

# Multi-family Program Overview

# DRAFT

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# EXECUTIVE SUMMARY

## Introduction

Multi-family buildings have been a topic of interest to the Massachusetts Energy Efficiency Advisory Council. As a result, the multi-family programs offered through Mass Save® have been studied through various evaluation research projects; however, the full picture of how these buildings are served is not well understood. There are complexities inherent to this market segment, which includes a broad range of building types, customers served, and split-incentive customer barriers. The original objective of this report was to provide an overview of the current status of the Mass Save multi-family energy efficiency initiatives. These initiatives include low income and market rate, new construction and retrofit, high rise and low rise, renters and condominiums and exist within both the Program Administrators' (PAs') Commercial and Industrial (C&I) and Residential Sector Programs. While assembling data to develop a program overview, the Consultants identified several issues related to data tracking and cost-benefit testing. These issues may be contributing to difficulty in terms of multi-family cost-benefit screening, program planning, implementation options, and measured impact. This report presents a description of the issues and recommended approaches to mitigate them, as well as a program overview.

## Summary of Massachusetts Multi-family Market and Energy Efficiency Programs

### HISTORY

The Massachusetts PAs have offered energy efficiency services to multi-family building owners at varying levels for the past three decades. Figure 1 highlights the evolution of Mass Save multi-family initiatives.

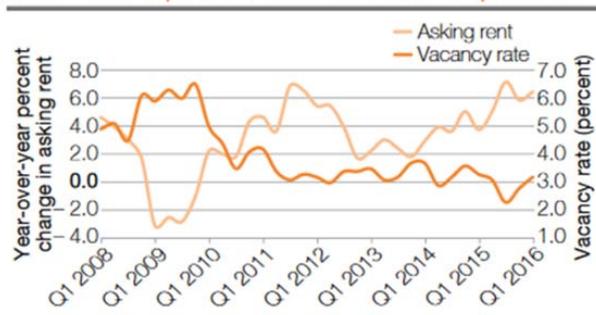
### MARKET AND SAVINGS OPPORTUNITY

While the energy savings opportunity from multi-family buildings may be relatively small compared to other sectors, the multi-family segment still remains an important piece of the overall energy efficiency and load management puzzle.

1990's- early 2000's	<ul style="list-style-type: none"> <li>• Electric DSM programs for retrofit and new construction</li> <li>• Delivery varied among PA's, some coordination of new construction via JMC</li> <li>• Fragmented approaches in retrofit, mostly prescriptive</li> <li>• Whole-building, performance based approaches introduced in retrofit</li> </ul>
2008-2009	<ul style="list-style-type: none"> <li>• Green Communities Act (GCA) Passed</li> <li>• Multi-family Working Group (MFWG) forms</li> <li>• Planning for first 3-year program cycle under GCA</li> </ul>
2010-2012	<ul style="list-style-type: none"> <li>• MF market potential, process evaluation, and program impact studies completed</li> <li>• Stakeholder workshop convened to develop multi-family strategy across all sectors</li> <li>• Delivery of gas programs integrated with electric programs</li> <li>• 5+ unit per site definition of MF adopted in retrofit</li> <li>• Alignment of market rate residential incentives started</li> <li>• Multi-family Market Integrator (MMI) introduced to coordinate market rate retrofit customers</li> </ul>
2013-2015	<ul style="list-style-type: none"> <li>• Consultants present and report to Council recommending integrating C&amp;I and Res MF retrofit</li> <li>• Energy Action Plan energy assessment report template for building owners introduced for market rate retrofit</li> <li>• LEAN completes statewide benchmarking of low income MF buildings</li> <li>• Further enhancement of MF initiatives recommended from 2016-18 planning stakeholder workshops</li> </ul>
2016-2018	<ul style="list-style-type: none"> <li>• Project Point of Contact (PPC) introduced for market rate MF retrofit</li> <li>• C&amp;I MF retrofit project tracking, budgets, and BCR's introduced</li> <li>• Performance-based MF High Rise New Construction model deployed</li> <li>• Introduction of new baseline (user defined reference home) for low rise new construction</li> <li>• New impact and process evaluation studies for market rate retrofit started</li> </ul>

Figure 1. Evolution of Mass Save Multi-family Initiatives

The apartment vacancy rate in the Boston area has been below 5 percent for 25 consecutive quarters.

