and market effects research (MA19X01-B-NCME) under the *Cross-Cutting Market Effects/Net-to-Gross Evaluation* contract.

Study Background and Purpose

- ***The study was intended to help the PAs redesign their program and position themselves to claim market effects.***

Under the New Buildings and Major Renovations initiative, the PAs currently offer an enhanced and optimized integrated design path in two standard packages for new construction projects in the earliest development phases: a "Small Buildings Whole Building Solution" for new construction projects between 20,000 and 100,000 sq. ft. and a "Large Buildings Whole Building Solution" for larger new construction projects. The packages offer a scaled incentive structure tied to savings above the applicable energy code. Smaller buildings, renovations, and buildings already under construction can access prescriptive and system-specific custom incentives. However, the program has required a fundamental re-assessment due to several reasons:

- Rising energy codes, municipal mandates, and industry standard practice (ISP) that often exceeds code mean that the PA NRNC program, as it is currently structured, faces diminishing opportunities for energy savings.
- The last program impact evaluation, using 2014 data and published in 2018, showed low realization rates for electric and demand savings.[2]
- The 2019-2021 three-year plan describes how the PAs will explore further-reaching design innovations that include (1) engaging with design teams to set energy-use intensity (EUI) targets that can lead to more zero net energy (ZNE)-ready or passive house (PH) projects and (2) offering incentives based on measured project performance rather than modeled savings. [3]

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[1] NRNC is not *entirely* synonymous with Commercial & Industrial (C&I), and while there is overlap with multifamily offerings in the broader C&I framework, we use the term C&I in this report.

[2] *Massachusetts Commercial and Industrial Impact Evaluation of 2014 Custom CDA Installations.* DNV GL, DMI, SBW Consulting, and ERS. April 25, 2018.

[3] http://ma-eeac.org/wordpress/wp-content/uploads/Exh.-1-Final-Plan-10-31-18-With-Appendices-no-bulk.pdf

The first purpose of this study was to facilitate the redesign of the program. The second purpose was to position that redesigned program to claim market effects.[4] Market effects are sustained increases in the adoption and penetration of energy-efficient technologies and practices that result from structural changes in the market, and from changes in behaviors of market actors that are induced by a market intervention.

METHODOLOGY

➢ ***The study included charrettes, a best practices review, in-depth interviews, and focus groups.***

For this study, the NMR team led charrettes, conducted a best practices review, fielded in-depth interviews (IDIs), and led focus groups. We structured the study around four charrettes:

- Before the first charrette, we conducted a best practices review and IDIs with MA program implementation staff and ten other entities, including participating market actors,[5] implementers in other jurisdictions, and industry experts. We then held the first charrette, where we convened a large group of stakeholders who largely included PA implementation and evaluation staff, Massachusetts Energy Efficiency Advisory Council (EEAC) consultants, and evaluators. We presented the results of our research and provided stakeholders a forum to share their ideas and confer on the essential considerations for a program redesign.
- After the first charrette, we conducted six follow-up IDIs with industry experts and implementers in other jurisdictions to solicit more feedback on implementing EUI-based approaches. We presented these findings at a second charrette, which convened a smaller group of stakeholders. The focus of this second charrette was to take a deeper dive into a new program design and its key inputs, such as EUI baselines.
- After the second charrette, we drafted a program theory and logic model (PTLM) for stakeholders' review. We presented the PTLM during a third charrette with a medium-sized group of stakeholders and actively engaged with them to improve the PTLM, making it comprehensive and accurate. During this third charrette, implementers shared their revised program design to attendees and garnered more feedback.
- The discussions at the third charrette led the PAs to sponsor focus groups with program participants. The NMR team hosted two focus groups shortly thereafter. We presented the results of these at the fourth charrette, which included a medium-sized group of stakeholders. We also separately shared a revised PTLM and a draft list of market effects indicators with a larger group of stakeholders. Discussion at the fourth charrette centered

[4] The study is considered both a market effects and spillover study, but we refer to the topic area as market effects for brevity.
[5] Throughout this report we use the term market actor for brevity. This includes anyone who would actively engage in the program as a participant in some capacity, such as developers, engineers, architects, designers, operators, and sustainability consultants.

around considerations for the program redesign – particularly around EUI baseline – and preparing for market effects measurement.

Between tasks, we issued seven interim memos (and then an eighth memo after the final charrette, before drafting this report) which we and attendees used as background material and discussion points for subsequent charrettes.[6]

PROGRAM REDESIGN

The charrettes and other research revealed many considerations that informed the program redesign during the course of the study; we discuss these issues in Section 3. Because the key end deliverable of this study is the development of indicators, outcomes, and a measurement approach to support the claiming of market effects, the executive summary emphasizes the key information regarding market effects.[7]

Proposed Design

➢ ***The program's redesign emphasizes low EUIs, technical assistance, early engagement, incentives based on actual energy consumption, and bonus incentives.***

Implementation has proposed four paths with differing objectives, activities, incentive structures, and targeted project types. The first two paths focus on optimized design and low EUIs, and the second two paths follow a more traditional measure-based incentive structure:

- The Deep Energy Savings (Path 1) and Whole Building Modeled (Path 2) paths involve expert technical assistance and provide incentives based on energy modeling with a focus on achieving lower EUIs. These will require early engagement. These two paths also offer design team incentives.
- The Deep Energy Savings path will include technical assistance directly focused on achieving the *low EUI required* to attain ZNE-readiness. The PAs will issue incentives for this path in a pay-for-performance (P4P) format: one portion will be paid at the end of construction and the remaining portion after one year of post-commissioning, with post-occupancy energy usage data required to demonstrate whether the project achieves its target. The program will also provide bonus incentives for attaining ZNE and PH certification, though this is not required.
- The Simplified Whole Building path (Path 3) will provide less intensive technical assistance. It will utilize a spreadsheet (i.e., workbook) approach with incentive amounts tied to prescriptive and custom measures, rather than energy modeling. In the longer term,

[6] Memos are included in the Appendices. We modified them somewhat to exclude detailed notes and/or address oversights that stakeholders requested. Readers may notice some redundancies across memos and some information – such as the program design and program theory discussions – that are outdated given that the project was intended to be an evolution of decisions through a semi-consensus approach. We excluded one memo which was later revised.

[7] Additionally, because there are limitations to the extent that evaluators should influence program designs, we do not make direct recommendations to the PAs related to the program redesign.

the program may explore creating packages for common building types. This path also requires early engagement.

- The Systems path (Path 4) will primarily be a prescriptive program available for smaller buildings (<20,000 sq. ft.), yet it will allow larger buildings to participate if they engage with the program after construction documents are complete. It also allows for scenarios where only some portions of a building, such as parking garages, are participating.

Energy Usage Intensity

➢ ***EUI is the right metric to use, but EUI baselines must be addressed further.***

Charrette discussions, focus groups, and IDIs revealed overwhelming agreement that using EUI is the best step forward. However, developing the methodology for establishing EUI baselines to estimate savings, creating a meaningful and appropriate incentive structure, and including a transparent process for measurement is a multilayered hurdle. Setting sector-specific or building-type-specific EUI baselines and accounting for fuel types is both essential and complex. In 2019, the PAs commissioned a study to investigate the possibility of establishing EUI baselines, but researchers encountered data issues that limited the usefulness of the results. Therefore, the PAs are commissioning a new study to analyze additional data sources with the goal of providing more robust EUI baselines.

Market Effects and Spillover

➢ ***This study established the program's intended outcomes, or market effects, and selected indicators for measuring progress towards these outcomes.***

Accounting for the program's market effects and spillover allows the PAs to capture the program-attributable savings that are not included in program tracking data but have the potential to be claimed as program savings if they are proven to be created or broadened by program activities.

Market effects and spillover can be significant savings contributors. For example, the PAs' low-rise Residential New Construction (RNC) program benefited from market effects, which it captured in the form of non-participant spillover. Charrette attendees described how that spillover has been critical to the survival of the low-rise RNC program because of its high free-ridership threats.

This study represents the first phase of a proposed three-phased research effort for the NRNC program. In this phase, we identified how program intervention should result in specific outcomes in the market, also known as market effects, and what indicators should be measured to track progress toward these outcomes. The next phase will include setting a market baseline for these indicators. The third phase will be to measure progress on the market indicators and to quantify market effects.

As part of the MA19CX01-B-PLANME study, we articulated the program theory and developed logic models to represent the program theory graphically with input from charrette attendees. The program theory describes how the program's activities are expected to cause changes among target audiences or market actors that will lead to changes in the market. The purpose of the program theory is to clearly identify the program's causal hypotheses (i.e., how a particular activity

or set of activities is expected to cause a particular outcome), and to highlight any assumptions that are embedded in the program design. We refer to the program theory and logic model as the "PTLM." After refining the PTLM,[8] the NMR team and charrette attendees identified indicators the PAs need to measure to determine progress toward the outcomes and what sources they should use to do so.

Table 1 shows the program's intended outcomes and the related indicators. At present, only the Deep Energy Savings and Whole Building Modeled paths are intended to influence these market effects outcomes as the other two paths are based on resource acquisition intervention approaches.

Table 1: NRNC Program Intended Outcomes and Indicators

(Outcomes in **green** should be measured *immediately*, discussed below)

#	Outcome	Indicator of Outcome
Short-term (1 to 3 years)		
1	Increased demand for high-performance buildings	Participant desire for high-performance buildings
		Participant ability to develop high-performance buildings
2	High program awareness and participation	Rates of program awareness
		Rates of program penetration
3	Increased understanding and awareness of EUIs	Participant understanding of EUI
		Participant awareness of EUI
4	Changes in EUI targets	Frequency EUI targets are included in design/RFP
		Level of EUI targets
5	Increased adoption of high-performance building practices by market actors	Self-reported building/operation practices of participating market actors
6	High participant satisfaction with program	Level of participant satisfaction with program support, services, and incentives
7	Increased understanding and awareness of ZNE-readiness/PH	Understanding of ZNE-readiness/PH
		Awareness of ZNE-readiness/PH
Mid-term (4 to 6 years)		
8	Increased demand for high-performance buildings in market overall	Proportion of new buildings[1] that are high performance
9	Increased proportion of market actors with ZNE/PH skills	Self-reported levels of skill for ZNE-ready/PH practices
		Proportion of market actors in MA who are skilled in ZNE/PH practices
10	Increased proportion of new buildings that are ZNE ready or PH	Proportion of new buildings in MA that are ZNE-ready/PH
11	Increased proportion of new buildings which are low EUI	Proportion of new buildings that are low EUI
12	New practices carried over to non-participating projects	Reports of applying knowledge/skills for high performance bldg./operation learned through program

[8] PTLMs should generally be considered living documents with flexibility in outcomes, indicators of progress, and sources of measurement.

#	Outcome	Indicator of Outcome
		Reports of changes in standard practices
13	Improved market actor ability to estimate EUI	Comparison of models to billing data (ex-post versus ex-ante)
14	High satisfaction with participating buildings	Level of participant satisfaction with participating buildings
Long-term (7 to 10 years)		
15	Advances in government building codes	Changes in building codes (e.g., inclusion of ZNE stretch codes)
		Perceptions of program influence
16	Persistent energy savings in market overall	Decreases in EUI in new commercial buildings
		Perceptions of program influence

[1] Proportions of new buildings could be weighted by square footage.

RECOMMENDATIONS FOR MEASURING MARKET EFFECTS INDICATORS

- ***The program should field surveys with market actors and conduct additional research as soon as possible to establish a market baseline for the indicators.***

It is important to establish baselines for the market effects indicators as soon as possible – ideally before the redesigned initiative launches or very soon after – regardless of how or when the PAs and EEAC ultimately agree to quantify market effects.

The market effects indicators listed above can be measured through primary and secondary research, such as periodic surveys with program participants and non-participants and data from third-party databases, such as those from the New Buildings Institute (NBI), Department of Energy (DOE), Passive House Institute U.S. (PHIUS), U.S. Energy Information Administration (EIA), and local assessors.

The PAs should field surveys either before or within the first year of implementing the new program to establish baseline market conditions. To that end, we recommend that the PAs immediately begin measuring the indicators associated with the outcomes in green in the table above. These indicators can all be measured through some combination of secondary research, review of PA billing data, and participant and non-participant market actor surveys.

The PAs should plan to measure the indicators again when there has been sufficient program activity and enough time so that measurable market effects may have accumulated. Ideally, remeasurement should be conducted using the same research methods and instruments as with the first and any subsequent measurements[9].

[9] Outcomes are organized into short, medium, and long terms which are associated with specific years, but the expected timing of an outcome does not directly correspond with the time in which it can be measured.

CONSIDERATIONS FOR QUANTIFYING MARKET EFFECTS

In addition to timing and sources, when determining how and when market effects might be applied to the redesigned NRNC program, the PAs, EEAC, and evaluators must consider how to apply them, how they overlap with other programs, and the policy framework in which they reside. These considerations are interconnected.

Delays in Claiming Market Effects

- ***The PAs may not be able to claim savings from market effects from the NRNC program until 2025.***

The construction time associated with new C&I buildings can span multiple years, making it difficult to generate and measure market effects in the short-term. In addition, Massachusetts currently has a policy framework that locks in net-to-gross (NTG) values prospectively for three years. Given this policy, if the PAs and EEAC decide to quantify market effects for the NRNC program as part of NTG measurement, the PAs might not be able to claim any market effects savings until at least 2025, as research for 2022 through 2024 NTG values will be measured between 2020 and 2021, prior to the program having time to generate market effects.

Program Overlaps

- ***The PAs and EEAC must determine if the NRNC program should be evaluated holistically with other Massachusetts NRNC programs.***

The NRNC program will directly overlap with the code promulgation (i.e., the Code and Standards Compliance Support Initiative [CCSI]) and code enhancement efforts that the PAs have used to help enhance the current Massachusetts energy code and associated compliance. An important next step is to consider whether or not the impacts of the NRNC program and the code promulgation and enhancement efforts should be measured at the market level or individually for each program; we recommend the former. Analytically, it becomes challenging to separate the impacts from distinct programs that are all affecting the same market actors and building practices. There is precedent from the RNC sector to study these initiatives holistically, measuring savings at the market level, through a structured expert judgment approach. This approach helps ensure that savings (including market effects) are neither double counted nor missed and left on the table. Moreover, if given sufficient background information and provided adequate compensation, a panel of experts can take the time to consider and weigh the available evidence, which is likely to be quite substantial in this case. The other methods for quantifying market effects for Massachusetts programs are described at a high level in the PAs' *Action Plan for Measuring Market Effects*.[10] In addition to structured expert judgment, which is typically implemented through a Delphi panel, there are self-report counterfactual analyses, cross-sectional analyses, and forecasting or retro-casting the non-intervention baseline. The *Methods for Measuring Market Effects of Massachusetts Energy Efficiency Programs*[11] offers detailed guidance for evaluators using these market effects quantification approaches for Massachusetts programs.

[10] http://ma-eeac.org/wordpress/wp-content/uploads/Action_Plan_Measuring_Market_Effects_FINAL_2019.02.15.pdf
[11] http://ma-eeac.org/wordpress/wp-content/uploads/Methods-for-Measuring-Market-Effects-of-Massachusetts-Energy-Efficiency-Programs.pdf

Policy Framework and Discussions

- ***The PAs and evaluators should work with the EEAC to track policy discussions and determine how and when to measure market effects for the redesigned program.***

The redesigned NRNC program, along with other initiatives such as the PAs' code promulgation activities, are being developed with long-term market transformation in mind, so they are best suited to be considered in a market transformation policy framework. Trying to generate, quantify, and claim savings from market effects in a resource acquisition policy framework creates challenges, such as heavy up-front investment in programs for which savings cannot be claimed for years. Such challenges might be more easily mitigated through a market transformation policy framework.

The PAs, EEAC, and the Department of Energy Resources (DOER) are currently addressing the complex issues associated with the PAs' market transformation programs, including codes and standards advocacy efforts, heat pump controls, and now the redesigned NRNC program. Given the evolving nature of these discussions, the NMR team, in agreement with the PAs and EEAC, will delay making a formal recommendation on how and when market effects should be measured for this program. We will work with the PAs and EEAC to revisit this item in the coming months and will provide an update to this report at the appropriate time.

Section 1 Introduction

From late 2018 through early 2020, NMR Group, Inc., and its subcontractor EMI Consulting (the NMR team), conducted the *MA19CX01-B-PLANME Commercial & Industrial (C&I) New Construction Program Planning & Market Effects/Spillover* study for the Massachusetts Program Administrators (PAs). This report includes the results of that study. The study offered guidance and support to the PAs, Energy Efficiency Advisory Council (EEAC) consultants, and other stakeholders regarding the redesign of the PAs' NRNC program. The study was intended to inform how the program can be designed to achieve meaningful and evaluable energy savings in the future and to drive and capture savings from market effects and spillover.

1.1 Rationale for Redesign

Under the New Buildings and Major Renovations initiative, the PAs currently offer an enhanced and optimized integrated design path in two standard packages for new construction projects in the earliest development phases: a "Small Buildings Whole Building Solution" for new construction projects between 20,000 and 100,000 sq. ft. and a "Large Buildings Whole Building Solution" for larger new construction projects. The packages offer a scaled incentive structure tied to savings above the applicable energy code. Smaller buildings, renovations, and buildings already under construction can access prescriptive and system-specific custom incentives. We outline the current program design in detail in Appendix A.3.

Due to rising energy codes, municipal mandates, and industry standard practice (ISP) that often exceeds code, the PA NRNC program, as it is currently structured, faces diminishing opportunities for energy savings. In particular, a recent evaluation [12] of custom comprehensive design assistance (CDA) projects within the new construction program found relatively low realization rates for electric and demand savings, in large part due to adjustments for lighting ISP. Moreover, the median EUI of participating projects in the study sample was higher than the existing buildings surveyed in 2012 – a sign that the program should focus on reducing load. The 2019-2021 three-year plan describes how the PAs will explore further-reaching design innovations that include (1) engaging with design teams to set energy-use intensity (EUI) targets that can lead to more zero net energy (ZNE)-ready or passive house (PH) projects and (2) offering incentives based on measured project performance rather than modeled savings.

[12] *Massachusetts Commercial and Industrial Impact Evaluation of 2014 Custom CDA Installations.* DNV GL, DMI, SBW Consulting, and ERS. April 25, 2018.

1.2 Study Objectives

Given the shifts described above, the program required a fundamental re-assessment. The purpose of this study was two-fold:

- The NMR team aimed to help the PAs redesign their program by facilitating charrette discussions and gathering information from literature, market actors, industry experts, and program participants to help inform the PAs' decisions.
- The primary goal was to position the program to measure and claim market effects in the future.

As part of the effort to reach the primary goal, the NMR team developed a program theory and logic model (PTLM). As part of that, we developed a list of market indicators that can be used to assess market effects. The results can later be used to develop estimates of total savings from true new construction (including gut rehabs) that can be attributed to the program. Evaluating the market indicators in the future and comparing them to baseline estimates will allow the PAs to estimate the program-attributable savings that are not accounted for by their program tracking data and should be claimed as program savings. Understanding how market conditions have evolved over time will also allow the PAs to understand the effectiveness of the program changes.

For further context, readers may wish to review these studies, which are described in detail in Appendix A.1: *Massachusetts Joint Statewide Electric and Gas Energy Efficiency Plan*, *Massachusetts Commercial/Industrial Baseline Framework*, *Massachusetts Commercial and Industrial Gross Impact Evaluation Framework*, *Recommended Methods for Assessing Market Effects of NRNC Programs* , and the *Massachusetts Commercial and Industrial Impact Evaluation of 2014 Custom CDA Installations* study.

1.3 Ongoing Research

1.3.1 Market Effects

This study represented the first phase of a proposed three-phased research effort for the NRNC program:

1. **Design and Framework.** MA19CX01-B-PLANME has helped formulate program redesign and build an evaluation framework for future market effects and spillover measurement. We developed a PTLM that explains how program interventions are expected to affect the market, identified indicators to track the program's market effects and spillover, and offered recommendations for how to measure those indicators.
2. **Market Effects Baseline Study.** In this report, we have offered guidance for pursuing a baseline market characterization. A market effects baseline study is the next logical phase; it should take place before the program redesign affects a large number of projects and will provide valuable data points for quantifying market effects in the future. We recommend scoping this phase immediately.
3. **Evaluation.** After program impacts have time to take hold, evaluators will reassess and quantify market effects after the redesigned program has been in place for some time.

We discuss the next phases of research and evaluation of market effects in Sections 4.3 and 4.4.

1.3.2 EUI Baseline

On January 24, 2020, DNV GL finalized the results of the *Massachusetts Non-Residential New Construction EUI Baseline Study*. The study was unsuccessful in establishing EUI baselines due to a variety of data limitations (described in the Charrette 2 and Charrette 4 Memos: Appendices D.2.1 and G.3). The PAs are in the process of commissioning a study to broaden the research scope to recommend EUI baseline. Readers can find more discussion of the considerations and concerns involved in establishing EUI baselines in nearly all memos. In Charrette 4, much of the EUI baseline discussion focused on the challenge of setting sector-specific or building-type specific EUI baselines and accounting for fuel types.

There is a need for early building-specific EUI baselines so there is transparency to the market. However, the data needs to be reliable. As such, coalescing various data sources and conferring with a larger group to establish baseline values in a follow-up study will be beneficial. One approach could be to use a default baseline for typical buildings and a real-time evaluation to estimate baselines for less typical buildings, yet this could introduce bias unless carefully managed.

1.4 Report Organization

Because most of the research fed into decision making regarding program redesign, informed the structure of subsequent tasks, and influenced the PTLM, we issued memos to implementers and evaluation stakeholders after each task.

The remainder of this report is organized as follows:

Table 2: Report Organization

Section	Content	Description
Section 1	Introduction	Provides high-level overview of current program design, introduces rationale for study, outlines study goals, and contextualizes ongoing research
Section 2	Methodology	Summarizes research methods
Section 3	Program Redesign	Describes latest proposed program design and rationale for study in greater detail; summarizes findings from research which informed redesign, including market trends and barriers, EUI, P4P, TA, additional considerations, and proposed redesign to date
Section 4	Market Effects	Defines market effects and their purpose, includes the current PTLM, and offers recommendations for future measurement
Appendix A	Up-front Research Memo	Reports results from literature and best practices reviews and in-depth interviews (IDIs)
Appendix B	Charrette 1 Follow-up Memo	Summarizes presentations and preliminary discussions at the charrette, addressing program direction, market penetration, and savings methodologies
Appendix C	Follow-up IDI memo	Summarizes results from follow-up IDIs with other implementers and industry experts, addressing aspects of program design
Appendix D	Charrette 2 Follow-up Memo	Outlines interim drafts of program redesign; reports preliminary outcomes of EUI baseline study; summarizes discussions around savings methodologies, participant engagement, and other concerns
Appendix E	Charrette 3 Follow-up Memo	Provides interim study update; shares updated draft program redesign and PTLM; summarizes discussion around other program elements; introduces market effects indicators and methods of measurement
Appendix F	Focus Group Summary Memo	Summarizes feedback from focus groups with program participants about program structure and barriers to participation
Appendix G	Charrette 4 Follow-up Memo	Summarizes presentations and discussions at the charrette, including revisions to program design, PTLM, indicators, market effects indicators and methods of measurement, and next steps for establishing EUI baseline
Appendix H	References	Lists studies referenced throughout report

Section 2 Methodology

Table 3 lists the research tasks included in this study. We describe these in detail below. Because most research fed into the decision making for the program redesign, informed the structure of subsequent tasks, and influenced the PTLM, we issued memos to implementers and evaluation stakeholders after each task. All of the memos can be found in the appendices.

Table 3: Research Tasks

Task	Count
Best practices review	6 programs
Program staff IDIs	4 interviews – 7 interviewees
Market actors / industry experts IDIs	Preliminary – 10 interviewees Follow-up – 6 interviewees
Charrettes	4 occurrences – over 20 attendees in each charrette
Focus groups	Session 1 – 6 attendees Session 2 – 5 attendees

2.1 Best Practices Review

The objective of this abbreviated best practices review was to identify lessons learned regarding the design of innovative C&I new construction programs. To conduct the best practices review, the research team conducted secondary research on NRNC programs offered by program sponsors in the United States. We researched the following six programs in detail:[13]

1. Xcel Energy, Colorado: Energy Design Assistance (EDA) Program
2. Energy Trust of Oregon (ETO): New Buildings, Path to Net Zero (PTNZ)
3. Fort Collins Utilities: Integrated Design Assistance Program (IDAP)
4. New Jersey Clean Energy Program (NJCEP): Pay for Performance (P4P)
5. Commonwealth Edison (ComEd): Advanced Performance
6. Seattle City Light: Metered Energy Efficiency Transaction Structure (MEETS)

The best practices review is in the Up-Front Memo (Appendix A.4).

2.2 In-Depth Interviews

In January 2019, the study's outset, we conducted IDIs with program implementation staff (i.e., program managers) from National Grid, Eversource, Cape Light Compact, Unitil, and Columbia Gas. We sought to solidify our understanding of the current program and expectations for future program design and to learn more about Eversource's and National Grid's *accelerated performance* demonstration projects.

[13] Following the release of the best practices review, the PAs suggested that we consider Pacific Gas & Electric's (PG&E's) program. With the limited literature available, it was most productive to rely on an IDI with a program manager to collect more comprehensive information on the program.

Around the same time, we conducted IDIs with market actors and industry experts to develop a well-rounded view of the market and evolution of programs (n=10). The five market actors all participated in the current iteration of the Massachusetts PA's program. The industry experts included two outside program implementers (described in Section A.2.1) who were implementing EUI-based approaches, two representatives from industry organizations, and one non-participating architect.

After holding Charrette 1 (described below), NMR and the Massachusetts PAs, together, conducted six more IDIs with industry experts (n=2) and program managers/implementers from other jurisdictions (n=4) to give Eversource and National Grid implementation staff the opportunity to ask detailed questions about program designs and available resources.

2.3 CHARRETTES

Following the IDIs, the NMR team led four charrettes as part of this study:

1. Charrette 1, held March 13, 2019, offered an opportunity to convene a large group of program implementers and evaluators to discuss considerations for a program redesign, specifically focused on EUI.
2. At Charrette 2, held June 4, 2019, implementation outlined five potential program paths that it had continued to explore since Charrette 1. Charrette 2 offered a small group of implementers and evaluators the opportunity to provide feedback on the five potential program paths.
3. Following Charrette 2, implementers further refined the program paths, minimizing it to four paths; they presented these during Charrette 3 on September 25, 2019 and garnered additional feedback from a small group of implementers and evaluators. However, Charrette 3 focused primarily on developing the PTLM.
4. Charrette 4, held January 15, 2020, informed stakeholders on the latest program design, obtained feedback on the revised PTLM, and discussed market effects indicators and measurement.

2.4 FOCUS GROUPS

In December 2019, NMR, in collaboration with the Massachusetts PAs, led focus groups with active participants of the Massachusetts NRNC program to obtain feedback on the revised program design. Before the groups convened, we emailed participants the description of the proposed program design. This description can be found in Appendix F.2. At the start of the focus groups, implementation staff described the proposed offerings in greater detail and then remained in the room during the focus groups to answer questions. In total, the two focus groups – which lasted two hours each – had 11 attendees. With fairly even mixes of participant types, the first group had five attendees and the second group had six attendees. They included building *owners* (e.g., facilities director), developers, engineers, sustainability consultants, and owner project managers (OPMs).

Section 3 Program Redesign

When this study concluded in March 2020, the most recent version of the proposed program design included four paths. The Deep Energy Savings (Path 1) and Whole Building Modeled (Path 2) paths are advanced paths that focus on optimized design with expert technical assistance, and focus on achieving low EUIs. Path 1 includes a pay-for-performance (P4P) component (explained below) and offers bonuses for attaining ZNE or PH certification. The Simplified Whole Building (Path 3) and Systems (Path 4) paths provide a more simplified offering and include incentive amounts tied to prescriptive and custom measures.

In this section, we summarize recurring themes related to program design that helped inform the redesign process. This section includes feedback relating to key themes considered during the redesign process: market considerations, EUI, incentives, technical assistance, and barriers to participation. It concludes with a description of the most recent proposed program redesign as of March 2020. To keep this report digestible and concise, we present findings at a very high level here and consistently refer readers to relevant appendices for further explanation and discussion.

3.1 Market Considerations

Charrette discussions and IDIs with market actors and industry experts emphasized the market dynamics in the NRNC market that the program needs to navigate and build upon. In terms of direction, IDIs found that operating costs in this sector will continue to rise, codes will continue to increase, interest in energy-efficiency and renewable energy will grow, electrification will take hold, and adaptation to climate change will rise in importance. Interviewees explained that energy efficiency in this sector is driven by increasing operating costs, program incentives and technical support, carbon emission reduction goals, mandates around transparency and code, non-energy impacts (NEIs), and other non-program factors. These overlap with the external factors considered in the market effects framework. The Up-front Memo provides a thorough discussion of this feedback (Appendix A.2).

Successfully penetrating the market means overcoming market barriers.[14] Our research indicated[15] that the major barriers this program seeks to overcome include the following:

- Financing requirements and availability
- Time commitments and project timelines
- Prioritization of aesthetics
- Perceptions of riskiness and upfront costs
- Lack of demand or recognition of the value of energy optimization
- Knowledge, expertise, availability, and willingness among market actors

[14] There are two layers of barriers that programs face: first, barriers to participation, and second, barriers to market actors adopting energy-efficient practices and technologies. We discuss barriers to participation later. Though, many barriers to participation overlap with barriers to reaching the market.

[15] Feedback across charrette attendees, focus group attendees, IDI interviewees, and the reviewed literature were almost always consistent; as such, we do not always directly link findings to sources for brevity.

- Conflicting priorities among market actors
- Technical feasibility
- Broader economic variables

The Charrette 3 memo explores these market barriers in more detail (Appendix E.4.3.3).

3.2 Energy Use Intensity

Charrette discussions, focus groups, and IDIs with market actors and industry experts expressed overwhelming agreement that using EUI is the best step forward, calling it a "pure metric" and "*the* approach." Though, the confounding problem on everyone's minds throughout this study was the method and ability to establish an EUI baseline to estimate savings and, therefore, develop a meaningful and appropriate incentive structure and a transparent process for measurement. Based on preliminary analyses of EUI data, charrette attendees concluded that additional research is needed to finalize how the program should move forward with developing EUI targets for the program. The NMR team was scoping out this additional research at the time this study concluded.

Readers may wish to explore Appendices D.2.1, E.1.2, and G.3 for substantive discussion about attitudes and approaches for building program paths around EUI. In short, other concerns around EUI included costs and complexity of ongoing data collection, costs of (often iterative) modeling, missing savings due to unplanned load or behavior, and lack of familiarity among some market actor segments. Interviewees/attendees warned against setting a single, fixed EUI target for all projects, describing the variations of end uses and occupancy density. Focus group attendees and an industry expert suggested using flexible EUI targets that allow for ranges and are tailored to the building type. Interviewees also underscored the need for planning for variance in EUI targets. Charrette attendees voiced that the program must "translate" its EUI-focused approach into something customers can digest and map to their business models, goals, and needs.

Implementation and charrette attendees considered how PH and ZNE designs and certifications might impact the use of electricity compared to natural gas, particularly for heating consumption. This may complicate how savings are calculated if an EUI baseline is applied. Attendees also discussed how savings might be allocated across the electric and gas PAs. These issues will be considered when developing EUI baselines and targets.

3.3 Incentives

Interviewees/attendees emphasized the importance of program accessibility and avoiding a model that serves only a subset of customers, reinforcing implementation's plan to keep Paths 3 and 4. Interviewees/attendees offered advice for incentive structures for optimized design: offer adequately sized rebates appropriate for project sizes, provide designer incentives, consider issuing incentives at different milestones *during* design and construction, and offer incentives on a dollars per square foot basis.

The Deep Energy Savings path, specifically, will use a P4P approach where the PAs will issue one portion of the incentive at the end of construction and the remaining portion after one year of post-commissioning, using post-occupancy energy usage data to demonstrate the project

achieves its target.[16] Interviewees/attendees conveyed that P4P's attractiveness is that it incentivizes real-world savings and encourages *good behavior*.

While the implementers decided to pursue this incentive structure for the Deep Energy Savings path, they pointed to some drawbacks to this approach: long project timelines complicate claiming savings and deter participation, especially considering upfront costs; the amount of cost/effort in tracking consumption and its impacts on program cost-effectiveness; the riskiness of relying on occupant behavior and future decisions related to load; the ambiguity of "post-occupancy"; and the potential to hinder customer/client relationships. The Focus Group Summary Memo (Appendix F) explains these concerns more thoroughly and also describes suggestions for how the PAs could successfully implement a P4P approach:[17]

- As planned, deliver a portion of the incentive post-construction.
- Make the post-construction incentive a large portion of the total incentive and frame the post-occupancy incentive as a bonus.[18]
- Garner buy-in from building operators and facilities managers.
- Deploy TA vendors to maintain hands-on up-front and ongoing support to operators.[19]
- Share and develop a clear M&V plan for post-occupancy calculations.
- Offer sub-metering incentives.[20]
- Clearly communicate implications of failing to meet EUI targets.
- Allow for flexible ranges in EUI targets.
- Create a feedback loop[21] to inform all types of participants of actual savings and to identify issues to fix.

On that note, there was confusion about the implications of achieving ZNE or PH certifications, with interviewees/attendees asserting that ZNE is very hard to attain, especially considering that the program does not support renewable energy. They worried that this hurdle would dissuade participation in the Deep Energy Savings path. As such, they underscored that the program should clearly communicate that the Deep Energy Savings path focuses on low EUI (i.e., ZNE-*readiness*) and provide a bonus for, but does not require, achieving ZNE certification.

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[16] The Up-front Memo provided a thorough description of the New Jersey Clean Energy Clean Energy Program (CEP) and provides feedback from the program implementer (Appendix A.2). The Follow-up IDI Memo garnered more feedback from the program implementer on this topic (Appendix C).
[17] Charrette attendees echoed much of this feedback.
[18] Though, one IDI interviewee emphasized the need to make the post-occupancy incentive "significant" in size.
[19] The PAs currently engage, to a limited degree, in supporting commissioning. One charrette attendee, in response to this recommendation, observed that the current PA efforts are inadequately linked to the outcomes being supported by the PAs. The attendee suggested that the program and market would be better served if the PAs supported increased engagement by the customers' commissioning agents.
[20] On that note, at least one charrette attendee suggested that submetering be included in project design requirements.
[21] Echoing an industry expert interviewee's recommendation, one small group later mentioned leveraging the ENERGY STAR® Portfolio manager to facilitate feedback loops.

3.4 TECHNICAL ASSISTANCE

The study found that the PAs need to provide a great deal of support to participants to successfully launch the new program paths (some suggestions also apply to the current program paths too). Above, we note types of support encouraged for a successful P4P program, such as, offering strong technical assistance for building operators and helping participants set EUI targets.

The research pointed to other strategies for improving program support beyond P4P. In particular, during the final charrette, the group reflected on the previous research and identified a need to provide more information on incremental construction costs and incentive amounts upfront, tailor education and training by role and building type, possibly expand the current pool of TA vendors, support project charrettes, intermittently review design plans, and increase technical assistance focus on modeling tools and EUI target setting. The Charrette 4 Memo offers more detail (Appendix G). All of this support will impact program costs; therefore, the PAs need to consider how the cost of bolstering resources and commissioning will impact cost-effectiveness.

The study identified a few additional issues relating to technical assistance. During the final charrette, several attendees voiced the belief that the PAs first need training to better understand the nuances of ZNE-ready and PH projects. This initial step will give them greater perspective when they are developing training materials for potential/future participants. On that note, early in the study, one IDI interviewee emphasized the importance of program staff being poised to communicate with engineers. Additionally, a charrette attendee suggested that the program support participants in incorporating incentive amounts and reduced energy costs into financial proformas to appeal to lenders and investors.

3.5 MARKETING AND OUTREACH

The PAs seek to improve their marketing and outreach as part of the program redesign. Interviewees suggested devoting full-time employees to marketing and outreach. In addition, interviewees/attendees emphasized the value of case studies incorporating customer testimonials with an end goal of driving buyer/tenant/customer demand for low-EUI buildings. Similar to technical assistance, they suggested tailoring outreach by roles and building type, as well as building/using relationships with all stakeholders, including manufacturers, lenders/financers/appraisers, certification groups, municipalities, etc. Interviewees/attendees also explained that using recognition and awards can be a means of drawing new projects to the program by "creating a buzz."[22] The up-front memo and the memos following the focus groups, Charrette 3, and Charrette 4 delve more deeply into these topics (Appendices C.1.5, E.4.1, F.1.3, and G.1.3).

Another consistent theme was the importance of engaging projects very early – ideally *before* RFPs are even drafted, with the hope of securing EUI targets into the RFPs.

[22] It can also be a way of encouraging current participants to strive for deeper goals.

3.6 PROGRAMMATIC BARRIERS TO PARTICIPATION

In Section 3.1, we described market barriers for NRNC programs. In addition to market barriers that the program is designed to overcome, the program has to contend with additional challenges that may discourage participation. For example, implementation staff spoke of the challenges that benefit-cost ratio (BCR) testing requirements have for the program; they pointed to its complexity and stringency as a basis for limiting savings and alienating potential participants. Other barriers that impede program participation include awareness of the program, incentive amounts that do not offset the program-related project costs or justify the time needed to comply with program requirements, lack of clarity on incentive calculations and timing, lack of eligibility for measures of interest, and the timing constraints of the design/construction process. We discuss these issues in greater detail in the Charrette 3 Memo (Appendix E.2.3).

3.7 PROPOSED REDESIGN

The proposed program design includes four paths with differing objectives, activities, incentive structures, and targeted project types. Table 4 outlines the four program paths.

