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Massachusetts Electric and Gas Program Administrators

Recommended Methods for Assessing Market Effects of Non-residential New Construction Programs

Final

February 26, 2015

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Massachusetts Electric and Gas Program Administrators

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Part of the Special and Cross-Cutting Evaluation Program Area

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1. INTRODUCTION

This document is one of a series of work products addressing consistent methodologies for the measurement of market effects from cross-cutting[1] energy efficiency programs run by the Massachusetts Program Administrators (PAs). It focuses specifically on the effects of PA programs on the market for non-residential new construction. The objective of this document is to outline appropriate methods for evaluating the programs' effects on this market based on the range of methods available for measuring market effects. This includes methods for establishing qualitative evidence of the programs' effects on markets and quantifying the effects, which incorporate spillover, as well as estimating net savings.

The Cross-Cutting evaluation team is tasked with developing methodologically consistent approaches for assessing market effects within markets identified by the PAs as most likely to be affected by their programs. At a series of workshops held in February 2014, the PAs identified non-residential new construction as a good candidate for market effects evaluation, which is the focus of this document. A related work product is a document describing the full range of methods available for measuring market effects, with some general guidance about when each is most appropriate.[2] Based on these documents, the Commercial & Industrial (C&I) evaluation team will be responsible for developing a work plan for a market effects study of the non-residential new construction market.

The body of this document outlines proposed methods. Appendix A is another (finalized) work product, *Market Effects—Types and Sources of Savings in Non-residential New Construction*, which identifies and differentiates among the types and sources of savings that may stem from program efforts in the non-residential new construction market in Massachusetts. This document also identifies other studies that estimate net savings in Massachusetts, assesses whether or not these estimates overlap with a possible non-residential new construction market effects study, and, where there is overlap, recommends how it can be accounted for.

There are two primary methodological components recommended for the market effects studies proposed in this document. The first is theory-based evaluation, described in Section 2. This qualitative approach identifies how program activities are expected to lead to market effects and measures the associated indicators periodically.

The second component is quantifying market effects and the associated net energy savings. We emphasize 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 made; hence, both components are necessary. The quantification component is described in Section 3.

The PAs' Commercial and Industrial New Construction Program is not limited to true new construction; it also addresses replacement on failure. True new construction, including gut rehab, is a definable market with a clearly definable set of market actors; we therefore suggest focusing only on true new construction, including gut rehab, in this evaluation.

[1] Residential and commercial/industrial.

[2] NMR Group, Inc. and Tetra Tech. 2014. *Methods for Measuring Market Effects of Massachusetts Energy Efficiency Programs*. Report prepared for the Massachusetts Electric and Gas Program Administrators. November 14.

As explained in the document produced for the PAs and the EEAC, *Market Effects—Types and Sources of Savings in Non-residential New Construction* (which is included as an appendix to this document), the programs and initiatives that may affect the non-residential new construction market include not only the C&I New Construction Program, but also the following:

- the Code Compliance Support Initiative
- the Upstream Subprograms/ Initiatives (HVAC and lighting)
- the C&I Retrofit Program

In the short term, the Tetra Tech team recommends conducting prospective work involving the tracking of indicators that would support theory-based evaluation, and also using the net-to-gross (NTG) estimates from the Electric and Gas Net to Gross studies for the 2016-2018 prospective estimate that is required for planning purposes. The NTG estimates from the Electric and Gas Net to Gross studies are based on self-reporting by program participants and address only free ridership and some forms of spillover, not including market effects.

In the long term—for completion in early 2018—the team recommends conducting a single retrospective market effects evaluation of all the programs and initiatives affecting the non-residential new construction market, and at the same time developing a prospective NTG estimate for the 2019-2021 period.

2. THEORY-BASED EVALUATION

As mentioned earlier, theory-based evaluation provides a qualitative framework for identifying how program activities are expected to lead to market effects and measures the associated indicators periodically. Theory-based evaluation ideally begins with the development of a market model depicting how the market functions and an associated 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 stemming from program activities. In turn, the evaluators should operationalize these outcomes so they can be measured and should conduct periodic research to track them. If these outcomes occur more or less in the order predicted by the program logic model and are logically linked to program activities, then a reasonable qualitative case can be made for market effects.

2.1 MARKET MODEL AND PROGRAM LOGIC MODEL

Figure 2-1 and Figure 2-2 show a preliminary market model and an associated program logic model for non-residential new construction. These models are based on interviews with PA program staff and have since been reviewed by PA program staff, PA evaluation staff, EEAC program staff, and EEAC evaluation staff. We recommend that the C&I evaluation team refine the market model and program logic model once they begin conducting the market effects evaluation.

As mentioned earlier, please note that this memo focuses on the “true new construction market”—that is, new commercial buildings constructed from the ground up, along with gut rehab projects. The PAs’ Commercial and Industrial New Construction Program is not limited to true new construction; it also addresses replacement on failure. The “true new construction market,” the focus of the possible retrospective market effects study, consists of the system of demand and supply for newly constructed commercial buildings, including the market actors involved in producing, selling, and purchasing the buildings.