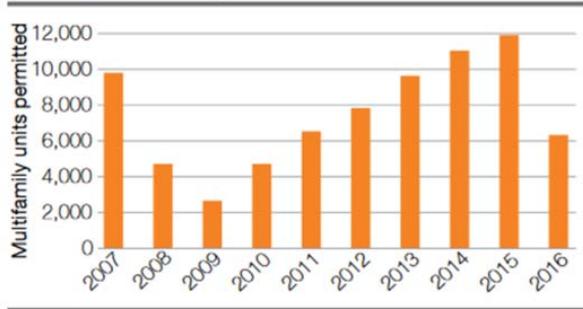


Source: MPF Research

Figure 2. Apartment Asking Rents and Vacancy Rates

Upon closer inspection, the relative impact of multi-family buildings on Massachusetts' residential energy consumption profile may be greater than previously thought. The Commonwealth is currently facing a multi-family housing capacity crisis. As seen in Figure 2, vacancy rates dropped to 2.6% in 2015 and rental and ownership costs are increasing. These factors are driving a rebound in new construction and multi-family housing starts while the affordability of living in existing apartments becomes increasingly challenging.

Since the first quarter of 2010, developers have responded to the tightening apartment market conditions in the Boston area by increasing production annually.



Note: Includes preliminary data from January 2016 through May 2016. Source: U.S. Census Bureau, Building Permits Survey

**Figure 3. Multi-family New Construction Permits for Metro Boston Region**

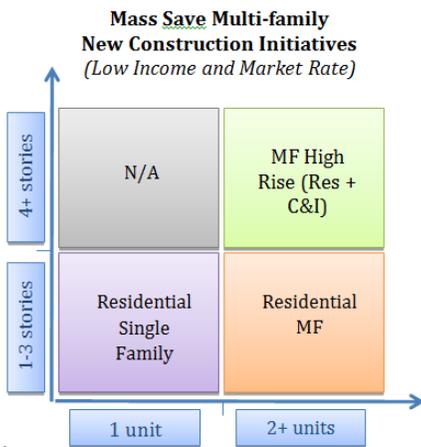
In the new construction market, the Massachusetts PAs can expect to see a healthy and growing market for new multi-family buildings over the next several years while single family new construction rebounds at a slower pace (see Figure 3).

Rising housing costs and limited mobility for apartment dwellers make the need for programs like Mass Save’s multi-family retrofit initiative all the more significant and timely for both market rate and affordable housing populations. In the low income market, the savings potential from improving these buildings alone is estimated to be 18.7 Million kWh and 2.3 Million therms of gas.

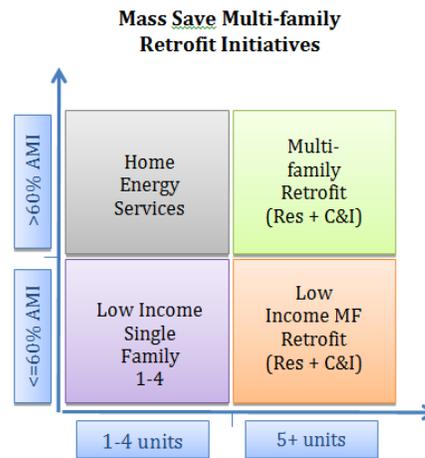
### Multi-family Initiative Profiles

As illustrated by the figures below, the multi-family initiatives offered within the Mass Save portfolio are delineated by building type (# of units and # of stories), occupancy type (low income or market rate), and sector (Commercially or Residentially metered accounts).

While the new construction initiatives are aligned primarily with the physical characteristics of the buildings, retrofit initiatives are primarily organized around the customer type in terms of income level and utility account type. The multifamily retrofit initiatives categorize by sector, building units, and customer income.



**Figure 4. Multi-family New Construction Initiatives**



**Figure 5. Multi-family Retrofit Initiatives**

The key characteristics of each of the multi-family initiatives offered in Massachusetts are described in Table 1 of the full paper.

### Multi-family Program Performance Indicators and Data Challenges

The Consultants attempted to establish a common set of multi-family program indicators to assess program performance. These indicators included estimated market targeted by the program as well as costs and savings accrued per building or dwelling unit. However, current practices for data collection and multi-family program activity tracking created challenges for assembling a list of common indicators. Challenges included inconsistencies between programs and incongruent data sets across sectors.

The difficulties the Consultant encountered obtaining segmented multi-family data suitable for analysis and associated recommended resolutions to these challenges are listed in below.