- The Deep Energy Savings and Whole Building Modeled paths involve expert technical assistance and provide incentives based on energy modeling (dollars per square foot), with a focus on achieving lower EUIs. These paths will also include design team incentives.
- The Deep Energy Savings path will include technical assistance directly focused on achieving low EUI. The PAs will issue incentives for this path in a P4P format: one portion will be paid at the end of construction and the remaining portion after one year of post-commissioning, with post-occupancy energy usage data required to demonstrate whether the project achieves its target. They will also provide bonus incentives for attaining ZNE and PH certification.
- The Simplified Whole Building path will provide less intensive technical assistance. It will utilize a spreadsheet (i.e., workbook) approach where pre-determined savings and incentive amounts are tied to prescriptive and custom measures, rather than energy modeling. In the longer term, the program will explore creating packages for common building types. These first three paths require early engagement.
- The Systems path will be primarily a prescriptive program available for smaller buildings (<20,000 sq. ft.), yet it will allow larger buildings to participate if they come to the program after construction documents are complete. It also allows for scenarios where only some portions of a building, such as parking garages, are participating.

Table 4: Snapshot of Proposed Program Paths

(Source: Implementation Staff)

Components	Program Path			
	Deep Energy Savings	Whole Building Modeled	Simplified Whole Building	Systems
Building size (sq. ft.)	>= 20,000	> 50,000	20,000-100,000 (Flexible)	< 20,000 (Any if late engm't. or not whole building)
Early engagement required	✓	✓	✓	
Technical assistance	✓	✓	✓	✓ (For custom measures)
Project specific modeling-based savings estimates	✓	✓		
Spreadsheet-based savings estimates			✓ (Possible Bundling in future)	✓
Post-occupancy EM&V	Required	Optional (Bonus?)		
Pay-for-performance incentives	✓ (Partial)[1]			
Prescriptive / custom incentives			✓	✓
Modeling-based incentives	✓ (Partial)[1]	✓		
Design team incentive (Capped at $15k)	✓	✓		
Certification bonus	✓			

Note: The program design is not yet final. Specifications denoted with question marks are particularly still under discussion.

[1] The first portion of the incentive is issued post-construction and is based on modeled savings. The second portion of the incentive is based on the performance-period savings.

Section 4 Market Effects and Spillover

Market effects are defined as *sustained increases in the adoption / penetration of technologies / practices resulting from market changes induced by market intervention.* Market effects and spillover can be significant savings contributors. For example, the PAs' low-rise RNC program benefited from market effects, which it captured in the form of non-participant spillover. Charrette attendees described how that spillover has been critical to the survival of the low-rise RNC program because of its high free-ridership threats.

To measure market effects and spillover, PAs and evaluators identify a target market, characterize said market and identify the baseline, develop a program theory and indicators of market effects, decide on a method for measuring net savings, and collect and analyze data required to quantify savings. PTLMs – consisting of activities, outputs, and outcomes – are used to identify how and why the program is expected to change the market. PTLMs should generally be considered living documents with flexibility in outcomes, indicators of progress, and sources of measurement.

Table 5 lists the program's intended outcomes and links them to indicators and methods of measurement. Section 4.2 describes these elements in greater detail, and Section 4.3 delves into the recommended approaches for measuring the indicators.

Table 5: Outcomes, Indicators, and Sources of Measurement

(Outcomes in **green** should be measured *immediately* through primary data collection to establish baselines)

#	Outcome	Indicator of Outcome	Sources for Measuring Indicator	
			Surveys[1]	Secondary Data[2]
Short-term (1 to 3 years)				
1	Increased demand for high-performance buildings	Participant desire for high-performance buildings	Customers, owners, build/design/developers (P, NP), funders	
		Participant ability to develop high-performance buildings	Build/design/developers (P, NP), funders	
2	High program awareness and participation	Rates of program awareness	Owners, build/design/developers (P, NP)	
		Rates of program penetration		Program and assessor databases
3	Increased understanding and awareness of EUIs	Participant understanding of EUI	Customers, owners, operators, build/design/developers (P, NP)	ASHRAE benchmarks
		Participant awareness of EUI		
4	Changes in EUI targets	Frequency EUI targets are included in design/RFP	Owners, build/design/developers (P, NP)	Program documentation
		Level of EUI targets		
5	Increased adoption of high-performance building practices by market actors	Self-reported building/operation practices of participating market actors	Customers, owners, operators, build/design/developers (P, NP)	
6	High participant satisfaction with program	Level of participant satisfaction with program support, services, and incentives	Owners, operators, build/design/developers (P)	
7		Understanding of ZNE-readiness/PH		

#	Outcome	Indicator of Outcome	Sources for Measuring Indicator	
			Surveys[1]	Secondary Data[2]
	Increased understanding and awareness of ZNE-readiness/PH	Awareness of ZNE-readiness/PH	Customers, owners, operators, build/design/developers (P, NP)	
Mid-term (4 to 6 years)				
8	Increased demand for high-performance buildings in market overall	Proportion of new buildings[3] that are high performance		Billing data (P, NP), LEED, operator certifications
9	Increased proportion of market actors with ZNE/PH skills	Self-reported levels of skill for ZNE-ready/PH practices	Owners, operators, build/design/developers (P, NP)	
		Proportion of market actors in MA who are skilled in ZNE/PH practices		DOE ZNE Partner, PHIUS certified professional lists
10	Increased proportion of new buildings that are ZNE ready or PH	Proportion of new buildings in MA that are ZNE-ready/PH	Customers, owners, operators, build/design/developers (P, NP)	NBI ZNE buildings, PHIUS certified buildings lists, assessor databases
11	Increased proportion of new buildings which are low EUI	Proportion of new buildings that are low EUI		Billing data (P, NP), CBECS, BPD
12	New practices carried over to non-participating projects	Reports of applying knowledge/skills for high-performance bldg./operation learned through program	Owners, operators, build/design/developers (P)	
		Reports of changes in standard practices		
13	Improved market actor ability to estimate EUI	Comparison of models to billing data (ex-post versus ex-ante)		Participating designer/developer models, billing data

#	Outcome	Indicator of Outcome	Sources for Measuring Indicator	
			Surveys[1]	Secondary Data[2]
14	High participant satisfaction with buildings	Level of participant satisfaction with participating buildings	Customers, owners, operators (P)	
Long-term (7 to 10 years)				
15	Advances in government building codes	Changes in building codes (e.g., inclusion of ZNE stretch codes)		Municipal/state code documents
		Perceptions of program influence	Code officials, regulatory representatives	
16	Persistent energy savings in market overall	Decreases in EUI in new commercial buildings		Billing data, CBECS, BPD
		Perceptions of program influence	Owners, operators, design/developers (P, NP)	

[1] Build/design/developers also includes engineers, architects, OPMs, and sustainability consultants. P = Participants; NP = Non-participants
[2] ASHRAE = American Society of Heating, Refrigeration and Air-Conditioning Engineers; LEED = Leadership in Energy and Environmental Design; PHIUS = Passive House Institute U.S.; NBI = New Buildings Institute; CBECS = Commercial Building Energy Consumption Survey; BPD = DOE Building Performance Database
[3] Proportions of new buildings could be weighted by square footage.

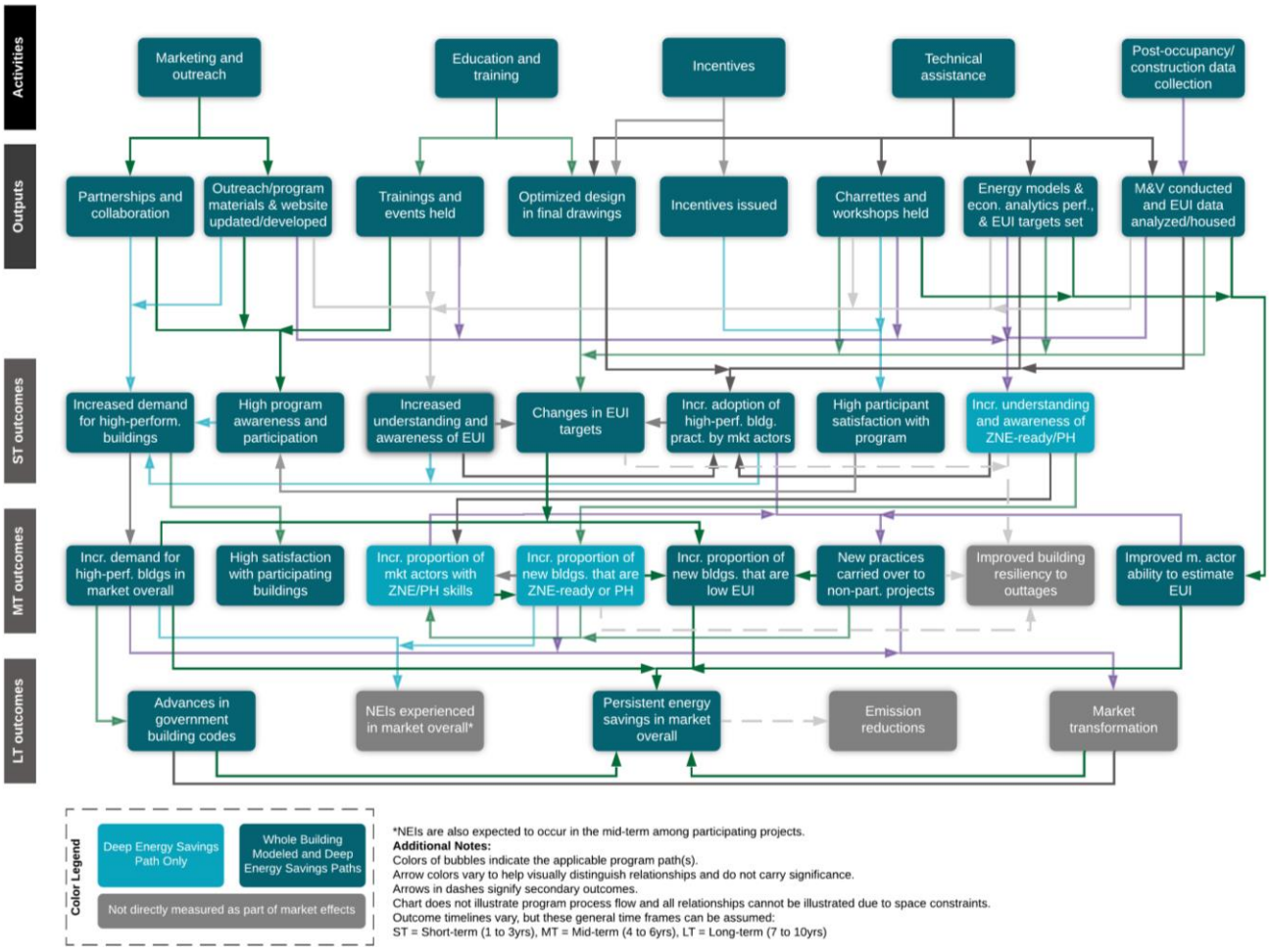
4.1 Logic Model

Figure 1 illustrates the activities, outputs, and outcomes for the Deep Energy Savings (Paths 1) and Whole Building Modeled (Path 2) paths. These two paths are intended to influence program outcomes, while the proposed Simplified Whole Building (Path 3) and Systems (Path 4) paths are *currently* structured as resource acquisition program models, which are not intended to generate market effects. For this reason, we do not present logic models or the associated program theory for Paths 3 and 4.

The purpose of the logic model is to visualize the program theory and to identify the market effects potentially induced by the program and display how the program may generate those market effects. Generally, the short-term outcomes influence participants only, and in the mid-term, they begin to spill into the market overall.

The arrows are in varying colors simply to help distinguish them in cases of overlaps, and these colors do not have any further meaning. Subsequent sections explain these relationships and offer definitions. Given space constraints, not all relationships can be illustrated; the logic models intend to show the strongest relationships.

Figure 1: Logic Model for Program Paths 1 and 2



4.2 PROGRAM THEORY

This section first explains the elements and relationships depicted in the logic model (activities, outputs, and outcomes) and describes additional elements or considerations critical to the program's function and/or market effects (resources, stakeholders, market barriers, and external factors). As mentioned, the program theory accounts only for Paths 1 and 2 with the assumption that Paths 3 and 4 are not expected to generate market effects given that they take a more "business as usual" resource acquisition approach.

4.2.1 Activities and Outputs

Below, we describe the key program activities and their quantifiable outputs:

Marketing and outreach

Program staff will work to reach customers and other market actors to raise awareness of the program and its offerings.

- **Output:** Outreach materials are developed and delivered, and the program website is maintained and refined as needed. Additionally, awards and recognition for performance are delivered to participating buildings and used as case study examples to generate media engagement/public interest and create a feedback loop.
- **Output:** Program staff participate in relevant industry organizations and form partnerships to conduct collaborative efforts.

Education and training

Through webinars and training events, the program will reinforce awareness of program offerings and provide training and education to the design and construction communities (including developers and design-build firms) and to building commissioners and operators on methods for decreasing building energy use, incorporating energy efficiency into projects, and developing high-performance buildings. Depending on the program path, education and training efforts will include information on the benefits and requirements of building to ZNE or PH standards and/or achieving lower building EUIs.

- **Output:** Training and events are held.
- **Output:** After learning new design methods for achieving optimized design, participants will include these in final construction drawings.

Incentives

Incentive offerings will vary by path. The Deep Energy Savings and Whole Building Modeled paths will award incentives based on a percentage EUI reduction relative to a baseline.[23] Incentives will be calculated in dollars per sq. ft., and the rates will vary by the range of EUI reduction. Also, the Deep Energy Savings path will offer P4P incentives and a bonus incentive for achieving ZNE or PH certification. Whole Building Modeled projects may receive a bonus for measuring and providing operational EUI data to the program.[24]

- **Output:** Incentives are incorporated into projects' financial proformas and distributed.

Technical assistance

The Deep Energy Savings and Whole Building Modeled paths will also include energy modeling services and offer EUI benchmarking and target setting for projects. Further, the program plans to provide commissioning assistance as part of the advanced paths that – under the technical assistance umbrella – would focus on project goals in building operations and ensure that measures and controls are installed correctly, building systems are operating as intended, and the building operators are trained on how best to manage building systems and monitor building performance to identify issues.[25]

- **Output:** Charrettes and technical assistance events are held.

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[23] The PAs are currently researching the possibility of applying sector based EUI baselines broken out by various building types. This research is not yet complete and as a result it is unclear exactly how baseline EUIs will be developed at this point in time.
[24] Simplified Whole Building and Systems path projects will receive custom and prescriptive incentives.
[25] Under the simplified paths, commissioning would be limited to traditional verification of ECM installation.

- **Output:** As a result of the charrettes and technical assistance meetings, energy models and economic analyses are performed, EUI targets are set, and optimized designs are included in final construction drawings.
- **Output:** Commissioning agent engaged early in design process to work with design teams and operators (or other end users) to document project goals, including energy targets, and use the commissioning process to support the team in achieving those goals throughout design, construction, and post-occupancy phases.

Post-occupancy/construction data collection

With its focus on both realizing decreased EUIs in practice and increasing the EUI data available to the program, the Deep Energy Savings path will require participants to provide one year of post-occupancy metered energy consumption data. The Whole Building Modeled path will include a bonus incentive for projects that provide one year of post-occupancy metered energy consumption data.

- **Output**: Granular actual EUI data on participating buildings is available, housed, and analyzed.
- **Output**: Inspections are conducted.

4.2.2 Short-term Outcomes

The outcomes described here are organized into short, mid, and long-term. Generally, a mid-term outcome would be caused by a short-term outcome and a long-term outcome would be caused by a mid-term outcome, and the timelines (i.e., calendar years) on which they are based vary.

A short-term outcome would likely occur one to three years following program intervention. Note that the expected timing of the outcome does not limit the timeline in which it can be measured; for example, an outcome expected to occur in the short-term can still be measured more than three years after program intervention and a long-term outcome can (and should) have a baseline established in the very near-term. The following short-term outcomes are expected to come directly from the program outputs. For each of the outcomes we list in Section 4.2, we include the data source(s) we propose to use to measure the related indicator(s).

Outcome 1: Increased demand for high-performance buildings

Nearly all program activities lead to this outcome, but we do not show this in the logic model due to space constraints. As shown, marketing and outreach efforts establish the value of energy efficiency among participants; however, education and training events, incentives, and technical assistance all encourage participants to adopt optimized designs. In addition, three short-term outcomes would increase the demand for development of high-performance buildings among participants: high program awareness and participation, increases in understanding and awareness of EUI, and increased adoption of high-performance building practices by market actors. Note, tactics to lower EUI do not rely solely on traditional energy conservation measures, so attention paid to proper building system management, occupant behavior, and advanced building design are included in this outcome.

- **Indicator A:** Participant desire for high-performance buildings
    - **Data sources:** Surveys with participating and non-participating customers, owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants and with funders
- **Indicator B:** Participant ability to develop high-performance buildings
    - **Data sources:** Surveys with participating and non-participating builders, designers, engineers, architects, developers, OPMs, and sustainability consultants and with funders

Outcome 2: High program awareness and participation

Two program activities increase awareness of the program among market actors, owners, and occupants: (1) marketing materials and outreach efforts and (2) education and training events. The first informs them that the new program paths exist and what they offer (e.g., technical assistance). The second – in addition to generating other outcomes – reinforces an understanding of the program's offerings or may elicit more awareness of new paths. Below we describe improvements in program satisfaction – which also fuels program participation levels.

- **Indicator A:** Rates of awareness of new program paths and their offerings
    - **Data sources:** Surveys with participating and non-participating owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants
- **Indicator B:** Rates of program penetration
    - **Data sources:** Program and assessor databases

Outcome 3: Increased understanding and awareness of EUIs

The marketing and outreach and educational and technical assistance activities described above will increase market actor, owner, and occupant awareness and understanding of EUIs.

- **Indicator A:** Participant understanding of EUI
    - **Data sources:** Surveys with participating and non-participating building operators, customers, owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants; American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) benchmarks[26]
- **Indicator B:** Participant awareness of EUI
    - **Data sources:** Surveys with participating and non-participating building operators, customers, owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants

[26] ASHRAE provides resources on EUI benchmarks for various building types, with an example here and several related resources linked in this FAQ.

Outcome 4: Changes in EUI targets

The program marketing, outreach and educational and technical assistance activities will lead to market actors setting lower EUI targets in participating buildings. Additionally, they may even increase the frequency with which market actors set EUI targets in their designs and RFPs. The critical outputs toward this end include charrettes, incentives, commissioning activities with operators, and inclusion of optimized designs. This will be driven by two other short-term outcomes: an increased understanding and awareness of EUI and increased adoption of high-performance building practices by market actors (both described above).

- **Indicator A:** Frequency with which EUI targets are included in building designs and RFPs[27]
    - **Data sources:** Surveys with participating and non-participating owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants; review of program documentation
- **Indicator B:** Level of EUI target
    - **Data sources:** Program documentation review, surveys with participating and non-participating building operators, customers, owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants

Outcome 5: Increased adoption of high-performance building practices by market actors

Market actors will learn of new and more advanced building practices and increase their understanding of EUI, ZNE, and PH through the program's educational and technical assistance activities. We describe below how, in the mid-term, they will also carry these practices over to non-program projects.

- **Indicator:** Self-reported building/operation practices of participating market actors
    - **Data sources:** Surveys with participating and non-participating building operators, customers, owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants

Outcome 6: High participant satisfaction with program

Participants who receive deeper technical assistance, an enhanced incentive structure, new bonus incentives, and recognition for their work may show increased satisfaction with the program. While participant satisfaction is not a market effect, it is an early indication that (1) the program offerings and outcomes resonate positively with market actors and (2) market effects will be sustained by high rates of program participation.

- **Indicator:** Level of participant satisfaction with program support, services, and incentives
    - **Data sources:** Surveys with participating building operators, owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants

Outcome 7: Increased understanding and awareness of ZNE-readiness and PH

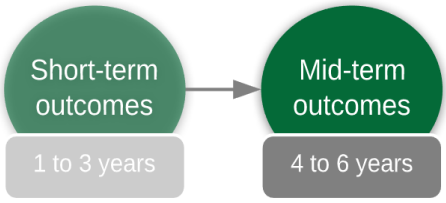
[27] Rates of EUI usage in buildings designs and rates of EUI specifications in RFP would be assessed separately.

Three program activities will primarily increase market actor understanding of how to achieve the low EUI required to attain these certifications: marketing and outreach, education and training, and technical assistance.

- **Indicator A:** Understanding of ZNE-readiness and PH
- **Indicator B:** Awareness of ZNE-readiness and PH
    - **Data sources:** Surveys with participating and non-participating building operators, customers, owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants

4.2.3 Mid-term Outcomes

Short-term outcomes typically are influenced by program activities and directly impact program participants. Alternatively, mid-term outcomes are the point at which the short-term outcomes impact the market more broadly, most likely occurring four to six years after program intervention.



Outcome 8: Increased demand for high-performance buildings in market overall

The demand for optimized designs in the program spills into the market overall. In particular, strategies related to ZNE and PH certification will see more widespread adoption. This outcome could occur even sooner than mid-term, so it will be worthwhile to measure it earlier than four years after the start of implementation. Perceptions of program influence on these and other indicators will be important to assess during measurement.

- **Indicator A:** Proportion of new buildings that are high performance[28]
    - **Data sources:** Billing data of participating and non-participating buildings;[29] Leadership in Energy and Environmental Design (LEED) projects registry,[30] New Buildings Institute (NBI) list of ZNE buildings,[31] PHIUS certified buildings lists;[32] operator certifications
    -

Outcome 9: Increased proportion of market actors with ZNE and PH skills

In addition to the short-term outcome of an increase in understanding and awareness of ZNE and PH, the program aims to increase the proportion of market actors in Massachusetts who are skilled in ZNE and PH practices. Note, the increase in skilled market actors will also lead to an increase in the number of ZNE-ready and PH buildings, making this a positive feedback loop. This will lead to a greater demand for local building professionals that are skilled in ZNE and PH practices and available to assist in the design process.

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[28] Proportions of new buildings could be weighted by square footage.
[29] DNV GL maintains the customer profile database that contains billing data.
[30] https://www.usgbc.org/projects
[31] https://newbuildings.org/resource/getting-to-zero-database/
[32] https://www.phius.org/phius-certification-for-buildings-products/certified-projects-database

- **Indicator A:** Self-reported levels of skill for ZNE-ready and PH practices
  - **Data sources:** Surveys with participating and non-participating building operators, owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants; ASHRAE benchmarks
- **Indicator B:** Proportion of market actors in Massachusetts who are skilled in ZNE-ready and PH practices
  - **Data sources:** DOE ZNE Partner[33] and Passive House Institute U.S. (PHIUS) certified professional lists[34]

Outcome 10: Increased proportion of new buildings that are ZNE-ready or PH certified

This will come primarily from the short-term outcome, increased market actor understanding and awareness of the ZNE-readiness and PH certifications. Moreover, it will be bolstered by the increase in the number of ZNE and PH skilled market actors (who rise to the demand for these buildings), including those who will conduct third-party verification inspections to confirm certified projects meet ZNE and PH requirements.

- **Indicator:** Proportion of new buildings in MA which are ZNE-ready or PH certified
  - **Data sources:** Surveys with participating and non-participating building operators, customers, owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants; NBI list of ZNE buildings, PHIUS certified buildings lists, assessor databases

Outcome 11: Increased proportion of new buildings that are low-EUI

All program activities are intended to lead to participating buildings with EUIs that are lower than they would have been in absence of Paths 1 and 2. However, they also should lead to reduced EUIs in the market overall. Most of the outcomes we have discussed lead either directly or indirectly to this outcome. The primary drivers of this outcome are further adoption of EUI targets and reduced EUI targets in participating buildings, increases in the EUI of new buildings that are ZNE-ready or PH, new practices carried over to non-program projects, and improved market actor ability to estimate EUI.

- **Indicator:** Proportion of new buildings which are low EUI
  - **Data sources:** Billing data of participating and non-participating buildings; U.S. Energy Information Administration (EIA) Commercial Buildings Energy Consumption Survey (CBECS);[35] DOE Building Performance Database (BPD)[36]

Outcome 12: New practices carried over to non-participating projects

The techniques, tools, and equipment that the market actors learn to use when working on participating projects can be carried over to non-participating projects. More specifically, an

[33] https://www5.eere.energy.gov/buildings/residential/locator
[34] https://www.phius.org/find-a-professional/find-a-phius-cphc-.
[35] https://www.eia.gov/consumption/commercial/
[36] https://www.energy.gov/eere/buildings/building-performance-database-bpd

increase in the number of ZNE and PH skilled market actors contributes to this outcome. This outcome would be more likely to occur among design professionals than developers.

- **Indicator A:** Reports of applying knowledge/skills for high-performance building practices or operation practices learned through the program
- **Indicator B:** Reports of changes in standard practices
    - **Data sources:** Surveys with participating building operators, owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants

Outcome 13: Improved market actor ability to estimate EUI

Participants in the Deep Energy Savings and Whole Building Modeled paths will be required or incented to submit post-occupancy EUI data. The PAs will house and likely analyze this data and provide feedback to program participants. As a result, building owners, architects, vendors, and design teams will receive feedback on whether their modeling predictions align with actual EUI. This type of feedback will help to improve modeling practices and accuracy and has the potential to influence occupant behavior in future projects. Additionally, this data will allow implementers and evaluators to more accurately estimate program energy savings.

- **Indicator:** Comparison of models to billing data (ex-post versus ex-ante)
    - **Data sources:** Participating designer/developer models; billing data of participating buildings

Outcome 14: High satisfaction with participating buildings

Owners and occupants of low-EUI buildings will be pleased with the energy savings they realize or other benefits (e.g., thermal comfort) they reap from occupying and operating ZNE and PH buildings. While participant satisfaction is not a market effect, it is an indication that market effects will be sustained by high rates of program participation.

- **Indicator:** Level of participant satisfaction with participating buildings
    - **Data sources:** Surveys with participating customers, owners, and operators

Other mid-term outcomes

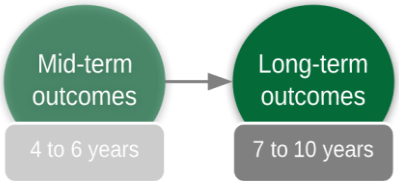
We do not suggest measuring the following outcomes to estimate market effects:

- **Improved building resiliency to outages.** We do not suggest measuring improved building resiliency because it is not a formal program outcome intended to be measured as a market effect. Yet, it is worthwhile to acknowledge that low EUI buildings, especially those built to ZNE or PH standards, will remain at a comfortable temperature and be able to self-sustain during a power outage for much longer than a building built only to code. Additionally, the lower EUIs of program buildings decreases the burden on the grid and makes the system more resilient. The short-term outcome of increased understanding of ZNE and PH supports this outcome. Additionally, two mid-term outcomes lead to it: (1) increased number of ZNE and PH and low-EUI buildings (program and non-program) and (2) improved market actor practices carried over to non-program projects.

- **Positive NEIs experienced in participating buildings.** Optimized building design may lead owners and occupants to experience NEIs, such as fewer tenant complaints, improved thermal comfort, and increased work productivity. This outcome may occur in the short-term, too. We do not suggest measuring NEIs under the market effects framework because (1) they are very complex to isolate and measure and (2) they are measured as their own impacts apart from market effects.

4.2.4 Long-term Outcomes

The following long-term outcomes would most likely occur seven to ten years after program intervention.



Outcome 15: Advances in government building codes

As the program promotes more efficient NRNC practices, particularly in the form of ZNE or PH certified projects, it is likely the state will acknowledge the increased use of high-efficiency design practices among market actors. In turn, this may lead to significant advancements in the energy code which will affect all NRNC buildings in the form of statewide mandates for efficiency. Similarly, demand for and construction of high-performance buildings will encourage communities to develop their own local zoning ordinances.[37]

- **Indicator A:** Changes in building code (e.g., inclusion of ZNE stretch codes)
  - **Data sources:** Municipal/state code documents
- **Indicator B:** Perceptions of program influence on code changes
  - **Data sources:** Surveys with code officials and regulatory representatives

Outcome 16: Persistent energy savings in market overall

Most outcomes directly or indirectly result in persistent energy savings in the market overall. These savings reduce emissions – another long-term outcome in the logic model – though emissions reductions are not a formal program outcome for market effects measurements.

- **Indicator A:** Decreases in EUI in new commercial buildings
  - **Data sources:** Billing data of participating and non-participating buildings; CBECS; BPD
- **Indicator B:** Perceptions of program influence
  - **Data sources:** Surveys with participating and non-participating building operators, owners, builders, designers, engineers, architects, developers, OPMs, and sustainability consultants

Other long-term outcomes

We do not suggest measuring these outcomes to estimate market effects:

[37] For further discussion see: https://neep.org/blog/getting-zone-using-green-zoning-achieve-our-carbon-reduction-goals

- **Positive NEIs experienced in market overall.** As the penetration of high-performance buildings in the market increases, the number of owners and occupants who experience related NEIs will increase. Similarly, this outcome may happen in the mid-term, too. We do not suggest measuring these for the same reasons as presented for the mid-term. Also, it would be even harder to measure NEIs in the long-term given tenant turnover.
- **Market transformation.** The increased proportion of buildings that are ZNE-ready and PH certified, spillover of market actor practices to non-participating projects, increased demand for and construction of high-performance buildings, and "locking in" of savings through code enhancements help to transform the NRNC market towards greater efficiency. Together, all of the previous indicators are an indication of market transformation. Throughout the transformation process, we would expect to see a general shift of market actors' perceptions of the normalcy of high-performance buildings. In other words, low-EUI buildings would become commonplace through the market transformation process.

4.2.5 Additional Program Theory Elements

There are several other elements considered in a PTLM, which we detail in the Charrette 3 Follow-up Memo (Appendix E.4.3):

- **Resources.** Program resources allow the program to carry out its activities. The primary resources of the MA NRNC program may include program budgets; program and sales staff efforts; program staff, TA vendor, and market actor expertise; relationships with market actors; past, present, and future evaluation research; partner organizations; and existing tools from outside organizations.
- **Stakeholders.** The program will touch various stakeholders to achieve the intended program outcomes. These include customers, building operators, occupants, building owners and OPMs, sustainability consultants, energy managers, designers, design-build firms, architects, engineers, construction managers, general contractors, and developers.
- **External factors.** To accurately understand the impacts the program has achieved, evaluators must place the program within a larger context affected by several external factors. To avoid attributing too much weight to a program's success or failures in achieving its outcomes, evaluators must consider external factors.[38] First, many municipalities have adopted codes or regulations that require efficiency levels beyond the base energy code. This affects both the baseline efficiency of buildings in those areas and the level of knowledge and expertise of market actors who operate there. In the case of the NRNC program, we should consider municipal mandates, municipal and state support, non-profit training and certification efforts, grassroots organizations, changes in energy or utility costs, economy and employment, and the MA PAs' PH program.

We listed the market barriers, another PTLM element, in Section 3.1.

[38] Some external factors are negative – dynamics or entities which *deter* energy-efficient building. These are considered market barriers.

4.3 Recommendations for Measuring Market Effects Indicators

In the previous section, we suggested sources of data with which to measure each market effects indicator. Here we describe in more detail the measurement methods. In Section 4.4 we outline considerations for the PAs and EEAC for measuring and applying market effects moving forward.

It is important to establish baselines for the market effects indicators as soon as possible – ideally before the redesigned initiative launches or very soon after – regardless of how or when the PAs and EEAC ultimately agree to quantify market effects. It is difficult to make a credible case for any quantitative estimate of market effects without a credible qualitative case. The market effects indicators are needed to support – or disprove – the program theory that explains the causal mechanism by which the program leads to the expected outcomes in the market. If there is too much of a delay in measuring the market effects baselines, it may not be possible to make the qualitative case needed to support a future claim of quantitative market effects.

4.3.1 Primary Data Sources

In the previous section, we suggested two primary data collection efforts:

- **Periodic participant surveys.** Many intended market effects from the redesigned NRNC program can be measured through periodic participant surveys. For example, at the start of program intervention, evaluators would interview/survey program participants, such as designers, and establish the frequency with which they set EUI targets on their NRNC projects. Years after program intervention, participants would be interviewed/surveyed again to determine how frequently they set EUI targets. The change over time can be an input into a market effects estimate. Another example indicator that would benefit from this type of approach could include changes in ability to design, develop, build, and/or operate optimized buildings.
- **Comparison surveys.** We recommend conducting periodic surveys that compare program participants to non-participants in Massachusetts or in another comparable region without a market transformation focused NRNC program.[39] Evaluators would compare differences in responses between these two groups after program intervention. For example, after the program hits its stride, evaluators could compare awareness and understanding of EUI between participating developers and non-participating developers. The difference between the two groups can be an input into a market effects estimate. Another example indicator that would benefit from this type of approach could include differences in skill levels in ZNE-ready or PH building techniques.

The timing of market effects measurement should correspond with the timing of program implementation.

First, the PAs should field surveys either before or very soon after implementing the new program to establish baseline market conditions. This is because the earlier in the life of the program the indicator baselines are measured, the greater the likelihood that evaluators will find measurable market effects and the more substantial they will be. Earlier, we highlighted the outcomes that

[39] Finding a reasonable comparison group in another state could be difficult, so it is more likely future efforts would focus on Massachusetts non-participants.

most urgently require a baseline measurement, as they are the most time sensitive. **With this in mind, we recommend that the PAs begin measuring the following indicators in baseline surveys with market actors as soon as possible:**

- Desire for high-performance buildings
- Ability to develop high-performance buildings
- Program awareness
- Understanding of EUI
- Awareness of EUI
- Frequency that EUI targets are included in design/RFP
- EUI target levels
- Building/operation practices
- Understanding of ZNE-readiness/PH
- Awareness of ZNE-readiness/PH
- Views about the value/uniqueness of high-performance buildings
- Levels of skill for ZNE-ready/PH practices

Then the PAs should plan to measure the indicators again when there has been sufficient program activity and enough time so that measurable market effects may have accumulated. Ideally remeasurement should be conducted using the same research methods and instruments as with the first and any subsequent measurements.[40]

Additionally, while a given outcome may be expected to occur only among program participants in the *short*-term (e.g., understanding of EUI), it is important to include non-participants in the baseline assessment of the indicator with an eye to the longer term expectation that the outcome will eventually be seen among non-participants.

4.3.2 Secondary Data Sources

We suggest using a few types of secondary data to measure market effects indicators and to support eventual quantification of market effects:

- **Third-party data.** Some of the indicators can be easily measured using third-party databases. For example, NBI's list of ZNE buildings across North America could be used to track changes in the number of ZNE buildings in Massachusetts. Similarly, DOE's list of Zero-Energy Ready Home partners by state and organization type and PHIUS lists for PH-certified buildings and professionals could be used to quantify partners and PH-certified buildings and professionals in a study now and then again down the road. Other useful third-party sources include CBECS, BPD, and assessor databases. Primary data would be needed to triangulate on the program's level of influence on observed statistical changes.
- **Billing data.** Multi-year billing data will be required to show how EUI changes among NRNC customers. For example, at its simplest, evaluators could estimate the EUI among

[40] As noted, outcomes are organized into short, medium, and long terms which are associated with specific years. These classifications set *expectations* for success, but it is never too soon to begin measuring an outcome. Moreover, the expected timing of an outcome does not *limit* the time in which it can be measured.

all NRNC buildings in 2020 and then again after the new program design has been fully implemented and compare how the proportions of NRNC customers who are low EUI has changed over time or how average EUI has changed over time.

- **Participation data.** Program tracking data will be useful for many evaluation activities. Other participation data, such as the participating designers' and developers' energy models, can be used with billing data to assess how well market actors' ability to estimate EUI changes after program engagement over time.
- **Benchmarks**. Secondary resources, such as ASHRAE, can be used to establish benchmarks against which to compare knowledge bases during surveys with market actors.

The PAs could begin measuring many indicators using these secondary data sources now.

4.4 Considerations for Quantifying Market Effects and NTG

There are a number of items that need to be considered when determining how and when market effects from the redesigned NRNC program might be quantified and credited to the program, most likely as part of measuring net-to-gross (NTG) at the market level. These include, but are not limited to, the following:

- **Timing.** The decision of when to measure market effects savings.
- **Quantification approach.** Market effects can be quantified using one or more of four general methods, as described in the Massachusetts *Action Plan for Measuring Market Effects* and discussed below.[41]
- **Overlap with other programs.** The NRNC program overlaps with other PA initiatives such as the Code Compliance Support Initiative (CSCS).
- **Policy framework.** Massachusetts is in the process of determining how to handle market transformation initiatives in a resource acquisition policy framework.

All of these items are interconnected. For example, the timing of measuring and applying market effects is linked to the NTG lock-in policy. In the RNC sector, market effects have been quantified using a Delphi panel as part of studies that quantified NTG at the market level. Massachusetts currently has a policy framework that locks in NTG values prospectively for three years. If the PAs and EEAC decide to quantify market effects for the NRNC program as part of NTG measurement, then the PAs might not be able to claim any market effects savings until at least 2025. Two primary factors could delay the PAs measuring and claiming market effects until 2025 using this approach:

1. The construction time associated with new C&I buildings can span multiple years, making it difficult to generate and measure market effects in the short term.
2. The three-year NTG lock-in policy means that the NTG values for 2022 through 2024 will be measured between 2020 and 2021. The redesigned program will not have had enough time to generate and measure market effects prior to the NTG lock-in.

[41] NMR Group. 2018. Action Plan for Measuring Market Effects.

Another key consideration for market effects is the overlap among the NRNC program and other PA programs that affect the NRNC market. In particular, the NRNC program will directly overlap with the code promulgation efforts that the PAs have used to help enhance the current Massachusetts energy code. For example, one of the code amendments supported by the PAs resulted in a decrease in the lighting power density (LPD) requirements for commercial new construction projects, requiring lighting to be more efficient. As mentioned in Section 1.1, the new code requirement, in theory, will result in a more efficient ISP that could reduce the savings associated with the NRNC program for lighting. The PAs' code compliance enhancement trainings will also limit the savings available to the NRNC program. As the PAs educate market actors about new code requirements (which they are also now influencing), they are theoretically helping to increase compliance and ISP, which leads to a more efficient baseline for the NRNC program.