Figure 2-1. Market Model—"True" Commercial New Construction

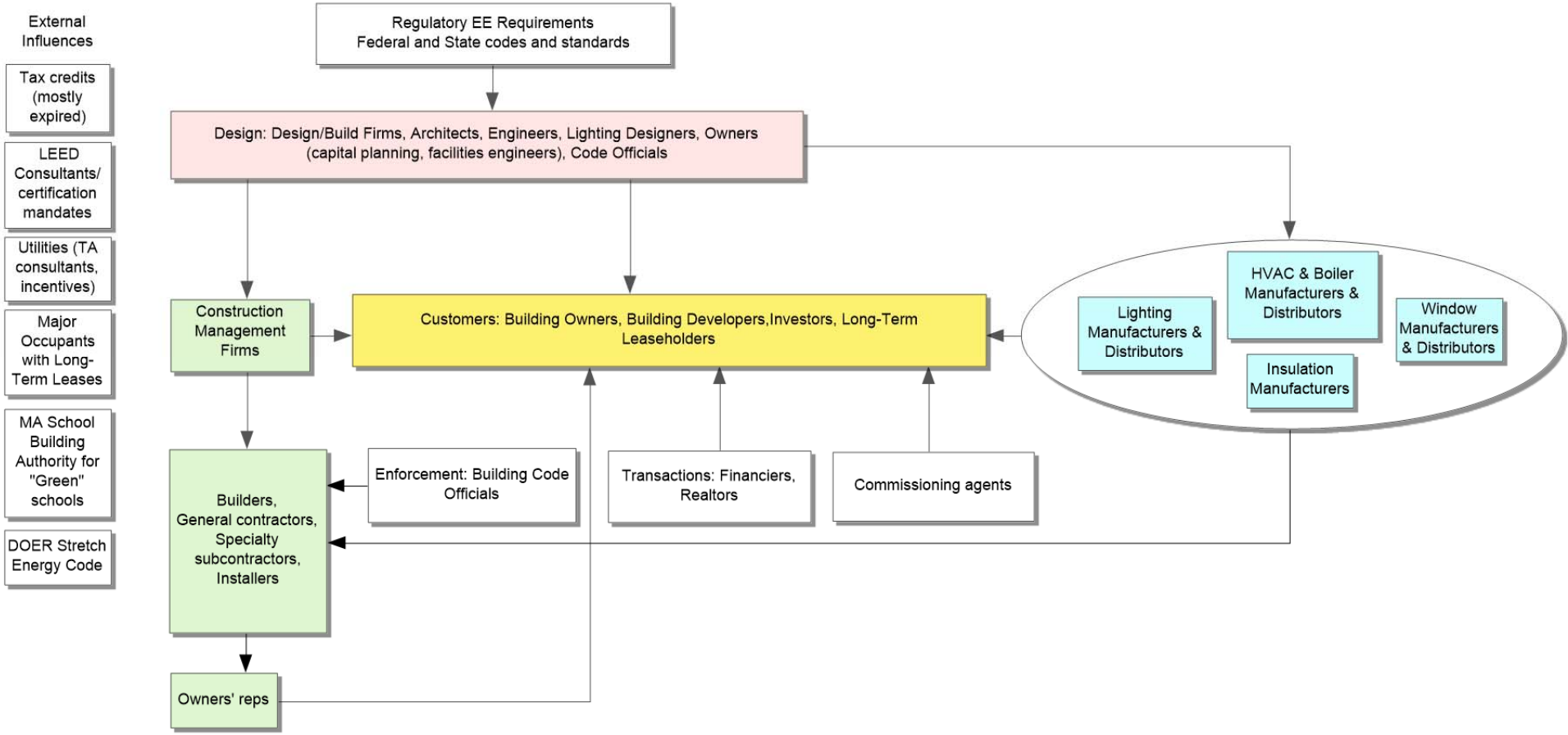
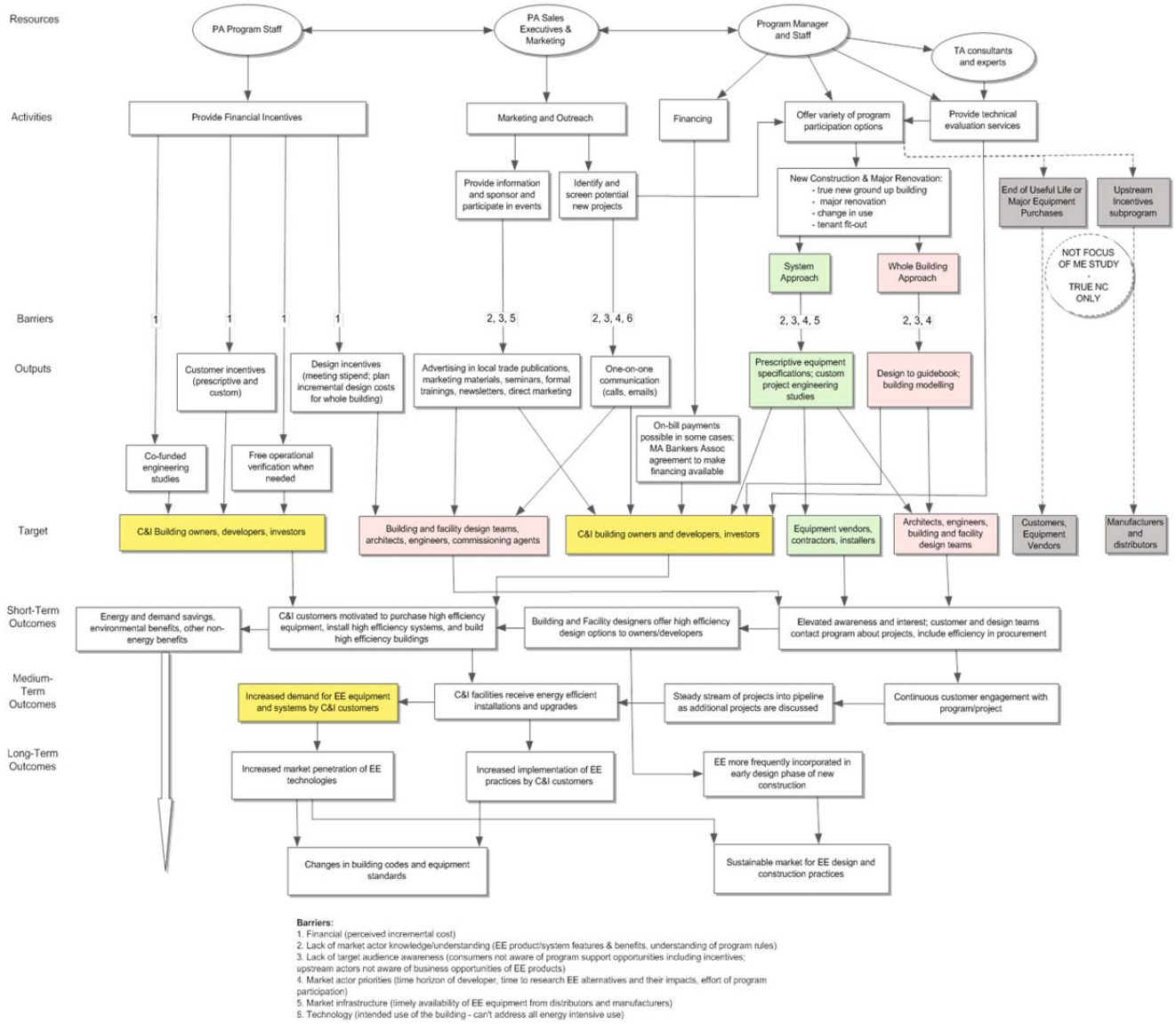


Figure 2-2. Logic Model—C&I New Construction Program



2.2 INDICATOR TRACKING

We suggest operationalizing the expected outcomes shown in the program logic model using the indicators shown in Table 2-1 below. This table also shows the recommended data source, timing, and responsible party for measuring the indicators. We recommend that the C&I evaluation contractor carry out the evaluation activities in order to leverage current and future sector evaluation efforts, such as baseline studies and surveys of market actors. Program planners and implementers may note that the outcomes and indicators posited in Table 2-1 essentially follow the AIDA model (Awareness, Interest, Desire, Action) for how to step a prospective customer through to a purchase or behavior.

Table 2-1. Preliminary Outcomes and Indicators for Commercial-Industrial New Construction Program

Outcomes	Indicators	Data Source	Timing
Elevated awareness	Building owners' and developers' awareness of program	Survey of non-participating building owners and developers	2015, 2017
	Design firms' awareness of program	Survey of non-participating design firms	2015, 2017
Elevated interest	Customers contact program about projects	Program tracking database	Annually
	Design firms contact program about projects	Program tracking database	Annually
C&I customers are motivated to purchase high-efficiency equipment, install high-efficiency systems, and build high-efficiency buildings	Customers include efficiency in procurement	Survey of participating and non-participating building owners and developers, survey of participating and non-participating design firms	2015, 2017
Increased demand for EE equipment and systems by C&I customers	Customers ask designers for energy-efficient designs	Survey of participating and non-participating building owners and developers, survey of participating and non-participating design firms	2015, 2017
Increased marketing by design firms	Proportion of design firms that report marketing the program to clients	Survey of participating and non-participating design firms	2015, 2017
	Proportion of design firms that report marketing the energy efficiency to clients	Survey of participating and non-participating design firms	2015, 2017
Energy efficiency more frequently incorporated in early design phase of new construction	Proportion of design firms that offer high-efficiency design options to owners/developers	Survey of participating and non-participating design firms	2015, 2017

Outcomes	Indicators	Data Source	Timing
Increased market share	Proportion of new construction projects that participate	Program tracking database, Dodge data	Annually
	Proportion of design firms that participate	Program tracking database, Dun & Bradstreet data	Annually
	Proportion of new construction projects in the market that are energy efficient	Baseline studies	2015, 2017
	Market share of efficient equipment in new construction	Baseline studies	2015, 2017
Increased efficient building management practices	Proportion of building managers who report using efficient building management practices	Survey of participating and non-participating building managers	2015, 2017
Net energy & demand savings	Net savings achieved in participating buildings	C&I Gas NTG study	2015, 2018
		C&I Electric NTG study	2014, 2017
		Market effects study	completed early 2018
	Net savings achieved in non-participating buildings	Market effects study	completed early 2018

3. QUANTIFICATION OF MARKET EFFECTS

3.1 OVERVIEW OF METHODS FOR QUANTIFYING MARKET EFFECTS

There are four basic choices for methods that can quantify market effects:[3]

1. Supply-side market actor self-reported counterfactual analysis. This involves surveys or in-depth interviews asking about free ridership and spillover.
2. Cross-sectional analysis, which may include time series data. This involves identifying one or more comparison groups that will be tracked along with the program area and will serve as the "baseline" for the program area.
3. Forecasting or retrocasting the non-intervention baseline. With this approach, evaluators develop 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. The estimate can be for a future date (forecasting) or a date that has already passed (retrocasting).
4. Structured expert judgment. This approach is typically implemented as a Delphi panel. With this method, evaluators identify a team of experts who review information on the market for the energy-efficient product or service and then go through a structured series of steps to converge on a single baseline estimate.

We believe that supply-side market actors do not have the perspective to assess the effect of PAs' programs on the broader market. We note that, in a study of residential new construction, surveyed builders attributed improved building practices to code changes, even for practices for which there had been no code changes.[4] However, because a prospective NTG estimate for 2016-2018 is required for program planning, we suggest using the values provided by the Electric and Gas Net to Gross studies. These studies are based on self-reporting by program participants and address only free ridership and some forms of spillover, not including market effects.

One option we considered is cross-sectional analysis. However, with differences in climates, codes, energy prices, and economies, we do not believe that cross-sectional analysis is practical for the C&I new construction market. Moreover, our approach relies on modeling detailed findings from new construction baseline studies conducted in Massachusetts; it is doubtful that such detailed findings could be developed for a comparison area.

Another option could be for the evaluation to rely on an econometric model to develop a non-intervention baseline. However, we believe that an econometric model would be prone to error due to the complexity of the new construction market. Decisions and savings in the new construction market go beyond individual products and equipment types and cover a wide range of decision making and savings trade-offs that such a model would not be able to address.