- **Challenge 1:** Lack of new construction planning and data tracking for multi-family building activity independent of other building types.
  - **Recommended resolution:** Develop a system to flag and track multi-family projects in the new construction programs for both C&I and Residential.
- **Challenge 2:** Limited Participant tracking and inconsistent participant definitions.
  - **Recommended resolution:** Review current PA participant counting practices for possible inconsistencies. Provide unique site identifiers to enable services tracking at the facility level that can be correlated to buildings and dwelling units across sectors.
- **Challenge 3:** BCR models and initiative level Total Resource Cost test do not accurately represent the multi-family market opportunity.
  - **Recommended resolution:** Review existing BCR inputs and consider alternative approaches for determining cost-effectiveness.
- **Challenge 4:** Recent draft impact evaluation results for multi-family market rate retrofit show low electric realization rates and broad precision ranges for electric and gas.
  - **Recommended resolution:** Conduct additional review to determine the cause(s) of low realization rates for electric savings and broad realization rate precision bands for both electric and gas in market rate multi-family retrofit.
- **Challenge 5:** BCR calculations for several PAs included negative participant costs in the market rate retrofit plan for 2016-2018.
  - **Recommended resolution:** PAs assess further and implement a solution that eliminates negative participant costs.

In addition to the recommendations described above, the Consultants provided recommendations for continued enhancements to the existing multifamily-retrofit initiative in a February 2016 report. For additional information, see: <http://ma-eeac.org/wordpress/wp-content/uploads/MA-EEAC-Consultant-Team-Multifamily-Retrofit-Report.pdf>.

## Summary and Next Steps

The PAs have made strong progress in improving and evolving their multi-family program efforts, but opportunities and challenges remain. As the Consultants began to compile basic information about the multi-family programs in Massachusetts, it became apparent that improvements in data collection and management are needed to provide an accurate picture of the various programs and their performance. The Consultants have also identified two priority areas for near-term focus that are needed to secure a strong future for multi-family retrofit efforts.

1. The PAs should develop basic performance indicators for all multi-family initiatives. Multi-family program data should be collected and managed in a way that allows for accurate tracking and assessment of these indicators.
2. Ongoing efforts to understand cost-effectiveness challenges should be a collaborative effort between the Consultants and PAs. This effort should include a bigger picture assessment of alternative program designs and approaches to measuring cost-effectiveness as well as additional program expansion and enhancement opportunities.

## INTRODUCTION

Multi-family buildings have been a topic of interest to the Energy Efficiency Advisory Council. As a result, the multi-family programs offered through Mass Save<sup>®</sup> have been studied through various evaluation research projects; however, the full picture of how these buildings are served is not well understood. There are complexities inherent to this market segment, which includes a broad range of building types, customers served, and split-incentive customer barriers. The PAs' multi-family initiatives include low income and market rate, new construction and retrofit, high rise and low rise, renters and condominiums, and exist within both the PAs' Commercial and Industrial (C&I) and Residential Sector Programs.

In August 2014, the Consultant Team completed an overview of the existing market rate multi-family retrofit programs. This led to the development of a report to the Council in February 2015 describing recommendations for continued enhancements. Several of the Consultants' recommendations are being addressed by the PAs in the 2016-2018 Plan. In addition, the PAs recently launched the roll-out of a performance-based approach for high rise new construction. A Council recommendation for the 2016-18 planning cycle called for the PAs to more effectively leverage multi-family refinance events. As a result of this recommendation, PAs communicated with the low income financing community and developed a set of mutually agreed upon recommended actions. Meanwhile, a recent impact evaluation<sup>1</sup> of the electric and gas market rate multi-family retrofit initiatives identified extremely low realization rates (electric) with large uncertainty bands (gas and electric), calling into question the cost-effectiveness of specific initiatives within the current program design.

The Consultant Team has prepared the following overview report to achieve several goals: enhance our understanding of the full picture of multi-family program offerings, provide a basis for assessing the current state of multi-family program efforts, review progress of ongoing multi-family enhancement efforts, and prioritize potential new ones.

## SUMMARY OF MASSACHUSETTS MULTI-FAMILY MARKET AND ENERGY EFFICIENCY PROGRAMS

### History

The Massachusetts PAs have offered energy efficiency services to multi-family building owners at varying levels for the past three decades. This includes serving both market rate and low income customers for retrofit and new construction projects. Issues were raised in Council meetings concerning appropriate treatment of multi-unit sites and equitable delivery of Mass Save services to all residential customers. To address this issue, the PAs modified the program to identify all properties with 5 units or more per site as multi-family. The PAs also made efforts to align the incentives offered to multi-family residents with those offered to 1-4 unit residents.

These program changes introduced challenges as well as the intended benefits. First, the unit count by site rule promoted a more holistic and comprehensive treatment of many rental sites. However, it also categorized many more condominium sites as multi-family (for instance, townhouses) and created a new set of challenges for market rate programs<sup>2</sup> as it can be notoriously difficult to secure broad participation of individual unit owners. Second, realigning dwelling unit incentives with those offered to 1-4 unit customers provided an equitable solution for all residents. However, it also highlighted the difference in cost-effective incentive levels available serving the residential and commercial meters for multi-family buildings. The former is an issue that continues to be an on-going hardship on the market rate retrofit program in particular. Changes rolled out in the 2016 market rate multi-family retrofit initiative seek to mitigate the latter issue by generating a building specific blended incentive offer for each project challenges still remain in new construction.