An important next step is to consider whether or not the PAs' various programs that affect the NRNC market should be evaluated together. Analytically, it becomes challenging to separate the impacts from distinct programs that are all affecting the same market actors and building practices. There is precedent from the RNC market to look at these initiatives holistically, measuring savings at the market level, through a structured expert judgment approach. This approach helps to ensure that savings (including market effects) are neither double counted nor missed and left on the table. The other methods for quantifying market effects for Massachusetts programs are described at a high level in the PAs' *Action Plan for Measuring Market Effects*.[42] In addition to structured expert judgement, which is typically implemented through a Delphi panel, they are self-report counterfactual analyses, cross-sectional analyses, and forecasting or retro-casting the non-intervention baseline. *Methods for Measuring Market Effects of Massachusetts Energy Efficiency Programs*[43] offers detailed guidance for evaluators using these market effects quantification approaches for Massachusetts programs.

4.4.1 Policy Framework and Discussions

Massachusetts energy-efficiency programs and their subsequent evaluations have historically been developed through the lens of a resource acquisition framework. As noted in the *Action Plan for Measuring Market Effects*, resource acquisition programs are designed to "purchase" energy savings in the public interest – they do not necessarily generate long lasting market changes. The redesigned NRNC program, along with other initiatives such as the PAs' code promulgation activities, are being developed with long-term market transformation in mind, so they are best suited to be considered in a market transformation policy framework. Trying to generate, quantify, and claim savings from market effects in a resource acquisition policy framework creates challenges for the PAs, EEAC, and evaluation consultants for a variety of reasons. One key challenge is that the PAs must invest heavily in market transformation efforts upfront while not being able to claim savings for years down the road. Challenges such as these might be more easily mitigated through a market transformation policy framework.

The PAs, EEAC, and the Department of Energy Resources (DOER) are currently addressing the complex issues associated with the PAs' market transformation programs. These include codes

[42] http://ma-eeac.org/wordpress/wp-content/uploads/Action_Plan_Measuring_Market_Effects_FINAL_2019.02.15.pdf
[43] http://ma-eeac.org/wordpress/wp-content/uploads/Methods-for-Measuring-Market-Effects-of-Massachusetts-Energy-Efficiency-Programs.pdf

and standards advocacy efforts, heat pump controls, and now the redesigned NRNC program. Given the evolving nature of these discussions, our team, in agreement with the PAs and EEAC, will delay making a formal recommendation on how and when market effects should be measured for this program. We will work with the PAs and EEAC to revisit this item in the coming months and will provide an update to this report at the appropriate time.

Appendix A Up-front Research Memo

Memo issued March 7, 2019

On March 13, 2019, NMR and its subcontractor, EMI Consulting, will hold the first of several charrettes that will bring together stakeholders to collaborate on the redesign of the NRNC program. Charrette attendees should review this memo in advance of Charrette 1. It includes the following information:

- Summary of previous, relevant studies (Appendix A.1)
- Preliminary findings from our upfront research activities (Appendix A.2)
  - Best Practices Review (Appendix A.2.1)[44]
  - Program Staff Interviews (Appendix A.2.2)
  - Market Actor and Industry Expert Interviews (Appendix A.2.3)

The *Massachusetts Joint Statewide Electric and Gas Energy Efficiency Plan* for the 2019-2021 period describes how the PAs will explore further-reaching design innovations that include (1) engaging with design teams to set EUI targets that can lead to more ZNE-ready projects and (2) offering incentives for projects based on actual-versus-modeled building performance. Appendix A.3 summarizes the program's current structure, though most attendees are likely aware of these details.

A.1 Previous Studies

This section provides brief summaries of important groundwork studies that attendees should consider as they prepare for charrette discussions.

A.1.1 CDA Impact Evaluation

In 2018, DNV GL conducted the *Massachusetts Commercial and Industrial Impact Evaluation of 2014 Custom CDA Installations* study. The electric and gas Custom Comprehensive Design Approach (CDA) is a track within the custom NRNC program. The objective of this study was to verify or re-estimate electric energy and demand savings and gas savings for a sample of CDA projects. The study found the following gross savings realization rate for CDA projects completed in 2017 and prospectively:

- The realization rates for gross annual electric (kWh) and gas (therms) savings were 57% and 101%, respectively. The realization rates for summer and winter on-peak demand (kW) savings were 57% and 43%, respectively.

[44] Appendix A.4 offers detailed results of the best practices review.

- The electric realization rates were low, mainly as a result of increasing lighting ISP baseline efficiency (lighting power density [LPD] of 0.78 of the 2009 IECC). Measures that were not installed or functioning as intended had a negative impact as well.

The study recommended that the program (1) adopt a more stringent LPD baseline, consistent with the ISP baseline values calculated in recent studies; (2) adjust the post-2017 realization rate to account for the adoption of new ISP baselines (LPD and others) and modify process improvements to avoid double-counting savings; and (3) improve the commissioning process to ensure that measures are installed and functioning properly. It also suggested that the program consider the following:

- Include a summary of the baseline selection in the project documentation so that it is clear how it was determined and why it was chosen for each project. Engineering firms providing technical assistance studies for CDA projects should use the most up-to-date building simulation software available to accurately model leading-edge design approaches.
- Consider moving this program to a "performance-based approach" given the low electric realization rates, and research the appropriate benchmarks for EUI comparison. This would require incorporating M&V and an energy management information system (EMIS) to verify performance. The EUI analysis performed in this evaluation found that the buildings in this sample had a higher EUI than the median existing buildings in the 2012 Commercial Building Energy Consumption Survey (CBECS) on average, though this may have been skewed by the prevalence of laboratories in the sample.

A.1.2 Baseline Framework

In 2017, DNV GL developed the *Massachusetts Commercial/Industrial Baseline Framework*. It presented a general statewide framework for evaluators to consistently characterize the baseline for an impact evaluation. This framework is applicable to electric- and natural gas-saving measures, prescriptive and custom measures, and to all Massachusetts C&I programs.

The framework systematically guides evaluators in assessing the appropriate baseline for a combination of situations, with the following key tenets:

- The baseline depends on the measure's combination of technology and application and whether it is unique or not.
- For non-unique measures, the baseline may be the applicable efficiency code/standard or ISP, whichever is more stringent. If an ISP study does not exist, evaluators should conduct one. For unique measures, the baseline must directly reflect what the customer otherwise would have done (using site-specific data) absent the measure.
- When the evaluation and tracking baselines differ, evaluators must cite the basis for characterizing each measure baseline.

The study defined two different baseline categories that would be applicable to NC based on the conditions at the time of installation. The study also provided a flowchart that depicts the basic decision-making based on the baseline event type: (1) measures installed at the time of new ground-up facility construction or as a part of a major renovation fall under the NC or major

renovation category and (2) measures installed in response to the failure of a previously functioning system fall under the Replace on Failure (ROF) category.

In particular, for NC measures, the relevant code or regulated standard defines the baseline unless research finds that a preponderance of evidence exists to the contrary.

Several additional factors affect the selection of NC/ROF baseline, such as the system context, the timing of decision on equipment specifications, the inclusion of fuel switching measures, and whether the baseline is non-regressive.

The study explained how industrial process measure baselines can be challenging to classify when capacity expansion is involved. If expansion is small (<25% of production capacity) or if added capacity could have been realistically reached without adding additional equipment, then the pre-project energy intensity or equivalent is the baseline. Otherwise, the NC market-wide baseline governs the portion of capacity the existing facility would not have met.

A.1.3 Gross Impact Evaluation Framework

In 2017, DNV GL developed the *Massachusetts Commercial and Industrial Gross Impact Evaluation Framework*. It was intended to determine which Massachusetts C&I impact evaluation studies to undertake, at what rigor, and when. The primary objectives were to explore and document any refinements to impact evaluation practices and to document a systematic approach to impact evaluation planning.

The framework addressed fundamental research questions that drive the issues of timing, new evaluation structures, establishing baselines, estimating NTG and measure life, and necessity of early EM&V involvement. It described how the potential approaches to expedite evaluation timeframes include adopting rolling evaluations, decoupling the impact evaluation sample from the annual data aggregation/reporting cycle, aligning evaluation with program cycles, deploying focused studies where appropriate, and extending the planning horizon. The framework recommended the following next steps that apply to NC projects:

- Initiate traditional evaluation of custom measures and consider evolving into longer duration evaluation structure (multiyear, continuous) or perform reconnaissance on custom measures to investigate stability of previous evaluation results.
- Lay groundwork for staged multiyear evaluation with evolving segmentation/sampling strategy. Also, test quarterly/continuous data as a proof of concept of non-traditional evaluation structure.
- Consider developing evaluation file review protocols as a possible basis for unbiased tracking correction.
- Integrate baseline and measure life research.

The framework also focused on higher level impact planning processes to document how impact evaluation planning can be done, including the structural challenges, research categories, and key indicators of interest to impact evaluations.

Lastly, the framework provided an overview of ways to maintain a repository of program data and various evaluation methods for use in planning impact evaluations and exploring possible gaps in

research. What the study refers to as the *Impact Evaluation Tool Box* includes a list of impact evaluation methodologies, the spreadsheet scoring tool, the impact evaluation calendar, and the documented history of tracking savings and impact evaluations conducted in Massachusetts.

A.1.4 Recommended Methods for Assessing Market Effects

In 2015, Tetra Tech and NMR issued the *Recommended Methods for Assessing Market Effects of NRNC Programs*. More recently, the PAs and NMR created an *Action Plan for Measuring Market Effects* (publicized after the release of this memo) that details how to measure market effects and design programs that generate market effects more broadly. These two documents are generally consistent; therefore, we have summarized the 2015 study given that it has a specific focus on the C&I NC market.

The objective of the 2015 report was to outline appropriate methods for evaluating market effects resulting from the C&I NC program. The report includes proposed methods for establishing qualitative evidence of the program's effects on the market and quantifying the effects, which incorporate spillover, as well as estimating net savings.

The report offered two primary components for evaluating market effects:

- **Theory-based evaluation.** This is a qualitative approach to identify how program activities are expected to lead to market effects. This approach also measures the associated indicators periodically. This process begins with the development of a market model, depicting how the market functions, and the related program logic model, showing how program interventions are expected to affect the market. The program logic model should include expected short-, intermediate-, and long-term outcomes resulting from program activities. The evaluators should operationalize these outcomes so they can be measured and should conduct periodic research to track them. The report included preliminary market and program logic models, indicators, and a framework for tracking the indicators.
- **Quantification of market effects**. The report noted that it is difficult to make a credible case for any quantitative estimate of market effects if a credible *qualitative* case – through theory-based evaluation – cannot be established; hence, both components are necessary. It offers four general methods for quantifying market effects and recommended using structured expert judgment to estimate the net savings attributable to the C&I NC program:
    1. *Supply-side market actor self-reported counterfactual analysis* through surveys or IDIs asking about free-ridership and spillover.
    2. *Cross-sectional analysis*, which involves identifying one or more non-program comparison groups to be tracked along with the program area and serve as the "baseline" for the program area.
    3. *Forecasting or retro-casting the non-intervention baseline* using a model to estimate how the market would behave over time without the intervention of the program and compare the estimate with the actual behavior of the market with the intervention.

4. *Structured expert judgment,* which employs a team of experts, typically a Delphi panel, who review information on the market for the energy-efficient product or service and then undertake a structured deliberation to converge on a single baseline estimate.

The report identified several other PA-sponsored programs and initiatives that may affect the C&I NC market, including the C&I Retrofit Program, the Upstream Subprograms / Initiatives (HVAC and lighting), and the Code Compliance Support Initiative (CCSI). The report acknowledged existing studies designed to assess attribution for each program or initiative and existing or additional data sources needed to quantify the program's effects on the C&I NC program. The report specifically recommended combining the CCSI evaluation and the non-residential NC market effects evaluation and called for a Delphi panel to estimate savings attributable to these programs. Data to inform the Delphi panel's estimates would include retrospective savings estimates; a description of current and expected program activities; a synopsis of expected code changes; and information on other factors that could influence building practices, such as naturally occurring market adoption (NOMAD), LEED building, energy prices, economic conditions, and climate change.

The report also noted that the C&I NC program is not limited to true new construction, as it also addresses ROF. The report suggested focusing only on true new construction, including gut rehab, when evaluating market effects stemming from the program.

A.2 Preliminary Findings

To date, we have conducted a best practices review and interviews with program staff, market actors, and industry experts. Here, we present high level findings from those tasks. Appendix A.2.1 offers the full results of the best practices review.

A.2.1 Best Practices Review

The objective of this abbreviated best practices review was to identify lessons learned regarding the design of innovative C&I new construction programs. To conduct the best practices review, the research team conducted secondary research on NC programs offered by program sponsors in the United States. We researched the following six programs in detail:

1. Xcel Energy, Colorado: Energy Design Assistance (EDA) Program
2. Energy Trust of Oregon (ETO): New Buildings, Path to Net Zero (PTNZ)
3. Fort Collins Utilities: Integrated Design Assistance Program (IDAP)
4. New Jersey Clean Energy Program (NJCEP): Pay for Performance (P4P)
5. Commonwealth Edison (ComEd): Advanced Performance
6. Seattle City Light: Metered Energy Efficiency Transaction Structure (MEETS)

We organized the key results into process-related and impact-related findings.

A.2.1.1 Process

Our research revealed several implications for program design, implementation, and processes.

Intervene early in the design phase. The most common theme in the literature was that through extensive hands-on energy modeling and technical assistance early in the design phase,

programs can help incorporate specific energy savings measures into design plans and budgets, which otherwise might not be considered until later stages of design, when plans and budgets are less adjustable. Early involvement should extend to the financial decision-makers, who should be made to understand the benefits of an energy-efficient building that creates a higher value asset. Moreover, working with the design teams helps "fill the pipeline" of projects; the design community often learns about projects long before the program sponsor does, and they have direct lines of communication with owners.

Personalize the customer experience. Meeting directly with participants to address goal setting, modeling results, construction-document review, and site walkthroughs results in positive responses. Although many building owners find performance-based programs exciting, some find building them cumbersome and/or confusing given the technical knowledge required. Additional marketing efforts through the program sponsor's website, conferences, and monthly partner calls can clarify program processes and make them feel less overwhelming.

Xcel Energy's EDA program has found positive results using building-specific energy modeling software. When repeated with various energy-saving options and targets, owners and design teams can have an energy-optimized building within their budget.

Targeted messaging can also be useful. Seattle City Light found positive responses from stressing non-energy benefits (e.g., increased asset value, higher quality living/working environment, health benefits, increased comfort, lower maintenance costs, improved productivity, and fewer tenant complaints) in their discussions with customers.

Consider a different approach to issuing incentives. Programs can issue incentives in stages. For example, the NJCEP P4P program issues incentives in three phases. The first is issued to engineers after receipt of modeled plans. The second – the bulk of the incentive – is paid after construction is complete. The final portion is paid after receipt of a year of bills demonstrating performance. The second and third incentives are associated with percentage cost savings – a sliding scale with minimum and maximum values. If participants achieve more savings than modeled, the program pays more than had been estimated. If they achieve less savings, the program pays less than had been estimated. If they "bottom out completely," the program issues a "conciliation prize" (small) incentive. The program also allows them another chance to remedy the problem and provide more usage data to demonstrate performance.

By providing financial support as early as possible in the design process, many energy reduction strategies can be linked to an EUI target, and this target links incentives that can overcome late-stage value engineering of energy efficiency.

On that note, programs tend to reimburse design teams (not just customers) for their time participating. Additionally, some programs offer extra incentives (on top of incentives associated with EUI or going above code) for deeper savings, non-lighting measures, demand reductions, or net savings versus gross savings.

Tailored tools can engage customers and reduce costs. Energy-efficiency upgrades may be thought to be too expensive for consideration or are considered someone else's job. Offering extensive energy modeling and technical assistance to design teams and building owners will help them see which energy-efficiency measures are worthwhile and within budget. ETO found

success through engaging design teams with an energy target-setting tool with a planning worksheet that states a minimum EUI, customized by building type.

Xcel Energy used a Project Tracker that reduced costs by allowing all system users (building owners, consultants, and utility staff) to track and manage project workflow in addition to its automated quality-control functionality. The reduction in transaction costs alone – versus a traditional email and phone-based system – allowed the program at one point to decrease the minimum eligible building size from 50,000 to 20,000 square feet.

Address usage patterns. Programs need to develop new mechanisms to address the operating phase when transitioning to an actual (versus modeled) approach, targeting all of the project players:

- **Occupants**. Because EUI is so heavily influenced by occupant behavior, developing effective strategies to engage occupants in energy conservation is critical to ensure a performance target is met. Occupants and operators need to learn how to appropriately manage their buildings to uphold the intended performance level. Programs can be an important conduit in providing feedback and encouraging operator training.
- **Contractors**. Encourage facility staff to collaborate with their controls contractors in actively managing building performance. This may include the controls contractor directly monitoring performance and reporting regularly to facility staff or setting up a system that alerts staff to abnormally high energy usage and other performance indicator abnormalities. Enlisting the help of controls contractors is important because they are usually more familiar with the complexities of building operation than the facility staff.
- **Market actors**. Designers and developers need to take on additional responsibilities after construction. Moreover, they need feedback on how their past projects are actually being used and performing so they can incorporate lessons learned in their future designs.

Address underperforming buildings. Potential solutions might include developing systems that can continuously adjust energy targets based on operational modes and occupancy patterns, setting performance ranges rather than single-point EUI targets, and focusing enforcement efforts only upon the worst-performing buildings.

A.2.1.2 Impact

Changing program design brings many questions about estimating and evaluating program savings to the forefront. Here, we characterize some ways to approach those questions based on the literature we reviewed.

Ensure verification site visits are effective. Savings adjustments are often needed because of differences in the assumed operation of systems (used to claim savings) and how customers actually operate systems. Therefore, programs should consider delaying verification of new buildings for as long as possible after construction – while still considering the need to claim savings within a particular program year. This will allow as much time as possible for occupants to learn how to adjust their behavior. Additionally, ETO learned the importance of ensuring that models or designs account for backup or redundant equipment to avoid conflicts with claimed savings.

Thoroughly review energy models. Most modeling software packages have the ability to apply more than one equipment operating schedule, and more than one internal load schedule (such as people or equipment loads). Model reviewers should take care to validate the equipment and loading schedule to ensure it is consistent with the anticipated operation of the building. To increase the likelihood of energy model success, incorporate a substantial technical review process of the model. In 2016, ETO identified that conducting technical reviews of energy calculation methods, inputs, and assumptions was extremely productive. The format of the technical review memo should isolate specific issues and responses to present findings clearly.

Learn how to successfully leverage EUI metrics. EUI is affected by building use type, climate, hours of use, and other factors that are normal variables in buildings. These differences do not reflect any inherent building performance issues, so EUI does not necessarily lead to conclusions about building performance between different buildings.

The key to successfully using EUI as a benchmark is having good data on the energy performance of similar buildings. Jurisdictions that collect and evaluate energy consumption disclosure data are in a strong position to set EUI targets and compare local building stock performance to these benchmarks. A recent ACEEE paper suggested that a program supporting ZNE should require – in addition to adequate site area for appropriately-sized generation systems – an EUI of 25 kBtu/sq ft or less. This EUI target is considered the balance point between what a building can consume in 12 months and what can be offset by renewable on-site energy sources.

Consider metrics besides EUI. An alternative metric to EUI is the Zero Energy Performance Index (zEPI). It sets a baseline using CBECS data, the same baseline used by the Architecture 2030 Challenge as a basis for building performance policy goals. The baseline is normalized to a value of 100, while zero net annual energy performance is set at a value of 0. The zEPI score places building performance on this 100 to 0 scale to represent progress toward ZNE (the lower the score, the better the performance).

Whatever metric is used, it needs to balance data granularity and simplicity. The metric needs to be simple enough for various end users to understand but robust enough to provide useful ongoing performance information.

A.2.2 Program Staff Interviews

In January 2019, we interviewed program implementation staff (i.e., program managers) from National Grid, Eversource, Cape Light Compact, Unitil, and Columbia Gas. We sought to solidify our understanding of the current program and current expectations for future program design and to learn more about Eversource's and National Grid's demonstration projects (also referred to as *accelerated performance* projects).

All interviewees acknowledged that market demands resulting from improvements to both building energy code and ISP require that the program evolve. Several themes emerged, which are important for stakeholders to keep in mind as they consider a program redesign approach:

- The program staff emphasized that the program redesign should maintain successful elements of the existing program, such as engaging design teams in the process and offering a tiered incentive.

- They asserted that moving to an EUI-based approach would require a substantial shift in design and implementation. For example, the proposed approach requires earlier engagement with and more education for both customers and design teams.
- To be expected, implementers were concerned about the complexities of claiming savings from an EUI-based approach. Stakeholders need to consider issues such as establishing the appropriate baseline, capturing incremental costs, retrospective and prospective forecasting, and factoring in persistence (which is particularly important for savings estimates from gas measures). These are all details that need further deliberation and planning.
- From the implementers' vantage, there are certain market segments or building types that are well-suited for the EUI-based approach (e.g., schools and municipal buildings), but others where this approach would be cost prohibitive (e.g., small to medium-sized buildings and hospitals). Moreover, the NC market varies across the PA territories, which limits a one-size-fits all solution.
- Interviewees pointed out that the program redesign must consider the building fuel type, construction timelines, implications for stretch code communities, and the role of existing and emerging technologies.

Representatives from Eversource and National Grid also offered insights from several accelerated performance demonstration projects (in partnership with Slipstream [formerly Seventhwave]). These include K-12 schools, municipal buildings, and universities. The process involves engaging with the customer and design team very early in the process and establishing EUI targets. The incentives are based on EUI reductions measured against a theoretical EUI baseline; however, Eversource and National Grid are relying on traditional baseline modeled estimates to claim savings. Early feedback from participants has been positive. The program managers will present more results during Charrette 1.

A.2.3 Market Actor and Industry Expert Interviews

We interviewed market actors and industry experts to develop a well-rounded view of the market and evolution of programs. Market actors have included two owner's project managers (OPMs) and two technical assistance (TA) vendors, and an architect who all participate in the Massachusetts PAs' program. Industry experts included two program implementers from other jurisdictions (described in Section A.2.1) who are implementing EUI-based approaches, two representatives from industry organizations, and one non-participating architect/author that is considered an expert in the industry. We plan to conduct follow-up interviews with the same individuals after Charrette 2.

Because the IDIs finished on March 6, we have not yet analyzed all of the results in detail. At the start of Charrette 1, we will offer a summary of the results to date. Below, we offer a high-level summary of all IDIs and then a more detailed summary of the program implementer IDIs.

A.2.3.1 High-Level Summary of Interviews

In this section, we summarize the key themes from the market actor and industry expert interviews.

Key players. When asked who plays the largest role in driving energy efficiency in the commercial NC market, responses varied. Market actors tended to point to building owners. Although, industry experts considered owners, architects, engineers, and even (Massachusetts and other) PAs as vital players. Interviewees observed that some owners – according to the RFPs they see – are interested in energy efficiency (or a certification) even before putting together their design team. Industry experts indicated that architects and engineers are in the position to "make the case" for energy efficiency to their clients. In fact, one implementer perceived that engineers hold greater weight than architects in this realm.

Timing. Interviewees agreed that early incorporation of energy efficiency into a commercial building's design is vital. They explained that energy efficiency, or even EUI targets, should be part of the RFP process as a best-case scenario. In other words, energy efficiency needs to be a goal from project inception (before the design phase) or, at the very latest, the early design phase.

Drivers and barriers. Interviewees observed a host of factors driving energy efficiency in the commercial NC market: desire for saving on operating costs, incentives/program support, concerns around climate change and emissions goals, occupant comfort and productivity, rent premiums, stretch codes, and mandated transparency.[45] However, interviewees also noted several barriers: perceptions of higher up-front/investment costs, tight project timelines, lack of owner interest, and aesthetic preferences.

Direction of the market. We asked interviewees to project how the Massachusetts commercial NC market will evolve in the next three to five years. They predicted that rising operating and utility costs will encourage more owners to pursue energy efficiency. They acknowledged that the increasing stringency of code and mandated transparency will require or encourage greater efficiency but noted the need for a well-trained workforce to support that transition. At least one interviewee expected that investment in renewable energy will outpace interest in energy efficiency. At the same time, others expected interest in energy efficiency to increase. At least one interviewee expected that electrification will take hold. They also mentioned the market moving to adapt to climate change and increase resiliency to lessen grid burden.

Certifications and guidelines. We asked interviewees if there are particular guidelines or certifications that are popular for designing ZNE-ready or low-EUI buildings in the commercial NC market. They mentioned, in no particular order, LEED, NBI's support for ZNE buildings, PH, International Living Future Institute's (ILFI's) Living Building Challenge, Collaborative for High Performance Schools, ASHRAE, American Institute of Architects, and the Architecture 2030 Challenge. They noted that interest in LEED has waned and that LEED buildings can have high EUI.

[45] Cities such as Boston and Cambridge have imposed mandated transparency, which exposes "poor performing" buildings relative to other buildings in the area.

Current program design. Market actors suggested an array of ideas for improving the Massachusetts program. Many of these are already program goals.

- Engage owners earlier in the design process.
- Streamline the participation process and provide clarity earlier on eligible measures.
- Make prescriptive path offerings "stronger" and more flexible.
- Be reasonable with modeling requirements. Market actors found that models are sometimes unnecessary. If models are analyzing similar spaces, they become redundant. On the other hand, industry experts felt that the more rigorous the model, the more likely modeled EUI will closely match the actual EUI of the occupied building.
- To increase participation, help designers with messaging and provide more examples – and more diverse examples – of projects that have earned incentives to convince developers of the range of possibilities.
- Focus on aggressive EUI goals through load reduction – such as through improved envelope and implementation of passive strategies – and less on equipment efficiency.
- "Sprinkle" incentives throughout the participation process (similar to the NJCEP design).
- Oversee the handoff to owners by requiring building operator training.
- Better integrate with Massachusetts Clean Energy Center (MassCEC) incentives for renewable energy measures.
- Support fuel switching and renewable energy measures.

Attitudes towards new approaches. Interviewees generally concurred that incentives should be paid based on actual savings versus modeled savings. Again, acknowledging this is easier in theory than practice, especially because of the reliance on occupant behaviors and plug loads. In fact, responsibility for plug loads was a particular point of concern, with interviewees pondering whose role it is to encourage appropriate building operations (for example, should designers be charged with training occupants to operate the building properly?). Their discussions also implied the need to refine the method to estimate and calculate plug load. Interviewees described how load reduction and management factors – envelope and controls – need to overshadow equipment efficiency.

Overall, interviewees were positive about programs moving to an EUI-based approach. Although, they wondered about post-construction accountability and measurement, saying it is great in theory to incentivize actual versus modeled savings but many factors are out of the hands of the design team (e.g., building manager buy-in, properly adapting controls to occupant behavior). They asked several unsurprising questions, including "What is the EUI baseline" and "How do you compare actual EUI versus baseline EUI to determine savings and incentives?" In summary, they considered EUI as a generally good way to measure savings, yet potentially problematic to employ. Both implementers claimed savings above the baseline code (the latest adopted version of ASHRAE) and felt that this was an effective, if simplistic, approach to claiming savings.

They noted the need for separate solar incentives to supplement ZNE-readiness programs. An industry expert noted that while a low EUI puts a building on the path to ZNE-readiness, very few

ZNE buildings currently exist in the U.S. due to the complexity and cost of including that much renewable energy on site. They explained that ZNE-ready buildings should also employ passive design techniques and work towards a tight building envelope that avoids thermal bridging – techniques that will also achieve low EUI.

A.2.3.2 Program Implementer Interviews

The interviewees included an implementation contractor for NJCEP and a program manager from ETO's PTNZ program. Here, we summarize the key themes from these two interviews.

Program Design. Both programs offer prescriptive measure options and incentives based on verified savings above ASHRAE 90.1 code (NJ uses 2013 and is moving to 2016 soon, and ETO uses 2010 with Oregon amendments[46]). For the NJ program, buildings must have 50,000 conditioned square feet and achieve a 5% cost savings over code to qualify. The NJ interviewee considered ASHRAE code a reasonable baseline, saying, "The harder the guidelines, the more barriers to participation." They find their approach effective, but the program is small (15-20 projects per year). The implementer explained that if they want to increase participation levels, it would be very costly for the program and the participants as the energy modeling can often be expensive.

The ETO program (a larger program) is modeled after and driven by the Architecture 2030 Challenge, which encourages participants to reduce the EUI of their planned building by a certain percentage of the baseline. In 2019, this recommended percentage is 70%, and will increase to 80% in 2020.[47] ETO sets their project EUI goals based on the 2030 Challenge framework, which includes building type, climate, load types, size, etc. The Zero Tool, produced by Architecture 2030, provides a simple interface for setting the baseline and target EUI of a planned project.[48] While ETO encourages ZNE-readiness, it is not a requirement.

Measuring Savings. Both programs take a similar approach to measuring savings. During planning, a full energy model is developed to estimate savings above the code. NJ Clean Energy mainly uses DOE's eQUEST software. Post-construction billing data is used to calculate the actual savings over a modeled baseline. NJ Clean Energy normally requires the first 12 months of data after the building is occupied.

The NJ interviewee suggested programs avoid getting too granular by asking for ongoing monthly data (rather than a one-time requirement of a year's worth of data). Granularity creates too much work, back and forth, and paperwork.

Incentives. As described in Section A.2.1.1, the NJ program allocates incentives into three payments and allows participants a chance to remedy problems if post-construction consumption is higher than projected (and then provide more consumption data). The NJ interviewee summarized, "We want people to hit the numbers and get incentives; we get zero benefit from people giving back money." He reported that many customers and partners want to undertake a

[46] An industry expert interviewee noted that Oregon's low-threshold code makes it particularly easy to claim savings.
[47] https://architecture2030.org/wp-content/uploads/2018/11/2030ImplementationGuidelines.pdf
[48] https://zerotool.org/zerotool/

comprehensive project but not the back-end work. Therefore, the program is considering making the third incentive optional with a revised, reasonable second incentive.

The ETO program has three incentive pathways, though the pathways are not mutually exclusive. There is an equipment-specific rebate pathway; a calculated/deemed savings pathway (e.g., a spreadsheet tool that calculates LPD); and a measured savings pathway, which has a good, better, and best incentive based on the measured EUI compared to baseline (paid per square foot).

Facility size. To be eligible for the NJ program, facilities must be at least 50,000 conditioned square feet. Incentives range from $1.20 to $1.85 per square foot and the level of effort required to participate implies a point of diminishing returns, becoming impractical for small buildings. The interviewee suggested that basic spreadsheet savings calculations could potentially be sufficient for smaller buildings. The ETO program does not have building size cutoffs and will still support an integrated design process if small projects want to pursue significant savings goals (like ZNE) or they will offer simple calculation tools for those projects.

Support. Both programs focus efforts on technical assistance. The ETO program manager explained that for those seeking more aggressive goals, such as ZNE, the program will engage in the *full* design process. Echoed by the ETO interviewee, the NJ interviewee imparted that participants do not want to use their (participants') own engineers' time to conduct "a lot of back and forth," especially if incentives are uncertain.

ETO encourages an integrated design process to bring all market actors together. The program manager underscored the importance of early intervention, describing working with participants to set goals based on building-use plans, financial resources, and composition of design teams. She summarized, "You don't [need] a huge budget for a ZNE or low-EUI project, but you do need training and experience." She suggested starting with training modules for architects to help them navigate discussions with owners. She also recalled that, when starting the program, they had a very helpful process evaluation that included interviews with market actors after every major engagement. She strongly suggested that Massachusetts replicate this effort. ETO is flexible when coming up with the target EUI for a given project. She highlighted the importance of setting clear EUI targets and being consistent. She suggested that if a project is seeking ZNE-readiness but is not targeting a reasonable EUI in early design and/or is lacking a concrete plan demonstrating how they will get there, then the program should provide direction on how to reach an EUI goal that will allow them to achieve ZNE-readiness.

Meeting metrics. Some interviewees summarized that achieving savings goals relies on building management practices (though, other industry expert interviewees generally dismissed this notion). Facility manager training is often insufficient, or the "handoff" period is too quick for new buildings with complex systems. The owner must ensure staff are trained for the savings to be achieved. Both interviewees explained that savings can also fall short due to incorrect settings on variable equipment. If a new system is not managed well, it can result in large utility bills in the first year of occupancy, meaning participants lose 15-20% of their estimated savings and the related incentive. Similarly, there may be unanticipated load (e.g., the addition of an office vending machine) that was not included in the initial model. The ETO program manager suggested that

programs include functional tests of building operation systems. The NJ implementer called controls a "make or break" factor to savings.

Sectors. The NJ representative suggested the program consider a "sector-level" approach, with EUI thresholds tailored to building type rather than just one size. Certain buildings are inherently more expensive to build and have different energy needs. For example, the needs of a laboratory and school are different. The NJ program sets lower thresholds for energy savings for high-EUI type buildings, such as data centers. The ETO program manager encouraged Massachusetts PAs to target specific types of customers, such as public and institutional customers and affordable multifamily housing.

Drivers. In the experience of the NJ interviewee, attractive incentives and an easy process to attain the incentives are the largest drivers for energy efficiency in this sector, but construction/design costs are the biggest prohibitive item. The ETO program manager called programs "the most important thing" to driving savings and implementation of energy efficiency.

Popular guidelines/certifications. In the words of the NJ implementer, "LEED is motivating… but there is no *silver bullet.*" The ETO program manager agreed that there is no single certification leading the market. She noted that LEED does not focus on energy efficiency per se, and several LEED buildings have been shown to have high EUIs. She added that everything is in flux: ASHRAE is moving to support ZNE and is influencing engineers and policy, and the market and forward-looking organizations are turning to EUI. She noted that some architects have committed to reaching the Architecture 2030 challenge.

Attitude towards EUI-based and ZNE-readiness approaches. As the NJ interviewee put it, "estimates are estimates and forecasts are forecasts." His program is conscientious about savings being overstated and performance falling short. Because incentives are tied to performance with EUI-based incentives, there may be fewer projects because of the additional requirements. He said that ZNE-readiness is a nice goal but will yield very few projects unless incentives are extremely high.

A.3 PROGRAM BACKGROUND

Under the New Buildings and Major Renovations initiative, the PAs offer an enhanced and optimized integrated design path in two standard packages for NC projects in the earliest development phases: "Small Buildings Whole Building Solution" for NC projects between 20,000 and 100,000 sq. ft. and "Large Buildings Whole Building Solution" for larger NC projects.

Both customers (i.e., building owners) and design teams can receive incentives. As shown in Table 6, the packages offer a scaled incentive structure tied to modeled (i.e., predicted) savings above energy code, which they consider the baseline. Projects must be cost-effective and on-site verification is required. Combined heat and power and renewable energy equipment cannot contribute to those savings. Customer incentives are intended to cover a cost-effective portion of incremental construction costs associated with energy-efficiency measures, while design team incentives contribute to "extra services," such as additional meetings and product research.

Smaller buildings (less than 20,000 sq. ft.), renovations, and buildings already under construction can access prescriptive and system-specific custom incentives.

Table 6: 2018-2019 Whole Building Solution Participation Incentives

Savings Beyond Code	Customer		Design Team[1]	
	$/kWh	$/Therm	$/kWh	$/Therm
Eversource Electric, Cape Light Compact, and Unitil Territories				
≥ 30%	$0.50	$2.10	$0.07	$0.34
20 to 30%	$0.40	$2.00	$0.04	$0.20
10 to 20%	$0.30	$1.90		
< 10%	$0.20	$1.80	-	-
National Grid Electric Territories				
≥ 10%[2]	$0.35	$1.70	$0.07	$0.34

[1] Capped at $15,000

[2] However, customers can receive incentives regardless of savings.

PAs provide technical assistance and design support. For Large Buildings, they also provide energy charrette stipends of $3,000 to design teams. Customers' and/or their design teams engage with the PAs throughout the design phases and must include them in all meetings identifying cost-effective measures. Participants work with the PAs' TA vendors; though, Large Building participants may choose their own TA vendors. The TA vendors conduct the modeling services that estimate the savings above baseline.

As shown in Table 7, in 2017, participation levels and savings were lower than planned. Nonetheless, the program exceeded its planned benefit-cost ratios (BCRs) for both gas and electric.

Table 7: 2017 C&I New Buildings & Major Renovations – Planned and Evaluated Metrics

Metric		Gas Tables		Electric Tables	
		Planned	Evaluated	Planned	Evaluated
Number of participants		417	168	638	546
Demand (kW)	Summer	-	-	9,862	7,363
	Winter	-	3	6,847	6,237
Electric savings (MWh)	Annual	1	11	65,449	49,721
	Lifetime	13	163	1,063,125	782,963
Gas savings (Therms)	Annual	2,727,895	2,136,721	62,593	228,853
	Lifetime	49,872,945	37,465,512	1,160,846	4,298,651
BCR		3.23	3.36	3.05	3.47

Source: Electric and Gas Statewide Summary Tables, 2017 Annual Results. Accessed December 26, 2018 at http://ma-eeac.org/results-reporting/.

A.4 Best Practices Review Details

This abbreviated best practices review sought to characterize and identify lessons learned from commercial NC programs utilizing performance-based approaches. To this end, we conducted secondary research on the approaches used by existing program sponsor initiatives in the U.S., including pilot programs beyond their first program year. While not the primary focus, we also reviewed non-program sponsor initiatives to determine whether relevant lessons could be applied to program sponsor initiatives.

We closely examined six program sponsor initiatives that have incorporated performance-based approaches for C&I NC or major renovations to existing building:

1. Xcel Energy (Colorado): Energy Design Assistance (EDA) Program
2. Energy Trust of Oregon: New Buildings, Path to Net Zero (PTNZ)
3. Fort Collins Utilities: Integrated Design Assistance Program (IDAP)
4. New Jersey Clean Energy Program (NJCEP): Pay for Performance (P4P)
5. Commonwealth Edison (ComEd): Accelerated Performance
6. Seattle City Light: Metered Energy Efficiency Transaction Structure (MEETS)

For each, we offer a snapshot of the program, the services provided and requirements to participate, program processes, and program impact.

A.4.1 Xcel Energy Colorado

Xcel Energy Colorado's Energy Design Assistance (EDA) program is a free, comprehensive approach to energy and cost savings for businesses considering NC or major renovation projects. The program builds energy efficiency into projects during the predesign or early schematic design in a way that helps both the building owner and the design team. It includes a free calculation of energy points for green building certifications, such as LEED.