[3] NMR Group, Inc. and Tetra Tech. 2014. *Methods for Measuring Market Effects of Massachusetts Energy Efficiency Programs*. Report prepared for the Massachusetts Electric and Gas Program Administrators. November 14.

[4] Residential New Construction Net Impacts Study (http://ma-eeac.org/wordpress/wp-content/uploads/Residential-New-Construction-Net-Impacts-Report-1-27-14.pdf).

As a result of these considerations, we recommend the use of structured expert judgment to estimate the net savings in the non-residential new construction market that are attributable to the PAs' programs. We describe this approach below.

3.2 METHODS FOR QUANTIFYING EFFECTS OF PROGRAMS ON THE NON-RESIDENTIAL NEW CONSTRUCTION MARKET

This is a summary of recommended methods for quantifying the effects of PA programs on the non-residential new construction market. The programs and initiatives that may affect the non-residential new construction market include the C&I New Construction Program, the C&I Retrofit Program, the Upstream Subprograms/Initiatives (HVAC and lighting), and the Code Compliance Support Initiative (CCSI). There is already a plan for estimating savings from the CCSI.[5] Because they cover the same market, we recommend combining the CCSI evaluation and the non-residential new construction market effects evaluation.

In order to estimate net savings attributable to CCSI, the CCSI evaluation plan calls for multiple baseline studies (including those that have been completed or are currently in process) assessing compliance at different points in two or more code cycles, followed by a retrospective Delphi study to identify the changes in construction practices that are attributable to the CCSI and other influences, possibly including the C&I New Construction Program and other PA programs. We recommend the following:

1. Combining the retrospective Delphi CCSI study with a retrospective Delphi non-residential new construction study to be completed in early 2018, and simultaneously estimating the savings attributable to the CCSI and to the C&I New Construction Program and other PA programs. The panelists would review: the findings from the 2012 and 2017 baseline studies; a description of PA program activities over time; a description of changing code requirements; discussion of other things that could influence code such as naturally occurring market adoption (NOMAD), LEED building, energy prices, economic conditions, and climate change; and results of the theory-based indicator tracking discussed in Section 2. The panel would be asked to review the baseline studies and see what current practices are (as-built) compared to the past, and then estimate what those practices would have been without the PA programs. Note that we are recommending asking the panel to estimate the effects of PA programs on building practices, not on energy use, net savings, or net to gross.
2. Modeling the counterfactual as identified by the Delphi panel using the baseline study data, then comparing it to the as-built models to develop separate net savings estimates for the CCSI and the C&I New Construction Program. The evaluation team would model energy use for the baseline buildings as they were built ("as-built"), and then model assuming the counterfactual practices to estimate energy use; in other respects the building models would be the same. The difference between the as-built and counterfactual models would be the estimated net energy savings. To simplify the process, above-code or above-prevailing practice savings could be attributed to the C&I New Construction Program, and savings from getting buildings closer to code or to the current prevailing practice could be attributed to the CCSI. The baseline

[5] NMR Group, Inc. and Tetra Tech. 2014. *Detailed Research Plan: Cross-Cutting Code Compliance Support Initiative Evaluation*. Report prepared for the Massachusetts Electric and Gas Program Administrators. August 12.

(counterfactual) for the C&I New Construction Program would be either code or prevailing practice—whichever is better for a particular technology or building practice—while the Delphi panel would develop the baseline (counterfactual) for the CCSI program.

3. After modeled retrospective savings estimates are complete, the C&I evaluation team will ask the Delphi panel to develop prospective net-to-gross estimates. Materials to help in their deliberation will include: the retrospective savings estimates; description of expected program activities; description of expected code changes; and discussion of other things that could influence building practices, such as naturally occurring market adoption (NOMAD), LEED building, energy prices, economic conditions, and climate change.

The *C&I Electric Net-to-Gross Study* and the *C&I Gas Net-to-Gross Study* estimate net savings for the C&I New Construction Program and the C&I Retrofit Program based on surveys with participating end-users and participating vendors and design professionals. As of now, none of the gas PAs can identify true new construction projects going through their programs. We recommend the following:

4. That the PAs begin tracking projects by project type so that new construction (including gut rehab) can be differentiated.

5. That the upcoming C&I Gas Net-to-Gross study include questions to identify project type, and estimate net-to-gross separately for the new construction subsample.

National Grid and NSTAR do track electric new construction projects, and Unitil and Cape Light Compact can identify individual new construction projects if necessary. We therefore recommend that the PAs begin tracking projects by project type so that new construction (including gut rehab) can be differentiated.

For the C&I Retrofit Program, any estimates of net savings from participating buildings estimated in the net-to-gross studies would not have to be accounted for in the non-residential new construction market effects study because the Retrofit Program provides incentives only for existing buildings, not new buildings. However, the net-to-gross studies noted in the paragraph above have estimated some forms of spillover in non-participating buildings and have not differentiated new buildings from existing buildings in these estimates. We recommend the following:

6. Incorporating questions to make this differentiation in future net-to-gross studies, including the upcoming gas net-to-gross study.

7. Estimating both electric and gas new construction outside spillover from the C&I Retrofit program, and taking them into account in the 2018 non-residential new construction study.

There is a retrospective T8 market effects study currently being planned, which would include the effects of the upstream lighting program. In this study, we recommend splitting out low, medium, and high new construction-only net savings estimates from the broader estimate of market-level T8 net savings attributable to the PAs' subprograms/initiatives. This technology-specific estimate may be subtracted from the non-residential new construction market effects net savings estimate or from the technology-specific estimate. The 2018 non-residential new

construction market effects study may also have to take savings estimates from LED, lighting controls, and HVAC market effects studies into account.

Table 3-1 summarizes the above recommendations. Please note that carrying out this market effects evaluation will require coordination among the PA implementers, the cross-cutting evaluation team, and the C&I evaluation team.

Table 3-1. Recommendations and Responsible Parties

Activity or Study		Timing	Party Presumed Responsible	Recommendation
Tracking		ASAP, and continuing	Implementation Team	Begin tracking participating projects by project type (including new construction).
A	C&I Gas Net-to-Gross Study	2015 2018	Cross-Cutting Team	In the upcoming gas net-to-gross study, include questions about project type in the survey and estimate net-to-gross separately for true new construction projects. Also include questions to differentiate true new construction outside spillover stemming from retrofit projects, and calculate the NTG separately. In the future, true new construction projects should be tracked and results reported separately.
B	C&I Electric Net-to-Gross Study	2014 2017	Cross-Cutting Team	In the future, true new construction projects should be tracked and results reported separately. Also in the future, include questions to differentiate true new construction outside spillover stemming from retrofit projects, and calculate the NTG separately.
C	Non-residential new construction baseline study	2012 2017	C&I Evaluation Team	In 2017, conduct a non-residential new construction baseline study to establish construction practices and market shares at end of the code cycle.
D	Savings attribution between CCSI & other programs	complete in early 2018	TBD	After completing the 2017 baseline study (Study C), combine the planned CCSI net savings study with the non-residential market effects net savings study; attribute savings from getting buildings closer to code due to CCSI, and above-code savings to the C&I New Construction Program and other PA programs. This will involve convening a Delphi panel to review the baseline studies and other information to identify changes in building practices that are attributable to the PAs' programs, then modeling the counterfactual based on their estimates and comparing it to the as-built models to develop a net savings estimate. Also ask the Delphi panel to develop prospective savings estimates.
F	T8 retrospective	2015	C&I Evaluation	Subtract the new construction technology-

Activity or Study		Timing	Party Presumed Responsible	Recommendation
	market effects study		Team	specific spillover estimates from the T8 market effects study from the total savings estimate from that study or from the 2018 non-residential new construction net savings estimate (Study D).
G	Technology-specific retrospective market effects studies (currently being planned)	2018	C&I Evaluation Team	Subtract the new construction technology-specific spillover estimates from the LED, lighting controls, and HVAC market effects studies from the total savings estimate from those studies or from the 2018 non-residential new construction net savings estimate (Study D).
Final study calculations		early 2018	C&I Evaluation Team	Subtract C&I New Construction Program net-of-free ridership in-program savings (Studies A & B) from the non-residential new construction market effects savings estimate (Study D).
				Subtract the inside like spillover and outside like spillover measured for the C&I New Construction Program through the electric and gas net-to-gross studies (Studies A and B) either from the total savings estimates from those studies or from the non-residential new construction net savings estimate (Study D).
				Subtract the outside like spillover measured for the Retrofit Program through the electric and gas net-to-gross studies (Studies A and B) either from the total savings estimates from those studies or from the non-residential new construction net savings estimate (Study D).