**Figure 1 below** provides a timeline highlighting key events in the evolution of the multi-family programs offered in Massachusetts.

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<sup>1</sup> [DNV-GL, 2013 National Grid Multi-family Program Gas and Electric Impact Study](#) (October 2016)

<sup>2</sup> This definition of "multi-family" appears to be unique to the MA program. Census definitions (also used by RECS) include 5+ unit buildings (aligned with DOE's low income Weatherization Assistance Program definition), but distinguishes townhouses as "single family attached" and row-houses are considered single family unless they share roofs.



**Figure 1. Evolution of Mass Save Multi-family Initiatives**

During the 2010-2012 program cycle, the PAs selected a Multi-family Market Integrator through a competitive process. The role of the Integrator is to act as a statewide call center and clearinghouse to assist multi-family residents and owners participating in the market rate retrofit initiative. However, an ancillary benefit of the MMI's function has been to also assist in directing multi-family customers eligible for the low income and new construction initiatives to the appropriate program resources. Also, as a 2013-2015 program cycle performance metric, the Low-Income Energy Affordability Network (LEAN) recently completed an ambitious project to benchmark the energy consumption profiles of all low income multi-family buildings in the state. The results of the project can be used to triage buildings in the greatest need and deploy resources appropriately. In 2016, the PAs introduced a "Project Point of Contact" (PPC) delivery model, which improves the customer support system by giving multi-family building owners of a single contact person assigned to assist them throughout their retrofit project. As part of the C&I program, multi-family retrofit is also now being tracked with specific line items for costs and savings in the 2016-2018 plans and program reporting.

Evaluation studies have driven a fair amount of the Mass Save multi-family program evolution described above. These studies are summarized in Appendix A.

## Market and Savings Opportunity

In a multi-family market characterization and potential study conducted in 2011<sup>3,4</sup> Cadmus estimated the number of occupied multifamily households in MA to be 524,000, or approximately 20% of the Commonwealth's 2.5 million households. This estimate is based on data extracted from the 2010 American Communities Survey (ACS). The U.S. Energy Information Administration (EIA)<sup>5</sup> analysis of 2009 Residential Energy Consumption Survey (RECS) data confirms this figure. That analysis estimates that there are approximately 500,000 dwellings in 5+ unit buildings and another 100,000 dwellings in "single family attached" buildings, a subset of which would fall within Mass Save's definition of multi-family (i.e. 5+ units per site).

While the energy savings opportunity from multi-family buildings may be relatively small compared to other sectors, having neither the potential for very large impact projects like C&I nor the capacity for very large volumes of projects like single family residential, the multi-family segment still remains an important piece of the overall energy efficiency and load management puzzle. Upon closer inspection, the relative impact of multi-family buildings on Massachusetts' residential energy consumption profile may be greater than previously thought. Massachusetts is currently facing a multi-family housing capacity crisis. Vacancy rates dropped to 2.6% in 2015 and rental and ownership costs have increased (see **Figure 2**).

**The apartment vacancy rate in the Boston area has been below 5 percent for 25 consecutive quarters.**



**Figure 2. Apartment Asking Rents and Vacancy Rates<sup>6</sup>**

These factors are driving a rebound in new construction multi-family housing starts, which we can anticipate will support increased participation in both high rise and low rise new construction initiatives. Meanwhile, the need for multi-family energy efficiency retrofit services for both market rate and low income residents and owners is also on the rise as the affordability of living in existing apartments becomes increasingly challenging.

In addition to trends in multi-family buildings overall, markets within the multi-family sector present unique characteristics and opportunities. These markets are described below.

<sup>3</sup> Cadmus, Massachusetts Multifamily Market Characterization and Potential Study, 2012

<sup>4</sup> This is the most recent study available for characterizing the MA residential market. A new study to establish the baseline for multi-family high rise new construction is underway but still in the process of collecting field data.