XCEL ENERGY EDA Program Snapshot[49]

Program Website	Xcel Energy Colorado EDA Program
State[50]	Colorado
Customer Type	Xcel Energy electric or combo (electric and gas) business customer constructing a new building, adding to an existing building or renovating an existing space by gutting and replacing equipment.
Budget (in 2017)	$8.4 million
Funding Source	DSM Cost Adjustment Factor ($/kWh charge on customer bill)
Implementor	Local energy modeling/engineering firm
Timing	Predesign to early design development, depending on selected track
Participation (in 2017)	46
Minimum sq ft	50,000 (20,000 for projects enrolled prior to 6/1/2018)
Rebates Offered[51]	$400 per kW and $0.04 per kWh. $4 per Dekatherm (Dth) is also offered for Xcel Energy natural gas customers; Design teams receive design fee reimbursements based on building size, with a max of $12,000
Annual Energy Savings (in 2017)	24,099,514 MWh net; 42,186 therms net

[49] https://aceee.org/sites/default/files/publications/researchreports/u1901.pdf
[50] Xcel Energy Minnesota has a similar program. Xcel Energy Minnesota EDA Program
[51] https://www.xcelenergy.com/programs_and_rebates/business_programs_and_rebates/new_construction_and_whole_building/energy_design_assistance

A.4.1.1 Program Offerings

There are three types of project tracks available in the EDA Program:[52]

1. **Express.** A cost-effective analysis process for projects that are a common building type and where kWh savings are estimated to be less than three times the total building square footage.[53] Efficiency strategies are analyzed by applying results from previous projects and models, or with other tools. Projects are considered on a case-by-case basis.
2. **Basic.** Xcel Energy's core offering for business construction projects with stated energy savings goals and the ability to take advantage of a fully integrated energy analysis, computer modeling, and meetings. Basic services include comprehensive energy modeling results for efficiency strategies, review of construction documents for inclusion of strategies, site verification, and monitoring of select installed strategies. Projects should be in the schematic or early design development stages and should be at least 50,000 square feet.
3. **Enhanced.** Enhanced is for design teams and owners interested in third party-verified green building certification goals, early goal setting, and evaluating energy-efficiency options beginning in the predesign and concept stages. This track includes early analyses in areas such as daylighting, lighting, massing and HVAC, with options refined and optimized as the design progresses, as well as calculations for LEED Energy and Atmosphere Credit 1 (or support of other green certification).[54] Projects should be in the predesign or early schematic stages and should be at least 50,000 square feet.

EDA, like many NC energy-efficiency programs, generally references local energy code as the baseline above which energy savings are incentivized.

1. **Basic:** A minimum of 15% electric energy and demand savings and 15% natural gas savings compared to either ASHRAE 90.1-2013 Energy Standard or the local energy code, whichever is more stringent
2. **Enhanced:** A minimum of 30% electric and energy demand savings and 15% natural gas savings compared to either ASHAE 90.1-2013 Energy Standard or the local energy code, whichever is more stringent

A.4.1.2 Program Processes

Figure 2 maps the program processes. To optimize energy options, Xcel Energy's EDA Program emphasizes planning via various meetings throughout the building design and operations process. After the introductory meeting with the owner, design team, architect, and third-party implementer (EDA Energy Modeling Service Provider from a local engineering firm), and the third-party implementer completes the initial computer modeling, the design team is presented with detailed results of the energy savings for a number of energy-savings strategies. Energy-efficiency opportunities are then packaged together in design alternatives to show expected

[52] https://www.xcelenergy.com/staticfiles/xe/Marketing/Files/CO-Bus-EDA-Info-Sheet.pdf
[53] https://www.xcelenergy.com/staticfiles/xe-responsive/Admin/Managed%20Documents%20&%20PDFs/CO-Bus-EDA-Scope-of-Work.pdf
[54] https://www.xcelenergy.com/staticfiles/xe-responsive/Company/Rates%20&%20Regulations/Regulatory%20Filings/DSM-Plan.pdf

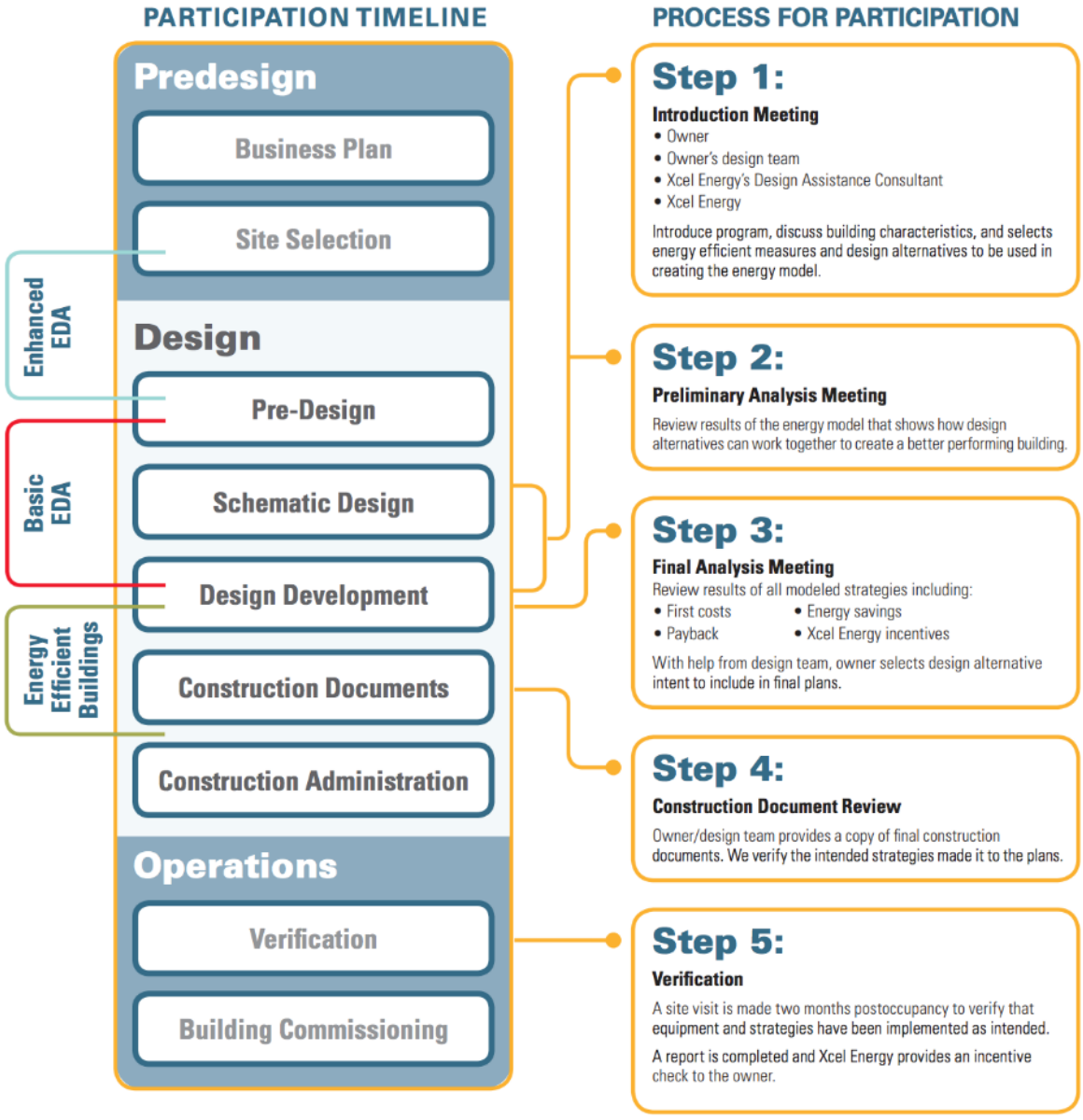
building energy savings, paybacks, and incentives. A whole-building approach is used to identify the net effect of multiple strategies on a project. The packaging of design alternatives also provides protection against pitfalls in the value-engineering phase of the design/construction process, which typically cuts individual elements of projects based on their first-cost and impact on the tangible elements of the building, with little regard for ongoing energy use. These energy alternatives are then presented to the design team and the customer to choose the best approach for their project.

The third-party implementer reviews the construction documents (CDs) and adjusts the energy model as needed. This energy model determines the expected incentives from Public Service and verifies compliance with the energy savings intent of the customer. The final step in the EDA offering occurs when Public Service completes an onsite verification of the energy alternative addressed within the energy model. Equipment and systems are logged to evaluate performance variables, as appropriate, to verify consistency with modeling assumptions. The actual results are compared to the estimated savings to determine the final customer rebate.

Xcel Energy completes the process by providing a rebate check to the owner.

Figure 2: Xcel Energy EDA Program Process

(Source: Xcel Energy)



A.4.1.3 Program Impact

Table 8 summarizes the EDA program performance from 2015 to 2017.

Table 8: Xcel Energy EDA Program Performance

(Source: Xcel Energy)

Metric	2015	2016	2017
Program spending	$9.4 million	$8.8 million	$8.4 million
Number of customers	64	45	46
Annual electric savings (MWh net)	42,095,945	25,345,531	24,099,514
Annual gas savings (therms net)	94,692	58,934	42,186
Cost-effectiveness results, Utility Cost Test (UCT), electric	4.36	4.40	3.27
Cost-effectiveness results, UCT, gas	6.97	5.25	3.38

A.4.2 Energy Trust of Oregon

ETO's New Buildings Path to Net Zero (PTNZ) program offers early design consulting and project incentives to achieve ultra-low-energy commercial buildings (both NC and retrofits). The program provides whole-building energy modeling and ongoing technical assistance as it helps designers integrate energy-efficiency and on-site solar design, construction, and installation. The program's key eligibility criterion is an EUI metric that aims for energy savings 70% greater than typical building goals.[55]

Energy Trust of Oregon PTNZ Program Snapshot

Program Website	Energy Trust of Oregon New Buildings, Path to Net Zero
State	Oregon
Customer Type	Customers of PGE, Pacific Power, NW Natural, Cascade Natural Gas, and Avista with commercial NC and major renovation projects
Budget (in 2017)	$10.7 million
Funding Source	Systems benefits charge and supplemental funding from investor-owned utilities, Portland General Electric, Pacific Power, NW Natural, Cascade Natural Gas, and Avista.
Implementor	CLEAResult Consulting, Inc.
Timing	Early design
Participation (2018)	56 (in progress as of Q3 2018)
Minimum sq ft	NA
Rebates Offered	$0.40 per kWh, $1.20 per therm; Up to $10,000 in Early Design Assistance; Solar, Completion and Post-Occupancy incentive
Annual Energy Savings (in 2017)	50 million kWh/year, 700,000 therms/year

[55] https://www.energytrust.org/wp-content/uploads/2018/11/ETO.Q3.18.Quarterly.Report.ETO_.pdf

A.4.2.1 Program Offerings

PTNZ, the nation's first-of-its-kind pilot, is designed to overcome barriers to the design of ultra-low-energy commercial buildings, including costs, risk aversion, and applying new strategies. PTNZ offers incentives for standard and custom measures for many building types statewide. Aligned with Architecture 2030, it coordinates with the Northwest Energy Efficiency Alliance to leverage regional activities in several areas, including enhanced codes and activities to support market development of emerging technologies, such as advanced lighting and HVAC. Some of the program components are as follows:[56]

- **Net Zero Early Design.** ETO offers up to $10,000 to offset the cost of a design charrette.
- **Technical Assistance.** In terms of technical assistance, they will pay up to 75% of the cost of energy studies (up to $50,000). Studies may include, but are not limited to, early design shoebox modeling, computational fluid dynamics (CFD) analysis, daylighting studies, energy modeling, and commissioning design review.
- **Solar Measures**. ETO provides solar development assistance to determine the solar potential of the building (up to $1,800). It addresses solar-ready design by providing up to $15,000 to build to ETO-solar-ready standards if solar panels cannot be installed at the time of construction. It also offers up to $60,000 to install a solar electric system
- **Completion and Post-Occupancy.**
    - **Functional Testing.** ETO offers $0.15/sq. ft. (up to $40,000) for functional testing (which it requires). Qualification requirements include testing all major energy systems. At a minimum, this must include HVAC systems and controls, lighting and daylighting controls, domestic hot water systems, and renewable energy systems.[57] It must meet the standards outlined in ASHRAE Guideline 0-2005 and be completed by a commissioning authority that is either an independent third-party or from the same company as the design firm but unaffiliated with the building project.
    - **Energy Metering.** ETO will provide up to 50% of the cost of energy metering (up to $40,000). At a minimum, project teams must install metering equipment for the site that provides whole-building, 15-minute interval data for electricity, one-hour electricity for gas, and one-hour interval for any on-site renewable energy. Project teams are encouraged to sub-meter HVAC equipment, lighting systems, plug loads, and process loads.
- **Net-Zero Certification.** Energy Trust can provide $2,000 for net-zero certification from the ILFI. In addition to incentives, PTNZ offers research grants called Net Zero Fellowships and additional small project grant opportunities.

[56] https://www.energytrust.org/commercial/new-buildings-path-to-net-zero/
[57] https://www.energytrust.org/wp-content/uploads/2017/01/NBE_FM0520CX-FT.pdf

A.4.2.2 Program Processes

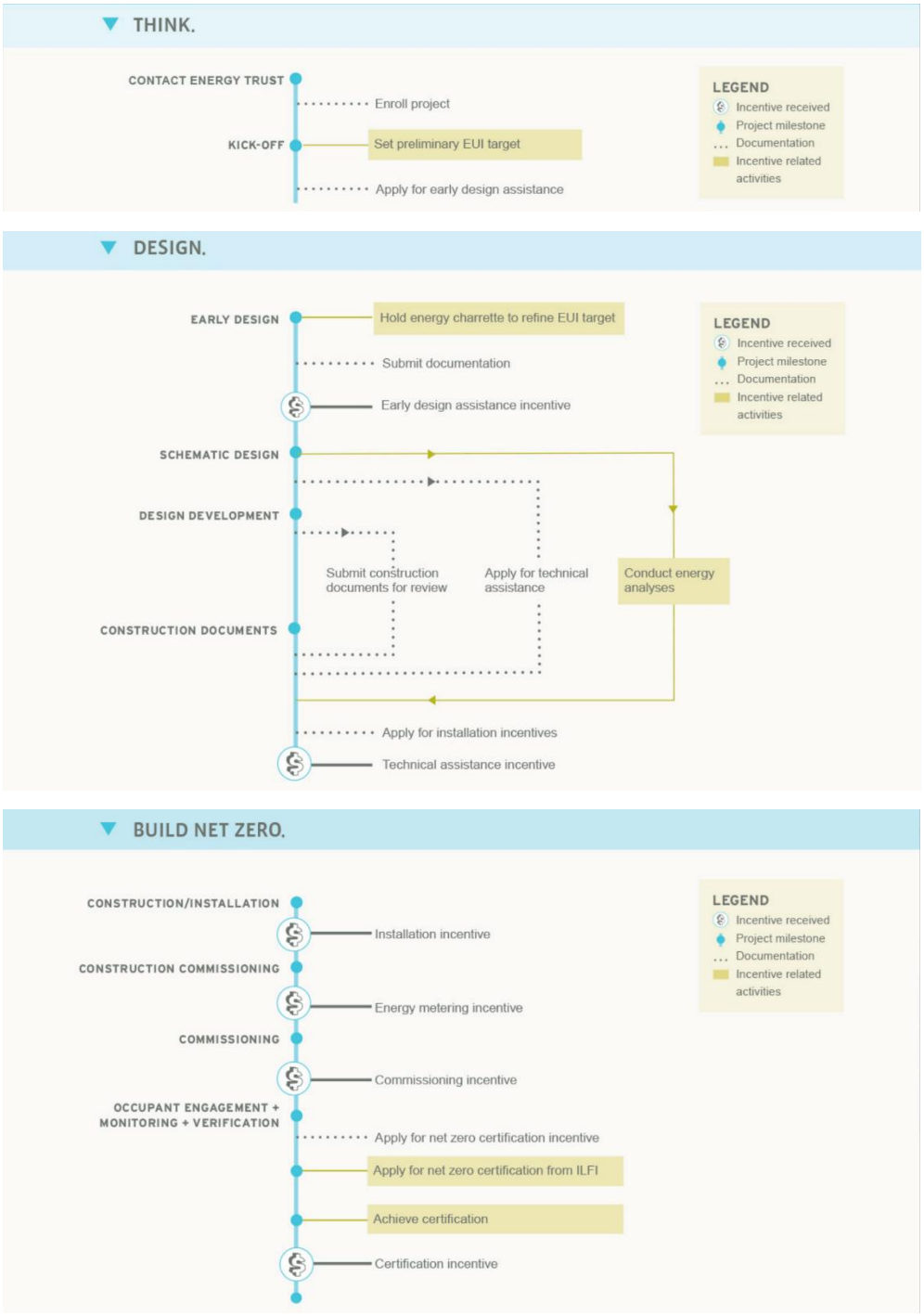
As ETO illustrates in Figure 3, the program supports the entire design and construction process, from project kick-off through completion and occupancy.[58] During kick-off, project teams meet with ETO outreach managers to establish preliminary EUI targets and energy-efficiency strategies that best fit the project. The program provides EUI targeting and planning worksheets, which state a minimum EUI, customized by building type. The worksheet is referred back to during the design and construction phases to ensure the project stays on track. ETO will also review construction documents to ensure they align with the target and strategies set during kick-off and planning. The program managers will work with the project team to identify the most relevant incentives and resources. ETO reviews each incentive application as it is submitted. The cash incentive is paid when the associated work is completed and approved.

As it develops, the program plans to provide feedback on results to the growing community of ultra-low-energy practitioners and enhance its current offerings. Building a community of professionals, the program is training design and construction practitioners and allies, as well as building owners, in emerging practices and capabilities.

[58] https://energytrust.org/pathtonetzero/

Figure 3: Energy Trust of Oregon PTNZ Program Process

(Source: ETO)



A.4.2.3 Program Impact

Of the 56 PTNZ projects in progress as of Q3 2018, 24 received early design assistance payments and nine were expected to receive installation payments by the end of 2018. Since starting the pilot of the program in 2009, annual enrollment has continued to increase and has helped steadily transform the market. Projects exceed energy code by 40%. According to ACEEE, it has achieved high customer satisfaction and consistently accurate final savings results.[59] Table 9 summarizes its impacts from 2015 to 2017.

Table 9: Energy Trust of Oregon PTNZ Program Performance44

(Source: ETO)

Metric	2015	2016	2017
Program spending	$6 million	$9.1 million	$10.7 million
Annual electric savings (MWh net)	50	59	55
Annual gas savings (therms net)	552,377	733,692	937,633
Cost-effectiveness results, Utility Cost Test (UCT), electric	3.54	3.21	2.94
Cost-effectiveness results, UCT, gas	17.9	17.5	18.1

A.4.3 Fort Collins Utilities

Fort Collins Utilities Integrated Design Assistance Program (IDAP) provides technical assistance and financial incentives to help architects, engineering professionals, and building owners optimize energy and demand savings and reduce operating costs in eligible NC and existing building major renovation projects. IDAP employs a whole building performance-based strategy that fosters an integrated design approach.[60]

Fort Collins Utilities IDAP Snapshot

Program Website	Fort Collins IDAP
State	Colorado
Customer Type	NC or major renovation, be categorized as commercial or high-rise residential as defined by ASHRAE 90.1 and located within the City of Fort Collins electric service territory.
Budget (2013)[61,62]	$71,000 (for incentives)
Funding Source	No data found
Implementor	Energy Consultants pre-approved by the utility
Timing	Conceptual or early Schematic Design phase
Participation (2013),	3
Minimum sq ft	5,000 gross sq ft
Rebates Offered	Max of $100,000 for the Design and Construction Incentives combined; The Performance Incentive is capped at $50,000 per year, per customer
Annual Energy Savings (2013)56	1,465 MWh

[59] https://aceee.org/sites/default/files/publications/researchreports/u1901.pdf
[60] https://www.fcgov.com/utilities//img/site_specific/uploads/idap-program-manual.pdf
[61] https://aceee.org/files/proceedings/2014/data/papers/10-711.pdf
[62] Unfortunately, more recent budget data were not available.

A.4.3.1 Program Offerings

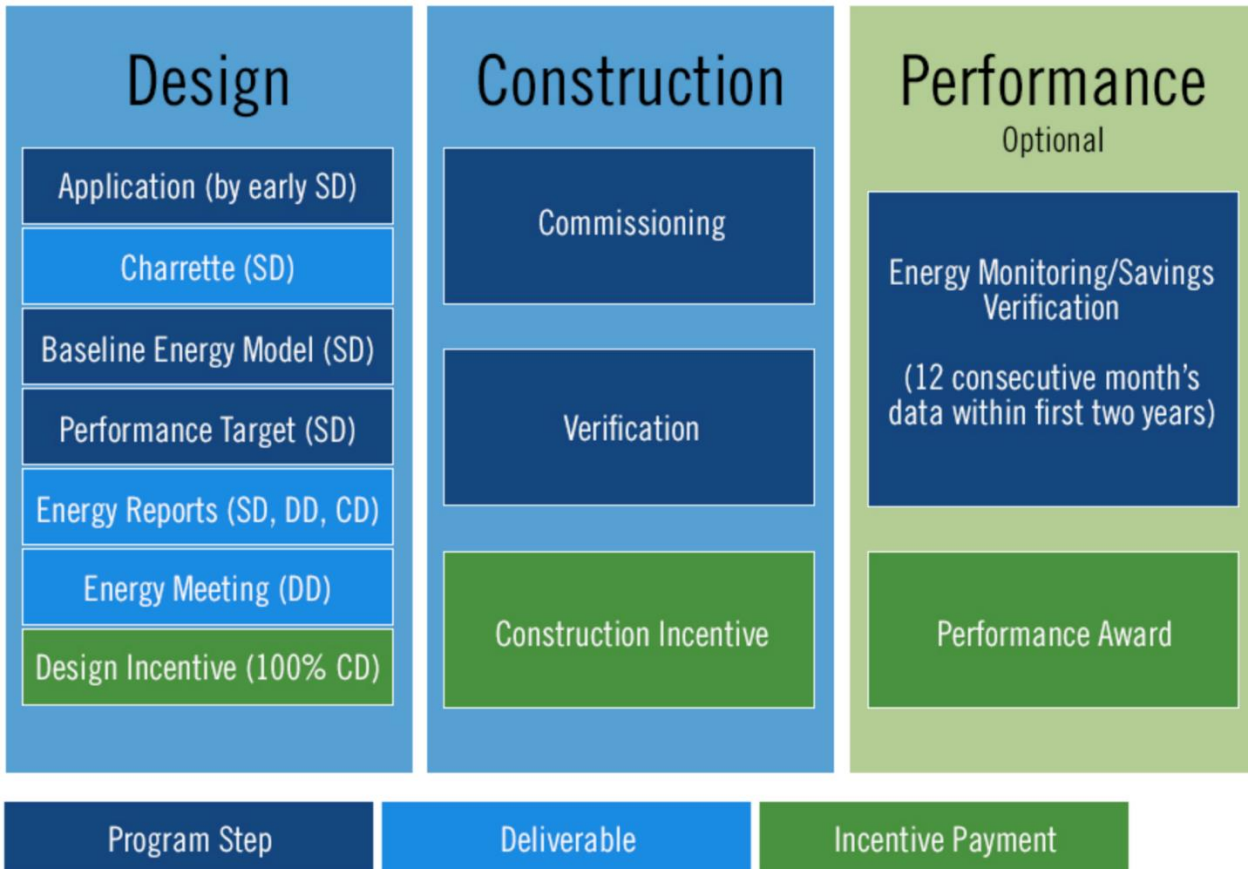
The IDAP design team and performance incentives increase with building size. For smaller buildings (typically less than 10,000 square feet), Fort Collins Utilities highly recommends that the owner and design team consider the cost-effectiveness of participating in the IDAP program. A cost-effectiveness assessment should include comparing energy modeling and design team costs to IDAP program benefits – potential design team and performance incentives, long-term energy savings, and life-cycle costs. The program is designed to be scalable for projects of varying size and flexible to grow with customer needs. For buildings achieving the target goal, Fort Collins Utilities will provide the owner with a plaque signifying they have met a special City of Fort Collins designation for building energy performance.

A.4.3.2 Program Processes

Building owners are ensured a more integrated design process and energy-efficient building through engaging the expertise of an energy consultant (EC) early in the project to provide the energy modeling services required by the IDAP. Providing quality information in a timely fashion is critical to informing the design team in order to incorporate energy-efficient design into buildings. As shown in Figure 4, the IDAP design process begins with a design charrette in early schematic design and ends with a review of the project construction documents to ensure that the final energy-efficient design features are included in the final design and report.

Figure 4: Fort Collins Utilities IDAP Process[63]

(Source: City of Fort Collins)



Abbreviations: Schematic Design (SD), Design Development (DD), and Construction Development (CD)

The program delivers incentives during the design and construction phases of the project with the option for building owners to earn a performance incentive within the first two years of building occupancy based on metered data. All incentive types are paid to the owner. The IDAP energy reduction target is based on the modeling guidelines in ASHRAE 90.1-2016 Appendix G and must exceed the current City of Fort Collins energy code by 10%, as shown in Table 10. The baseline used for the energy target will be set based on the City of Fort Collins code cycle that applies at the time building is expected to be permitted.

[63] https://www.fcgov.com/utilities/business/improve-efficiency/rebates-incentives/integrated-design-assistance/

Table 10: Code and IDAP Building Performance Factors

(Source: City of Fort Collins)

Building Type	Code (ASHRAE 90.1 – 2016)	IDAP (10% Savings above Code)
Multifamily	0.80	0.72
Healthcare/Hospital	0.52	0.47
Hotel	0.61	0.55
Office	0.61	0.55
Restaurant	0.58	0.52
Retail	0.59	0.53
School	0.50	0.45
Warehouse	0.61	0.55
Other	0.57	0.52

As described in the 2019 Participant Manual, to be considered for a Performance Incentive, the customer must have qualified for the Construction Incentive and must submit a separate application within six months of receiving the Construction Incentive. The performance period is within the first two years of occupancy and requires submetering the regulated loads for 12 consecutive months within that period to determine the Actual Regulated Energy Cost. Both utility data and sub-metered regulated electrical and gas data need to be submitted for review by the IDAP program administrator. Utilities will partner with the applicant to provide support for sub-metering the regulated loads. The electrical distribution system design must include the ability to easily add sub-metering equipment for those loads. The Performance Incentive is paid when actual utility data for any 12 consecutive months within the first two years of occupancy is submitted. The two-year period allows a buffer during early occupancy to get the building working optimally, if necessary. The formula for calculating the performance incentive is as follows:

Performance Incentive =
(*BPF Relative to Code * Baseline Building Regulated Energy Cost*)
– Actual Regulated Energy Cost

This represents the actual annual regulated energy cost savings. If it is greater than the target IDAP regulated energy cost, the project is still eligible for the incentive, but it will be reduced per the calculation above.

A.4.3.3 Program Impact

There are no publicly available data summarizing the program impact.

A.4.4 New Jersey Clean Energy Program

As noted in the body of this memo, the NJCEP P4P NC program takes a comprehensive, whole building approach to energy efficiency in the design and operation of new commercial and industrial buildings, as well as in major renovations. The program does this by requiring the use of standardized energy simulation software to estimate energy costs of the proposed design compared to a code-compliant baseline. A portion of project incentives is tied to actual building performance to emphasize to building owners the critical value of addressing operational practices.[64]

NJCEP P4P Program Snapshot

Program Website	New Jersey Pay for Performance
State	New Jersey
Customer Type	Non-residential retail electric and/or gas service customers of the following New Jersey utilities that collect the Societal Benefit Charge: Atlantic City Electric, Jersey Central Power & Light, Rockland Electric Company, New Jersey Natural Gas, Elizabethtown Gas, PSE&G, and South Jersey Gas.
Budget (FY 2018)[65]	$19,112,656
Funding Source	New Jersey Societal Benefits Charge (public benefits fund); surcharge on utility customer bills
Implementor	Program-Approved Energy-Efficiency Technicians
Timing	Pre-Planning Phase (prior to beginning work on Proposed Energy Reduction Plan)
Participation[66]	38 completed projects
Minimum sq. ft.	50,000 sq. ft., with some building types exempt
Rebates Offered	Varies from $0.08 to $1.40 per square foot, depending on building type and min. cost reduction over ASHRAE 90.1-2013 baseline
Annual Energy Savings (2019)[67]	6,362 MWh (FY2019 goal); 82,744 Dth (FY2019 goal)

A.4.4.1 Program Offerings

The NJCEP P4P Program is available to all C&I customers with a peak demand in excess of 200 kW in any of the preceding 12 months (100 kW for select multifamily buildings), or 50,000 square feet or more of planned conditioned space. [59,68] The program manager has the discretion to approve projects that are within 10% of the minimum 50,000 square foot threshold. Hospitals, public college and universities, non-profits, affordable multifamily housing, and local governmental entities are exempt from the 50,000 sq ft requirement.

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[64] http://www.njcleanenergy.com/files/file/Program%20Guides/P4P_PG_FY19%20Final_clean.pdf
[65] https://www.state.nj.us/bpu/pdf/boardorders/2018/20180522/5-22-18-8D.pdf
[66] http://www.njcleanenergy.com/files/file/Library/PTG/PTG%20June%202018%20-%20FY18%20v3.pdf
[67] http://www.njcleanenergy.com/files/file/Library/Compliance%20Filings/fy19/TRC%20Compliance%20Filing%202019%20Vol%201%20v4%20FINAL.PDF
[68] http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/faqs

Projects may include a single building meeting square footage requirements or multiple buildings, as long as those buildings are owned by the same entity, are located on adjacent properties, and are designed and constructed within the same time period. Multiple buildings that are grouped into one program application are viewed as a single project that is eligible for one set of program incentives, and all incentive caps apply to the group of buildings.

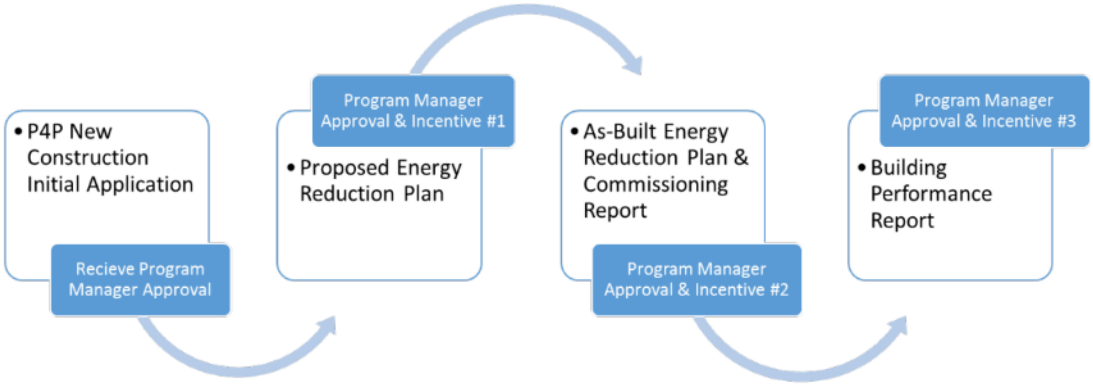
Program Partners provide technical services to program participants. The services include developing an Energy Reduction Plan (ERP) with whole-building simulation and a financial plan outlining a payment strategy for the energy saving upgrades.[69] The P4P program aligns with other rating authorities, such as LEED, ENERGY STAR, and ASHRAE Building Energy Quotient. Partners are required to develop whole building energy simulations using approved simulation tools. In general, software needs to conform to the software requirements outlined in Section 11/Appendix G of ASHRAE 90.1.

A.4.4.2 Program Processes

Figure 5 maps the program process.[70]

Figure 5: NJCEP P4P Program Process

(Source: NJCEP)



Performance Targets

Referred to as Program Partners, engineering firms, architecture firms, Energy Service Companies (ESCOs), and HVAC and lighting contractors engage in this market-based program and are selected through a Request for Qualifications process.[64] The customer and Program Partner complete and submit the application and participation agreement and, once approved, the Partner discusses building plans and energy-efficiency goals. The Partner submits the proposed ERP that details recommended measures that will achieve the minimum performance target, a computer simulated energy model of the customer's planned building, and a partner-

[69] https://aceee.org/files/proceedings/2010/data/papers/2028.pdf
[70] http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/new-construction/participation-steps

participant contract to the assigned case manager with a request for the first portion of the incentive as defined in the participation agreement.

The submitted Proposed ERP must include a package of energy-efficiency measures that achieve the minimum performance target of 5% savings for commercial and industrial buildings and 15% for multifamily buildings. Lighting measures cannot make up more than 50% of the total projected savings. The minimum performance target will be measured in terms of energy cost, which is consistent with ASHRAE 90.1 Appendix G, EPAct Federal Tax Deductions, and LEED NC.

Incentive Disbursements

The P4P program includes incentives-based project milestones. The program calculates the performance incentive (Payments II and III) as a variable $/kWh, $/therm, or $/sq. ft. incentive based on projected energy savings. Incentives are issued in three phases:

1. The customer receives the first incentive after the proposed ERP is approved. The Partner helps the customer with the bidding process and will monitor construction to ensure the appropriate steps are being taken to achieve the expected performance goals in the proposed energy reduction plan. The energy cost savings are compared to a code compliant baseline that is based on normalized pre-implementation meter data. Incentives range from $0.08-$0.16 per square foot (up to $60,000) and are contingent on moving forward with construction. Any changes between the proposed design and as-built conditions will be documented by the Partner in an As-Built ERP.
2. The Partner will complete Commissioning of the building system and submit a complete Commissioning Report to the project's case manager along with a request for the second portion of the incentive. Submittal and approval of an As-Built ERP and commissioning report confirm energy-efficiency measures are installed and performing as expected. Incentives range from $0.80-$1.40 per square foot, up to 75% of the projects incremental cost.
3. Lastly, the customer provides 12 months of post-construction utility bills to the Partner who will benchmark the building against the As-Built ERP in ENERGY STAR Portfolio Manager. If the building receives a score of 75 or more and obtains ENERGY STAR Certification, the customer will receive the third and final incentive. If the minimum savings is not reached after 24 months after implementation, the third incentive is not awarded. As described in the body of the memo, participants will receive "conciliation prizes" if they cannot achieve their goal. Incentives range from $0.35-$0.40 per square foot, up to 25% of project's incremental costs.

Incentives are capped at the lesser of $1 million per gas and electric account, or 50% of the total project cost, and $4 million per entity per year.[71] Program guidelines outline equivalent savings values depending on the modeling compliance path chosen. Gas-only customers are eligible to receive incentives for natural gas measures only.

[71] https://www.nrdc.org/sites/default/files/pay-for-performance-efficiency-report.pdf

Captured from program materials, Table 11 outlines program incentive levels.

Table 11: NJCEP: P4P Program Incentives
(Source: NJCEP)

	Cost reduction over 90.1-2013 Baseline	Incentive by Building Type Per Square Foot	
Minimum Performance Requirement	15% Multifamily 5% All other	Industrial/High Energy Use Intensity	Commercial and Multifamily
Incentive #1 Proposed Energy Reduction Plan	+ 0 - <2% (Tier 1)	$0.10	$0.08
	+ 2 - <5% (Tier 2)	$0.12	$0.10
	+ 5% or greater (Tier 3)	$0.14	$0.12
	Max	$50,000.00	
	Pre-Design Bonus	$0.02	
	Max	$10,000.00	
Incentive #2 As-Built Energy Reduction Plan and Cx Report	+ 0 - <2% (Tier 1)	$1.00	$0.80
	+ 2 - <5% (Tier 2)	$1.20	$1.00
	+ 5% or greater (Tier 3)	$1.40	$1.20
	Max	75% Measure Incremental Cost	
Incentive #3 Building Performance		$0.40	$0.35
	Max	25% Measure Incremental Cost	

Modeling Paths

The program offers two modeling compliance paths to demonstrate that the proposed design meets or exceeds the minimum performance target:

1. **ASHRAE Building Energy Quotient (bEQ) As-Designed Path.** Under this path, the Partner will develop a single energy model representing the proposed project design using prescribed modeling assumptions that follow *ASHRAE Building Energy Quotient (bEQ) As-Designed* simulation requirements. Proposed design simulation results, including EUI ($EUI_{standard}$), will be measured against the median EUI for the building type (EUI_{median}) to evaluate the Performance Score. Performance Score = ($EUI_{standard}$ / EUI_{median}) x 100. Measures must be modeled within the same proposed design energy model, but as parametric runs or alternatives downgraded to code compliant parameters.
2. **ASHRAE 90.1-2013 Appendix G Path.** Under this path, the Partner will model a baseline and proposed building using ASHRAE 90.1-2013 Appendix G *modified by Addendum BM*. Addendum BM sets a common baseline building approach that will remain the same for ASHRAE 90.1-2013 and all future iterations of ASHRAE 90.1, and is roughly equivalent to ASHRAE 90.1-2004. To comply with ASHRAE 90.1-2013, a proposed building must have energy cost savings of 11-40% from the Addendum BM baseline, depending on the building type and climate zone. Measures must be modeled as interactive improvements to the ASHRAE 90.1-2013 Appendix G baseline with Addendum BM accepted.

A.4.4.3 Program Impact[59]

Table 12 shows the program cost-benefit analysis results from FY2019.

Table 12: NJCEP P4P Program Cost-Benefit Analysis Results

(Source: NJCEP)

Cost-Benefit Test	2019
Participant Cost (PCT)	6.7
Program Administrator Cost (PACT)	1.5
Rate Payer Impact Measure (RIM)	0.3
Total Resource Cost (TRC)	1.6
Societal Cost (SCT)	2.6

A.4.5 Commonwealth Edison

The ComEd Energy Efficiency Program NC offering helps owners and developers implement this innovative performance-based procurement approach with technical assistance and enhanced financial incentives. The program helps building owners and developers prioritize project energy goals, determine and specify appropriate energy performance requirements, and select design and contractor teams. Energy performance is verified after occupancy to ensure contractual obligations have been met.[72] The program is implemented by the same contractor implementing the Massachusetts demonstration projects.