It is important to take into account any savings already accounted for in other studies, whether it is net of free ridership or spillover. The formula is as follows:

x = a - b - c - d - e

where:

x = additional energy savings from non-residential new construction market effects not already estimated by another study

a = overall market-level savings in non-residential new construction attributable to the PA programs (Study D)

b = new construction technology-specific spillover (Studies F and G)

c = net-of-free ridership in-program savings stemming from the C&I New Construction Program (Studies A and B)

d = inside like spillover and outside like spillover stemming from the C&I New Construction Program (Studies A and B)

e = outside like spillover in new construction stemming from the Retrofit Program (Studies A & B)

APPENDIX A: MARKET EFFECTS: TYPES AND SOURCES OF SAVINGS IN NON-RESIDENTIAL NEW CONSTRUCTION

In order to help in the planning of a possible retrospective non-residential new construction market effects study, this memo seeks to identify and differentiate among the types and sources of savings that may stem from program efforts in the non-residential new construction market in Massachusetts. The memo also seeks to identify other studies that estimate net savings, determine whether or not these estimates overlap with a possible non-residential new construction market effects study, and, if so, determine how the overlap can be accounted for. The work has involved a review of program logic models, program websites, the *2013-2015 Massachusetts Joint Statewide Three-Year Electric and Gas Energy Efficiency Plan*, the *C&I Electric Net-to-Gross Study,* the upcoming *C&I Gas Net-to-Gross Study,* the *High-Bay Lighting Market Effects Study,* the upcoming *LED Market Effects Study,* and efforts that are currently underway to evaluate the Code Compliance Support Initiative (CCSI). The team has also relied on PAs and other Tetra Tech Cross-cutting Team members to answer specific questions.

Please note that this memo focuses on the "true new construction market"—that is, new commercial buildings constructed from the ground up.

A.1 SUMMARY

The programs and initiatives that may affect the non-residential new construction market include the C&I New Construction Program, the C&I Retrofit Program, the Upstream Subprograms/ Initiatives (HVAC and lighting), and the Code Compliance Support Initiative.

In order to estimate net savings attributable to CCSI, the CCSI evaluation plan calls for multiple baseline studies assessing compliance at different points in two or more code cycles, followed by a retrospective Delphi study to identify the changes in construction practices that are attributable to CCSI and other influences, possibly including the C&I New Construction Program and other PA programs. We recommend:

1. Combining the retrospective Delphi CCSI study with a retrospective Delphi non-residential new construction study, and simultaneously estimating the savings attributable to the CCSI and to the C&I New Construction Program and other PA programs.
2. Modeling the counterfactual as identified by the Delphi panel using the baseline data, then comparing it to the as-built models to develop separate net savings estimates for CCSI and for the C&I New Construction Program. To simplify the process, above-code savings could be attributed to the C&I New Construction Program, and savings from getting buildings closer to code could be attributed to the CCSI. The baseline would be either code or prevailing practice—whichever is better for a particular technology or building practice.

However, the CCSI net savings estimation task will occur in late 2018 or 2019. The CCSI evaluation plan suggests a non-residential new construction baseline study in 2015, and there was another one completed in 2012, focusing on the 2009-2011 period. We suggest:

3. Conducting a retrospective Delphi study soon after the 2015 baseline study is completed (probably 2016), covering the January 1, 2012 to June 30, 2014 period (as the new code was implemented on July 1, 2014). The Delphi panel would review

changes in construction practices between the 2012 and 2015 baseline studies, along with other evidence.

4. Having the evaluators model the without-C&I New Construction Program counterfactual as identified by the Delphi panel using the 2015 baseline data and compare that to the as-built models to estimate net savings, and the program could potentially be able to claim both above-code savings and savings from getting buildings closer to code (because the CCSI will not have had time to affect new construction practices during that period).

The *C&I Electric Net-to-Gross Study* and the *C&I Gas Net-to-Gross Study* estimate net savings for the C&I New Construction Program and the C&I Retrofit Program based on surveys with participating end users and participating vendors and design professionals. Apparently, none of the gas PAs can identify true new construction projects going through their programs. We recommend:

5. That the PAs begin tracking projects by project type so that new construction can be differentiated.
6. That the upcoming Gas C&I Net-to-Gross study include questions to identify project type, and estimate net to gross separately for the new construction subsample.

National Grid and NSTAR do track electric new construction projects, and Unitil and Cape Light Compact can identify individual new construction projects if necessary. We therefore recommend:

7. Going back to the recently completed Electric C&I Net-to-Gross study to identify all true new construction projects, and estimating net to gross separately for that subsample. The new construction net-of-free ridership savings estimates from the Gas and Electric C&I Net-to-Gross studies could then be subtracted from the non-residential new construction market effects savings estimate. New construction spillover estimates from the net-to-gross studies could be subtracted either from the net-to-gross studies' savings estimates or from the non-residential new construction market effects savings estimate.

For the C&I Retrofit Program, any estimates of net savings from participating buildings estimated in the net-to-gross studies would not have to be accounted for in the non-residential new construction market effects study, because the Retrofit Program provides incentives only for existing buildings, not new buildings. However, the net-to-gross studies noted in the paragraph above have estimated some forms of spillover in non-participating buildings and have not differentiated new buildings from existing buildings in these estimates. We recommend:

8. Incorporating questions to make this differentiation in future net-to-gross studies, including the upcoming gas net-to-gross study.
9. Ignoring electric outside spillover from the Retrofit program in the 2016 new construction market effects study; it is likely to be small anyway.
10. For outside spillover gas savings from the C&I Retrofit program, subtract it either from the gas net-to-gross study or from the 2016 non-residential new construction market effects study.

11. Estimate both electric and gas new construction outside spillover from the C&I Retrofit program should in later net-to-gross studies, and take them into account in the 2019 non-residential new construction study.

There is a retrospective T8/T5 market effects study currently being planned, which would include the effects of the upstream lighting program. In this study we recommend splitting out low, medium, and high new construction-only net savings estimates from the broader estimate of market-level T8/T5 net savings attributable to the PAs' subprograms/initiatives. This technology-specific estimate may be subtracted from the non-residential new construction market effects net savings estimate, or from the technology-specific estimate. We also recommend that the T8/T5 net savings estimates cover the January 1, 2012 to June 30, 2014 period, or at least have separate estimates for that period. The 2019 non-residential new construction market effects study may have to take savings estimates from LED, lighting controls, and HVAC market effects studies into account.

Table A-1 summarizes the recommendations above.

Table A-1. Recommendations and Responsible Parties

Activity or Study		Timing	Party Presumed Responsible	Recommendation
Tracking		ASAP, and continuing	Implementation Team	Begin tracking participating projects by project type (including new construction).
A	C&I Gas Net-to-Gross Study	2015 2018	Cross-Cutting Team	In the upcoming gas net-to-gross study, include questions about project type in the survey and estimate net-to-gross separately for true new construction projects. Also include questions to differentiate true new construction outside spillover stemming from retrofit projects, and calculate the NTG separately. In the future, true new construction projects should be tracked and results reported separately.
B	C&I Electric Net-to-Gross Study	2014 2017	Cross-Cutting Team	For the recent electric net-to-gross study, go back to the projects included in the sample and identify true new construction projects, then estimate net-to-gross separately for new construction projects. In the future, true new construction projects should be tracked and results reported separately. Also in the future, include questions to differentiate true new construction outside spillover stemming from retrofit projects, and calculate the NTG separately.
C	Non-residential new construction baseline studies	2015 2018	C&I Evaluation Team	In 2015 and 2018, conduct non-residential new construction baseline studies.
D	Retrospective Non-res New Construction Market Effects Study	2016 2019	TBD	After completing the 2015 baseline study, convene a Delphi panel to review the baseline studies and other information to identify changes in building practices that are attributable to the PAs' programs, then model the counterfactual based on their estimates, and compare it to the as-built models to develop a net savings estimate.
E	Savings attribution between CCSI & other programs	2019	TBD	After completing the 2018 baseline study, combine the planned CCSI net savings study with the non-residential market effects net savings study; attribute savings from getting buildings closer to code due to CCSI, and above-code savings to the C&I New Construction Program and other PA programs.
F	T8/T5 retrospective market effects study	2015	C&I Evaluation Team	Subtract the undifferentiated but technology-specific spillover estimates from the T8/T5 market effects study from the total savings estimate from that study or from the 2016 non-residential new construction net savings estimate.
G	Other technology-specific retrospective	2018	C&I Evaluation Team	Subtract the undifferentiated but technology-specific spillover estimates from the LED, lighting controls, and HVAC market effects studies from the total

Activity or Study	Timing	Party Presumed Responsible	Recommendation
market effects studies (currently being planned)			savings estimate from those studies or from the 2019 non-residential new construction net savings estimate.
Post-study calculations	2016 2019	TBD	Subtract C&I New Construction Program net-of-free-ridership in-program savings (Studies A & B) from the non-residential new construction market effects savings estimate (Study C)
			Subtract the inside like spillover and outside like spillover measured for the C&I New Construction Program through the electric and gas net-to-gross studies (Studies A and B) either from the total savings estimates from those studies or from the non-residential new construction net savings estimate (Study C).
			Subtract the outside like spillover measured for the Retrofit Program through the electric and gas net-to-gross studies (Studies A and B) either from the total savings estimates from those studies or from the non-residential new construction net savings estimate (Study C).