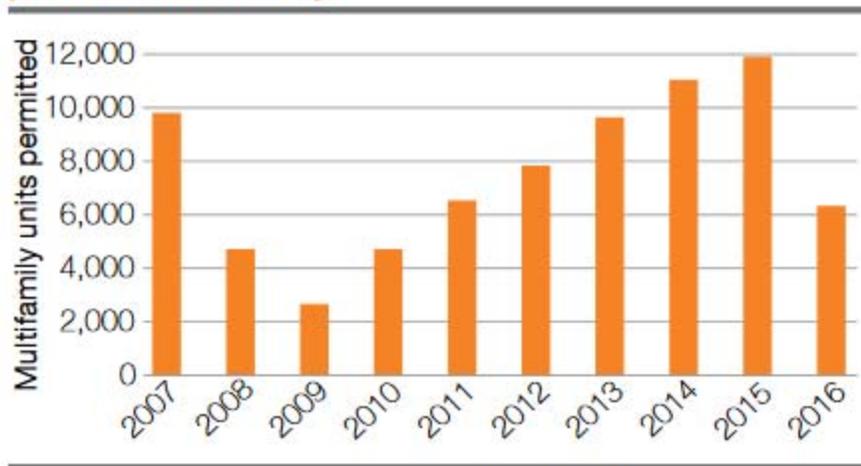
<sup>5</sup> 2009 Residential Energy Consumption Survey, U.S. Energy Information Administration

<sup>6</sup> HUD PD&R Housing Market Profiles, 2016 Northeast Region, U.S. Department of Housing and Urban Development, <https://www.huduser.gov/portal/periodicals/USHMC/reg/BostonMA-HMP-July16.pdf>

### NEW CONSTRUCTION MARKET

In 2014, the Metropolitan Area Planning Council estimated a need for 435,000 new housing units in the metro Boston region by 2040<sup>7</sup> to maintain the region's economic health. In 2012, Governor Patrick's administration set a goal targeting 10,000 new units of multi-family housing annually through 2020. New construction permits were issued for 11,925 new multi-family units in the Metro Boston region<sup>8,9</sup> (the highest since 1986), with 4,900 issued in the City of Boston alone (the highest since 1980). Therefore, the Commonwealth can expect to see a healthy and growing market for new multi-family buildings over the next several years while single family new construction rebounds at a slower pace (see **Figure 3**).

Since the first quarter of 2010, developers have responded to the tightening apartment market conditions in the Boston area by increasing production annually.



Note: Includes preliminary data from January 2016 through May 2016.  
Source: U.S. Census Bureau, Building Permits Survey

**Figure 3. Multi-family New Construction Permits for Metro Boston Region**

### RETROFIT MARKET

Apartment vacancy rates have been at near all-time lows in Massachusetts for more than five consecutive years (see **Figure 2**). As a result, the Commonwealth's apartment dwellers are faced with rising housing costs and limited mobility. This makes the need for programs like Mass Save's multi-family retrofit initiative all the more significant and timely for both market rate and affordable housing populations. While the new construction market is re-bounding, the existing apartment market will likely remain tight for the foreseeable future. Furthermore, in a tight rental market, the typical motivators for building owners to improve their buildings (reducing renter churn and turnover rates, reducing vacancy rates, commanding higher rents, market differentiation) are diminished or absent. As a result, it will be important to focus special attention on leveraging Mass Save's programs to incentivize and motivate building owners to action for many years to come.

### LOW INCOME MARKET

As previously mentioned, the PAs funded an energy performance benchmarking effort in 2013 for housing multi-family buildings statewide. Approximately 64%, or 11,265 of the 17,600 affordable housing buildings identified for this study were benchmarked. Notably, the benchmarking effort identified more than 1,600 (567 electric, and

<sup>7</sup> MAPC, "Population and Housing Demand Projections for Metro Boston", 2014; estimates include 164 municipalities in eastern Massachusetts

<sup>8</sup> For the Boston-Cambridge-Newton, MA-NH Metropolitan Statistical Area comprised of Essex, Middlesex, Norfolk, Plymouth, and Suffolk Counties in Massachusetts and Rockingham and Strafford Counties in New Hampshire.

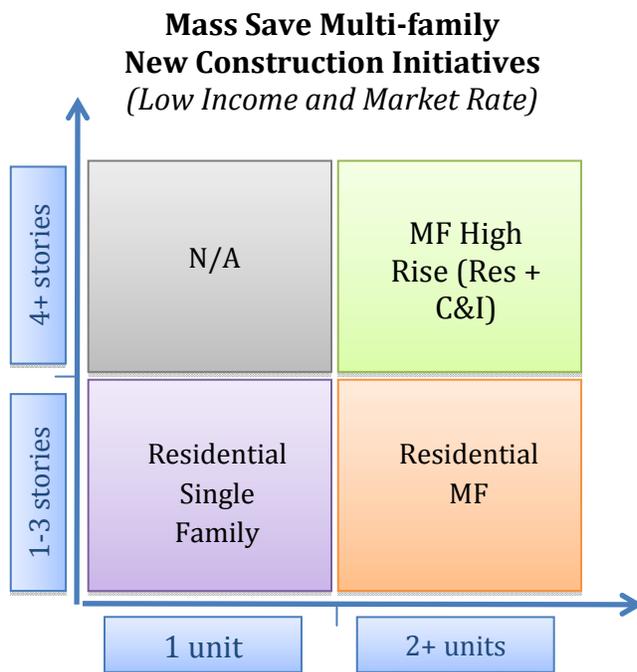
<sup>9</sup> HUD PD&R Housing Market Profiles, 2016 Northeast Region, U.S. Department of Housing and Urban Development, <https://www.huduser.gov/portal/periodicals/USHMC/req/BostonMA-HMP-July16.pdf>