ComEd Accelerated Performance Program Snapshot67

Program Website	ComEd Energy Efficiency Program
State	Illinois
Customer Type	Commercial, Industrial, Nonprofit, Federal Government, Multifamily Residential, and Institutional sectors with NC or major renovation of an existing space
Budget (in 2016)	>$100 million
Funding Source	ComEd and Nicor Gas customers' utility bills in compliance with Illinois law
Implementor	Seventhwave
Timing	Pre-planning Phase
Participation (in 2016)	76
Minimum sq ft	5,000 sq ft
Rebates Offered[73]	Electric: $0.10/kWh up to 5 million kWh, $0.05/kWh above 5 million kWh; Gas: $0.50/therm; Design team incentive: 10% of measure incentive
Annual Energy Savings (in 2016)	34,642 MWh; 878,974 therms

[72] https://www.comed.com/WaysToSave/ForYourBusiness/Pages/FactSheets/AcceleratePerformance.aspx
[73] http://programs.dsireusa.org/system/program/detail/3716

A.4.5.1 Program Offerings

The program provides the following benefits to owners:

- Procurement language that integrates into existing Request for Proposal (RFP) and contract document
- Technical assistance to establish project energy requirements and evaluate team submittals
- Easy-to-use processes from RFP through operations
- Training and resources that allow owners to replicate this procurement approach across a portfolio of buildings
- Connection to higher financial incentives for savings beyond a minimally code compliant building

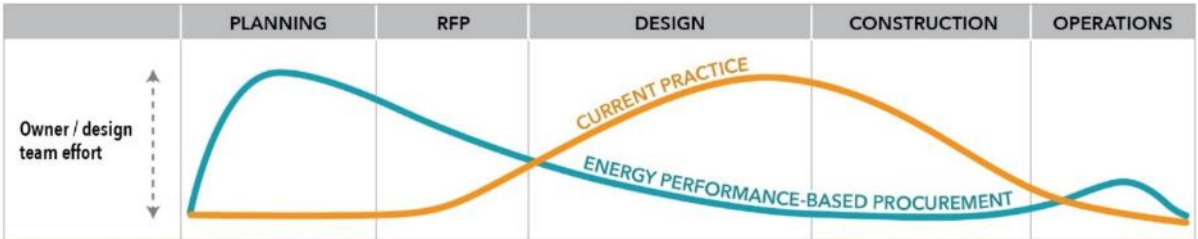
The program requires that projects achieve 35-70% energy reduction goals, they enter the program before the design team is contracted (pre-planning phase), and the building is at least 5,000 square feet.

A.4.5.2 Program Processes

Figure 6 compares performance-based procurement (accelerated performance) processes with standard practices.[74]

Figure 6: Performance-Based Procurement

(Source: NREL Commercial Buildings)



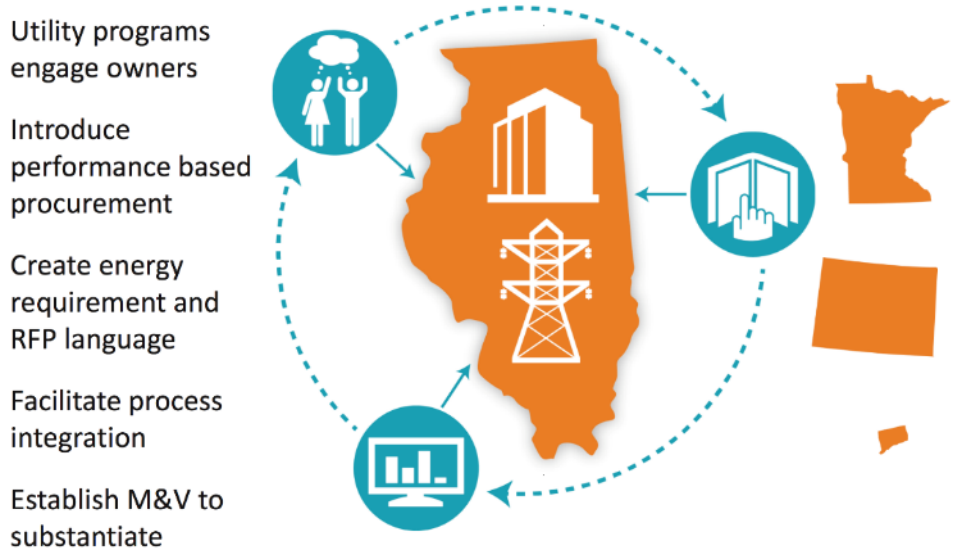
	PLANNING	RFP	DESIGN	CONSTRUCTION	OPERATIONS
Current practice	Little or no interaction	Respond to RFP Prepare contracts	Design building, fit energy utilization into design	On-site inspections	Program incentive paid
Energy performance-based procurement	Concept modeling Establish energy requirements Prepare RFP	Interact with A&Es to ensure RFP compliance Respond to RFP Prepare contracts Review submittal	Build RFP requirements into design Review design team submittals	On-site inspections Conduct measurement & verification on site Compare to RFP requirements	Program incentive paid Realize high performing building

[74] https://www.energy.gov/sites/prod/files/2016/04/f30/222109_McMillen_040416-1635.pdf

Figure 7 maps program processes at a high-level. More specifically, the first step is to set a firm price for the project during planning. Then participants specify a whole building EUI target. They then align project metrics with the performance criteria by prioritizing goals in order of importance: *mission-critical*, *highly desirable*, and *if-possible*. They then assemble the RFP document. Next, they invite design and construction teams to propose solutions that meet their prioritized requirements and select a team, in part, based on demonstrated ability to meet the EUI. They then review energy analysis throughout project life. Finally, they establish a measurement and verification plan to assess energy performance after substantial completion.[75]

Figure 7: Accelerate Performance Program Process

(Source: Seventhwave)



Project goals help design teams prioritize their focus on the mechanical, electrical, and plumbing (MEP) and building performance design. As noted, the program categorizes goals into three key types:

1. **Mission-critical goals.** Required by contract and critical to success.
   - Maximum energy target of 45 KBTU/gsf annually; lower is preferred
   - Meet LEED NC version 4, Silver Certification
   - Superior occupant comfort
   - 100% of occupied spaces physically or visually connected to nature
2. **Highly desirable goals.** Not required by contract and have influence on the recommended design.
   - Maximum energy target of 35 kBtu/gsf annually; lower is preferred
   - Passive design strategies (i.e., daylighting, passive solar heating, etc.)

[75] http://www.seventhwave.org/sites/default/files/shenry2016.pdf

- Low recycled air content
- Strong HVAC response to quickly changing occupancy (limit precooling with air)
- Usable daylight in all occupied spaces
- Exceed LEED NC version 4, Silver Certification

3. **If-possible goals.** Influence recommended design and are considered highly beneficial if included in the solution.
   - Living Building full certification
   - Net Zero Energy Design

A.4.5.3 Program Impact

The program targets the following impacts:[70]

- Targeting a 15-30% improvement versus average (30-50% better than code)
- Contract includes energy performance requirement
- Measured savings versus modeled savings
- Utility incentive based on actual performance

The program began by executing a pilot with University of Chicago Pilot. Seventhwave and ComEd developed a preliminary energy model to demonstrate what energy performance was realistically achievable. Seventhwave chose TRNSYS as the primary modeling tool and used eQUEST for initial calculations and follow-ups to check EUI. They also used ENERGY STAR Target Finder (EPA 2009) to analyze CBECS data. Through this process, the University learned the site would need to achieve a EUI of 85 kBtu/ft2-year to receive ENERGY STAR certification.

The University set several mission-critical goals: an EUI of 65 kBtu/ft^2-year, ENERGY STAR certification, at least LEED silver, and superb occupant comfort. Their highly desirable goals included passive design strategies, ENERGY STAR equipment, project maintainability, geothermal installations, and visual displays of current energy efficiency. With project goals established, they issued a request for qualifications to 22 architects and ten contractors with instructions to assemble design-build teams. Four teams were selected to complete a schematic design and compete for final selection for the building design. The competition resulted in four unique designs, all with modeled energy performance less than 55 kBtu/ft2-year.

There are no publicly available data summarizing the program impact.

A.4.6 Seattle City Light

Seattle City Light's Metered Energy Efficiency Transaction Structure (MEETS) is a radically new approach, designed to achieve deep energy-efficiency improvements in commercial buildings. It protects utility revenues, eliminates utility risk, and provides strong financial returns for investors in deep (35% savings or greater) energy efficiency.[76]

Seattle City Light MEETS Snapshot

Program Website	MEETS
State	Washington
Customer Type	Deep energy retrofit market and ultra-efficient NC
Budget (in 2018)	About $44,000 a year
Funding Source	Financing based on energy savings
Implementor	MEETS Accelerator Coalition
Timing	Pre-Planning Phase
Participation (in 2017)	1 building (Pilot phase)
Minimum sq ft	20,000
Rebates Offered	NA
Annual Energy Savings (in 2019)	647,626 kWh

A.4.6.1 Program Offerings

A utility MEETS arrangement takes P4P one step further by re-directing the benefits of the savings from the tenant to the investor while covering the costs of the utility services. With MEETS, the utility sells energy services (heating, cooling, illumination, fresh air), not kilowatt hours, to the building's tenants. The utility initially receives the same gross revenue that it would have received had the building been built and operated to code (i.e., the tenants pay for actual consumption plus saved energy). Then the utility pays an amount based on metered energy saved back to the investors, valued at a negotiated rate at the time and adjusted over time for inflation, minus a portion to cover administrative expenses. There is an additional efficiency incentive offered by the utility to the investors. The price the utility pays under the MEETS Power Purchase Agreement (PPA) ensures that over the life of the PPA the utility pays out less than the retail revenue received. A MEETS transaction is one that meets the following criteria: [77]

- The savings from metered energy efficiency from a customer facility is delivered to the utility/Load Serving Entity (LSE) – not the facility;
- The utility/LSE bills the facility, at retail, for the metered yield/saved energy of which the utility/LSE took delivery; and
- The metering is done through a dynamic baseline meter that meets utility resource grade standards.

[76] https://aceee.org/files/proceedings/2016/data/papers/3_433.pdf
[77] http://www.meetscoalition.org/wp-content/uploads/MEETS-AC-Description.pdf

The MEETS transaction does not have to be limited to energy savings from efficiency but must always include efficiency. The MEETS Accelerator Coalition describes how it offers several benefits for Utilities/LSE:

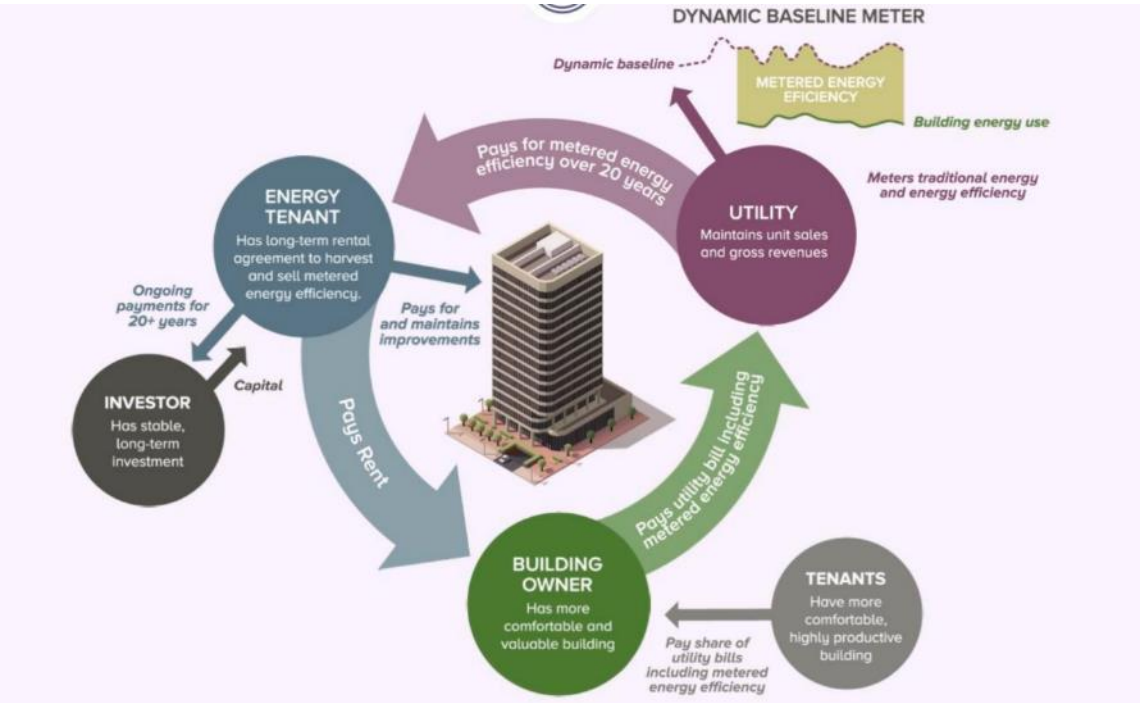
- Growing revenue and unit sales (not shrinking, as in all current efficiency models)
- Opportunity to invest for regulated rate of return
- Payment system based on proven delivery
- New, reliable, location-specific, at-scale load resource
- Provable measurements (not *deemed* estimates) for reporting to regulators

A.4.6.2 Program Processes

The MEETS Accelerator Coalition mapped out the program process (Figure 8).[78]

Figure 8: MEETS Process

(Source: MEETS Accelerator Coalition)



Under the MEETS program, there is an *energy tenant* (building owner or third-party), usually financed by an investor, who signs a rental agreement with the owner to harvest the energy savings. In turn, the energy tenant pays for and maintains comprehensive energy-efficiency retrofits to the building. The utility pays the energy tenant each month under a 20-year power purchase agreement (PPA) for the value of the resulting saved energy. The building owner and/or tenant pay the utility for the sum of the energy saved and the energy used (as if they had a single pre-energy-efficiency project energy bill). The energy tenant pays back the financing investor for

[78] http://www.meetscoalition.org/how-meets-works/

the retrofit with the revenues received from the utility for the energy savings. DeltaMeter software (by EnergyRM) tracks the energy saved and energy used for the whole building and reports to all parties. This transaction structure gives building owners a way to finance efficiency upgrades, and also helps with the split incentive problem that usually discourages building owners from investment in buildings where tenants pay the energy bills.

A.4.6.3 Program Impact

MEETS is designed to work with, or without, incentives. Because the saved power follows the utility's load curve, and because the utility pays only for actual savings after they have been achieved and measured against a baseline, the utility willingly pays a premium.

DeltaMeter® software (by EnergyRM) tracks energy saved and energy used for the whole building and reports to all parties. Every DeltaMeter® building will have a unique counter-factual model derived from its own pre-retrofit performance or an appropriate planning prototype.

The DeltaMeter uses a building simulation model derived from one year of all fuels' monthly billing data and local temperatures. This modeling approach includes a regression analysis that uses physical building parameters to create a "dynamic baseline" model as the counterfactual for calculating energy savings at future temperatures and occupancy conditions. The DeltaMeter then takes the dynamic baseline and compares it with a parallel "as improved" simulated building model that incorporates measures to predict savings potential. To determine savings after measures are implemented, the dynamic baseline is adjusted to current conditions on a monthly basis, and that predicted counterfactual usage minus that month's actual meter data is used to estimate the monthly savings.

The monthly energy savings are calculated by subtracting the consumption of an EnergyPlus model (calibrated to the actual building consumption) from the EnergyPlus Composite Baseline consumption. It is considered best practice to subtract modeled consumption from a modeled baseline, but other methods can be implemented for comparison, such as ASHRAE 90.1 Appendix G or the 2009 Seattle Energy Code.

According to the MEETS Accelerator Coalition, the DeltaMeter®'s savings for the first nine months of the pilot were calculated at **647,626 kWh**, while the EnergyPlus calculated savings totaled 647,297 kWh over the same period. The nine-month difference is less than 1%, while higher differences were observed for individual monthly data. These results lend confidence to the simplified modeling afforded by the DeltaMeter®.

Under the MEETS contract, SCL pays for energy savings at 8.41 cents/kWh with a 2% escalator (on all but 2.5 cents of the per kWh payment, which is a product of the negotiation of this specific contract). In contrast, retail rates for commercial customers are about 6 cents/kWh and are expected to increase by about 4.5% per year, making energy more expensive than savings over time. In the first year, the project generated about **$54,000** in energy savings payments for the investor, who had paid $84,000 upfront to fund the upgrades for the building. Assuming the building's high-efficiency levels persist, the MEETS PPA is expected to pay the customer $1.2 million over the twenty-year term.

Appendix B Charrette 1 Follow-up Memo

Memo issued April 1, 2019

On March 13, 2019, NMR and its subcontractor, EMI Consulting, held the first of several charrettes that brought together stakeholders to collaborate on the redesign of the Massachusetts (MA) NRNC program. This memo summarizes the key themes, takeaways, and questions raised at Charrette 1. For additional context, reviewers may wish to review the upfront memo (circulated March 7, 2019) and the charrette agenda and presentations.

NMR, EMI, and the MA PAs originally scheduled the next charrette (Charrette 2) for late April 2019. Charette 2 was intended to focus on PTLM development. However, the discussion at Charrette 1 indicated the need to further develop the program design prior to launching program theory and logic modeling. Therefore, we will reschedule Charrette 2 for mid-to-late May. We have asked attendees to respond to a poll and will confirm the rescheduled date later this week.

In the meantime, the implementation team will develop a more concrete program design. The NMR Team will conduct additional background research on existing programs and additional interviews with program implementers and industry experts. Additionally, the PA evaluation staff are currently working with DNV GL to develop a study to estimate an EUI baseline (described below).

B.1 Themes and Considerations

The charrette began with presentations from the MA PAs and evaluation consultants. Chris Chan of Eversource provided a description of the relevant evaluation landscape and offered context for this study. Kim Cullinane of Eversource and Denise Rouleau and Tracey Beckstrom of National Grid provided the implementation perspective; they outlined market and policy trends, described the current program's constraints, offered an update on the demonstration projects, and summarized lingering questions. Finally, Tom Mauldin and Nicole Rosenberg of NMR summarized the background research that NMR and EMI had conducted before the charrette, including the results of IDIs with market actors and industry experts and a best-practices program design review.

The afternoon included small-group breakouts where groups of four to six attendees separately addressed one of seven topic areas. The full group then reconvened and summarized results of the small-group discussions where all attendees could comment and ask questions on each topic area.

While grappling with issues related to measuring savings, the group naturally agreed on the general direction of the program and focused on how to impactfully and broadly engage the market while still addressing issues that threaten program savings.

B.1.1 Program Direction

Attendees concurred that the long-term vision of the MA NRNC program should be to lower the EUI of buildings and achieve greater long-term energy savings. The overarching outcome would be a general downward trend of energy use in C&I buildings in MA.

Eversource and National Grid implementation staff described their current accelerated performance project effort. Attendees supported this effort and agreed it should augment the current program offerings. Eliminating current program offerings, such as prescriptive incentives, may inadvertently leave some customers and/or territories behind.

B.1.2 Reaching the Market

The group took care to consider the importance of program accessibility and avoiding a model that serves only a subset of customers. Background research pointed to various participation obstacles associated with advanced performance-based approaches, such as program complexity, investment risks, and modeling costs.

First, the group overwhelmingly agreed that the program must engage projects at the very outset – ideally *before* RFPs are even drafted. The group discussed how early identification of projects and engagement with owners, developers, and decision makers is necessary to secure energy-usage targets into RFPs. The implementers also noted that learning about certain types of projects, such as schools and institutions, is far easier than for other types of projects where advance public notice is not available.

More specifically, group members observed that compressed design and construction schedules hinder integrated-design opportunities (and accordingly opportunities for program intervention), noting that this time pressure is often driven by the need to pay back construction loans. In the face of this constraint, the group discussed the idea of issuing incentives at different milestones during the design and construction process – similar to New Jersey's Clean Energy Program P4P design. This type of approach may support greater participation than one that solely issues incentives as a lump sum after post-construction usage data have been provided.

The group also discussed the prospect of reaching contractors, code officials, and commissioning agents through training and education to improve practices and generate market effects. In other words, communicating the benefit of EUI targets to market actors and integrating an EUI approach into ISPs. In particular, the group raised the possibility of a targeted approach to generating market effects; specifically, focusing on schools where it may be easier to consistently engage projects early.

Attendees voiced that the program must *translate* its EUI-focused approach into something customers can digest and map to their business models, goals, and needs.

B.1.3 Estimating Savings

Group discussions focused on approaches for estimating savings both for structuring incentives and supporting evaluation efforts. While these topics were not fully resolved, the dialogue laid a useful foundation for the next steps in program design.

B.1.3.1 Energy-Use Intensity

Attendees agreed that EUI is theoretically a good indicator for the desired program outcome (decreasing energy use). According to the background research and attendees, other programs have successfully leveraged EUI as a metric, ASHRAE and other organizations use it extensively, and industry members understand it. However, attendees pointed out that some professionals, particularly HVAC engineers, are still familiarizing themselves with the EUI concept and instead typically focus on peak load. Separately, they noted EUI can readily be converted to cost metrics (dollars per sq. ft.) easily understood by commercial owners and developers, meaning they should be comfortable understanding the costs and benefits as they relate to EUI.

At the same time, attendees acknowledged EUI is not the *only* metric to consider and, in practice, it can be challenging to employ. That is, when it comes to structuring programs and incentives around EUI – particularly estimating savings and establishing baselines – attendees generally agreed that leveraging EUI is not straightforward. We discuss this issue more below.

Attendees touched on the distinction between site and source EUI, explaining that one is more beneficial for gas savings and the other is more beneficial for electric savings, so some attendees questioned if the program should address whether one fuel type could be favored over others.

B.1.3.2 Actual versus Modeled Savings

The group discussed various approaches for issuing incentives. Should the incentives be solely based on modeled savings, solely based on metered (actual) savings, or a combination? While an EUI-based approach reflects a normalized indicator of energy consumption, background research shows that differences between actual and modeled savings can rely on various factors, such as unforeseen loads and occupant behavior.

Attendees generally agreed that using actual, measured savings would promote improved building operation and motivate operators and managers to utilize systems to maximize efficiency. To that end, charrette attendees emphasized training and garnering buy-in from building operators and facilities managers to ensure that systems and controls are used to their full potential. One small group suggested that the program maintain involvement with projects through building commissioning and during post occupancy.

The group was interested in implementing first-year monitoring and feedback loops to continue optimizing building and system performance. This approach would include verifying savings, identifying issues to fix in the warranty period, and supporting energy performance as buildings age. Echoing an industry expert interviewee's recommendation, one small group mentioned leveraging the ENERGY STAR® Portfolio manager to facilitate feedback loops.

Questions arose as to how granular and how many months of energy-usage data would be needed to truly assess consumption for issuing post-construction incentives. As referenced earlier, some attendees concurred that because customers may object to waiting long periods for the incentive, an actual-savings-based incentive may serve as a bonus incentive beyond what is awarded immediately after construction, for example. Attendees pointed out that over the first year, buildings may not be fully occupied, and operators are still optimizing performance. This situation means that even the first year of usage data is insufficient for measuring actual EUI.

Moreover, the group acknowledged that long-term consumption could change due to unplanned loads (e.g., EV chargers) or building uses that were not originally factored into projected EUI baseline. On that note, some attendees wondered if an EUI-based approach creates *potential* for *gaming the system* (e.g., designing a larger building than needed to reduce EUI or a partially occupied building during early months that artificially lowers EUI and inflates perceived performance).

Attendees also paused to consider how customer relationships are endangered if programs unexpectedly deny incentives after construction. Lastly, the group pointed out that measuring and evaluating actual EUI may require more staff, equipment, and time, which may threaten program cost-effectiveness.

B.1.3.3 Establishing Baselines

Attendees generally agreed that it would be advantageous to establish baselines in concert with the three-year planning cycles to ensure stability. They can be studied and refined over that time, then updated for the next cycle. One small group identified three possible sources for assessing baseline EUI:

1. **C&I Evaluation database:** Measured EUI, in theory, could be analyzed by building type using the database developed by DNV GL that incorporates both energy consumption data and program tracking data. One major advantage is the inclusion of all PA customers in the database. However, there may be no measure-level details or construction timing (permit to completion) data for newly constructed buildings. These limitations could complicate future research to assess market effects. The PAs are currently working with DNV GL to research how they could use the database to establish an EUI baseline.
2. **On-site inspections and plan reviews:** This would provide some measure-level data that could inform modeled baseline EUI for a redesigned program. However, on-site visits can become expensive, so sample sizes would be limited – this is particularly problematic because baselines will need to vary by market segment.
3. **Publicly available databases:** Some communities – namely Boston and Cambridge – require energy-use reporting for large buildings. In theory, it is accurate, but building size requirements miss characterizing smaller commercial buildings.

The group questioned if the C&I evaluation database (source 1) would provide the granularity necessary to measure market effects, implying the need for additional evaluation efforts, particularly those that collect measure-level details. From their perspective, baselines should be estimated at a minimum by building type or space type; however, tailored, site-specific baselines might be necessary. At the same time, the program should adopt a design that is as streamlined as possible.

Appendix C Follow-up IDI Memo

Memo issued May 29, 2019

On June 4, 2019, NMR and its subcontractor, EMI Consulting will hold a workshop with a subset of key stakeholders for the Massachusetts C&I New Construction program to collaborate on the program's redesign. As a precursor to this workshop, NMR and the Massachusetts PAs, together, completed six in-depth telephone interviews (IDIs) with industry experts and program managers and implementers from other jurisdictions. The IDIs offered Eversource and National Grid implementation staff the opportunity to ask detailed questions about program designs and available resources. Three of these interviewees had previously responded to preliminary IDIs in February 2019; these include a program manager from the Energy Trust of Oregon (ETO), a program implementer from the New Jersey Clean Energy Program (NJCEP), and a staff person from the NBI. The other IDIs were with program staff and implementers from Commonwealth Edison (ComEd) in Illinois and Pacific Gas and Electric (PG&E) in California and a program director at the International Living Future Institute (ILFI).

We summarize the findings from the IDIs in this memo.

C.1 FINDINGS

The interviews were, for the most part, an open forum that offered the Massachusetts program implementers the opportunity to ask questions which would inform their decision making.

C.1.1 Program Structures

Table 13 presents the overall structures of the ETO, PG&E, ComEd, and NJCEP C&I NC programs focusing on the "advanced" offerings of interest (like Massachusetts, the other jurisdictions typically offer various program tracks to serve different types of projects).[79] While ILFI and NBI also run "programs," they do not offer rate-payer funded incentive programs like the Massachusetts PAs; rather, their programs are in support of rate-payer funded incentive programs to some extent.

[79] The Upfront Memo delivered on March 7, 2019 provides additional detail on comparable programs in its best practices review.

Table 13: C&I New Construction Program Comparison – Overview

	ETO	PG&E	ComEd	NJCEP
C&I New Construction Tracks	Three tracks: (1) Path-to-Net Zero (PTNZ), an EUI-based pathway; (2) a Middle pathway – a group of prescriptive measures; and (3) individual prescriptive incentives.	Savings by Design program (whole-building option or prescriptive); supplemented with ZNE activities	Three tracks: (1) AP – performance-based track, (2) Comprehensive, and (3) Expedited	Two programs: (1) P4P and (2) prescriptive
Advanced Options				
Website	New Buildings, Path to Net Zero	ZNE outreach activities	Accelerated Performance	Pay for Performance
Overarching Summary	Provide whole-building energy modeling and ongoing technical assistance; helps designers integrate energy efficiency into planning. Eligibility is based on EUI metric that aims for energy savings a percentage greater than ASHRAE	Support ZNE development at different project phases and partners with advisory teams that help meet ZNE goals through design and technical assistance	Empower projects to achieve desired energy performance goals; help prioritize energy goals, determine and specify appropriate energy performance requirements, and select teams	Incentivize projects to take a holistic/ longer-term approach to energy efficiency through more stringent M&V post-occupancy process. Includes a package of EE measures that achieve the minimum performance target of 5% savings compared to ASHRAE 90.1-2013 (state code).
Incentive Structure	Modeled savings: $0.40 per kWh, $1.20 per therm	$15,000 incremental cost buy down; hold $25,000 design competition Architecture at Zero	Currently paid on a ¢ per kWh/therm, based on modeled savings above baseline. Hope to move to a $/ft^2 basis soon, to make value clearer to customers.	Staged (1) energy reduction plan ($/ft^2 up to $60k), (2) as-built ERP + commissioning report ($/ft^2 up to 75% of incremental cost), (3) payment for performance ($/ft^2 up to ~50% of total incentive); up to 100% of the measure costs
Eligibility	None, but modeling requirements often discourage smaller projects from participating in this track	None, work with design team/builders to get project to ZNE, help them past obstacles if not initially successful.	5,000 square feet or larger	50,000 square feet or larger

ComEd is turning away from its accelerated approach. The Massachusetts' demonstration project is modeled after ComEd's Accelerated Performance (AP) program; however, the ComEd interviewees explained that they are shifting focus away from this approach, noting the costs and barriers to participation (described below) and transitioning their focus to a quasi-prescriptive path with a base packet of measures that should be feasible in all new buildings – this is a similar concept to ETO's "middle" pathway.

PG&E has a pathway without incentives. PG&E's Savings by Design program offers a straightforward approach similar to that of Massachusetts; however, they also support in-depth technical assistance and education for projects – including post-construction – to achieve ZNE.

The goal is to both guarantee the desired result and reinforce high-performance building and design practices to transform the market.

Some cities are undertaking their own unique approaches to incentivize sustainability. The NBI interviewee described a unique incentive for net zero new construction as part of the Net Zero Action Plan[80] adopted by Cambridge, Massachusetts. New construction projects that achieve net zero emissions are awarded a "density bonus" where they may exceed the floor area ratio (FAR) and/or building height dictated by their zoning ordinance.[81] The details of this incentive are still in the exploratory planning stage and NBI has been collaborating with the city. The NBI interviewee suggested that the Massachusetts PAs may wish to align with that program to assist with market transformation.

C.1.2 Pay for Performance

Implementers hesitate to use P4P, yet it can be a "shining star" in a portfolio. The NJCEP P4P program is the only of the four program sponsors that issue incentives based on actual (not modeled) energy consumption post-occupancy. The NJCEP implementer acknowledged that customers are deterred by the P4P program's lengthy participation process (which requires waiting for the final incentive); he suggested educating customers on long-term savings opportunities and how participation could influence their bottom line and rent premiums. In the same vein, he stressed implementers need to account for the complexities of lengthy projects in their annual budget and savings estimates. He noted that the program is considering making the final incentive optional given pushback on the lengthy effort involved in post-occupancy engagement. Nonetheless, he called P4P programs a "shining star" in the portfolio if structured appropriately – all projects that complete the NJCEP P4P program have demonstrated real-world whole-building savings over the code baseline and may serve as case studies for future projects.

The other implementers also expressed reservations:

- ComEd has considered moving to P4P but are concerned with disappointing customers by delaying incentive payments. ComEd interviewees noted reservations about establishing baselines for a P4P scenario, suggesting they would need a statistically significant control group.
- The ETO interviewee said that P4P programs are not as beneficial – support for initial costs seems more valuable to customers, from her perspective – and, in turn, would prevent the program from growing and impacting the market.

The ILFI interviewee suggested that assuring customers that they will not be "punished" for slightly failing to meet their targets will help overcome barriers to participation in P4P programs; he pointed out that using a *range* EUI target versus a single hard EUI target would facilitate that flexibility. He suggested that the program incentive structure take a "hybrid approach" that marries physical building components (e.g., successful installation of a high-efficiency measure) with EUI goals to drive good post-occupancy behavior.

[80] https://www.cambridgema.gov/CDD/Projects/Climate/NetZeroTaskForce
[81] Building size relative to zoning plot size.

C.1.3 EUI and Measurement

EUI is viewed as the "path forward." The NBI interviewee called EUI "*the* approach," pointing to its clarity and ability to be building- and climate-specific. Moreover, she stated that it – as a measurement of energy efficiency – is a very important part of carbon reduction. While PG&E does not claim savings based on EUI, the interviewee believed that it was the path forward – programs should aim to drive EUI down rather than *solely* supporting renewables.

Table 14 summarizes the programs' modeling approaches and requirements/support for M&V.

Table 14: C&I New Construction Program Comparison – Savings Estimates and M&V

Program Element	ETO PTNZ	PG&E ZNE	ComEd AP	NJCEP P4P
Iterative modeling	No, initial model is reviewed, but it is not an iterative process	Yes, model is adjusted during design/construction to get the building to ZNE if possible	Somewhat	Yes, but this is minimized by setting realistic expectations upfront
Completion and Post-Occupancy	No post-occupancy data required for program participation, though evaluation verifies the savings of a sample of buildings	Validates modeled savings to see if the actual savings match, determines why/why not and helps adjust if needed	Performance verified after occupancy to ensure obligations have been met	Final incentive paid after 12 months of utility data received. Incentive is ~50% of incentive total (which ranges from $400k to $2M).
Functional Testing/ Commissioning	(Required) Up to $0.15/sq. ft., up to $40,000 cap	Does not appear to be required	Does not appear to be required	Required. The second (of three) incentives is paid after the commissioning report is received.
Energy Metering	Support ≤50% of cost of energy metering, up to $20,000	Not supported	Not supported	Not supported

C.1.3.1 EUI Targets

Setting EUI targets involves many inputs. NBI helps jurisdictions set EUI targets (by building type and climate): they use building stock assessments, guidelines, feasibility studies, Architecture 2030 targets, and other research. In the representative's words, "We look at all the benchmarks out there and then the technical feasibility studies; then, we draw a line between what is the maximum technology available and where are buildings now." She said they also prepare guidelines on approaching unique buildings, too. The ILFI interviewee emphasized that successful EUI targets (i.e., those that are attained) are well-founded based on the building type and occupancy and awareness of similar buildings' achievements – EUI/energy targets that are "just picked out of the air" are less likely to be attained.

The ETO interviewee explained they do not offer extensive technical assistance for establishing EUI targets; instead, participants set their own EUI goals and must illustrate with rigorous modeling how they will reach them. ETO will review plans – such as partway through the construction documents (CD) phase – to ensure the participant is on track to achieve the goal.

C.1.3.2 Estimating Savings

All of the other programs use code (not ISPs) as their baselines, yet they take different approaches to estimating savings:

- ComEd calculates the EUI for a basic code-compliant building and then sets an EUI goal. Interviewees explained that the program claims savings based on modeled EUI (not measured); however, they hope to simplify this with a revised program approach (described below).
- ETO measures savings in relation to percentage of savings over ASHRAE code – they are advancing this baseline to ASHRAE 90.1 2019 in the next year or so after adopting ASHRAE 90.1 2016 in the near future (likely October 1, 2019). Participants must submit energy models before occupancy to qualify.
- As noted, NJCEP measures cost-savings based on post-occupancy metered data. The NJCEP implementer described how goal setting is not directly based on EUI – they set cost-savings percentage above NJ code (ASHRAE 90.1 2013), which varies by building type, size, and structure.

When asked how to identify actual savings while keeping fuel mixes in mind, the NBI interviewee mentioned referring clients to leverage ILFI certifications such as the Living Building, Petal, or Net Zero Energy Building certifications.[82]

Calculating consumption should occur after adequate occupancy. ILFI's certification is based on 12 months of continuous meter data after 85% occupancy.[83] While ETO does not measure consumption after occupancy, they do offer incentives for commissioning, functional testing, and monitoring. Program staff encourage participants (owners) to closely monitor energy bills to determine necessary operational changes or for the program to help them troubleshoot.

C.1.3.3 Accuracy of Models

Energy models are imperfect. When asked about the accuracy of energy models, the NJCEP interviewee acknowledged that energy models are inherently imperfect yet later indicated that most projects met their targets. The ILFI interviewee asserted that models are never accurate: variance depends on occupant behavior – a "simple 9am to 5pm operation is easy, but anything more complex is bound to have errors." He underscored the need to run sensitivity analyses during planning/modeling in order to set realistic expectations. On that note, he reasoned that if a project is within 5%-10% of modeled EUI, programs should accept them (likely for issuing incentives), saying "I encourage you to have variance built in to give wiggle room" to participants trying to meet program requirements. The ILFI interviewee concluded that buildings that meet their post-occupancy goals are those who have a "stronger linkage to organizational values," meaning that users are invested in the outcomes; he cited a successful example of a school who integrated their ZNE building into their curriculum, making it a source of pride and inspiration for occupants.

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[82] https://access.living-future.org/living-building-challenge/certification/certification-options.
[83] The interviewee likely meant that the building should be used to 85% capacity but did not specify exactly what this means and the ILFI website does not clarify.

C.1.4 Program Support and Engagement

The programs' foundations for success are built on providing support to owners, designers, and developers from project conception to post-occupancy. Table 15 lists their services.

Table 15: C&I New Construction Program Comparison – Program Support

Program Element	ETO PTNZ	PG&E ZNE	ComEd AP	NJCEP P4P
Owner Support	Offer optional language for RFPs; do pre-bond engagement for public projects; include owner education	Education integral to program, work closely with project to offer technical expertise, leverage case studies.	Offer procurement language for RFP, training resources to replicate procurement approach across portfolio of buildings	Require customer work with a vetted program partner.
Early Design Assistance	Hold simple kickoff meetings to set EUI, conduct construction document review (model provided by design team/ MEP)	Provide intensive technical consulting by industry experts (for small selective set of buildings—choosing different building types)	Technical assistance to establish project energy requirements and evaluate team submittals	Help set a cost-savings % goal above NJ code.
Design Team Incentive	up to $10,000	Yes	Under development (unclear)	Incentive for energy model by $/ft^2, up to $60,000.
Technical Assistance Cost Share	75% up to $50,000	Unclear	Unclear	Yes
Technical Assistance	Early design shoebox modeling, computational fluid dynamics, CFD, analysis, daylighting studies, energy modeling, commissioning design review	Work with production builders to study/model deep energy savings and work with them to get EUI down so that they can apply learning to other buildings	Validate progress	Review energy reduction plans (incl. model) closely, work with partner to refine, help with initial planning and commissioning, model baseline against actual
Training	Allies for Efficiency, Building Energy Simulation Forum, and other special events trainings	Workshops for design professionals, education series for building professionals, general contractor/designer training through deep consultation	Creating introductory educational materials for customers.	Partners help educate customers.