A.2 DEFINITIONS

The following terms are important for this discussion.

Naturally occurring savings—also called the *baseline* or the *counterfactual*—are what would have happened in the absence of the program.[6]

"Free riders are those who adopt an energy efficient product or service who would have adopted it without the intervention."[7]

In-program non-free ridership is savings counted within a program that would not have occurred without the intervention.

A *market* is the system of demand and supply for a product or service, including the "market actors" involved in producing, selling, and consuming the product or service.[8] *Spillover* is "the energy savings associated with energy efficient equipment installed by consumers who were influenced by an energy efficiency program, but without direct financial or technical assistance from the program. Spillover includes additional actions taken by a program participant as well as actions undertaken by non-participants who have been influenced by the program."[9]

> *Participant "like" spillover* refers to when a customer has installed energy-efficient end-use equipment through the program and then installs additional end-use equipment of the same type due to program influences.[10]
>
> *Participant "unlike" spillover* is when the customer installs types of energy-efficient end-use equipment other than those offered through the program but is influenced by the program to do so.[11]
>
> *Inside spillover* occurs when, due to the project, additional actions are taken to reduce energy use at the same site, but these actions are not included as program savings.[12] It can be either like or unlike spillover.

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[6] NMR Group, Inc. 2014. "Methods for Measuring Market Effects of Massachusetts Energy Efficiency Programs," November 25, 2014.

[7] Sebold, F. D., Fields, A., Skumatz, L., Feldman, S., Goldberg, M., Keating, K., and J. Peters, "A Framework for Planning and Assessing Publicly Funded Energy Efficiency," Study PG&E-SW040, 2001, accessed July 9, 2013, http://library.cee1.org/sites/default/files/library/1235/412.pdf. Page 5-23.

[8] NMR Group, Inc. 2014.

[9] New York Department of Public Service. November 2012. "Evaluation Plan Guidance for EEPS Program Administrators." Update #3. Appendix F. Albany NY.

[10] Tetra Tech, *Commercial and Industrial Electric Programs Free Ridership and Spillover Study,* Submitted to the Massachusetts Program Administrators, June 2011.

[11] Tetra Tech, *Commercial and Industrial Electric Programs Free Ridership and Spillover Study,* Submitted to the Massachusetts Program Administrators, June 2011.

[12] New York Department of Public Service. November 2012. "Evaluation Plan Guidance for EEPS Program Administrators." Update #3. Appendix F. Albany NY.

Outside spillover occurs when an actor participating in the program initiates additional actions that reduce energy use at other sites that are not participating in the program.[13] It can be either like or unlike spillover.

Nonparticipant spillover involves (1) changes in the array of energy-using equipment that manufacturers, dealers and contractors offer all customers as a result of program availability, or (2) changes in the energy use of nonparticipants as a result of utility programs, whether direct (e.g., utility program advertising) or indirect (e.g., stocking practices or changes in consumer buying habits).[14] It can be either like or unlike spillover.

A *market effect* is "a change in the structure of a market or the behavior of participants in a market that is reflective of an increase in the adoption of energy-efficient products, services, or practices and is causally related to market intervention(s)."[15] Market effects are "spillover savings that reflect significant program-induced changes in the structure or functioning of energy efficiency markets."[16] Some examples of these changes are:

- Increased availability of efficient technologies through retail channels
- Reduced prices for efficient models
- Build-out of efficient model lines, and an increase in the ratio of efficient to inefficient goods sold or practices undertaken in the market.

[13] New York Department of Public Service. November 2012. "Evaluation Plan Guidance for EEPS Program Administrators." Update #3. Appendix F. Albany NY.

[14] New York Department of Public Service. November 2012. "Evaluation Plan Guidance for EEPS Program Administrators." Update #3. Appendix F. Albany NY.

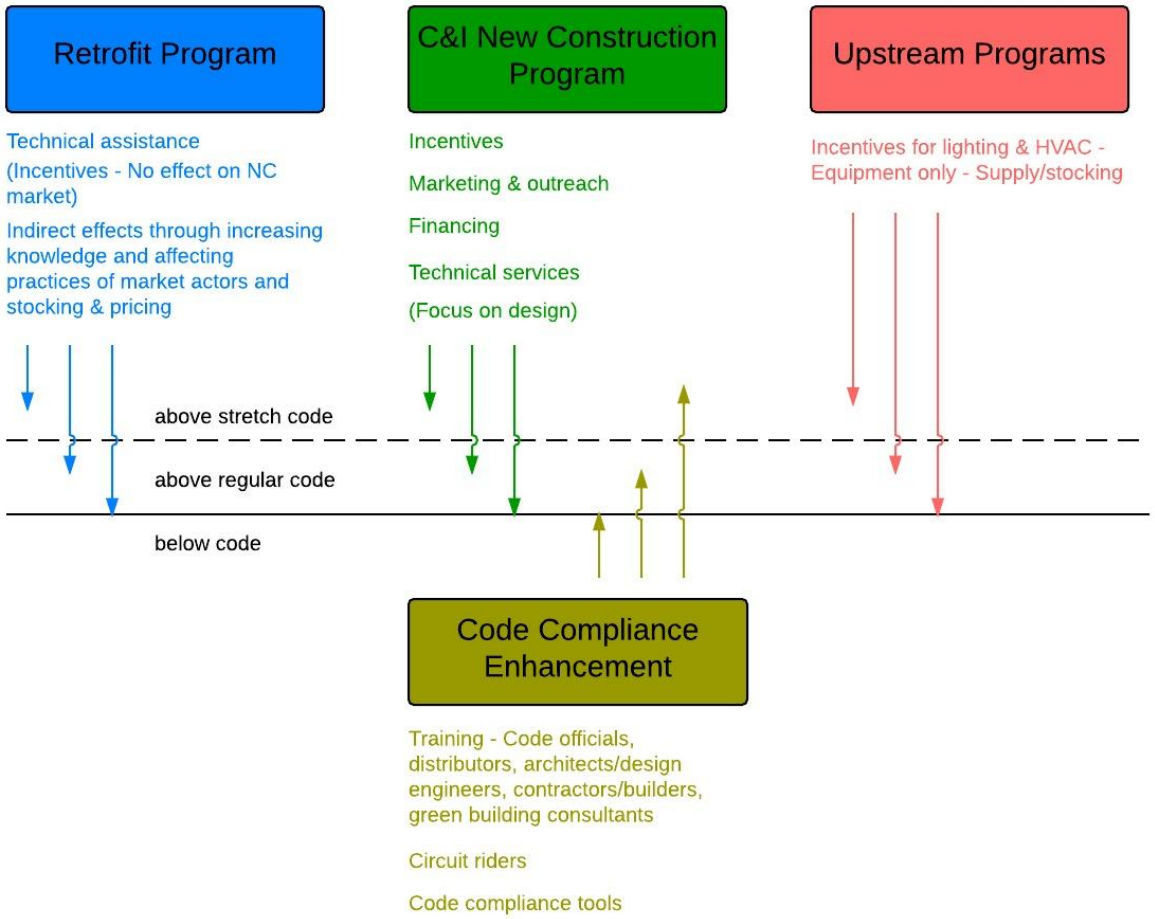
[15] Eto, J., Prahl, R. and J. Schlegel. 1996. "A Scoping Study on Energy-Efficiency Market Transformation by California Utility DSM Programs." Paper prepared for the California Demand-Side Measurement Advisory Committee. July. Accessed August 22, 2014 from http://emp.lbl.gov/sites/all/files/lbnl%20-%2039058.pdf. Pg. 9.

[16] Prahl, R., Ridge, R., Hall, N. and W. Saxonis. 2013. "The Estimation of Spillover: EM&V's Orphan Gets a Home." In Proceedings of the 2013 International Energy Program Evaluation Conference. Chicago, August 13-15. Accessed November 11, 2014 from http://www.iepec.org/conf-docs/conf-by-year/2013-Chicago/095.pdf.

A.3 PROGRAMS WITH POSSIBLE EFFECTS ON THE NON-RESIDENTIAL NEW CONSTRUCTION MARKET

Figure A-1 depicts how the PAs' major C&I programs might affect the non-residential new construction market in Massachusetts.