1,101 gas) low income multi-family buildings in the state, across all PAs, that were performing in the bottom (least efficient) quartile. The study estimated the savings potential from improving these buildings alone to be 18.7 Million kWh and 2.3 Million therms of gas.

There are considerable complexities associated with managing and implementing energy efficiency projects for multi-family buildings. Additionally, customer equity considerations are driving a need to provide similar services to both single family home occupants and apartment dwellers. Therefore, this market segment merits special attention from the Mass Save program to ensure all cost-effective energy savings opportunities are being captured.

### MULTI-FAMILY INITIATIVE PROFILES

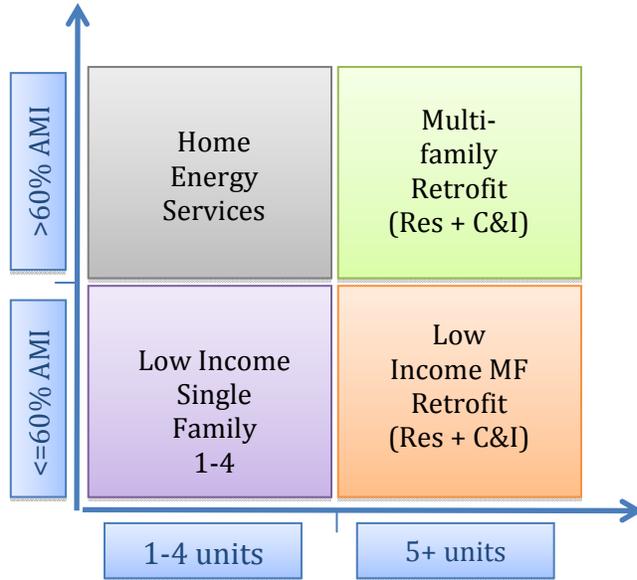
The multi-family initiatives offered within the Mass Save portfolio are delineated by building type (# of units and # of stories), occupancy type (low income or market rate), and sector (Commercial or Residential metered accounts). **Figure 4** illustrates how the multi-family new construction initiatives are categorized by sector and building characteristics for both low income and market rate occupants. Since single family buildings with more than 4 stories are extremely rare, they are not specifically called out in the program definitions. In new construction, any building with more than one unit is eligible for the multi-family program. This enables the program to provide appropriate technical services to address the special needs of buildings with attached dwelling units.



**Figure 4. Multi-family New Construction Initiatives**

While the new construction initiatives are aligned primarily with the physical characteristics of the buildings, retrofit initiatives are primarily organized around the customer type in terms of income level and utility account type. **Figure 5** illustrates the multifamily retrofit initiatives categorized by sector, building units, and customer income. Note that to be eligible for low income services, at least 50% of the building occupants must fall within the low income definition with household income less than or equal to 60% of the area median income (AMI).

## Mass Save Multi-family Retrofit Initiatives



**Figure 5. Multi-family Retrofit Initiatives**

Although the divisions within the retrofit model are programmatically expedient, given their alignment with program funding streams, the delineations may seem less rational to the occupants and owners of these buildings. In new construction, all attached dwellings are considered multi-family and the dividing line between high rise and low rise is the same as the cutoff between residential and commercial codes. From a developer’s perspective, it is standard practice that buildings over 3 stories will be subject to a different rule set compared with low rise buildings and the program structure mirrors that. Meanwhile, the retrofit initiatives are organized around utility-defined customer types, making it more challenging for a lay-person to understand what program offers are available for any given building or site. This construct creates a critical need for third-party program support to assist customers in knowing which rules and incentives apply to them (the MMI) and to facilitate the integration of whole building and cross-sector services (the PPC).

**Table 1** provides a set of profiles summarizing the key characteristics of each of the initiatives and associated offers available to multi-family building owners and residents in Massachusetts. To populate these tables, information was collected from existing program materials available to the public, descriptions provided in the 2016-18 statewide Plan, and supplemental information provided directly by the PAs. In general, the Multi-Family Market Integrator (MMI) serves as the primary clearinghouse for incoming requests for multi-family program services and connects customers with the appropriate program vendor.