Early engagement is key. Quickly steering people towards energy savings early in design became a paramount goal for ComEd. The AP program guides customers to immediately document energy goals, thereby adequately addressing energy efficiency and increasing accountability. Because ComEd finds that private owners (which tend to have rapidly progressing projects) are harder to engage before they issue their RFP, program intervention is challenging, yet they have still found some success incorporating EUI targets after project design. The ILFI interviewee observed that successful teams set an energy target – an EUI target explicitly – early in design; he, like all interviewees, suggested baking energy goals into the RFP (RFQ), as well.

Simplify expectations. ETO limits upfront meetings – when discussing potential program participation and goals – to just a single meeting. Their typical stock of buildings is small (< 50,000

ft^2, on average), meaning modeling is only cost-effective if projects have large savings goals. ComEd found that a hands-on, comprehensive, energy-modeling approach was unattractive to some customers, with customers perceiving that incentives do not offset the time and effort involved in complying with program requirements – one motivation for changing program design. Real-time feedback during ETO's PTNZ pilot period showed that the costs of early design meetings were negligible compared to lifecycle cost savings.

Partners can help usher projects. NJCEP has "partners": architecture, engineering, and energy consulting firms, including ESCOs, vetted to ensure they can handle modeling large commercial projects. The interviewee suggested growing and supporting a solid base of partners who can usher participants through participation and conduct early modeling. They influence the early stages of projects to steer owners towards efficiency. Well-vetted partners ensure fewer modeling revisions, in the interviewee's opinion, overcoming owners' concerns of large upfront costs. He suggested that program engineering staff review partners' models but allow for variations within reason. Additionally, he described how the NJCEP program partners are responsible for the majority of program outreach.

Training and education are important side benefits. According to the ETO interviewee, most design teams have limited in-house modeling expertise, or their modeling approach is not iterative; this offers the program an opportunity to pursue market transformation through training and education on enhanced modeling practices. This approach is at the heart of the PG&E ZNE program, which works with only 15-20 projects annually but aims for lasting impact on each participant's subsequent work. The PG&E interviewee observed, "the tendency is to overfund the rebate and underfund the technical assistance." The NBI interviewee acknowledged that AP is daunting to some designers, but education is helpful and garners attention. According to the ETO interviewee, their participants sometimes forgo incentives because they simply want technical assistance.

Post-construction engagement is important. While the PG&E program does not provide incentives for reaching the ZNE goal, they verify if the project achieved ZNE status and continue to engage with projects that fall short to diagnose and solve outstanding issues. In line with the ILFI interviewee's thinking, PG&E does not have a penalty for falling short, and the end result is a better performing building and enhanced knowledge among project teams. The NJCEP interviewee reported the P4P program also helps customers remedy and address situations where they initially fall short of their goals.

C.1.5 Project Channeling and Program Promotion

Adopt simple incentive terminology. A ComEd interviewee noted that positioning incentives in terms of kWh means little to potential participants, so they, like ETO, position incentives as dollars per square foot. NJCEP communicates in terms of cost savings because – in the interviewee's experience – it is more meaningful to participants than EUI.

Execute targeted, multi-pronged, and persistent outreach. ComEd interviewees described the program's strong direct outreach component; with two and a half full-time employees (FTEs) specifically devoted to outreach, they regularly connect with existing contacts, issue eBlasts, and target leads for months and call as many as five times. They recommend devoting specific FTEs

to outreach only – adding that these individuals should avoid technical jargon. The NJCEP P4P track conducts only limited and targeted marketing efforts because it is not intended to be a large-volume program – it only represents 10% of NC projects (20 to 25 very large buildings per year).

Obtain leads via multiple approaches. ComEd program staff review industry publications and databases (e.g., Construction Wire) to identify project leads. While effective, leveraging existing customers represents a small share of projects (5%-10%). NJCEP also focuses on their existing contacts who they consider "major players"; they also leverage the NJ Board of Public Utilities for leads.

Consider targeting specific sectors. The NBI interviewee lauded the advantages of pursuing schools – a tactic the Massachusetts PAs are favoring too: they are often early adopters, she observed, with clear goals and infrastructure that readily supports ZNE. ComEd is targeting four building types going forward: multifamily, office, retail, and warehouse.

Create a buzz. Both the ILFI and PG&E interviewees mentioned the impact of case studies in generating program participation. The ILFI interviewee underscored the effectiveness of storytelling. In his experience, presenting interesting and inspiring case studies are what draw new projects (and encourage good user behavior post-occupancy). The PG&E interviewee suggested hosting regional competitions as well.

C.1.6 Additional Context

Table 16 offers additional context on the programs, describing the cost-effectiveness and regulatory frameworks they are subject to and program size and market penetration.

Table 16: C&I New Construction Program Comparison – Additional Context

	ETO PTNZ	PG&E ZNE	ComEd AP	NJCEP P4P
Cost-effectiveness	Tested at the measure-level	Unclear	Projects must be cost-effective	P4P not as cost effective as prescriptive program because of technical support; no cost-effectiveness requirements, though
Regulation of PA	No	Yes	Yes	No
Full-Time Employees	10-12 outreach employees that support all three pathways, other employees support those outreach employees behind the scenes	Did not ask	13-15	Did not ask
Projects/year (approximate)	~15 (all pathways together cover 700 projects/year)	15-20 projects per year	~70 in AP track; 5% of program projects go through AP track	20-25 projects/year (10% of all NC projects that go through NJCEP programs)
Market Penetration	50% of projects (includes all program tracks)	Very low	~50% of eligible ft^2 (AP track)	<5% (P4P program)

Participation rates are low in advanced program pathways. Program administrator interviewees reported smaller participation levels in the more rigorous program tracks. For example, only 2% to 5% of ComEd C&I NC projects pursue the AP track. Observing decreases

in savings and project sizes,[84] ComEd's C&I NC program restructuring is intended to increase private sector participation rates and achieve greater cost-effectiveness through lower program delivery costs and larger incentives. They anticipate the program will maintain the same number of about 14 FTEs and serve more projects because they will be offering tiered incentives based off of common equipment and shell upgrades within a given sector, which will greatly simplify energy modeling. They estimated that in terms of market penetration, ComEd's overall C&I NC program has served roughly one-half of the eligible square footage in their territory.

The NJCEP implementer estimated that the P4P program requires about 15% of the organization's C&I budget yet P4P projects comprise only 10% of the *NC* program's projects. Incentives range between $400,000 and $2 million per project. The interviewee reported that the P4P program has tapped into less than 5% of the eligible NC market – again, the program is intended to be small.

Combined pathways offer benefits. Though ETO is not subject to regulation, the interviewee relayed that their C&I NC program is very cost-effective because of the combination of pathway options and simplified structures.

Measure-level cost-effectiveness is a barrier. The NJCEP implementer acknowledged that the P4P program was not as cost-effective as their prescriptive program due to technical support costs. However, measure-level cost-effectiveness carries less weight because they are concerned with overall consumption. In contrast, ETO must perform measure-level cost-effectiveness testing which, the interviewee explained, impedes AP projects, especially for small commercial customers. She believes that the new ASHRAE code impedes measuring incremental improvements, so they are seeking to move everything to a whole-building approach, suggesting the result would be more cost-effective in early design and encourage market transformation. The NBI interviewee asserted that HVAC is critical for achieving savings goals, while acknowledging that it does not always meet cost-effectiveness requirements.

C.1.7 Resources

NBI offerings. NBI is a nonprofit that works with stakeholders "to promote advanced design practices, innovative technologies, public policies and programs that improve energy efficiency" in new commercial buildings. They offer numerous resources to entities, such as energy-efficiency PAs – in fact, National Grid is a member. Some NBI activities may be beneficial for the Massachusetts PAs to consider leveraging or, at least, to be aware of: NBI assembles best practices for C&I and ZNE buildings; hosts a housing database of technologies; drafts white papers; tracks ZNE buildings across the nation and new buildings' energy consumption; tracks jurisdictional policy changes; develops and updates a "multi-measure tracker" that links measures with codes; offers suggestions for aligning program measures with code development and yielding market-transformation savings; recommends program designs; researches fellowships that programs can leverage to promote their program and develop partnerships; provides trainings on

[84] Based on their comments, the issues seem to be associated with the program as a whole (not just the AP track). For example, they cited concerns over free-ridership and baseline increases.
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ZNE and other topics; helps jurisdictions establish energy targets by building type; assesses baselines; conducts modeling and helps projects set energy targets.

Other resources. The NBI interviewee mentioned other resources: (1) As noted, she mentioned that her team leveraged ILFI certification as a mechanism for measuring actual savings; (2) ASHRAE published a ZNE prescriptive advanced energy guide for schools that may be ideal for the PAs to explore if they move forward with targeting schools.[85] The ILFI interviewee thought highly of Architecture 2030's Zero Tool which calculates consumption baselines and targets and is normalized by inputs such as climate, occupancy, and schedule, and uses the Commercial Building Energy Consumption Survey (CBECS) data as a baseline.[86]

[85] https://www.ashrae.org/about/news/2018/new-advanced-energy-design-guide-available-to-help-k-12-schools-achieve-zero-energy
[86] https://architecture2030.org/the-zero-tool-is-here/

Appendix D Charrette 2 Follow-up Memo

Memo issued July 10, 2019

On June 4, 2019, NMR and its subcontractor, EMI Consulting, held a workshop that brought stakeholders together to collaborate on the redesign of the MA C&I New Construction program. This memo summarizes the key themes, takeaways, and questions raised at the workshop. The workshop began with three presentations: First, the C&I process evaluation team provided a brief summary of the interim research results reported in the memo NMR issued on May 29, 2019. Second, implementation staff presented a proposed program design *strawman* for discussion. Third, the C&I impact evaluation team presented preliminary results from their EUI baseline research. Following the presentations, EMI led the group in discussion, during which attendees untangled the complexities of and considerations for the proposed program paths.

Appendix D.1 shares the latest details of the proposed (draft) program paths and defines the program goals. Appendix D.2 summarizes the key themes from the workshop and highlights next steps.

Table 17 outlines the next steps in the program redesign. After DNV GL issues its draft EUI baseline study results and the New Construction Subcommittee meets in July, the group will solicit feedback from the EEAC EM&V Consultants on key issues and technical assumptions being considered for the program design, particularly the development and adoption of EUI-based baselines. Next, implementation and the Subcommittee will refine the program design. NMR and EMI will then lead two more charrettes. The first will be with a small group and will focus on developing program theories and logic models (PTLMs) for the program paths. The second charrette will solicit feedback from a larger group of stakeholders on the overall program design and draft PTLMs.

Table 17: Next Steps in the MA C&I New Construction Program Redesign

Step	Tentative Timing (2019)	Format
DNV GL issues EUI baseline results	July 12	Memo
Subcommittee meeting (refining of program design)	July 18	Meeting
Feedback from EEAC EM&V Consultants on EUI baseline	Late July	Email/Call
Update larger group on any decisions made in July	Early August	Email
Implementation expands draft program design[1]	August or September	Email or Memo
Small group charrette on PTLMs	September or October	Charrette (3)
Summary of charrette and draft PTLMs	September or October	Memo
Large group charrette on program design and PTLMs	October or November	Charrette (4)

[1] This, and the following steps, will be dependent on the July 18 Subcommittee call and progress over summer.

D.1 PROPOSED PROGRAM PATHS (DRAFT)

Table 18 provides a snapshot of the five possible program paths that implementation staff presented. We discuss these in greater detail below. Implementation continues to adjust these paths. The following description reflects only the most recent evolution of the program design. **[Note: the program paths have since been updated (March 2020)]**

Table 18: Snapshot of Draft MA C&I New Construction Program Paths

(Source: Implementation Staff)

Components	Program Path				
	Deep Energy Savings	Whole Building Modeled	Simplified Whole Building	Late Engagement – Small	Late Engagement – Large
Building size (sq. ft.)	> 5,000	> 50,000	20,000-100,000	< 100,000	> 100,000
EUI-based incentives	Likely	Yes	No	No	No
Rx / custom incentives	No	No	Yes	Yes	Yes
Modeling	Yes	Yes	No	No	No
Post-occupancy EM&V	Required	Likely	No	No	No
Performance / bonus	Possibly	Possibly	No	No	No
Technical assistance	Yes	Yes	Yes	Dependent	No
Early engagement required	Yes	Yes	Unclear	No	No

Since the workshop, implementation staff have been drafting a charter with program background and goals to help communicate the program framework moving forward. They will share it when it is further developed. During the workshop, they provided a handout that listed ten key goals of the proposed program design:

1. Drive lower operational EUIs, not just theoretical energy savings.
2. Obtain measured energy savings/results (not just modeled) and provide feedback for project teams and owners.
3. Claim savings from non-regulated loads (i.e., plug and process loads versus HVAC, lighting, and envelope loads) and non-traditional measures that reduce EUI.
4. Enable PAs, customers, and other program partners to calculate a project's potential incentive at the beginning of the project.
5. Move away from an equipment-based model of supporting new construction to a performance-based model.
6. If possible, offer similar incentives to similar projects with similar outcomes.
7. Set customers up for long term success by requiring commissioning, giving incentives for monitoring-based commissioning (MBCx), and getting customers to understand their own role in achieving and maintaining low EUI over time.
8. Deliver a streamlined customer and stakeholder-centric program.

9. With exception of the “Path to Zero” or the ZNE path, provide level of effort and resources commensurate with savings achieved – low touch and scalable.
10. Assist market uptake (education, exemplars, proof of concept, expert guidance) to achieve commercial ZNE buildings.

D.1.1 Deep Energy Savings

Projects participating in the first proposed path, Deep Energy Savings (i.e., Path to Zero or ZNE path), would be those pursuing ZNE-readiness and have the deepest energy savings goals (compared to other paths). The program would claim savings associated with the project’s EUI. Efforts would focus on driving the lowest possible EUI. Implementation expects that it would be an uncommon path. The following would likely be the key program elements and requirements:

- Participating projects would be buildings with more than **5,000 sq. ft.** of conditioned space (excluding core and shell projects, likely).
- The focus would be on **early engagement**. Projects would need to engage with the program and receive technical assistance prior to 50% through schematic design (SD) and/or before hiring a design team. Before design development (DD), the PAs would provide a design charrette(s) for the project.
- Other **technical assistance** would include help with benchmarking, setting EUI targets, language for RFPs, and sustainability owner’s project manager (OPM) type services, such as further goal setting services, and mid-design review and feedback.
- Design teams would receive **incentives** of up to $15,000 per project, but it is unclear how that would be calculated. Construction incentives for customers would likely be associated with ranges of **predicted EUI** (PEUI), binned into **three tiers** (*good*, *better*, *best*), and calculated on a dollars per sq. ft. basis. Deep Energy Savings projects would be encouraged to pursue the best (i.e., lowest) EUI tier. It has not yet been decided how the EUI baseline and savings would be claimed.
- Design teams would conduct their own **iterative modeling** throughout the participation process to ascertain progress toward the targeted EUI. PEUI would account for customer plans for IT, plug-load, and other operation **policies** to reduce the EUI of the building. Modeled savings would account for regulated and **unregulated loads**, including **unconventional** energy conservation measures (ECMs).
- This program path will require a certain level of **commissioning**, with at least one year of post-commissioning usage data. After receiving and assessing the first-year data, the program might then offer a ***bonus* incentive** (dollars per sq. ft.) for reaching the PEUI target. The bonus could also be positioned as a final portion of an incentive that the program/modeling efforts estimate upfront (there was some discussion of this final incentive/bonus being issued regardless of whether the project attains its goal).

D.1.2 Whole Building Modeled

The second path, Whole Building Modeled, would leverage many of the same components as the Deep Energy Savings path:

- However, this path would focus on larger buildings **greater than 50,000 sq. ft** and this could include core and shell buildings.
- **Early engagement** would again be critical. PAs would engage much the same way they have historically. They would require and provide a charrette before completion of the DD phase. Technical assistance could also include OPM-type services.
- The technical assistance (TA) vendors would construct an **EQuest energy model** and provide an interim report to customers to aid in decision making. It is likely this would also be part of the Deep Energy Savings path, but this has not yet been determined.
- As implied by the name, projects would not seek the same level of savings as the Deep Energy Savings path projects, but they would still target a certain level of savings reduction. This path requires customers to work toward **reduction of PEUIs**. Customer incentives would also be offered on a dollars per sq. ft. basis in accordance with the same EUI based **incentive tiers** used in the Deep Energy Savings path. Design teams would also receive incentives of up to $15,000.
- It is uncertain if this path would require some type of post-occupancy EM&V. Perhaps, customers could choose to submit one year of post-occupancy usage data and receive a bonus incentive. At the end of design, TA vendors would finalize the energy model and submit for PA review. Measured savings could either be **modeled or actuals** and would ideally allow for **unregulated** loads and **unconventional** ECMs, as described under the Deep Energy Savings path.
- This program design would likely set unique **EUI baselines** for a **subset of sectors** with consistent and clearly definable consumption patterns. It is unclear exactly how to handle baselines and savings estimates for other sectors; they would need to be determined on a project-by-project basis using an agreed upon methodology. It is uncertain if those sectors would follow an EUI approach or if they would revert to a more conventional modeling approach. This same concern or approach to estimating savings may be applicable for the Deep Energy Savings path, but this continues to be a topic of discussion.

D.1.3 Simplified Whole Building

The Simplified Whole Building path has the following differences from the previous pathway:

- The path allows for smaller buildings, with the participation cutoff ranging from **20,000 to 100,000 sq. ft**.
- While projects pursue savings holistically, their buildings would be **less complex**. For example, supermarkets and laboratories would be ineligible.
- Instead of leveraging EUI to estimate savings and incentives, estimates would be more equipment based. The pathway would rely on a **spreadsheet containing a menu of**

ECMs, with prescriptive and some calculated custom offerings. All savings would be captured in the spreadsheet, and it would also calculate customer incentives.

- There would **be no post-occupancy EM&V requirements**.
- It is undecided if there would be a design team incentive.

D.1.4 Late Engagement – Small Building

The Late Engagement Pathway is split into two segments: the first path is offered to buildings **under 100,000 sq. ft.** and the second is offered to buildings over 100,000 sq. ft. However, *any* projects **under 20,000 sq. ft.** would be required to use the Late Engagement path if they are not pursuing the Deep Energy Savings path. Other pathway characteristics include the following:

- This path uses a **spreadsheet approach** and is essentially a **bundling of prescriptive and typical custom measures** in one place; it could be used for whole buildings or partial renovations.
- Like the previous path, the incentives would be included in the spreadsheet and would be on a measure-by-measure basis, so projects must have **uncomplicated systems and ECMs**.
- Unlike the other paths, projects can enter the program **after the DD phase**, so, in those cases, the PA would not provide charrettes or design team incentives. PAs would provide charrettes if projects begin participation before the completion of the DD phase, and will provide mid-design review and final design review.
- Participation will **not include post-occupancy EM&V**.

D.1.5 Late Engagement – Large Building

The Late Engagement offering for buildings **over 100,000 sq. ft.** is very similar to that for small buildings:

- It includes *off the shelf* applications for **prescriptive or custom measures**. Savings are based on **TRM values** or **custom calculations**.
- Unlike the other pathways, it has **no technical assistance** unless a TA vendor is required to calculate custom measure savings.
- Participation would also **not include post-occupancy EM&V**.

D.2 Key Themes

Workshop presentations and discussions clarified that that there is no *silver bullet* in terms of program design. Discussion gravitated around the process for determining EUI baselines, mitigating evaluation risks, and creating an approachable experience for customers that does not force a large number of projects into prescriptive (i.e., Late Engagement) paths.

D.2.1 EUI Baseline

Results from DNV GL's preliminary research indicate that it is possible to develop a set of sector-based EUI baselines for the program to leverage. During the workshop, DNV GL reviewed the resources, primarily MassGIS standardized Level 3 (L3) assessors' parcel mapping data set and Boston tax data, that they are drawing on to estimate EUI baseline. They will use other secondary sources, such as Dodge data or town-specific resources, to inform gaps in L3 data. The group suggested exploring other data, such as that of Lawrence Berkeley National Lab, LEED, NBI, DOE Portfolio Manager, and Pacific Northwest National Lab, etc. EUI baseline inputs include building square footage, year built, land use code, annual energy consumption, program participation status, weather data, and building codes.

The presentation brought important considerations to light. In particular, the vintage of existing data (2016 data) generated concern and elicited suggestions from the group. One suggestion was to calculate percentage changes across years to project current EUIs. Additionally, some databases do not account for mixed uses within a building (e.g., kitchens and gyms), occupancy rates, and other inputs. DNV GL will account for a number of other caveats, such as skewing by fuel type, availability of billing data, sizes, and renewable energy infrastructure.

- **Next step: DNV GL will share more detailed results in July 2019 for review and consideration by the Subcommittee.**

D.2.2 Modeling

Attendees were generally opposed to entirely abandoning the current Integrated Design approach, which relies on predicted modeling of regulated loads and conventional ECMs. Some attendees liked the idea of pursuing EUI ranges (i.e., tiers) as targets but estimating savings in a different way (such as the way the Integrated Design approach does). However, to other attendees, this approach did not seem to move in the direction of adopting a more performance-based approach and capturing a higher level of savings. Though a few attendees pointed back to this difference: while the equipment may be the same, the end result might not because there would be a different conversation with the customer, which would hover around performance and EUI even if the backend calculations are different. Potentially, the calculations could also include unregulated loads and unconventional ECMs, which much of the group concurred was ideal.

The group set aside the decision of using *actuals* (i.e., basing savings on post-occupancy EM&V data).

- **Next Step: In the process of further refining proposed program approaches, the Subcommittee will determine if they will associate incentives and savings with post-occupancy data.**

D.2.3 Fuel Types

The group addressed the complexity of setting fixed EUI baselines by building type when considering fuel types. One person summarized that there are two EUI baseline scenarios: blended gas and electric or all-electric. The group seemed to concur that the default is blended unless it is clearly documented that the project originally (without program intervention) intended to go all-electric. One implementer asserted that restrictions around fuel types sometimes means

that projects are treated differently because of where they are geographically, but it is unclear how to advocate for treating projects the same way.[87]

- **Next Step: The Subcommittee, PA evaluation staff, and EEAC EM&V Consultants will determine how to appropriately incorporate fuel types into EUI baselines.**

D.2.4 Evaluation Risks

The group further discussed how an EUI-based path would realistically be broken into two *camps* within a program path, such as the Whole Building Modeled path: one camp would establish standardized EUI baselines for common and homogenous sectors, excluding overly complex buildings, and projects in other sectors (the second camp) would need to take a different approach.

Attendees, in different ways, expressed hesitation for developing standardized EUI baselines, observing a plethora of "exceptions to the rule." As alluded to previously, the need to establish statistically reliable EUI baselines for specific sectors is critical for the success of the proposed program paths. DNV GL's preliminary research indicates that they already observe large enough samples for some sectors – such as mercantile retail (not mall), offices, warehouse/storage, service, and food service – to potentially estimate statistically reliable sector specific EUI baselines. That said, the group still focused on the importance of tight standard deviations to justify values.

Several attendees suggested using *adders* in instances where there might be unique building elements (e.g., pools) that are not built into standardized sector-level EUIs. One person asserted that those adders themselves would also require statistical rigor. Another person added that some projects might not know upfront that they will include unique building elements, which would be important to anticipate if post-occupancy EM&V is factored into claiming savings. One attendee reminded the group that "sub-metering is a tool in our toolbox" to estimate loads for specific end uses.

Attendees generally agreed to slowly establish sector-level EUI baselines – perhaps, to start, only doing so for four (unspecified) building types with *reasonable* average baselines. Some attendees agreed that examining three to five buildings in depth (likely through on-site visits and billing data review) as a sanity check in that process would be reassuring.

One attendee pointed out that leveraging actuals for the Deep Energy Savings path would be less risky. This is likely because buildings pursuing ZNE may (1) have occupants who will be committed to conservation behavior and (2) have low metered consumption due to the presence of renewable energy measures. A few attendees discussed the benefits of issuing tenant guidelines around post-occupancy behavior as a mechanism to encourage good occupant behavior.

Some new revelations about evaluation came to light during the workshop. In particular, PA evaluation staff and the EEAC EM&V Consultants are developing a baseline repository document

[87] Implementers clarified a few considerations: if projects are not gas customers, gas PAs cannot claim those savings; for projects seeking purely electric operations, if there is a gas pipeline available, then they can claim gas savings.

and an approach or framework for conducting ex-ante or early evaluation reviews, which may affect how baselines for new construction are determined and evaluated. Nonetheless, the group would like more clarity from evaluation about the adoption of and the flexibility with which EUI-based baselines can be established.

- **Next Step: Evaluation will follow-up with the EEAC EM&V Consultants for clarity about the adoption of and the flexibility with which EUI-based baselines can be established.**
- **Next Step: The Subcommittee will review and consider DNV GL's results on EUI baselines.**

D.2.5 Participant Engagement

Discussion of incentives seemed to gravitate around customer interactions and the struggle to communicate with customers around complex program designs:

- It seemed clear that presenting incentives in terms of dollars per sq. ft. would be most marketable and interpretable.
- One attendee suggested that, behind the scenes, you can model EUI and map it back to terms the customer understands, such as dollars per sq. ft. – this is the method that the New Jersey Clean Energy Program's P4P approach undertakes.

The group also acknowledged the importance of general outreach to the design and development communities.

D.2.6 Additional Topics

A few other topics arose:

- A question of site versus source energy usage arose; however, evaluation assesses saving for reductions in site energy usage.
- An implementer mentioned that implementation has formally asked evaluation to determine a proxy for incremental cost on a dollars per sq. ft. basis. Evaluation will keep this request on their radar.
- Another attendee pointed out that the RNC program's redesign grappled with similar issues and may therefore provide lessons for this redesign.

- **Next Step: Explore RNC program design development documentation.**

Appendix E Charrette 3 Follow-up Memo

Memo issued January 7, 2020

On September 25, 2019, NMR and its subcontractor, EMI Consulting, held a third charrette that brought stakeholders together to collaborate on the redesign of the Massachusetts (MA) Commercial and Industrial (C&I) New Construction (NC) program. The purpose of the charrette was to obtain feedback on the revised program design and a preliminary PTLM.[88] This memo reports the results of the charrette and provides a revised draft PTLM. Table 19 outlines the memo contents.

Table 19: Memo Contents

Section	Content	Description
Appendix E.1	Background and Next Steps	Documents this study's deliverables, offers context, and outlines next steps
Appendix E.2	Proposed Program Redesign	Describes the latest *draft* proposed program paths designed by implementation staff and explains challenges towards implementation
Appendix E.3	Logic Models	Graphically maps program activities to outputs and outcomes for each program path
Appendix E.4	Program Theory	Describes the activities, outputs, outcomes, and other considerations, including resources, stakeholders, market barriers, and external factors, displayed in the logic model
Appendix E.5	Measuring Market Progress	Considers the indicators of progress toward expected outcomes that future evaluations could use in measuring market effects

E.1 Background and Next Steps

E.1.1 Charrettes

The NMR Team has led three charrettes as part of this study:

1. Charrette 1 offered an opportunity to convene a large group of program implementers and evaluators to discuss considerations for a program redesign, specifically one that focused on EUI.
2. At Charrette 2, implementation outlined five potential program paths that it had continued to explore since Charrette 1. Charrette 2 offered a small group of implementers and evaluators the opportunity to provide feedback on the five potential program paths.

[88] The *program theory* is a formal description of the program's activities and the short-, medium-, and long-term outcomes it is designed to achieve. The *logic model* is a graphical representation of the program theory.

3. Following Charrette 2, implementers further refined the program paths, minimizing it to four paths; they presented these during Charrette 3 and garnered additional feedback from a small group of implementers and evaluators. However, Charrette 3 focused primarily on developing the PTLM.

We will hold Charrette 4 in January 2020. The focus will be to inform stakeholders on the latest program design, obtain feedback on the revised PTLM from a larger group, and discuss market effects indicators and measurement. In the meantime, the NMR Team has facilitated two focus groups with key market actors and implementation to receive feedback on the current iteration of the revised program. Implementation continues to refine the program design. See below for more details.

E.1.2 EUI Baseline

DNV GL – in collaboration with the PAs – has been examining average EUIs and their variability across sectors, using MA-specific data, and identifying which sectors may be good candidates for using sector-level EUI baselines. Implementation, with input from the New Construction Subcommittee, has taken DNV GL's findings into account as they are redesigning the program, which would ideally leverage EUI for its advanced paths. DNV GL continues to refine the EUI baseline study analysis and the PAs will continue to consider its findings in their program planning. The NMR Team acknowledges the importance of key baseline questions that have been raised at the various charrettes. That said, it is beyond the scope of this study to determine what baseline values should be and, as a result, the baseline issues are being discussed in different forums, such as the New Constriction Subcommittee meeting.

E.1.3 Upcoming Research

As part of this study (MA19 CX01-B-NCPLANME), the NMR Team planned to undertake market actor interviews to garner feedback on the proposed program changes/additions. However, the NMR team, implementation, and the PA study lead, Alexandra Bothner (Eversource), determined that focus groups with active program participants (e.g., developers, architects, engineers) would be more beneficial. We held these in mid-December 2019 and will issue a memo summarizing the results.

E.1.4 Market Effects

As noted earlier, Charrette 3 was primarily intended to serve as a platform for developing the PTLM. Before the charrette, the NMR Team developed a draft PTLM and distributed it to attendees. During the charrette, we worked with attendees to refine the PTLM to ensure that it considered all key elements and relationships. The PTLM in this memo incorporates attendees' comments and suggestions. We intend to refine the PTLM further and create a nearly final version prior to the fourth charrette. We will finalize the PTLM after implementation has finalized the design for the program.

NMR will finalize the PTLM following Charrette 4. We suggest that during Charrette 4, the PAs and evaluators discuss the indicators and measurement approaches (explained in Appendix E.5) needed to measure market effects (which leverage the PTLM). Either during or just after the charrette, the indicators and measurement approaches should be agreed upon because time is

of the essence given that evaluation should establish baseline market conditions before the redesigned program is launched. NMR will not finalize the PTLM until the PAs and EEAC have determined how baselines will be applied to the new program as this may affect some of the PTLM components.

E.1.5 Next Steps

The following are the next steps:

- The NMR Team and implementation conducted focus groups
- Charrette 4 will take place in early 2020.
- The PAs should determine if/how they will use the findings from DNV GL's EUI baseline study and what baselines they will use for measuring savings.
- During and after Charrette 4, the PAs should identify market effects indicators and determine how they will measure them, particularly to establish a market baseline in the short term. As a starting point, the NMR Team suggests a potential list of indicators for consideration in Appendix E.5.

The PAs continue to consider and study elements needed to move forward with a revised program design and preparation for measuring market effects. Examples – some of which overlap – include the following:

- Establishing EUI baselines
- Setting incentive structures (dollars per square foot, P4P, bonuses, etc.)
- Treatment of incremental cost
- Methods of calculating savings (e.g., site versus source EUI, modeled vs. actual energy usage, etc.)
- Treatment of strategic electrification and energy optimization, particularly for the Deep Energy Savings path
- Extent and type of technical assistance needed

E.2 PROPOSED PROGRAM DESIGN

This section provides a brief overview of the proposed program's paths and goals, as well as the challenges it faces for implementation.

E.2.1 Program Paths

The proposed program design includes four paths with differing objectives, activities, incentive structures, and targeted project types. Table 20 outlines the four program paths.

- The Deep Energy Savings and Whole Building Modeled paths involve expert technical assistance and provide tiered incentives based on energy modeling with a focus on achieving lower energy usage intensities (EUIs).

- The Deep Energy Savings path will include technical assistance directly focused on achieving the low EUI required to attain ZNE or PH certification. The PAs will issue incentives for this path in a P4P format: one portion will be paid at the end of construction and the remaining portion after one year of post-commissioning, post-occupancy utility data demonstrate the project achieves its target. They will also provide bonus incentives for attaining ZNE and PH certification.
- The Simplified Whole Building path will provide less intensive technical assistance. It will utilize a spreadsheet (i.e., workbook) approach that incentivizes savings and incentive amounts tied to prescriptive and custom measures and not based on energy modeling. In the longer term, the program will explore creating packages for common building types.
- The Systems path will primarily be a prescriptive program available for smaller buildings (<20,000 sq. ft.) yet will allow larger buildings to participate if they come to the program after construction documents are complete.

Table 20: Snapshot of Proposed Program Paths

(Source: Implementation Staff)

Components	Program Path			
	Deep Energy Savings	Whole Building Modeled	Simplified Whole Building	Systems
Building size (sq. ft.)	> 5,000**	> 50,000	20,000-100,000 (Flexible)	< 20,000 (Any if late engm't. or not whole building)
Early engagement required	✓	✓	✓ (To receive some benefits)	
Technical assistance	✓	✓	✓*	✓ (For custom measures)
Project specific modeling-based savings estimates	✓	✓		
Spreadsheet-based savings estimates			✓ (Possible Bundling in future)	✓
Post-occupancy EM&V	Required	Optional (Bonus?)		
Pay-for-performance incentives	✓ (Partial)			
Prescriptive / custom incentives			✓	✓
Tiered modeling-based incentives	✓ (Partial)	✓		
Design team incentive (Capped at $15k)	✓	✓		
Certification bonus	✓			

Note: The program design is not yet final. Specifications denoted with question marks are particularly still under discussion.
* Only can receive if engaged early
**** As of March 11, 2020, this number increased to >= 20,000.**

E.2.2 Program Goals

Program goals differ from the outcomes embedded in the PTLM. Outcomes describe program impacts, while goals identify the ways in which the program is intended to operate and serve its participants. Implementation staff outlined nine key goals for the redesigned program:

1. Drive lower operational EUIs and not just theoretical energy savings.
2. Claim savings from non-regulated loads (i.e., plug and process loads versus HVAC, lighting, and envelope loads) and non-traditional measures that reduce EUI.
3. Enable PAs, customers, and other program partners to calculate a project's potential incentive at the beginning of the project.
4. Move away from an equipment-based model of supporting new construction to a performance-based model.
5. If possible, offer similar incentives to similar projects with similar outcomes.
6. Set customers up for long-term success by requiring commissioning, considering incentives for monitoring-based commissioning (MBCx), and getting customers to understand their own role in achieving and maintaining a low EUI over time.
7. Deliver a streamlined customer- and stakeholder-centric program.
8. With the exception of the Deep Energy Savings path, provide level of effort and resources commensurate with savings achieved – low touch and scalable.
9. Assist market uptake (education, exemplars, economic analyses, proof of concept, expert guidance) to achieve commercial ZNE buildings.

E.2.3 Considerations for Implementation

There are interconnected layers of challenges that programs face: internal challenges for implementation/administration, barriers that prevent entities from participating in the program, and barriers to market actors' adoption of energy-efficient practices and technologies.

As noted in Appendix E.1, all three charrettes have addressed issues the program will have to contend with to successfully implement this program design. First, the revised program design will focus on EUI, specifically for the Deep Energy Savings and Whole Building Modeled paths. At present, the PAs have not determined how they would establish and use such an EUI baseline. This will be important in determining how to implement these program paths, in terms of calculating savings and incentives. Throughout all three charrettes, attendees addressed the challenges that benefit-cost ratio (BCR) testing requirements have for the program; they pointed to its complexity and stringency as a basis for limiting savings and alienating potential participants. These types of concerns are appropriate for consideration for impact evaluation research.

The NMR Team and charrette attendees brainstormed barriers that impede program participation:

- **Awareness of program.** A lack of awareness of the program's presence and array of opportunities is a continual barrier that all programs must address through marketing and outreach activities. Further, while a design team may be aware of the program, they might not pursue participation unless a client requests it – this requires broad outreach tactics.

- **Incentive amounts.** Potential participants may not believe that the incentive amounts will be substantial enough to (1) offset the program-related project costs or (2) warrant the time needed to comply with program requirements – such as participation in technical assistance offerings or completing program applications. Including efficiency design upgrades, along with modeling and metering (if required), brings additional upfront project costs that some potential participants may view as prohibitive.
- **Incentive clarity and timing.** Charrette attendees discussed how the current method for calculating incentives creates an enigma for potential participants who do not know what their incentive amount will be until project completion. This issue can prevent them from engaging with the program entirely.
- **Measure inclusion.** As noted above, program staff have described challenges with cost-effectiveness requirements dictating which optimization approaches the program can support. Furthermore, program staff have indicated that each participating project must be cost-effective to receive incentives. In some cases, these issues preclude the program from supporting measures that some participants seek to install, and, in effect, have prevented them from participating and/or pursuing those approaches altogether.
- **Timing.** Design teams or other market actors may find that participating in the program will lengthen the design or construction process. Additionally, one charrette attendee noticed a transition in the market to a design-build construction process, which results in a faster construction timeline that limits the potential for program engagement or intervention.
- **Strategic electrification.** PH and ZNE designs and certifications may lead to an increase in the use of electricity (as opposed to natural gas), particularly for heating consumption. This may complicate how savings are calculated if an EUI baseline is applied and also how savings might be allocated across the electric and gas PAs.

Appendix E.4.3.3, as part of the program theory description, describes barriers that can impede a program's ability to achieve its intended outcomes on the broader market – **note, market barriers can both limit the program's success in achieving the intended outcomes on the market overall and (as a result) impede program participation**.

E.3 Logic Models

Market effects are sustained increases in the adoption and penetration of energy-efficient technologies and practices that result from market changes induced by a market intervention. The purpose of the logic model is to visualize the program theory and to identify the market effects potentially induced by the program and display how the program may generate those market effects.

Figure 9 through Figure 12 include the draft logic models for each program path. These factor in the feedback of charrette attendees. The bubbles are color coded to illustrate the program's *touchpoints* – indicating if it directly influences program participants only or both participants and the market overall. Generally, the short-term outcomes influence participants only and, in the mid-term, they begin to spill into the market overall. The arrows are in varying colors simply to help

distinguish them in cases of overlaps, and these colors do not have any further meaning. Subsequent sections explain these relationships and offer definitions. **Given space constraints, not all relationships can be illustrated; the logic models intend to show the strongest relationships**.