Figure A-1. How Programs Could Affect the Non-residential New Construction Market



A.3.1 C&I New Construction

The "true new construction market," the focus of the possible retrospective market effects study, consists of the system of demand and supply for newly constructed commercial buildings, including the market actors involved in producing, selling, and purchasing the buildings. There are a number of PA programs that could influence this market. First and most obviously, as Figure A-1 shows, the Commercial and Industrial (C&I) New Construction Program provides equipment incentives, design incentives, financing, and technical services, focusing especially on design, with the aim of optimizing the efficiency of building design and systems in new construction of commercial, industrial, institutional, and government facilities. Following are some of the main ways the program might affect the market above and beyond direct participation:

- Design assistance increases the knowledge and abilities of the design community, carrying over to other projects.
- Incentives increase availability and reduce prices of energy-efficient equipment.
- Marketing and outreach increase awareness of energy-efficient design and construction, including among nonparticipants, some of whom adopt energy-efficient practices and equipment in new construction projects.

Because the orientation is toward maximizing efficiency, we assume this means above code, so Figure A-1 shows the C&I New Construction program helping to increase above-code practices in the market. However, by influencing nonparticipants to construct more efficient buildings, the program could help some buildings achieve or move closer to code compliance.

The PAs' Commercial and Industrial New Construction Program is not limited to true new construction; it also addresses replacement on failure. True new construction is a definable market with a clearly definable set of market actors, which is why we suggest focusing on it, but many PAs' tracking systems cannot differentiate true new construction from other types of projects. *We therefore recommend that all PAs begin tracking projects by project type so that true new construction may be identified.*

A.3.2 Code Compliance Support

Another program aiming to directly affect the nonresidential new construction market is the Code Compliance Support Initiative. This initiative provides training for code officials, distributors, architects/design engineers, contractors/builders, and green building consultants on specific aspects of the code (currently 2012 IECC); technical assistance through circuit rider visits and fielding of phone calls; code compliance tools; and marketing and outreach to market actors. The aim is to increase code compliance, but it is reasonable to expect some above-code effects, and possibly above-stretch-code effects, as depicted in Figure A-1. Note, however, that the regular commercial building code is based on IECC 2012, while the stretch code is based on IECC 2009 and ASHRAE 90.1-2007. There are Massachusetts stretch code amendments to IECC 2009 that make it more stringent, but given that the regular code is more recent than the stretch code, the two may not be all that different. Following are some of the main ways the program might affect the above-code practices in the market:

- Training and circuit riders increase market actors' knowledge about efficient technologies and practices, and some actors then use the knowledge to achieve above-code practices.
- Code compliance tools will allow designers and builders to communicate more effectively with plan reviewers and inspectors on how specific projects can comply with code, thus allowing them to see how to exceed code as well.
- Marketing and outreach increases awareness of energy-efficient design and construction, creating interest in above-code practices.

A.3.3 Upstream Programs

The PAs currently have upstream subprograms/initiatives for some types of lighting and HVAC. As described in the three-year plan, "The upstream model leverages existing distributor networks and infrastructure to influence thousands of customers and contractors,

cost-effectively accelerating the introduction and sale of more efficient equipment, helping to transform markets. This streamlined approach accelerates the adoption of more efficient technologies by removing or reducing the initial cost hurdle at the point of sale without the need for the end user to submit paperwork or rebate forms." Following are some of the main ways the program might affect the market:

- Some of the sales supported by the programs go to new construction projects.
- Incentives help increase availability and reduce prices.

These could help nonparticipants in the C&I New Construction Program meet or exceed some aspects of the code.

A.3.4 C&I Retrofit Program

The C&I Retrofit Program encompasses a broad array of subprograms and initiatives targeting such end uses as lighting and controls, motors and drives, HVAC, energy management systems, compressed air and other industrial processes, furnaces and boilers, steam opportunities (steam traps, boiler control upgrades, burners, boiler room optimization), combined heat and power, energy recovery ventilation units, and dehumidification and humidification. The program is explicitly aimed at existing buildings; new buildings cannot go through the program. Nonetheless, there are some possible sources of spillover onto new construction, including the following:

- Trade allies get experience that carries over to new construction.
- Customers' Retrofit Program experience influences their new construction projects.
- Availability of efficient equipment increases and prices decrease, which carries over to new construction.
- PA marketing leads to greater awareness of and interest in EE, including in new construction.

A.4 OTHER MEASUREMENTS OF NET SAVINGS

Identifying possible overlap in estimates of net savings in the nonresidential new construction market requires reviewing recent and planned studies. The studies we have considered are the *C&I Electric and Gas Net-to-Gross Studies,* the upcoming *C&I Gas Net-to-Gross Study,* the upcoming T8/T5, LED, and HVAC market effects studies*,* and the study that is currently underway to evaluate the Code Compliance Enhancement Initiative*.*

A.4.1 The C&I Electric Net-to-Gross Study and the C&I Gas Net-to-Gross Study

The *C&I Electric Net-to-Gross Study* and the *C&I Gas Net-to-Gross Study* survey participating end-use customers and participating vendors and design professionals. These studies estimate net-to-gross ratios based on the following for program-eligible C&I measures in the C&I New Construction Program and the C&I Retrofit Program:

- Free ridership
- In-program non-free ridership

- Inside like spillover
- Outside like spillover for both participating end-users and participating vendors/design professionals.[17]

The studies do *not* estimate savings for the following:

- Inside unlike spillover[18]
- Outside unlike spillover[19]
- Nonparticipant like spillover
- Nonparticipant unlike spillover
- Naturally occurring outside program—like
- Naturally occurring outside program—unlike.

The PAs apply these net-to-gross estimates to evaluated gross savings estimates from C&I impact studies, if available, and if not, to unevaluated program tracked savings.

Following are the measures covered by the *C&I Electric Net-to-Gross Study.*

Table A-2. Electric Measure Types by PA and Program

PA	Program	Measure Type
Cape Light Compact	C&I New Construction	HVAC
		Lighting
		Motors & Drives
		Process
		Refrigeration
	C&I Products and Services	HVAC
		Lighting
		Motors & Drives
	Government New Construction	HVAC
	Medium and Large C&I Retrofit	Building Envelope
		HVAC
		Lighting
		Motors & Drives

[17] The *C&I Electric Net-to-Gross Study* and the *C&I Gas Net-to-Gross Study* label outside like spillover from participating vendors/design professionals as nonparticipant spillover.
[18] Assessed qualitatively, but not quantified.
[19] Assessed qualitatively, but not quantified.

PA	Program	Measure Type
		Refrigeration
	Medium and Large Government Retrofit	HVAC
		Lighting
		Motors & Drives
		Refrigeration
	Small C&I Retrofit	Building Envelope
		Hot Water
		HVAC
		Lighting
		Motors & Drives
		Refrigeration
	Small Government Retrofit	Building Envelope
		HVAC
		Lighting
		Motors & Drives
		Refrigeration
National Grid	Design 2000plus	Compressed Air
		Custom
		Lighting
		Non-unitary HVAC
		Other
		Unitary HVAC
		VFD
	Energy Initiative	Custom
		HVAC
		Lighting
		VFD
		Total
	Small Business	Lighting
		Non-lighting
NSTAR	Direct Install	Hot Water
		HVAC
		Lighting

PA	Program	Measure Type
		Motors/Drives
		Process
		Refrigeration
	New Construction	Comprehensive
		Compressed Air
		HVAC
		Lighting
		Motors/Drives
		Process
		Refrigeration
	Retrofit	CHP
		Compressed Air
		HVAC
		Lighting
		Motors/Drives
		Process
		Refrigeration
Unitil	C&I Large Retrofit	Compressed Air
		HVAC
		Lighting
		Motors & Drives
		Process
	C&I New Construction	Compressed Air
		Process
	C&I Small Retrofit	Lighting
		Refrigeration
Western Massachusetts Electric	New Construction	Comprehensive
		Compressed Air
		HVAC
		Lighting
		Motors/Drives
		Process
		Refrigeration

PA	Program	Measure Type
	Retrofit	CHP
		Compressed Air
		HVAC
		Lighting
		Motors/Drives
		Process
		Refrigeration
	Small Business Energy Advantage	Hot Water
		HVAC
		Lighting
		Refrigeration