**Table 1. Mass Save Multi-family Initiative Profiles**

Residential New Construction (includes low rise MF and all 1-4 unit buildings)	
<b>Target Market</b>	Residential new construction including single family and multi-family up to 3 stories. Includes market rate and low income housing.
<b>Incentive Offers</b> <sup>10</sup>	<p>Eligibility is determined based on meeting the requirements of a prescriptive path or achieving a performance path<sup>11</sup> threshold. The performance path offers tiered incentives for improvements of 15%, 30%, and 45% above baseline.<sup>12</sup> Depending on the # of units in the building and the tier achieved, builder incentives range from \$350-\$2,000 with an additional \$25 per unit adder for ENERGY STAR. Additional incentives up to \$900 are available to defray the costs of a home energy rater for the project and heating and cooling equipment rebates are also available.</p> <p>NOTE: THE PAS ARE CURRENTLY IN THE PROCESS OF REVIEWING AND MODIFYING THE RESIDENTIAL NEW CONSTRUCTION INCENTIVE STRUCTURE AS A RESULT OF CHANGES TO THE “USER DEFINED REFERENCE HOME” USED AS A BASELINE FOR THESE PROJECTS.</p>
<b>Delivery Model</b>	Home Energy Rater provides rating, design assistance, and performance testing with oversight of lead vendor.
<b>Key Features</b>	<p>Participation rates year over year can be difficult to predict as they are dependent on the construction markets and the timing of large projects.</p> <p>The new construction program offers ENERGY STAR® certification for buildings with fewer than 5 units. Planned enhancements for the 2016-18 program cycle include exploring home automation technologies, pay for savings incentive models and net zero energy ready home.</p>
High Rise MF New Construction	
<b>Target Market</b>	Residential new construction 4 stories and higher. Includes market rate and low income housing. This is a sub-category of the Residential New Construction initiative.
<b>Incentive Offers</b>	Blended incentives benefitting both commercial and residential metered accounts are determined using the modeled energy performance of the building compared to a user defined reference building <sup>13</sup> as described in the TRM. Incentives are determined based on a model that maps recommended measures to the correct sector and assigns pre-determined measure level dollar amounts per unit of savings (\$/kwh or \$/therm) and then combines those figures into a blended, packaged single offer for the customer. The possible range of incentives under this model is: \$0.25-\$0.34/kWh and \$1.75-\$3.15/Therm.
<b>Delivery Model</b>	Home Energy Rater provides rating, design assistance, and performance testing with oversight of lead vendor.
<b>Key Features</b>	Cross-cutting between Residential and Commercial sectors. Performance based program delivery model described above was introduced in January 2016.

<sup>10</sup> As a result of the new user defined reference home (UDRH) baseline for new construction, a new incentive structure is being developed to be effective July 1, 2017, including sun-setting of separate heating and cooling equipment rebates for new construction.

<sup>11</sup> A similar performance based offer is also available for single family new construction.

<sup>12</sup> Note that the baseline for measure eligibility screening in new construction is a user defined reference building as described in the TRM (not code).

<sup>13</sup> An evaluation study is currently underway to review and update the reference building specifications.

<b>MF Retrofit (Residential and C&amp;I)</b>	
<b>Target Market</b>	Residential existing buildings with 5+ units or sites and less than 50% low income occupancy. This includes condominiums and side-by-side attached units and some detached units in 5+ unit sites. This initiative was recently granted DPU approval to include services benefitting customers of delivered fuels.
<b>Incentive Offers</b>	Prescriptive incentives based on eligible measures list including free in unit lighting, air sealing, smart strips and programmable thermostats, and common area lighting fixtures. A 75% incentive is paid for eligible insulation work, hot water demand controllers, and outdoor reset boiler controls. Custom measures are available on a case-by-case basis and subject to cost effectiveness screening.
<b>Delivery Model</b>	Lead vendor or other PA-approved entity provides a project manager who acts as a single point of contact to the building owner from the initial assessment through the installation of improvements and final testing and verification. An Energy Action Plan is provided to the building owner based on energy assessment results including a proposed set of eligible improvement measures and the incentive available to the owner for that package of measures.
<b>Key Features</b>	Cross cutting between Residential and Commercial sectors. Single Project Point of Contact (PPC) model was newly introduced in April 2016. The initiative also encourages building owners to benchmark their energy consumption using EPA's Portfolio Manager.
<b>Low Income MF Retrofit</b>	
<b>Target Market</b>	Residential existing buildings with 5+ units in which at least 50% of the occupants are at or below 60% of the Area Mean Income (AMI).
<b>Incentive Offers</b>	Program pays 100% of the cost of the building assessment and installation of eligible measures. Gas projects must cost no more than \$15/therm saved and electric projects must have a 5-7 year payback.
<b>Delivery Model</b>	LEAN oversees the Low Income Multi-family Retrofit initiative. LEAN is an association of community action agencies providing energy efficiency and weatherization services. LEAN and PA-approved vendors provide assessments, technical assistance, measure installation and final testing and quality control verification. Building owners receive training for new equipment.
<b>Key Features</b>	LEAN's Multi-family Advisory Committee includes representatives from the utility, housing finance, community development, tenant and ownership communities who also assist with program outreach to their communities.  Statewide benchmarking of low income MF buildings completed in 2015 assists in identifying savings opportunities and prioritizing work.