We describe the logic model activities and outputs in Appendix E.4.1 and relationships with/between the logic model outcomes in Appendix E.4.2. Then, in Appendix E.4.3, we discuss the barriers, stakeholders, external factors, and resources behind the logic models (not illustrated).

Figure 9: Deep Energy Savings Path – Logic Model

[Logic Model has since been updated. We have removed it from this memo to minimize confusion]

Figure 10: Whole Building Modeled Path – Logic Model

[Logic Model has since been updated. We have removed it from this memo to minimize confusion]

Figure 11: Simplified Whole Building Path – Logic Model

[Logic Model has since been excluded. We have removed it from this memo to minimize confusion]

Figure 12: Systems – Logic Model

[Logic Model has since been excluded. We have removed it from this memo to minimize confusion]

E.4 PROGRAM THEORY

This section first explains the elements and relationships depicted in the logic model (activities, outputs, and outcomes), then describes additional elements or considerations critical to program function and market effects (resources, stakeholders, market barriers, and external factors).

E.4.1 Activities and Outputs

Below, we describe key program activities and their quantifiable outputs. Three primary activities are central to all program paths:

- **Marketing and outreach.** Program staff will work to reach customers and other market actors to raise awareness of the program and its offerings.
    - **Output:** Outreach materials are developed and delivered, and the program website is maintained and refined as needed. Additionally, awards and recognition for performance are delivered to participating buildings and used as case study examples to generate media engagement/public interest and create a feedback loop.
    - **Output:** Program staff participate in relevant industry organizations and form partnerships to conduct collaborative efforts.

- **Education and training.** Through webinars and training events, the program will reinforce awareness of program offerings and provide training and education to the design and construction communities (including developers and design-build firms) on methods for decreasing building energy use, incorporating energy efficiency into projects, and developing high-performance buildings. Depending on the program path, education and training efforts will include information on the benefits and requirements of building to ZNE or PH standards and/or achieving lower building EUIs.
    - **Output:** Training and events are held.
    - **Output:** After learning about the merits and approaches behind the program's energy-efficiency goals, participants will include them in final construction drawings.
- **Incentives.** Incentive offerings will vary by path. The Deep Energy Savings and Whole Building Modeled paths will award incentives in tiers based on a percentage EUI reduction relative to a baseline, as measured by energy modeling. Incentives will be calculated in dollars per sq. ft., and the rates will vary by the range of EUI reduction. Also, the Deep Energy Savings path will offer P4P incentives and a bonus incentive for achieving ZNE or PH certification. Whole Building Modeled projects may receive a bonus for measuring and providing operational EUI data to the program. Simplified Whole Building and Systems path projects will receive custom and prescriptive incentives.
    - **Output:** Incentives are incorporated into projects' financial proformas and distributed.
        - The Deep Energy Savings and Whole Building Modeled paths will also include energy modeling services and offer EUI benchmarking and target setting for projects. Further, the program plans to provide commissioning assistance as part of the advanced paths, which – under the technical assistance umbrella – would focus on project goals in building operations and ensure that measures and controls are installed correctly, building systems are operating as intended, and the building operators are trained on how best to manage building systems and monitor building performance to identify issues.[89]
    - **Output:** Charrettes and technical assistance events are held.
    - **Output:** As a result of the charrettes and technical assistance meetings, energy models and economic analyses are performed, EUI targets are set, and optimized designs are included in final construction drawings.
    - **Output:** Commissioning with design teams and operators (or other end users) is conducted.
- **Post-occupancy/construction data collection**. With its focus on both realizing decreased EUIs in practice and increasing the EUI data available to the program, will require participants to provide one year of post-occupancy metered energy consumption data. The Whole Building Modeled path will include a bonus incentive for projects that provide one year of post-occupancy metered energy consumption data.

[89] Under the simplified paths, commissioning would be limited to traditional verification of ECM installation.

- **Output**: Granular actual EUI data on participating buildings is available, housed, and analyzed.
- **Output**: Inspections are conducted.

E.4.2 Outcomes

The outcomes described here are organized into short-, mid-, and long-term. Generally, a mid-term outcome would be caused by a short-term outcome and a long-term outcome would be caused by a mid-term outcome. The timelines (i.e., calendar years) on which they are based vary.

E.4.2.1 Short-term Outcomes

A short-term outcome would likely occur one to three years following program intervention. The following short-term outcomes are expected to come directly from the program outputs:

- **Increased program awareness and participation.** Two program activities increase awareness of the program among market actors, owners, and occupants: (1) marketing materials and outreach efforts and (2) education and training events. The first informs them that the program exists and what it offers. The second – in addition to generating other outcomes – reinforces an understanding of the program's offerings or may elicit more awareness of new paths. Below, we describe improvements in program satisfaction, which also fuels program participation levels.
- **Increased understanding and awareness of EUIs.** The marketing and outreach and educational and technical assistance activities described above will increase market actor, owner, and occupant awareness and understanding of EUIs. This will be particularly pronounced in the advanced paths (i.e., Deep Energy Savings and Whole Building Modeled) given that EUI will be an integral component to measuring project success.
- **Reduced EUIs in participating buildings.** The inclusion of optimized designs in participant projects – influenced by marketing, outreach, and educational and technical assistance activities, and supported by program incentives – will lead to reductions in EUIs in participating buildings, particularly in the advanced paths where substantially reducing EUIs is a central program component. The critical outputs toward this end include charrettes, the setting of EUI targets, commissioning activities with operators, and inclusion/installation of optimized designs. This will be driven by two other short-term outcomes: an increased understanding of EUI (described above) and improvements and changes in market actors' practices (described below).
- **Improvement and changes in market actors' practices.** Market actors will learn of new and more advanced building practices and increase their understanding of EUI, ZNE, and PH through the program's educational and technical assistance activities. Below, we describe how, in the mid-term, they will also carry these practices over to non-program projects.
- **Improved participant satisfaction.** Participants who receive deeper technical assistance and an enhanced incentive structure and new bonus incentives may show increased satisfaction with the program. There are two other possible causes for improved satisfaction, which are not shown in the logic model: First, owners and occupants of low-

EUI buildings will be pleased with the energy savings they realize or other benefits (e.g., thermal comfort) they reap from occupying and operating ZNE and PH buildings. Second, the PAs are considering a bundling approach that could become central to the Simplified Whole Building path. This approach may provide a more streamlined participation experience, which might improve participant satisfaction experience.

- **Increased understanding and awareness of ZNE and PH certifications**. Three program activities will primarily increase market actor understanding of how to achieve the low EUI required to attain these certifications: marketing and outreach, education and training, and technical assistance.
- **Reduced cost barriers.** Program incentives and technical assistance will reduce the cost barriers associated with meeting EUI targets through optimized design the installation of high-performance measures.
- **Increased demand for and construction of high-performance buildings among participants.** Nearly all program activities lead to this outcome, but we do not show this in the logic model due to space constraints. As shown, marketing and outreach efforts establish the value of energy efficiency among participants; however, education and training events, incentives, and technical assistance all encourage participants to adopt optimized designs. In addition, three short-term outcomes would increase the demand for development of high-performance buildings among participants: increases in program participation, increases in understanding of EUI, and improvements and changes in market actor building practices. Note that tactics to lower EUI do not rely solely on traditional energy conservation measures, so attention paid to proper building system management, occupant behavior, and advanced building design are included in this outcome.

E.4.2.2 Mid-term Outcomes

Typically, short-term outcomes are influenced by program activities and directly impact program participants. Alternatively, mid-term outcomes are the point at which the short-term outcomes impact the market more broadly, most likely occurring four to six years after program intervention.

- **Increased demand for and construction of high-performance buildings in the market overall.** The demand optimized design in the program spills into the market overall. In particular, ECMs related to ZNE and PH certification will see more widespread adoption.
- **Positive NEIs experienced in participating buildings.** This outcome may occur in the short-term, too. Optimized building design may lead owners and occupants to experience NEIs, such as fewer tenant complaints, improved thermal comfort, and increased work productivity.
- **Increased number of ZNE and PH skilled market actors.** In addition to the short-term outcome of an increase in ZNE and PH understanding and awareness, the program aims to increase the number of ZNE and PH buildings as a mid-term outcome. The number of ZNE and PH buildings will naturally lead to an increase in the number of ZNE and PH market actors. Note that the increase in skilled market actors will also lead to an increase

in the number of ZNE and PH buildings, making this a positive feedback loop. This will lead to a greater demand for local building professionals that are skilled in ZNE and PH practices and that are available to assist in the design process.

- **Increased number of ZNE and PH certified buildings.** This will come primarily from two short term outcomes: (1) increased market actor understanding and awareness of the ZNE and PH certifications and (2) reduced cost barriers. Moreover, it will be bolstered by the increase in the number of ZNE and PH skilled market actors (who rise to the demand for these buildings), including those who will conduct third-party verification inspections to confirm certified projects meet ZNE and PH requirements.
- **New practices carried over to other projects.** The techniques, tools, and equipment that the market actors learn to use when working on participating projects can be carried over to non-participating projects. More specifically, an increase in the number of ZNE and PH skilled market actors contributes to this outcome.
- **Improved building resiliency to outages.** Improved building resiliency is not a formal program outcome intended to be measured as a market effect. Yet, it is worthwhile to acknowledge that low EUI buildings, especially those built to ZNE or PH standards, will remain at a comfortable temperature and will be able to self-sustain during a power outage for much longer than a building built only to code. Additionally, the lower EUIs of program buildings decreases the burden on the grid and makes the system more resilient as a whole. The short-term outcome of increased understanding of ZNE and PH supports this outcome. Additionally, two mid-term outcomes lead to it: (1) increased number of ZNE and PH and low-EUI buildings (program and non-program) and (2) improved market actor practices carried over to non-program projects.
- **Improved market actor ability to estimate EUI.** Participants in the Deep Energy Savings and Whole Building Modeled pathways will be required or incented to submit post-occupancy EUI data. The PAs will house and likely analyze this data and provide feedback to program participants. As a result, building owners, architects, vendors, and design teams will receive feedback on whether their modeling predictions align with actual EUI. This type of feedback will help to improve modeling practices and accuracy and has the potential to influence occupant behavior in future projects. Additionally, this data will allow implementers and evaluators to more accurately estimate program energy savings.
- **Reduced EUIs in market overall.** All program activities are intended to lead to reduced EUIs in program projects. However, they also should lead to reduced EUIs in the market overall. Most of the outcomes we have discussed lead either directly or indirectly to this outcome. The primary drivers of this are reduced EUIs in participating buildings, increases in the number of ZNE and PH buildings and optimized design in the market overall, new practices carried over to non-program projects, and improved ability of market actors to estimate EUI.

E.4.2.3 Long-term Outcomes

The following long-term outcomes would most likely occur seven to ten years after program intervention:

- **Changes in building codes.** As the program promotes more efficient NRNC practices, particularly in the form of ZNE or PH certified projects, it is likely the state will acknowledge the increased use of high-efficiency design practices among market actors. In turn, this may lead to significant advancements in the energy code, which will affect all NRNC buildings in the form of statewide mandates for efficiency. Similarly, demand for and construction of high-performance buildings will encourage communities to develop their own local zoning ordinances.[90]
- **Positive NEIs experienced in market overall.** As the penetration of high-performance buildings in the market increases, the number of owners and occupants who experience related NEIs will increase. Similarly, this outcome may happen in the mid-term, too.
- **Persistent energy savings.** Most outcomes directly or indirectly result in persistent energy savings. These reduce emissions – another long-term outcome in the logic model – though emissions reductions are not a formal program outcome for market effects measurements.
- **Market transformation.** The increased number of ZNE and PH buildings, spillover of market actor practices to non-participating projects, increased demand for and construction of high-performance buildings, and *locking in* of savings through code enhancements help to transform the NRNC market towards greater efficiency.

E.4.3 Additional Elements

E.4.3.1 Resources

Program resources allow the program to carry out its activities. The primary resources of the program are as follows:

- Program budgets
- Program and sales staff efforts
- Program staff, TA vendor, and market actor expertise
- Relationships with market actors
- Past, present, and future evaluation research
- Partner organizations (e.g., U.S. Green Building Council's [USGBC] MA chapter)
- Existing tools from outside organizations (e.g., Living Building Challenge resources)

[90] For further discussion, see: https://neep.org/blog/getting-zone-using-green-zoning-achieve-our-carbon-reduction-goals

E.4.3.2 Stakeholders

As implied in previous discussion and illustration, the program will touch various stakeholders to achieve the intended program outcomes:

- Customers;
- Building operators;
- Occupants;
- Building owners and owners' project managers (OPMs);
- Energy managers;
- Designers;
- Design-build firms;
- Architects;
- Engineers;
- Construction managers;
- General contractors; and
- Developers.

As an example, education and training activities would target all stakeholders. Market actors would learn of new practices and incorporate them into their standard practices, thus carrying them over to non-program projects, which would allow for persistent energy savings in the long term – both through program and non-program projects. Further, the webinars would teach occupants, operators, and energy managers how to realize the low EUI targeted in the project design. Those recipients would carry over the new information and practices to non-program buildings – again, sustaining persistent energy savings.

There are external stakeholders who the program will touch and who will influence the program's implementation: commissioning providers, Massachusetts School Building Authority and other grantors, Massachusetts DOER, financing institutions and lenders, planning/permitting companies for zoning, and code officials.

E.4.3.3 Market Barriers

As noted earlier, there are two layers of barriers that programs face: (1) barriers to participation and (2) barriers to market actors adopting energy-efficient practices and technologies. In this section, we discuss the barriers that can impede a program's ability to achieve its intended outcomes on the broader market. Some barriers can both impede program participation and limit the program's success in achieving its intended outcomes:

- **Financing requirements and availability and upfront costs.** Including optimized design brings additional upfront project costs that some market actors may view as prohibitive. Requirements from lenders or grantors – unrelated to energy efficiency – add complexity to design and building processes. Market actors may perceive that incorporating energy efficiency – regardless of program participation – in the midst of compressed design and construction schedules dictated by loan periods deters them from including energy efficiency in building design. One charrette attendee shared more insight into the financing hurdles that developers/owners face: First, construction financing tends to be short term and at a higher cost, creating significant pressure to fast-track design and construction

and allowing less time to incorporate high-performance design. Second, the market value of high performance is not yet fully recognized, so a higher first cost may require developers/owners to carry a higher cost share than a standard building, but the standard approach is to minimize equity. Third, if costs exceed budgets, energy efficiency is likely to be deprioritized.

- **Demand.** A lack of demand or recognition of the value of energy-efficiency upgrades is a typical market barrier. This can be perpetuated by a lack of awareness among customers and market actors and some of the other factors listed here.
- **Knowledge, expertise, availability, and willingness.** Energy-efficient building may be hindered by a lack of knowledge of energy-optimized design, construction, and operations. Moreover, market actors may not have the bandwidth to undertake an energy-optimized design approach, and they may be skeptical of the significant design and construction changes required to achieve low-EUI projects. These barriers are compounded by the iterative energy modeling process that is often necessary to achieve energy-optimized design. New practices have the potential to affect subcontractor performance and timing. This issue may be exacerbated by a lack of market actors that have familiarity with advanced building design techniques. A dearth of local ZNE or PH-certified buildings also hinders awareness and fuels skepticism. Additionally, operators may not be knowledgeable about how to implement the intended operation of the building controls. Following the charrette, one attendee noted that market actors may perceive that *all* new buildings are *already* high performance.
- **Conflicting priorities.** The occupancy plan for each project could directly affect the motivations of the owner to build greater efficiency into the design and operation of a building. Building owners who intend to quickly sell a property or lease to tenants who are less concerned with operating costs may be less inclined to build more efficient buildings – one implementation staff person cited an instance where tenants prefer “floor-to-ceiling windows” instead of energy-efficient design. There are also conflicting priorities between market actors. For example, designers may wish to pursue an energy-efficient building but also have a preference for extensive glazing, which is a design decision that is in direct conflict with an energy-efficient building shell.
- **Technical feasibility.** Despite desires to include energy efficiency, it is not always technically possible. For example, one charrette attendee described how customers may wish to install geothermal heat pumps, but sometimes their lots may not be amenable for digging.
- **Economy and employment.** Confidence in the economy can be the tipping point for a developer or other market actor to undertake the risk of pursuing a more expensive or complex project that may be required to achieve a highly efficient building. For example, one implementation staff person noted that when unemployment is low, builders or other market actors may have difficulty finding adequate workforce to construct projects.

E.4.3.4 External Factors

To accurately understand the impacts the program has achieved, evaluators must place the program within a larger context affected by several external factors. To avoid attributing too much weight to a program's success or failures in achieving its outcomes, evaluators must consider external factors.[91] First, many municipalities have adopted codes or regulations that require efficiency levels beyond the base energy code. This affects both the baseline efficiency of buildings in those areas and the level of knowledge and expertise of market actors who operate there. In the case of the NRNC program, external factors, such as the following, must be considered:

- **Municipal mandates.** There are various municipal mandates that influence building design. For example, some municipalities have enacted regulations that require all newly constructed or retrofitted government buildings to meet LEED certification requirements. Also, under MA DOER provisions, cities can adopt the MA "Stretch" version of the energy code, which requires building to higher energy-efficiency performance standards than base code. This now affects over 70% of the municipalities in the state.[92]
- **Municipal and state support**. Climate Action Plans in cities, such as Boston, can limit the need for certain PA efforts. The Massachusetts School Building Authority provides information and resources to schools to exceed Massachusetts base energy code with new construction or major renovation projects. Additionally, the Green Communities Act provides grants to towns to make energy-efficiency upgrades. Separate from regulations or code compliance, municipalities have explored offering incentives such as relaxed floor-area ratio requirements or additional height allowances for building to certain efficiency standards, such as achieving ZNE.
- **Non-profit training and certification efforts.** Several organizations, such as the NBI and the International Living Futures Institute (ILFI), are working to increase the knowledge and application of efficient building and design practices around the country. For example, ILFI offers design challenges and certification opportunities. Other organizations include USGBC, American Institute of Architects (AIA), ASHRAE, etc.
- **Grassroots organizations.** Organizations, such as Mothers Out Front, promote ZNE building. However, influential organizations can also promote aesthetics over energy efficiency.
- **Changes in energy or utility costs**. Demand for optimized design practices can be impacted by increasing or decreasing energy costs or expectations that costs will change substantially over the span of ownership.
- **Economy and employment.** As mentioned, confidence in the economy can be the tipping point for market actors in their decision to develop highly efficient buildings. In addition to

[91] Some external factors are negative – dynamics or entities which *deter* energy-efficient building. These are considered market barriers.
[92] https://www.mass.gov/files/documents/2019/11/14/stretch-code-towns-adoption-by-community-map-and-list.pdf

being a barrier, this can also be an external factor that can *feed into* the program's intended outcomes.

MA PAs' Passive House program. The PAs are adding a PH element to both the high-rise and low-rise/single-family portions of the RNC Program. The PAs hope to build awareness of PH building and design practices, provide education and training to market actors, and increase demand among customers for PH buildings. Progress toward the goals of this program could influence market actors who also operate in C&I spaces.

E.5 Measuring Market Progress

In this section, the NMR Team considers the indicators of progress toward expected outcomes that would help future evaluations to measure qualitative and quantitative market effects.

Table 21 links the outcomes described in Appendix E.4.2 with possible indicators of progress toward these outcomes and likely data sources. The NMR Team presents these indicators as a starting point for discussion with the PAs. Since the indicators were not addressed during Charrette 3, we will use Charrette 4 as an opportunity to refine the indicators and identify the best sources for measuring each. Below, we provide a couple examples of how evaluators could measure the outcomes in the future:

- Increased awareness of the program could be assessed through participant and non-participant surveys. Survey questions would assess the level of program awareness among market actors. Ideally, surveys would be issued in several waves to measure changes in awareness over time.
- Secondary sources refer to resources such as the NBI's list of ZNE buildings across North America,[93] which could be used to track changes in the number of ZNE buildings in Massachusetts. Similarly, the U.S. DOE maintains a list of Zero Energy Ready Home partners by state and organization type.[94] PHIUS maintains similar lists for PH certified buildings and professionals.[95]

Depending on the indicator, progress toward the outcomes would be measured either as year-over-year changes or as differences between data of participating and non-participating projects/market actors/customers/owners.

[93] https://newbuildings.org/resource/getting-to-zero-database/
[94] https://www5.eere.energy.gov/buildings/residential/locator
[95] https://www.phius.org/phius-certification-for-buildings-products/certified-projects-database and https://www.phius.org/find-a-professional/find-a-phius-cphc-.

Table 21: Program Outcomes and Possible Sources for Measurement

Outcome	Sources				Possible Indicators
	Participant Survey[1]	Non-participant Survey[1]	Program and billing data review	Secondary database or doc. review	
Short-term					
Increased program awareness and participation	M,C	M,C	✓	✓	Rates of program awareness and program penetration
Increased understanding and awareness of EUIs	M,C	M,C			Participant understanding and awareness of EUI
Reduced EUIs in participating buildings			✓		EUI of participating buildings, as shown via billing data
Improvements and changes in market actors' practices	M				Self-reported practices of participating market actors
Improved participant satisfaction	M,C				Participant satisfaction with the program experience and buildings
Increased understanding and awareness of ZNE/PH	M,C	M,C			Participant and non-participant understanding and awareness of ZNE/PH
Reduced cost barriers	M,C				Participant reports of upfront costs
Increased demand for and construction of high-performance program buildings	M,C		✓		Participants desire for and ability to develop high-performance buildings
Mid-term					
Increased demand for and construction of high-performance buildings in market overall	M,C	M,C		✓	Participants and non-participants reports of number of high-performance non-participating buildings; number of ZNE/PH certified buildings in MA
NEIs experienced in participating buildings	C	C			Comparison of reported NEIs among participants and non-participants (e.g., fewer sick days)
Increased number of ZNE/PH skilled market actors	M	M		✓	Market actor levels of skill for ZNE/PH practices; certified professionals or partners in MA
Increased number of ZNE/PH buildings	M,C			✓	Count of certified ZNE/PH buildings in MA
New practices carried over to other projects	M				Participant reports of applying knowledge, skills for high-performance building learned through the program; reports of changes in standard practices
Improved market actor ability to estimate EUI			✓		Comparison of program models and billing data
Reduced EUI in market overall			✓		EUI changes in participating and non-participating projects
Long-term					
Changes in building codes		O		✓	Local building codes and market actor perceptions of program influence
NEIs experienced in high-performance buildings in market overall	C	C			Comparison of reported NEIs between high-performance and standard buildings
Persistent energy savings			✓		Changes in EUI in new commercial buildings
Market transformation	M,C	M,C			A combination of the previous indicators

[1] M = market actors (builders, designers, architects, etc.); C = customers (occupants, owners); O = Others, such as code officials and regulatory representatives.
Note: Table excludes peripheral outcomes in logic model (resiliency to outages and emission reductions).

Appendix F Focus Group Summary Memo

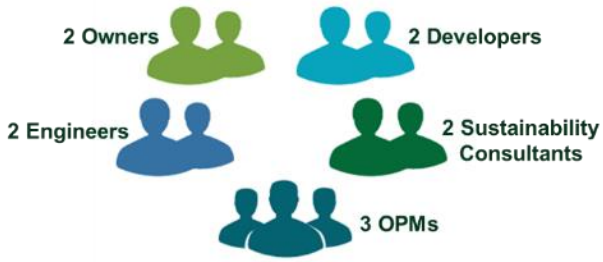
Memo issued January 8, 2020

On December 11 and 16, 2019, NMR, in collaboration with the Massachusetts PAs, led focus groups with active participants of the Massachusetts NRNC program to obtain feedback on the revised program design.

Before the groups convened, we emailed participants the two-page description of the proposed program design in Appendix F.2. This memo assumes that readers are familiar with the ongoing developments of the program redesign and this study (MA19CX01-B-NCPLANME), which has included four previous memos reporting the results of three charrettes, a best practices review, and IDIs with Massachusetts market actors and industry experts.

At the start of the focus groups, implementation staff described the proposed offerings in greater detail and then remained in the room during the focus groups to answer questions. In total, the two focus groups – which lasted two hours each – had 11 attendees. With fairly even mixes of participant types, the first group had five attendees and the second group had six attendees; they included building *owners* (e.g., facilities director), developers, engineers, sustainability consultants, and owner project managers (OPMs).

Focus Group Attendees



F.1 Key Takeaways

We asked attendees for their reactions to the proposed paths, the use of EUI as a metric, incentive structures, barriers, and program activities/support. The instrument is in Appendix F.2.

> ***"Don't let perfection be the enemy. We need these [new paths]."***
> **-Participating Engineer**

Participants generally approved of the four proposed program paths. While most attendees were enthusiastic about the addition of the Deep Energy Savings path (Path 1), the two developers asserted they were very unlikely to pursue Path 1, pointing to issues of split incentives between builders and occupants and lack of demand for energy efficiency among building owners and tenants. This highlights the need for the program to **include designer-specific incentives** (included in the proposed

redesign), **focus on education efforts**, and **provide multiple paths to meet varying customer needs/goals.**

Participants agreed that **EUI is the right metric** for the program to leverage. They warned against setting a single, fixed EUI target for all projects in Path 1, describing the variations of end uses and occupancy density. They suggested the PAs **use flexible EUI targets that allow for ranges and that are tailored to building type** in Path 1.

Attendees liked the plan to structure incentives in terms of dollars per square foot for Path 1 and the Whole Building Modeled path (Path 2); however, they wondered how square footage should be defined. They did not hold strong perspectives on what that dollar value would need to be to drive a project towards ZNE or PH certification.

Path 1's intent is to support buildings to achieve low EUIs that will then *enable* a building to achieve ZNE/PH certification, but participants were particularly focused on the program's expectations and support for renewable energy infrastructure. Their questions indicated that efforts to promote Path 1 need to **clearly communicate its focus on supporting ZNE *readiness*** and how it will or will not consider and support renewable energy in the EUI and incentive calculations.

Participants were enthusiastic about the potential P4P component of Path 1 and saw its value. They offered numerous suggestions for how the PAs could mitigate the perception that P4P would be risky, such as (1) **make the post-construction incentive a large portion of the total incentive** and at least equivalent to that of Path 2, (2) with that, **frame the post-occupancy incentive as a bonus**, (3) **provide hands-on up-front and ongoing support to building operators** to achieve the goals through commissioning and education, (4) **share and develop a clear M&V plan** for post-occupancy calculations, (5) **offer sub-metering incentives**, and (6) clearly **communicate implications of failing to meet targets**.

Participants often expressed a strong need for more information on incremental construction costs and incentive amounts upfront in order to prove the value of program participation and the feasibility of high-efficiency building practices to their clients/stakeholders. On that note, nearly all participants at some point noted the importance of PA marketing and outreach, training and education, or technical support to the success of the program. In particular, they recommended (1) **informing the market of the program**, (2) **educating the market on the mechanics and benefits of low EUI buildings**, (3) **handholding participants throughout the participation process** with program staff in a type of "project champion" role, (4) **analyzing post-occupancy data and sharing results and implications** with all project actors, (5) **developing case studies/marketing collateral** and **formally recognizing participants' success**, (6) **sharing data on construction costs**, and (7) **providing on-going support to building operators**. Attendees also suggested that the program align its modeling approach and requirements with that of other entities (code, LEED, etc.) to minimize the burden on participants.

The PAs have been aware from the start of program redesign that early intervention is a priority and focus group participants underscored this point. Their feedback confirms that the PAs need to **devote resources to staying in the forefront of market actors' purviews** so that engaging with the program becomes a cornerstone of project conception. From our viewpoint, this means **maintaining and even strengthening its industry presence through outreach, event**

attendance, and relationship building activities. Moreover, the program will need to **prove its ability to quickly engage with project teams** during compressed, early planning phases.

F.1.1 Program Structure

This section describes participants' reactions to the program paths and incentive structure.

F.1.1.1 EUI as a Metric

According to participants, EUI is the right metric. In fact, when asked if setting incentives based on percentage reduction in EUI is the right way to move towards deeper energy savings, one OPM enthusiastically responded, "Absolutely, it is the right metric. It is simple and everyone understands it." Though, an OPM in another group said the majority of occupants do not understand EUI.

> ***"I love the idea of using the metric of EUI. That is something you should never let go of."***
> **-Participating**

While conceptually, all attendees approved of EUI as a measurement tool, they did not appear to currently set EUI targets for their new construction projects. Several voiced the concern that EUI can be "unfair" in part because it does not account for occupancy/usage density – specifically in university settings. An attendee representing a university admitted "we know modeled isn't real and we rarely hit it. I can't really create an occupancy schedule [for a university building]." However, none suggested a preferred alternative.

Implementation staff posed the idea of selecting a single EUI target of 25 for *all* building types in Path 1. Attendees reactions were consistent; **they warned against using a fixed EUI target:**

- Several pointed out that some building types simply will not be able to meet that goal given the end uses (e.g., commercial kitchens).
- Similarly, one engineer asserted that the program would exclude laboratories because, even if those buildings are doing "all the right things" towards conservation, they would never be able to meet an EUI of 25.
- A facilities director added that the only way to get to an EUI of 25 would be to implement geothermal technology which would be cost-prohibitive.
- A developer concluded, "I'm fine with the metric but not a fan of the cliff."

They suggested using flexible EUI targets, ranges of targets, and sector-specific targets instead.

F.1.1.2 Pay-for-Performance

Path 1 would include a P4P component where one portion of the incentive would be distributed post-construction and the other would be distributed post-occupancy based on real EUI. Some participants focused on the risk in P4P. Many offered strategies to help overcome hesitation on the part of participants:

- The **post-construction incentive should be a sizeable portion** of the total incentive.

- Realize that the **first year of occupancy can be tumultuous** as building operations hit their stride, so including a second year of data may be a more accurate measure of usage.
- **Provide training, education, ongoing feedback, and hands-on site visits to help building operators** implement new, more sophisticated practices because occupant behavior is critical under this model. An engineer suggested the program even conduct quarterly observations after the first year because commissioning often occurs over the course of the first year.

> ***"I think we're relatively advanced in how we run our buildings and engage with occupants, but it still takes time to commission a new building and learn how to 'drive that new car.' So [the quirks in the] first few months should be factored in."***
> **-Facilities Director (Owner)**

- **Ensure proper submetering is in place** to diagnose problems and calibrate post-occupancy energy models, implying the need for a clear M&V plan.
- **Clearly identify how incentive levels would change** for not hitting an exact target.

One person suggested making the Path 1 post-construction incentive roughly equal to that of Path 2 total incentive to couch the post-occupancy incentive as a bonus. In the words of one engineer, this would **prevent the perception that pursuing Path 1 is a penalty** (in the form of waiting) because some clients may not want or be able to wait for a post-occupancy incentive. A developer worried about the timing of occupancy, saying "I wouldn't want the [incentive] to be held hostage until the space is rented."

Additionally, an attendee suggested that the program conduct post-mortem assessments on Path 2 projects and issue incentives equivalent to Path 1 if an equivalent EUI is achieved.

F.1.1.3 Inclusion of Renewables

> ***"If you're hearing nervousness from [a university] on Path 1, you should take that very seriously. [These] institutions have the most financial and educational resources to push the envelope."***
> **-Participating Developer**

Attendees' reactions indicated that Path 1 marketing needs to clearly communicate that it is focused on ZNE *readiness*, with a focus on low EUI and a *bonus* for certification. They immediately expressed concern about the inclusion of renewable energy, the time required for interconnection agreement processing, how PV would be handled, and if renewable energy infrastructure would need to be on or offsite. One engineer stressed that the program needs to clearly communicate what they consider ZNE. A university representative described how space constraints consistently preclude renewable infrastructure onsite. A developer responded that if that university cannot execute this, then it is doubtful others could. Two others concurred they have experienced similar hurdles with pursuing ZNE.

F.1.1.4 Incentive Offerings

Aside from the feedback above, several other findings related to incentive offerings emerged:

- **Attendees supported the proposal to structure incentives in terms of dollars per square foot.** Knowing the total incentive amount ahead of participation would be useful for garnering participation in all paths. One attendee said it would need to be $25 per square foot to achieve ZNE because the projects would need to invest in geothermal; others did not propose a value. The first group questioned how square footage would be defined, so in the second group we asked for guidance – one attendee softly suggested using gross square footage,[96] but others did not express opinions.
- Since the start of the redesign of the program, implementation staff have appreciated the value of current, less comprehensive paths for entities with fewer resources. Echoing their concern, **participants underscored the value that the current Systems path provides**. Therefore, they were happy to see the inclusion of Paths 3 and 4 in the proposed program redesign.
- While most attendees were enthusiastic about participating in Path 1, both developers admitted they would likely never pursue it, explaining that they do not benefit from decreased energy bills and their occupants do not care about it. On that topic, **several attendees emphasized the importance of design team incentives to ensure the construction community is motivated.** One OPM described knowing "who gets the check" ahead of time would be important; he warned later that clients can perceive the design team incentive as a discount for them.
- A few attendees discussed the **attractiveness of sub-metering incentives**, referencing that Massachusetts DOER has provided incentives for it.
- Two attendees requested that the program provide **demand-based incentives**. One engineer advised that demand-based incentives may be a dimension to add to the program design in later years to limit complexity.

[96] Gross square footage encompasses the total enclosed space measured to the outside of a buildings' exterior walls (including unusable spaces).

F.1.2 Barriers

Discussion addressed why projects enter the program late, challenges with participation, and barriers to high-efficiency building overall.

F.1.2.1 Barriers to Program Participation

> ***"I like the [proposed] paths and that you have set the timeframes of when they should be in [the program]. Being in before you're done with SD – it is huge from our world."***
> **-Participating OPM**

Attendees echoed implementation staff's understanding that timing is critical to influencing a project and eliciting participation. One owner representative asserted that the program must be involved and EUI targets set before a project reaches 100% design development (DD). One OPM said that getting involved during schematic design (SD) can even be too late, declaring that programs should be involved during the feasibility phase.[97] We asked all participants to explain what prevents a project from engaging the program early:

- Teams for large projects often want to **avoid pulling in a third party**, such as Mass Save, so they can "control the discourse" during planning. One attendee criticized the timing of program charrettes, saying measures advised during the charrettes may have already been considered, analyzed, and removed from consideration.
- Projects must move quickly, and teams **do not have time to engage in modeling** required to participate.
- Moreover, one person mentioned, and others concurred, the **array of models required by LEED, municipalities, and code differ**, so participating in Mass Save requires yet another step. They requested the program make efforts to align these methods.
- Customers are **set in the mindset of a prescriptive path**. One attendee explained that market actors have "in the back of their head" that the Mass Save rebates exist and intentionally engage with the program as an afterthought (not an integral consideration in design direction). Use of the *term* rebate is also indicative of a somewhat static view of the program offerings.

Attendees also described participation hurdles with the current program implementation which primarily included murkiness in processes and gaps in communication. One sustainability consultant summarized, "We run around not knowing what to do sometimes; there would be more participation if it was easier and clearer." Two others mentioned checks being delayed due to lack of communication around missing information or sent to the wrong person, and another pointed to gaps in communication across gas and electric utilities. One group concurred that a program-participation checklist would be helpful. (We discuss program support in greater detail below.)

[97] To participate in Path 1, projects must enter the program before 50% SD, and for Path 2 they must enter before 100% DD (which follows SD).

They also expressed frustration with hurdles that are not directly within the program's purview. They wished the PAs could help with issues, such as bottlenecks in PV interconnection agreements and service requests; disconnects between service departments and energy-efficiency programs; account manager awareness; and electric vehicle rates.

F.1.2.2 Barriers to High-Efficiency Building

More broadly, participants described how **financing, costs, and lack of education prevent teams from pursuing high-performance designs** (implicitly program participation barriers themselves):

- Attendees' clientele/stakeholders typically **want to know incremental construction costs** (and incentive amounts) upfront but there is a dearth of clear data to leverage. A sustainability consultant provided an example of clients asking her how much it will cost them to go from LEED silver to LEED gold. An engineer asserted that there is not extensive information on construction costs, especially for the high-efficiency HVAC systems needed to reach an EUI of 25.
- One large developer pointed to split incentives, explaining that tenants usually pay the energy bills, so the developer has no incentive to invest in energy efficiency – clarifying that **there is not a rent premium for highly efficient buildings because "no one seems to care."** The developer in the second focus group echoed this sentiment.
- In the second focus group, a few participants pointed to **long payback periods** ranging from 15 to 25 years acting as a deterrent to investing in the measures that would be needed to participate in Path 1.
- Many attendees identified **a need to raise awareness of and education** on energy-optimized building and design practices. For example, one OPM described how customers conflate terminologies (e.g., ZNE, LEED, and EUI).

> ***"A payback period of 25 years is a hard sell."***
> **-Participating OPM**

F.1.3 Program Activities

Attendees' suggestions for program activities, such as outreach and technical support, overlap with some of the feedback described above:

- **Provide estimates of incremental construction costs and incentive amounts upfront**. Nearly all attendees described a need for more information on the costs of implementing high efficiency buildings and what they could earn from the program. Attendees asked for such information to include estimations of who will receive incentives under various scenarios of meeting program requirements and when then incentives will be received.
- **Promote the program more comprehensively**. Lay out how and when to participate and its value – several attendees acknowledged they needed more support in navigating the application process.

- **Provide participants with marketing collateral, such as case studies**, to prove to their stakeholders why an optimized project design is achievable and worthwhile. Nearly all attendees mentioned lack of education as a problem. Two attendees emphasized that the lobbying involved in their work with municipalities rests on having evidence of success. A developer explained that it is important to convince owner-investors that these practices work so they will "bake it in early." The other developer suggested that the program provide some type of recognition for high-performance buildings, such as a framed certificate.
- As mentioned earlier, **provide checklists of participation requirements**. Also, outline program processes and expectations clearly upfront, particularly before the charrette.
- **Conduct systematic outreach and support.** Attendees described their hope for a kind of project champion who will help usher projects through investors, regulators, and other entities. One attendee surprised the group when he shared a desire for the PAs to send more emails and phone calls reminding him of changes to the program. Note, the proposed program design intends to involve greater technical support.
- As discussed earlier, **ensure proper submetering is in place** to diagnose problems and calibrate post-occupancy energy models. On that note, develop and communicate a clear M&V plan.
- **Provide upfront and ongoing support to building operators** after construction to ensure that actual low EUIs are achieved. Several attendees urged the PAs to make use of all the data collected to incentivize owners to operate correctly.
- **Share the results of the data the program collects with project teams** in the longer term. One developer speculated that reflecting back on actual usage data "could encourage our guys to take risks [since] they will see the outcomes." One owner attendee said they want feedback after occupancy so they can tweak their energy models.