Following are the measures covered by the *C&I Gas Net-to-Gross Study.*

Table A-3. Natural Gas Measure Types by PA and Program

PA	Program	Measure Type
National Grid	New Construction Custom	Food Service, HVAC, Water Saving Measures
	Retrofit Custom	Insulation, Controls, HVAC, Other, Water Heating
	Small Business Direct Install	Controls, Water Heating, Water Saving Measures
	New Construction Prescriptive	Food Service, HVAC, Water Heating
	Retrofit Prescriptive	Controls, Water Saving Measures
NSTAR	Business Solutions	Controls, HVAC
	Construction Solutions	HVAC
	Small Business Solutions	Controls, Food Service, HVAC, Water Heating, Water Saving Measures
Columbia Gas	Small Custom	Insulation, Controls, HVAC, Other, Water Heating, Water Savings Measures
	Prescriptive	Controls, Food Service, HVAC, Other, Water Heating, Water Saving Measures
	Large Custom	Controls, HVAC, Other
Unitil	Custom	Insulation, Water Saving Measures
	Prescriptive	Controls, Food Service, HVAC, Water Heating, Water Saving Measures
Berkshire Gas	Custom	Insulation, Controls, HVAC, Other, Water Heating
	Prescriptive	Controls, Food Service, HVAC, Water Heating
New England Gas	Custom	Controls, Other
	Prescriptive	Controls, Food Service, HVAC, Water Heating, Water Saving Measures

We recommend that the upcoming Gas C&I Net-to-Gross study include questions to identify project type, and estimate net to gross separately for the new construction subsample. National Grid and NSTAR track electric new construction projects, and Unitil and Cape Light Compact can identify individual new construction projects if necessary. We therefore recommend going back to the recently completed Electric C&I Net-to-Gross study to identify all true new construction projects, and estimating net to gross separately for that subsample. The new construction net-of-free ridership savings estimates from the Gas and Electric C&I Net-to-Gross studies could then be subtracted from the non-residential new construction market effects savings estimate. New construction spillover estimates from the net-to-gross studies could be subtracted either from the net-to-gross studies' savings estimates or from the non-residential new construction market effects savings estimate.

The C&I Retrofit Program provides incentives only for existing buildings, not new buildings, so for a nonresidential new construction market effects study it would not be necessary to take into account C&I Retrofit Program estimates of free ridership, in-program non-free ridership,

or inside like spillover. However, the C&I Retrofit Net-to-Gross Study survey questions on outside like spillover do not differentiate existing buildings from new construction, so it is not possible simply to subtract their estimates of outside like spillover from a market-level market effects estimate. We recommend incorporating questions to make this differentiation in future net-to-gross studies, including the upcoming gas net-to-gross study. Meanwhile, we suggest ignoring electric outside spillover from the Retrofit Program in the upcoming new construction market effects study; it is likely to be small anyway. Outside spillover gas savings from the C&I Retrofit program could either be subtracted from the gas net-to-gross study or from the 2016 non-residential new construction market effects study. Both electric and gas outside spillover from the C&I Retrofit program should be accounted for in later net-to-gross studies, and can be taken into account in the 2019 non-residential new construction market effects study.

A.4.2 Lighting and HVAC Market Effects Studies

There is a T8/T5 retrospective market effects study in the planning stages.[20] This study is only one to cover the upstream subprograms/initiatives, but it will cover more than that—it will cover any program or initiative involved in the T8/T5 market. It will estimate savings at the market level, which would include the effects of all these programs and initiatives.[21] Of course, it will focus on a specific technology, so it will estimate only like spillover (all types), not unlike spillover. In particular, this study will estimate net savings based on the following factors for T8s/T5s:

- Free ridership
- In-program non-free ridership
- Inside like spillover
- Outside like spillover
- Nonparticipant like spillover
- Naturally occurring outside program—like.

The study will not estimate the following:

- Inside unlike spillover
- Outside unlike spillover
- Nonparticipant unlike spillover
- Naturally occurring outside program—unlike.

[20] The PAs are also conducting an LED market effects study and are planning an HVAC market effects study and a lighting controls study, but they are prospective and so will not produce net savings estimates. However, it is important that they differentiate true new construction from other projects so that later studies can produce new construction-only technology-specific net savings estimates, which can then be accounted for in the 2019 new construction market effects study.

[21] There is an upstream lighting program and an upstream HVAC program, but the only net savings estimate associated with those programs that needs to be taken into account in the 2016 new construction market effects study are from T8s/T5s.

Technology-specific markets overlap the new construction and retrofit markets (as shown in Figure A-2). In the planned T8/T5 market effects study, we recommend splitting out a new construction-only net savings estimate from the broader estimate of market-level T8/T5 net savings attributable to the subprograms/initiatives. The evaluators leading this study could consider following the approach taken in the already complete high-bay lighting study market effects study, which estimated market size based in part on total square footage of commercial and industrial facilities in Massachusetts associated with high-bay lighting purchases. We recommend that the upcoming T8/T5 study also estimate the percentage of that square footage represented by new construction in a given year, then apply that percentage to the total T8/T5 market effects savings estimate to derive a new construction-only estimate—possibly a range of high, medium, and low. We then recommend subtracting this new construction-only savings estimates for T8s/T5s from the total market-level savings estimate for nonresidential new construction, or alternative subtracting it from the overall T8/T5 market effects savings estimate. We recommend that the T8/T5 market effects study cover the January 1, 2012 to June 30, 2014 period, or at least provide separate estimates for this period.

There are prospective market effects studies currently underway or in the planning stages for LEDs, lighting controls, and HVAC. Assuming that follow-up retrospective studies are completed by 2018, then the 2019 new construction market effects study could take savings estimates from these studies into account.

Figure A-2. Overlap of Markets

A.4.3 Code Compliance Support Study

As mentioned earlier, the Code Compliance Support Initiative has three main components: training, technical assistance, and code compliance tools. It also involves marketing and outreach. (The effects expected from these efforts do not easily translate into inside like spillover, nonparticipant unlike spillover, etc.) The CCSI evaluation is assessing the training component by (1) tracking the number of trainings by type and location and the number of trainees by category and job titles/descriptions, (2) conducting immediate surveys after training to assess what the trainees learned and what they expect to apply, and (3) conducting follow-up interviews to see what the trainees recall and what they have actually applied in practice. The CCSI evaluation is assessing the technical assistance component in a similar manner. That is, they are (1) ensuring that the appropriate data are collected, (2) conducting immediate surveys of those calling for technical assistance or receiving circuit rider visits, and (3) conducting follow-up interviews with those calling for technical assistance

or receiving circuit rider visits. The expectation is that these efforts will provide indicators of the effect of the CCSI on the market. (The code compliance tools have not yet been developed, so the CCSI evaluation does not yet address that component.)

In order to estimate net savings attributable to CCSI, the CCSI evaluation plan calls for multiple baseline studies assessing compliance at different points in two or more code cycles, followed by a Delphi study to identify the changes in construction practices that are attributable to CCSI and to other influences.

A.4.4 Overlap of Studies

Again, it is important to account for the various estimates of net savings that would overlap with the non-residential new construction market effects study and to account for those overlaps; a component of savings may be *measured* more than once, but it should be *counted* only once. Figure A-3 shows these overlaps from one perspective, and Table A-4 shows them from another. Insofar as two studies produce estimates of savings for a category of net savings, then the overlap should be subtracted from one of the studies. The non-residential new construction market effects study will estimate naturally occurring savings as a single lump sum, without differentiating outside program savings and within-program savings. No naturally occurring savings estimates (pink in Figure A-3, the bottom several lines in Table A-4) need to be subtracted from either the non-residential new construction market effects estimate, or from estimates produced by other studies. The net-of-free ridership estimate from the new construction portion of the net-to-gross studies, however, should be subtracted from the non-residential new construction market effects estimate; in Figure A-3, this is depicted by the blue part of the circle entitled “New Construction Within-Program Savings,” and in Table A-4 it is “Inside Program Non-Free Ridership” minus “Free Ridership.”

Overlapping spillover estimates include the following (light blue circle in Figure A-3; anything with the word “spillover” in Table A-4):

- Inside like spillover from the C&I New Construction Program
- Outside like spillover from the C&I New Construction Program
- Outside like spillover from the Retrofit Program
- Technology-specific market effects (various types of undifferentiated spillover) focusing primarily but not exclusively on upstream programs. The only such study that would have to be accounted for in the 2016 non-residential new construction market effects study is the T8/T5 market effects study; the 2019 non-residential new construction market effects study would have to take into account the LED market effects study, the lighting controls market effects study, and the HVAC market effects study.

These overlapping spillover estimates can be subtracted either from the non-residential new construction market effects study or from the other studies.