F.2 FOCUS GROUP HANDOUT

Mass Save Commercial New Construction Program Redesign – Focus Group

Goal: Learn from attendees if the Mass Save program administrators are going in the right direction with the program redesign. Do the proposed offerings make sense for your projects? Are they missing anything? They propose four paths:

	Path 1	Path 2	Path 3	Path 4
Proposed Paths	Deep Energy Savings	Whole-Bldg. Modeled	Simplified Whole Bldg.	Systems
Current Paths	(none)	Integrated Design - Large Bldg.	Integrated Design - Small Bldg.	Systems (same)

Path 1. Deep Energy Savings (Zero Net Energy/Passive House) is a new path designed to specifically help customers achieve ZNE and Passive House goals by providing expert technical assistance, enhanced incentives, and certification support. Incentives will be set on a flat $/sf basis for this path (dollar amount per sf TBD). We anticipate total incentives to be more generous for this path than the top tier of incentives offered under Path 2. This path is characterized by enhanced technical assistance intended to help customers design toward, evaluate and realize ZNE and EUI targets post occupancy. Incentives will be paid in at least 2 parts - some percentage of the incentives will be paid at the end of construction and the remaining portion would be paid when one year of post commissioning, post occupancy utility data demonstrate the project achieves its ZNE/EUI target. PA provided post occupancy technical analysis is anticipated.

Path 2. Whole-Building Modeled (EUI Metric) is similar to the current Integrated Design offering, but is centered on setting EUI targets with customers and offering incentives based on site EUI percent reductions. Technical assistance will include early EUI target setting and benchmarking support, early charrette assistance, ECM recommendations, energy modeling and mid design feedback. This path is for larger and fairly complex buildings with multiple energy conservation measures and where customers enroll with PAs early in the design process. Incentives will be offered on a dollar/sf basis in accordance with a set of TBD incentive tiers. As with the current program, incentive payments will be made at the end of construction with some potential hold back for trend data in certain circumstances.

Path 3. Simplified Whole Building path provides a more cost- and time- effective way to provide technical feedback and calculate energy savings for smaller buildings with less complex energy conservation measures. PAs and vendors will provide incentive and savings feedback using a spreadsheet tool rather than an energy model. Technical assistance will include charrette assistance, ECM recommendations, analysis of incentive/savings potential using spreadsheet tool, and mid design feedback. Incentives will be offered on an ECM by ECM basis as calculated in the spreadsheet tool.

Path 4. Systems (Prescriptive/Custom) is a participation pathway for customers who engage PAs late in the design process (after the end of design development), or for customers who have very small projects and are not also interested in pursuing deep energy savings under Path 1. This path is the same as is currently offered.

The table below compares the current and proposed offerings at a high-level for paths that have changed. **The program administrators will provide more details during the focus group.**

	Snapshot of Comprehensive Paths				
	Current Paths		**Proposed Paths**		
	Integrated Design (Small)	**Integrated Design (Large)**	**Deep Energy Savings**	**Whole-Building Modeled**	**Simplified Whole Building**
					
Building size	**20,000-100,000 ft²**	**>100,000 ft²**	**>5,000 ft²**	**>50,000 ft²**	**20,000-100,000 ft²**
Early engagement required	✓	✓	✓	✓	✓
Technical assistance	✓	✓	✓ **Enhanced**	✓ **Enhanced**	✓
Energy modeling	✓	✓	✓	✓	**(Spreadsheet only)**
Post-occupancy usage data required			✓	**Optional**	
Tiered incentives	✓	✓		✓	**(Calculated by ECM)**
Certification bonuses*			✓		
Charrette incentives		✓			
Design team incentive	✓	✓	✓	✓	

***Certifications are for achieving Zero-Net Energy-readiness or Passive House specifications.**

F.3 FOCUS GROUP GUIDE

MA C&I NC Focus Group Guide

December 2019

Background [for reviewers only]

There will be two groups of six to eight attendees who are active participants in the MA C&I NC program, and include mixtures of developers, architects, designers, engineers, sustainability consultants, OPMs, and owners:

- *Group 1: 12/11/19, 11am to 1pm*
- *Group 2: 12/16/19, 2pm to 4pm*

We do not plan to hold a break given that it is only a two-hour time block. Attendees will be invited to arrive 30 minutes before the start time for a late breakfast or late lunch. The focus groups, facilitated by NMR, will be informal and held in a conference room at Eversource's office with PAs in attendance.

NMR will provide a two-page handout (prepared in collaboration with implementation) to attendees in advance of the focus group. It will summarize the proposed program structure. We will also print name cards for attendees, listing their first name and profession.

The text in this guide is meant to be read by the facilitator who will loosely use this as a script and probe as needed.

Introductions [10 Minutes]

Today, we will discuss the proposed redesign of the Mass Save Commercial New Construction program. We have a few representatives from the Mass Save PAs – who I will refer to as "the PAs" – here with us today to provide details and answer your questions. My team and I are an independent third-party contractor and we will facilitate the discussion. Your perspectives are critical to ensuring the program best serves you and the Massachusetts ratepayers.

--

We are recording the conversation to make sure we capture everything, but we will not share the recording with anyone and will not in any way link your responses back to you personally in our reporting process.

Before we begin, let's establish the ground rules. Please listen to one another and feel free to build on what someone else says, but do not talk over each other or have side discussions. We want to hear from everyone and have a lot to cover, so I may need to interrupt you at some points. However, if there are topics you raise that we don't have time to delve into, the PAs may wish to contact you after the group for more details. Please let me or one of my colleagues know, either now or just after the group, if you would prefer not to be contacted.

We feel it would be most productive if everyone put away their cell phones and laptops except for our notetakers, Katie and Nicole. Finally, we need to know your honest opinion. There are no right or wrong answers. Don't be afraid to disagree with someone else.

We will wrap up at [time].

--

Let's begin by introducing ourselves. Please tell us your name, company, the number of projects you have been involved with in the Mass Save New Construction program, and your role in those projects in just a few words.

Overall Program Structure [20 Minutes]

Now, Kim, Denise, and Tracey have a short presentation. They will present the current proposed program design that is described in the handout you received and the motivations behind the changes. It is fine to ask high-level clarifying questions as they speak, but let's wait for them to finish before we get into all the details.

[Implementation Team Presentation (10 minutes): Introduction of new paths, what they include, eligibility requirements, and motivations for revisions/additions]

1. Are there any (other) clarifying questions?
2. What are your high-level reactions to this proposed framework? Do you think it will enable participation across all different types of new construction projects the PAs might see?
    - Would this design fit with the types of projects you are involved with? [Limit probes; will circle back at the end]
3. What prevents a project from engaging with the program in the early phases? **[WHITEBOARD BRAINSTORM]**

ZNE and Passive House [15 Minutes]

1. For those who have worked on ZNE-*ready* buildings or PH projects, would the program we described help support you in moving a project to a ZNE or PH design?
2. Of the types of technical assistance the PAs could offer, what is most important in driving projects to ZNE outcomes? Are they missing anything critical?

EUI as a Metric [10 Minutes]

As the PAs explained, the new program design is hoping to rely on EUI as a key metric.

1. Do you and your project teams set EUI targets?

    [IF YES]

    - How do you go about setting EUI targets?
    - What are the motivations for doing so?
2. Would having the PAs assist in setting EUI targets contribute to a project achieving low-energy usage?

3. Is setting incentives based on the percent reduction in EUI the right way to move toward deeper energy savings?

Incentives and Savings [10 Minutes]

Let's talk more about incentives.

1. **HIGH PRIORITY:** What do you think of the approach of structuring incentives in terms of dollars per square foot for Paths 1 and 2?
    - How should square footage be defined for program purposes?
2. **HIGH PRIORITY:** In reference to Path 1, what do you think of breaking the incentives paid to the customer into two payments: one at the end of construction and one a year or more out after the building has been monitored and running for at least a year?

Technical Assistance [25 Minutes]

The new program design heavily supports technical assistance, particularly in Path 1.

1. **HIGH PRIORITY:** What type of technical assistance would the teams involved in your projects need to move forward with ZNE-ready buildings or PHs?
2. **HIGH PRIORITY:** What about projects in Path 2, will the proposed level of technical assistance adequately support the projects you are generally involved with? [Probe: What is needed?]
3. Which of these types of technical assistance would be the highest priority for your team? The lowest?

Closing [30 Minutes]

Let's step back now.

1. What would make it easier for you to participate in Paths 1 and 2?
2. **HIGH PRIORITY:** Are there key components missing from any of the four paths? **[WHITEBOARD BRAINSTORM, IF NEEDED]**
3. **[IF NEEDED]** Would you participate and advise the PAs' clients to participate in any of the four paths? Why or why not?
4. Before we wrap up, do you have any other thoughts you wish to share on how the program can best serve you and your projects?

On behalf of the Mass Save PAs, we would like to thank you for your time today. Kim, Denise, and Tracey are on hand to answer any follow-up questions. Please see Katie and Nicole to receive your participant compensation checks.

Appendix G Charrette 4 Follow-up Memo

Memo issued February 19, 2020 (Revised)

On January 15, 2020, NMR and its subcontractor, EMI Consulting, held a fourth charrette that brought stakeholders together to discuss the redesign of the Massachusetts (MA) Commercial and Industrial (C&I) New Construction (NC) program. **For more context on this study (MA19CX01-B-NCPLANME) and outcomes of previous research activities, readers can reference these memos:**

- The upfront research memo, issued March 7, 2019
- Charrette 1 follow-up memo, issued April 1, 2019
- Charrette 2 follow-up memo, issued July 10, 2019
- PTLM memo, issued September 9, 2019
- Charrette 3 follow-up and revised PTLM memo, re-issued January 7, 2020
- Focus group summary, issued January 8, 2020

The purpose of Charrette 4 was to inform stakeholders on the latest program design, obtain feedback on the revised PTLM from a larger group, and discuss market effects indicators and measurement. This memo summarizes those results and includes the notes. **The charrette resulted in the following key action items**:

- Ben Crosby (National Grid) will take the lead in moving forward efforts to set an EUI baseline. He has since taken the first steps in this direction.
- NMR will issue an overarching report for MA19CX01-B-NCPLANME with an updated PTLM, refined market effects indicators, and considerations for measuring market effects. NMR plans to issue this in the next several weeks.
- Alex Bothner (Eversource) will look into incorporating incremental cost questions into a market effects study.

G.1 PRESENTATIONS

The charrette began with three presentations, which included a large group – many of whom tuned in via webinar. First, Alex Bothner (Eversource), the study lead, introduced the agenda and described how this study has included a series of charrettes – each with different goals. The presentations were primarily intended to inform stakeholders on the latest program design and underlying rationale and to offer attendees a small amount of time for high-level feedback and ask questions.

G.1.1 Program Redesign

Kim Cullinane (Eversource) presented the motivations behind the new program design and described its structure. She noted that the redesign process has incorporated feedback and

information through various research efforts, including IDIs, focus groups, and other engagement with industry experts. These research activities and their outcomes have been described in the previous memos and will be included in the overall report for this study.

Charrette attendees generally agreed with the draft program design. The redesigned program would include four paths, which overlap with the current program offerings:

- The Deep Energy Savings (Path 1) and Whole Building Modeled (Path 2) paths involve expert TA and provide tiered incentives based on energy modeling, with a focus on achieving lower EUIs. The Deep Energy Savings path will include technical assistance directly focused on achieving the low EUI required to position the project to be able to attain ZNE or PH certification. The PAs will issue incentives for this path in a P4P format: one portion will be paid at the end of construction and the remaining portion after one year of post-commissioning, post-occupancy utility data demonstrate the project achieves its target. They will also provide bonus incentives for attaining ZNE and PH certification. In Path 2, they will provide a bonus for the provision of post-occupancy data but will not require it as part of the incentive structure.
- The Simplified Whole Building (Path 3) path will provide less intensive TA. It will utilize a spreadsheet (i.e., workbook) approach that incentivizes savings and incentive amounts tied to prescriptive and custom measures (not based on energy modeling). In the longer term, the program will explore creating packages for common building types. Outside of the new calculation mechanism (spreadsheet vs. energy model), this path is similar to current PA offerings.
- The Systems (Path 4) path will primarily be a prescriptive program available for smaller buildings (<20,000 sq. ft.); however, this path will allow larger buildings to participate if they enter the program after construction documents are complete. This pathway is consistent with current program offerings.

These paths are described in Appendix G.4 in more detail. Attendees asked for clarification on topics such as design incentives, methods for estimating savings, implementation costs, and expected program volume.

G.1.2 Focus Group Results

Nicole Rosenberg (NMR) presented the results from focus groups held in December with active program participants, including building owners, architects, engineers, developers, and owner's project managers (OPMs). The full results can be found in the focus group summary memo issued January 8, 2020. The key takeaways were as follows:

- **Participants are enthusiastic and agree with the proposed program paths.**
- They see value in keeping the less comprehensive paths.
- They also liked EUI as a metric yet described concerns about baselines and the desire for EUI targets to be flexible and tailored.
- They liked the structure of the incentive as dollars per sq. ft. for Paths 1 and 2. They asked how square footage would be defined.

- They were highly concerned with how to support renewable energy infrastructure to participate in Path 1, so the program needs to emphasize that it is supporting low EUI and ZNE-readiness, rather than moving buildings all the way to ZNE certification
- Attendees worried about the risks involved in P4P and gave ideas to address it, such as making the first portion of incentives a large portion of the total incentive.
- Participants' needs are extensive in terms of marketing, outreach, and support.
- Early PA intervention during project development is critical.

G.1.3 Program Activities

The charrette included lightning rounds where small groups reviewed PTLM relationships between activities and their outcomes and identified what elements (e.g., offerings, efforts) would be needed to achieve those outcomes. The group offered creative and instrumental approaches to draw on as the PAs continue to refine the redesigned program. The following key takeaways are based on the items that charrette attendees listed on flipcharts and the group discussion that followed:

- **Marketing & Outreach.** Echoing feedback from focus group attendees, charrette attendees emphasized the value of case studies, in particular those that incorporate customer testimonials, with an end goal of driving buyer/tenant/customer demand. They also suggested tailoring outreach by roles and building type as well as building/leveraging relationships with all stakeholders, including manufacturers, lenders/financers/appraisers, certification groups, and municipalities.
- **Education & Training.** Attendees highlighted that training PAs and the program's TA vendors is the next critical step. After that the PAs should develop robust training materials and find trainers and existing trainings for participants. Again, education and training should be tailored by role and building type.
- **Incentives.** Based on attendee responses, the PAs should offer adequately sized rebates appropriate for the project size, issue incentives quickly, provide a streamlined application process, provide transparency around implications for missing EUI targets in Path 1, encourage participants to incorporate incentive amounts into financial proformas to appeal to lenders and investors, and provide designer incentives.
- **Technical Assistance.** Again, attendees emphasized the need to educate the TA vendors. They suggested expanding that pool to capture more skillsets. They also suggested that technical assistance should focus on increasing knowledge of modeling tools; setting EUI targets; consider the relationships of modeling, M&V, and operations; and supporting post-occupancy diagnostics and data sharing. Though, they pointed out that the PAs should consider the cost implications of expanding TA.
- **Post-Construction/Occupancy Data Collection.** Attendees suggested that helping with corrective actions, collecting sub-metered data, and accounting for renewable energy generation and usage through sub-metering were all necessary. They also highlighted the need for the feedback loop, as well as the need for identifying what is going wrong after occupancy and facilitating corrective actions. Charrette attendees suggested that the

program can enlist TA vendors to help with this. Attendees noted that ramp up time needs to be adequate to collect these data. They also said the program needs to account for proper QA/QC and conduct more comprehensive commissioning.

G.2 PTLMs and Market Effects

G.2.1 Introduction

Market effects are defined as *sustained increases in the adoption / penetration of technologies / practices resulting from market changes induced by market intervention.* To measure them, PAs and evaluators identify a target market, characterize said market and identify the baseline, develop a program theory and indicators of market effects, decide on a method for measuring net savings, and collect and analyze data required to quantify savings. s PTLMs – consisting of activities, outputs, and outcomes – are used to identify how and why the program is expected to change the market. We offered a deeper explanation of PTLMs and market effects in the memos issued on September 9, 2019, and January 7, 2020.

NMR presented the most recent draft PTLM, which was included in the memo issued January 7, 2020. Since it was first presented at Charrette 3 (shown in the memo submitted on September 9, 2019), NMR revised the PTLM based on charrette attendees' feedback before, during, and after Charrette 3. Revisions included language adjustments, outcome additions, timing of outcomes placement, cause and effect connection realignment, and revised path associations. **PTLMs should generally be considered living documents with flexibility in outcomes, indicators of progress, and sources of measurement.**

G.2.2 Leveraging Market Effects

The Massachusetts EEAC consultant attendees said that the **PAs should not expect market effects from Paths 3 and 4** because they are essentially *business-as-usual* approaches. One acknowledged that the overall program redesign appears to be "a serious effort to create market transformation." However, the group discussed the possibility that Paths 1 and 2 may still create spillover in Paths 3 and 4 because it can influence market actors such as architects and engineers.

NMR shared an example that illustrated how **market effects can be significant savings contributors**: The MA low-rise (LR) RNC program benefited from market effects, which it incorporated into its Net-to-Gross Ratio (NTGR) in the form of Non-Participant Spillover (NPSO), which was 55%. This longstanding, high-volume program was a major contributor to developing a robust HERS rater market, which has enabled communities to comply with stretch codes. Attendees described how the NPSO has been critical to the survival of the LR RNC program because of high free-ridership threats.

Market effects likely will not be able to be claimed for another five years. This is primarily because market effects rely on a baseline measurement, adequate program participation, and time for impacts to materialize. This is especially true in a non-residential NC market, where the time associated with project development to completion is highly variable. Additionally, in MA,

NTGRs are locked in for three years. This could mean that savings from market effects may not be able to be claimed until 2025 at the earliest.

G.2.3 Program Outcomes, Indicators, and Measurements

Market effects baselines should be established immediately, and NMR should provide clear recommendations for future studies. Indicators should be measured as soon as possible – ideally by the end of 2020, before market effects happen – to establish a baseline for measurement over time.[98] NMR will recommend (1) follow-up studies to conduct and (2) timing to conduct them. One attendee asked that the report parse out study recommendations by plan cycles (2022-2024 and 2025-2027). The same attendee asked that the report assume that the policy framework would not change – measuring success of market effects requires that enough projects participate, so timing of future studies will need to have caveats to account for this.

At two intervals in the charrette, attendees discussed the draft indicators and sources for measuring market effects included in the memo that was delivered on January 7, 2020.[99] Their questions and responses implied that the report should include the following clarifications:

- **Explain connection between program and market progress.** Short-term outcomes, such as participation rates, can determine if the program is making *any* impact, which is essential for generating market effects down the road. As one attendee put it, they are "like a finger to the wind."
- **Acknowledge attribution.** Attribution of market effects and within-program impacts (i.e., participant spillover [PSO]) are important considerations.
- **Account for differences across territories.** Sampling and assessments of market effects should account for regional differences, such as penetration rates and base knowledge.
- **Clearly define terminology.** Some terms need to be more clearly defined for various indicators – in particular, *market actors*, *high-performance*, and *changes in market actor practices*.
- **Parse out indicators.** Some phrasing in the draft indicators table insinuates that the PAs would study indicators in a double-barreled fashion. These need to be explicitly separated so that it is clear that they should be studied separately (i.e., there is more than one indicator for a given outcome).
- **Explain indirect market effects.** Some suggested that ZNE/PH *certification* should not be an indicator because low-EUI buildings are the actual intended goal. That said, certifications are still measurable indicators that the program may, *in part*, support.
- **Long-term measurement is not limited.** Timing of market effects is not directly associated with the timing in which the market effect is expected to occur, so a mid-term outcome could still be valuable to measure in the long-term.

[98] Many indicators could be measured in a single study and, depending on timing, could be included in an upcoming baseline study.
[99] This summary assumes readers have reviewed the draft indicators and sources.

- **Specify units of measurement.** For example, non-participants (NPs) can be both buildings *and* people. Additionally, persistent energy savings will be assessed in terms of changes in the market, cumulatively – not in the tracking of a single building over time.

They offered more specific feedback on the indicators table, which NMR will consider:

- **Incorporate NPs more.** NP surveys should be included in the measurement of most short-term outcomes. Moreover, indicators need to more explicitly reference NPs because signals for market effects will often be differences between participants and NPs.
- **Change focus of EUI indicators (and associated outcome).** The short-term outcome, *Reduced EUIs in participating buildings*, implies that reductions will be accurately measurable immediately. Indicators (and the outcome) should focus on increased understanding of EUI and frequency of usage in goal setting, designs, and RFPs.
- **Program models should not be a sole benchmark.** The outcome, *Improved market actor ability to estimate EUI*, should be assessed based on other models too. If the goal is to generate market effects, then assessing non-program models should be a priority as well.
- **Remove some outcomes.** Not all outcomes should be included in the indicators table. Market transformation is too broad – success would be measurable through other outcomes. Including NEIs as an indicator for market effects is problematic for a variety of reasons, such as complexity around measurement.
- **Measure energy reductions.** *Persistent energy savings* should be measured in terms of *decreases* in EUI not *changes* in EUI.
- **Add an indicator for progress in ZNE/PH awareness.** For the *Increased understanding and awareness of ZNE/PH* outcome (measured separately), add *ability to implement new skills*.
- **Change timing of outcomes.** One attendee suggested that some outcomes placed in the mid-term should move to the short-term.
- **Add an indicator for increased demand.** *Increased demand for and construction of high-performance buildings in market overall* could also measure *requests from customers for high-performance buildings*.
- **Include other elements.** The indicators table should include recommendations for timing of measurement, feasibility, level of rigor, and priority. (It is likely this will need to be split into more tables.)

G.3 EUI BASELINES

While the charrette objective was not to address the remaining questions about how EUI baselines would be set, discussion made it clear that it was important to address baselines for planning purposes because they are an integral component of program design. On January 24, 2020, DNV GL finalized the results of the *Massachusetts Non-Residential New Construction EUI Baseline Study*. The study's objectives were to assess whether the "MA Data Warehouse" maintained by DNV GL can be used to (1) estimate EUI baselines for various building types, (2) identify supplemental information that may be needed to support the creation of the EUI baselines, and (3) conclude whether those methods will work. DNV GL also described how some results were problematic:

> *"[The analysis] contains very small (or no) populations of buildings that are most likely to participate in the PAs' initiative for large new construction buildings: hospitals, colleges, and other campuses. Unfortunately, it is unlikely that we would be able to develop defensible EUIs for those categories given the caveats discussed throughout this memo. Finally, while clustering EUIs within the building use categories substantially reduces variation and highlights differences within categories potentially based on operating hours, occupancy, and specific business activity, unfortunately, this level of detailed information is not available for all buildings without primary research."*

Under "Considerations," DNV GL wrote the following:

> *"DNV GL suggests that the PAs consider developing pilot baselines informed by these results for some building use size categories with less variable EUIs. Good candidates would include large (>50,000 sqft) education, large outpatient healthcare, large office, large multifamily, large food sales, large lodging, and large warehouse and storage. We also suggest that the PAs consider additional research to gather detailed information on specific buildings to allow tailoring of EUIs to more granular building use subsegments (e.g., medical imaging and primary care physician versus outpatient healthcare)."*

Charrette attendees agreed that the PAs should sponsor an additional study with more data points and that Ben Crosby would bring that to the Evaluation Management Committee's attention.[100]

Much of the focus of the EUI discussion was on the challenge of setting sector-specific or building-type specific EUI baselines and accounting for fuel types. Attendees made the following points:

- Site EUI is not always comparable for different building types. If source energy is a proxy for emission reductions, just because there is large percentage site EUI reduction, if you compare mixed fuel, you do not always have large percentage site and large source reductions. The PAs control for that already by not allowing fuel mixing and switching.
- Currently, percentage site and percentage source are linear, but if the PAs start comparing fuels, they will not know that with as much certainty.

[100] He has since done this.

- If the PAs compare a sector average EUI with gas buildings with proposed all-electric buildings, it might show a large site difference, controlling for increased use of electric resistance.
- If granting and incentivizing site EUI, the PAs cannot use site EUI with gas heat. It does not remove EUI baseline from discussion, but the PAs would need two baselines. When it is time for booking savings, they would need EUI baseline for a gas-heating scenario and a separate for electric if using site.
- In the past, the PAs applied a ratio to electric to make it comparable and came up with a blended efficiency. If it is a modeled approach, it is a way to make it equitable, but not strictly site.
- It might be worthwhile to use a combined MMBTU to allow a more holistic approach. But the PAs do not have good EUI data at the single-fuel level.
- Comparing ground-source heat pumps to all-electric baseline can result in more benefits to the program. It makes it better to compare to electric savings because it is worth more.
- Identifying sector-based or building type EUIs is a critical early step for the program so that the PAs can anticipate what savings might be and where to set their incentives. Part of the baseline development will need to consider the electric vs. gas and site vs. source issues described above.

There is a need for early building-specific numbers so there is transparency to the market. However, the data needs to be comprehensive and reliable. As such, as noted, the group discussed coalescing the data (DNV GL, CBECs, and BPR) and conferring with a larger group to establish baseline values. One approach could be to use a default baseline and a real-time evaluation for less typical scenarios, yet this could introduce bias unless carefully regulated.

G.4 DRAFT PROGRAM DESIGN (HANDOUT)

Implementation and NMR prepared this handout for attendees. Note that some program design details are still under consideration.

Program Redesign Objectives: 1) Achieve deep energy savings and market transformation through a Deep Energy Savings pathway and a broader focus on driving down project EUIs, 2) Respond to the requirements of the 3 year plan, 3) Accelerate a growing trend toward carbon reduction, electrification, zero-net energy (ZNE) buildings and Passive House, 4) Provide a simplified and cost-effective approach for smaller and less complex buildings, and 5) Provide paths to meet varied customer needs and project timing.

	Path 1	Path 2	Path 3	Path 4
Proposed Paths	Deep Energy Savings	Whole-Bldg. Modeled	Simplified Whole Bldg.	Systems
Current Paths	(none)	Integrated Design - Large Bldg.	Integrated Design - Small Bldg.	Systems (same)

Path 1. Deep Energy Savings (Zero Net Ready/Passive House) is a new path designed to specifically help customers achieve low EUIs in ZNE Ready and Passive House projects by providing expert technical assistance, enhanced incentives, and certification support. Incentives will be set on a flat $/sf basis for this path (dollar amount per sf TBD). We anticipate total incentives to be more generous for this path than the top tier of incentives offered under Path 2. This path is characterized by enhanced technical assistance intended to help customers design toward, evaluate and realize ZNE/PH and related EUI targets post occupancy. The EUI target for participating projects is 25 or better, or a 40% EUI improvement over the Program's baseline, which generally reflects the state energy code. Incentives will be paid in at least 2 parts - some percentage of the incentives will be paid at the end of construction and the remaining portion would be paid when one year of post commissioning, post occupancy utility data demonstrate the project achieves its ZNE/EUI target. PA provided post occupancy technical analysis is anticipated.

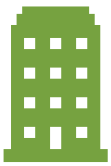
Path 2. Whole-Building Modeled (EUI Metric) is similar to the current Integrated Design offering, but is centered on setting EUI targets with customers and offering incentives based on modeled site EUI percentage reductions. Technical assistance will include early EUI target setting and benchmarking support, early charrette assistance, design recommendations, energy modeling and mid design feedback. This path is for larger and fairly complex buildings where customers enroll with PAs early in the design process (before the end of design documents). Incentives will be offered on a dollar/sf basis in accordance with a set of TBD incentive tiers. As with the current program, incentive payments will be made at the end of construction with some potential hold back for trend data in certain circumstances.

Path 3. Simplified Whole Building path provides a more cost- and time- effective way to provide technical feedback and calculate energy savings for smaller buildings with less complex energy conservation measures (ECMs). PAs and vendors will provide incentive and savings feedback using a spreadsheet tool rather than an energy model. Technical assistance will include charrette assistance, ECM recommendations, analysis of incentive/savings potential using spreadsheet tool, and mid design feedback. Incentives will be offered on an ECM by ECM basis as calculated in the spreadsheet tool.

Path 4. Systems (Prescriptive/Custom) is a participation pathway for customers who engage PAs late in the design process (after the end of design development), or for customers who have very small projects and are not also interested in pursuing deep energy savings under Path 1. This path is the same as is currently offered.

The table below compares the current and proposed offerings at a high-level for paths that have changed. **PA implementation staff will provide more details during the Charrette.**

Snapshot of Comprehensive Paths

	Current Paths		Proposed Paths		
	Integrated Design (Small)	**Integrated Design (Large)**	**Deep Energy Savings**	**Whole-Building Modeled**	**Simplified Whole Building**
					
Building size	**20,000-100,000 ft²**	**>100,000 ft²**	**>5,000 ft²**	**>50,000 ft²**	**20,000-100,000 ft²**
Early engagement required	✓	✓	✓	✓	✓
Technical assistance	✓	✓	✓ **Enhanced**	✓ **Enhanced**	✓
Energy modeling	✓	✓	✓	✓	**(Spreadsheet only)**
Post-occupancy usage data required			✓	**Optional**	
Tiered incentives	✓	✓		✓	**(Calculated by ECM)**
Certification bonuses*			✓		
Charrette incentives		✓			
Design team incentive	✓	✓	✓	✓	✓

***Certifications are for achieving Zero-Net Energy-readiness or Passive House specifications.**

Appendix H References

"Accelerate Performance (New Project) 2016 Building Technologies Office Peer Review," energy.gov, https://www.energy.gov/sites/prod/files/2016/04/f30/222109_McMillen_040416-1635.pdf

"ASHRAE Technical FAQ," ASHRAE.org, https://www.ashrae.org/File%20Library/Technical%20Resources/Technical%20FAQs/TC-07.06-FAQ-105.pdf

"Building Performance Database (BPD)," energy.gov, https://www.energy.gov/eere/buildings/building-performance-database-bpd

"Business New Construction and Renovation Project Service," PG&E.com, https://www.pge.com/en_US/small-medium-business/building-and-property/building-and-maintenance/building-and-renovation/understand-the-process.page

"Certified Projects Database," phius.org, https://www.phius.org/phius-certification-for-buildings-products/certified-projects-database

"ComEd - Energy Efficiency Program for Commercial New Construction," dsireusa.org, July 8, 2019. https://programs.dsireusa.org/system/program/detail/3716

"Commercial Buildings Energy Consumption Survey (CBECS)," eia.gov, https://www.eia.gov/consumption/commercial/

"Demand-Side Management Plan Electric and Natural Gas," xcelenergy.com, April 18, 2019. https://www.xcelenergy.com/staticfiles/xe-responsive/Company/Rates%20&%20Regulations/Regulatory%20Filings/DSM-Plan.pdf

"DOE Zero Energy Ready Home Partner Locator," energy.gov, January 7, 2014. https://www5.eere.energy.gov/buildings/residential/locator

Dunning, Kai Palmer. "Getting Into The Zone: Using Green Zoning To Achieve Our Carbon Reduction Goals," neep.org, April 23, 2019. https://neep.org/blog/getting-zone-using-green-zoning-achieve-our-carbon-reduction-goal

"Energy Design Assistance (EDA)," xcelenergy.com, https://www.xcelenergy.com/programs_and_rebates/business_programs_and_rebates/new_construction_and_whole_building/energy_design_assistance

"EUI Introduction Page and Notice," ASHRAE.org, http://cms.ashrae.biz/EUI/

"Find a PHIUS CPHC," phius.org, https://www.phius.org/find-a-professional/find-a-phius-cphc-

"Fort Collins Utilities: A Municipal Utility Leading Innovation," ACEEE, 2014. https://www.aceee.org/files/proceedings/2014/data/papers/10-711.pdf

"Getting to Zero Buildings Database," newbuildings.org, May 6 2019. https://newbuildings.org/resource/getting-to-zero-database

"Get on the Path to Net Zero," energytrust.org, https://www.energytrust.org/commercial/new-buildings-path-to-net-zero/

"How MEETS Works," meetscoalition.org, http://www.meetscoalition.org/how-meets-works/

"Integrated Design Assistance Program," fcgov.com, https://www.fcgov.com/utilities/business/improve-efficiency/rebates-incentives/integrated-design-assistance/

"Integrated Design Assistance Program (IDAP) Program Manual," fcgov.com, January 31, 2019. https://www.fcgov.com/utilities/img/site_specific/uploads/idap-program-manual.pdf

Massachusetts Commercial and Industrial Impact Evaluation of 2014 Custom CDA Installations. DNV GL, DMI, SBW Consulting, and ERS. April 25, 2018.

"New Buildings Incentive Application Form," energytrust.org, https://www.energytrust.org/wp-content/uploads/2017/01/NBE_FM0520CX-FT.pdf

"Metered Energy Efficiency Transaction Structure in Ultra-Efficient New Construction: Pay-For-Performance at the Bullitt Center in Seattle, WA," ACEEE, 2016. https://www.aceee.org/files/proceedings/2016/data/papers/3_433.pdf

"New Jersey's Clean Energy Program: Pay for Performance: Integrating Performance Programs and ENERGY STAR ." ACEEE, 2010. https://www.aceee.org/files/proceedings/2010/data/papers/2028.pdf

NMR Group, Inc., "Action Plan for Measuring Market Effects," February 15, 2019. http://ma-eeac.org/wordpress/wp-content/uploads/Action_Plan_Measuring_Market_Effects_FINAL_2019.02.15.pdf

NMR Group, Inc., "Recommended Methods for Assessing Market Effects of Non-Residential New Construction Programs," Submitted to *Massachusetts Electric and Gas Program Administrators,* February 26, 2015. http://ma-eeac.org/wordpress/wp-content/uploads/Recommended-Methods-for-Assessing-Non-residential-New-Construction-Market-Effects.pdf

"Pay for Performance Frequently Asked Questions - NJ OCE Web Site," njcleanenergy.com, https://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/faqs

"Pay for Performance - New Construction - Participation Steps," njcleanenergy.com, https://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/new-construction/participation-steps

"Pay For Performance (P4P) Program Guide for Commercial & Industrial (C&I) New & Existing Buildings," njcleanenergy.com, 2019. https://www.njcleanenergy.com/files/file/Program Guides/P4P_PG_FY19 Final_clean.pdf

"Plan For Energy Savings In Your New Building Or Renovation," xcelenergy.com, June 2. https://www.xcelenergy.com/staticfiles/xe/Marketing/Files/CO-Bus-EDA-Info-Sheet.pdf

"Putting Your Money Where Your Meter Is A Study Of Pay-For-Performance Energy Efficiency Programs In The United States," nrdc.org, January 2017. https://www.nrdc.org/sites/default/files/pay-for-performance-efficiency-report.pdf

"Quarter Three 2018 Report to the Oregon Public Utility Commission & Energy Trust Board of Directors," energytrust.org, November 15, 2018. https://www.energytrust.org/wp-content/uploads/2018/11/ETO.Q3.18.Quarterly.Report.ETO_.pdf

"Scope Of Work for Energy Modeling Consultants," xcelenergy.com, May 2015. https://www.xcelenergy.com/staticfiles/xe-responsive/Admin/Managed_Documents_&_PDFs/CO-Bus-EDA-Scope-of-Work.pdf

"The Clean Energy Programs And Budget For Fiscal Year 2018 4th Budget Revisions," state.nj.us, May 22, 2018. https://www.state.nj.us/bpu/pdf/boardorders/2018/20180522/5-22-18-8D.pdf

"The New Leaders of the Pack: ACEEE's Fourth National Review of Exemplary Energy Efficiency Programs." Washington, DC: American Council for an Energy-Efficient Economy, 2019. https://www.aceee.org/sites/default/files/publications/researchreports/u1901.pdf

"Think. Design. Build Net Zero," energytrust.org, https://energytrust.org/pathtonetzero/

"U.S. Green Building Council," sgbc.org, https://www.usgbc.org/projects

"Verified! How Performance-Based Procurement Can Boost New Construction Program Savings and Empower Building Owners," ACEEE 2016. http://www.seventhwave.org/sites/default/files/shenry2016.pdf

"An Energy-Performance-Based Design-Build Process: Strategies for Procuring High-Performance Buildings on Typical Construction Budgets." ACEEE 2014. https://www.aceee.org/files/proceedings/2014/data/papers/4-643.pdf

"Zero Tool ," Architecture 2020, https://zerotool.org/zerotool/

"2030 Implementation Guidelines : A Resource for Firms and Organizations Adopting The 2030 °Challenge ," Architecture 2020, https://architecture2030.org/wp-content/uploads/2018/11/2030ImplementationGuidelines.pdf.

"New Jersey's Clean Energy Program™ Fiscal Year 2019 Program Descriptions and Budget : Energy Efficiency and Renewable Energy Program Plan Filing ,FY19 Compliance Filing Vol. 1," TRC, June 22, 2018, https://www.njcleanenergy.com/files/file/Library/Compliance%20Filings/fy19/TRC%20Compliance%20Filing%202019%20Vol%201%20v4%20FINAL.PDF.

"Accelerate Performance," ComEd, 2020, https://www.comed.com/WaysToSave/ForYourBusiness/Pages/FactSheets/AcceleratePerformance.aspx

"MEETS: The Metered Energy Efficiency Transaction Structure," MEETS Coalition, February 1, 2019, http://www.meetscoalition.org/wp-content/uploads/MEETS-AC-Description.pdf

"Stretch Code Adoption, by Community," Massachusetts Department of Energy Resources, November 14, 2019, https://www.mass.gov/files/documents/2019/11/14/stretch-code-towns-adoption-by-community-map-and-list.pdf