Figure A-3. Savings Categories and Coverage by Existing and Planned Studies—First View

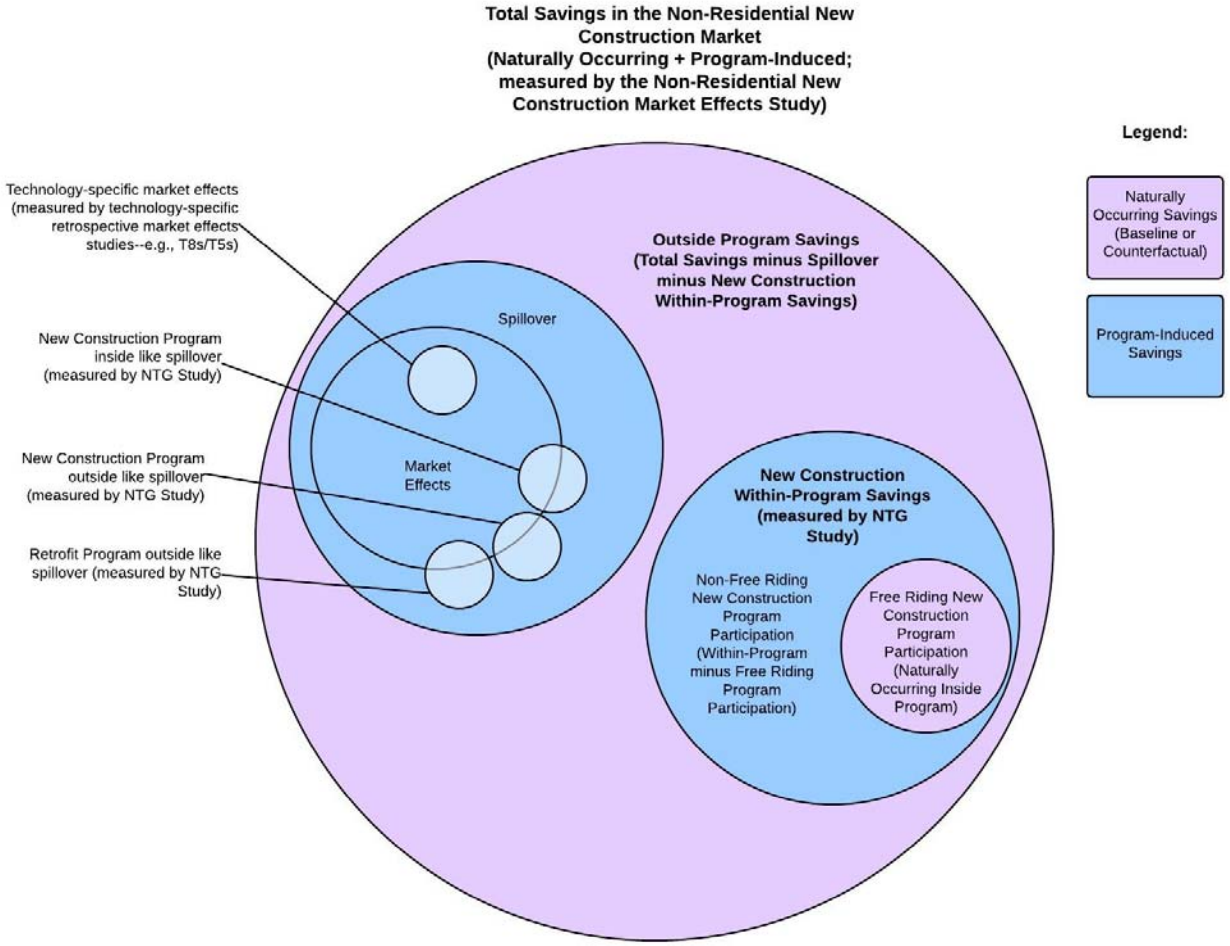


Table A-4. Savings Categories and Coverage by Existing and Planned Studies—Second View

Programs Covered	C&I New Construction	Retrofit	Upstream, C&I New Construction, and Retrofit	C&I New Construction, CCSI, Retrofit, and Upstream
Net Savings Studies	**Measured by NTG Studies**	**Measured by NTG Studies**	**Measured by T8/T5 Market Effects Study**	**Measured by Non-residential New Construction Market Effects Study**
Savings Not Attributable to Program(s)—Baseline or Counterfactual				
Naturally Occurring Outside Program—Unlike				•
Naturally Occurring Outside Program—Like			•	
Free Ridership (Naturally Occurring Inside Program)	•			
Savings Attributable to Program(s)				
Inside Program Non-Free Ridership	•		•	•
Inside Like Spillover	•			
Outside Like Spillover	•	•		
Nonparticipant Like Spillover				
Outside Unlike Spillover				
Inside Unlike Spillover				
Nonparticipant Unlike Spillover				
Whole-building Spillover				

A.5 OVERVIEW OF PRELIMINARY APPROACH TO ESTIMATING NET SAVINGS

Estimating the net savings attributable to the C&I New Construction Program and other PA Programs would be a straightforward (if not easy) add-on to the CCSI evaluation—and in fact the CCSI Evaluation Plan calls for such an approach. It would be possible to model the without-PA program counterfactual as identified by the Delphi panel using the baseline data and compare them to the as-built models to estimate net savings, similar to the approach taken in the Residential New Construction Net Impacts Study (http://ma-eeac.org/wordpress/wp-content/uploads/Residential-New-Construction-Net-Impacts-Report-1-27-14.pdf). We recommend having the Delphi panel estimate counterfactuals for below-code practices and above-code practices, and to attribute the savings associated with getting buildings closer to code due to the CCSI, and the savings associated with getting buildings above code due to the C&I New Construction Program and other PA programs.

The CCSI evaluation plan calls for relying on the 2012 *Code Compliance Baseline Study,*[22] two additional baseline studies to be conducted in 2015 and early 2018, and the Delphi component to be conducted in late 2018 or 2019. This schedule is suggested because the CCSI has only recently started and will likely not affect any completed buildings for a few years.

Therefore, a retrospective non-residential new construction market effects study conducted in the meantime, focusing on January 1, 2012 through June 30, 2014 (as the new code was implemented on July 1, 2014), would not have to take savings from CCSI into account. We suggest conducting a retrospective study soon after the 2015 baseline study is completed. We recommend convening a Delphi panel to review changes in construction practices between the 2012 and 2015 baseline studies, along with other evidence such as changes in codes, the PAs' new construction-related activities, past trainings provided by the PAs, Department of Energy Resources (DOER) activities, activities of the Massachusetts chapter of the US Green Building Council, other factors, and naturally occurring market adoption (NOMAD). Again, the evaluators would model the without-PA program counterfactual as identified by the Delphi panel using the 2015 baseline data and compare them to the as-built models to estimate net savings, including both above-code savings and savings from getting buildings closer to code. The baseline would be either code or prevailing practice, whichever is better for a particular technology or building practice.

None of the gas PAs can identify true new construction projects going through their programs. As mentioned earlier, we recommend that the PAs begin tracking projects by project type so that new construction can be differentiated. Meanwhile, we also recommend that the upcoming Gas C&I Net-to-Gross study include questions to identify project type, and estimate net to gross separately for the new construction subsample. National Grid and NSTAR do track electric new construction projects, and Unitil and Cape Light Compact can identify individual new construction projects if necessary. We therefore recommend going back to the recently completed Electric C&I Net-to-Gross study to identify all true new construction projects, and estimating net to gross separately for that subsample. The new construction net-of-free ridership savings estimates from the Gas and Electric C&I Net-to-Gross studies could then be subtracted from the non-residential new construction market effects savings estimate. New construction spillover estimates from the net-to-gross studies could be subtracted either from the net-to-gross studies' savings estimates or from the non-residential new construction market effects savings estimate.

While there may be some outside spillover from the Retrofit program, the recently completed electric net-to-gross study did not differentiate outside spillover in new construction from outside spillover in retrofit. We recommend incorporating questions to make this differentiation in future net-to-gross studies, including the upcoming gas net-to-gross study. Meanwhile, we suggest ignoring electric outside spillover from the Retrofit program in the upcoming new construction market effects study; it is likely to be small anyway. Outside spillover gas savings from the C&I Retrofit program could either be subtracted from the gas net-to-gross study or from the 2016 non-residential new construction market effects study. Both electric and gas outside spillover from the C&I Retrofit program should be estimated in later net-to-gross studies, and they can be taken into account in the 2019 non-residential new construction market effects study. While the net-to-gross studies cover just a single year, we

[22] http://ma-eeac.org/wordpress/wp-content/uploads/Code-Compliance-Baseline-Study.pdf.

recommend applying their savings estimates over the entire period covered by the non-residential new construction market effects study.

For the retrospective T8/T5 market effects study that is being planned, we recommend splitting out low, medium and high new construction-only net savings estimates from the broader estimate of market-level T8/T5 net savings attributable to the subprograms/initiatives. This T8/T5 new construction-only estimate may be subtracted from the non-residential new construction market effects net savings estimate, or alternatively from the broader T8/T5 market effects savings estimate. We also recommend that the estimates cover the January 1, 2012 to June 30, 2014 period, or possibly separate out estimates for that period.

Finally, we assume that the other aspects of the retrospective non-residential new construction market effects study, such as market sizing and theory-based evaluation, will be developed in the evaluation planning process.