When comparing the delivery models and incentive structures between new construction and retrofit projects, it is important to note that new construction enables a greater opportunity to develop and implement comprehensive packages of improvements to be incorporated into a single construction project. In retrofit, building owners generally select measures based on a myriad of factors including building access issues, integration with existing capital improvement plans, and budget constraints to name a few. As a result, installed retrofit packages are often less comprehensive than the full range of measures offered by the program and may also need to be staged over time to accommodate the building's specific needs.

### **Multi-family Program Performance Indicators**

As shown in **Table 2**, an attempt was made to establish a common set of multi-family program indicators to assess program performance. These indicators included the estimated market targeted by the program as well as costs and savings accrued per building or dwelling unit. Such indicators are intended to quantify the potential

program impact from the customer's perspective in something closer to layperson's terms than the normal regulatory reporting required of the PAs. Indicators provide additional insight to the value of these initiatives as perceived by building owners and residents, allow comparisons of results from different program designs, and support assessment of the equity of rate-payer funded services (e.g., how do the benefits apartment residents receive compare to those their single-family dwelling neighbors receive?) Given the various ownership structures included within the multi-family market, the ability to quantify program benefits per building and dwelling unit is of particular interest for retrofit. Being able to better quantify the impact of the program on a condo owner's household budget or a building owner's bottom line would strengthen the "pitch" when selling program services.

Current practices for data collection are aligned with utility meters to enable accounting of program expenditures and accrued benefits associated with existing utility rate categories. This is important as it provides an "apples to apples" assessment of the program's use of rate-payer funds within each contributing category. However, being limited to using these practices for accounting created challenges with assembling a list of common program indicators. These challenges included inconsistencies between programs (e.g. retrofit initiatives track multi-family projects independent of 1-4 unit projects while the new construction program does not) and incongruent data sets across sectors (e.g. "participants" tracked via C&I are by metered account and cannot be matched to Residential "participants" at the dwelling unit level.) As a result, there are many caveats and limitations associated with the data presented in Table 2. The data is also limited to the retrofit initiatives since multi-family activity is not easily segmented from other residential and C&I new construction. Additionally, due to the fact that participant counts are not directly associated with dwelling unit or building counts, it is currently not possible to estimate the historical market penetration of the Mass Save programs. These issues are more fully described below the table.

Table 2. Mass Save Multi-family Retrofit Initiative Performance Indicators, 2016-2018 Plan

		Overall Statewide		Average per Participant <sup>14</sup>	
		Res MF/ C&I MF Retrofit <sup>15</sup>	LI MF Retrofit	Res MF/ C&I MF Retrofit	LI MF Retrofit
Participation	Market Size (# units)	362,000 total statewide <sup>16</sup>	162,000 total statewide <sup>17</sup>	N/A	N/A
	Annual Participants	28,676/ 1,962	29,578	N/A	N/A
Annual Saving	Electricity Savings (MWh)	32,072/ 9,235	79,521	1.12/ 4.70	2.69
	Gas Savings (therms)	373,687/ 343,652	129,516	1.30/ 175.00	4.38
	All Fuel Savings (MMBtu)	78,502/ 74,796	226,912	6.20/ 38.10	20.9
Lifetime Savings	Electricity Savings (MWh)	323,845/ 85,853	648,821	11.30/ 43.80	21.9
	Gas Savings (therms)	6,091,609/ 5,593,692	2,571,320	21.20/ 2,850.00	86.9
	All Fuel Savings (MMBtu)	1,098,871/ 853,642	3,615,604	91.70/ 435.00	374
Costs	Program Cost	\$49,696,086/ \$103,067,784	\$125,645,928	\$1,733/ \$52,532	\$4,248
	Participant Cost	-\$2,114,147/ \$356,511,096	\$0	-\$74/ \$181,708	\$0
	Participant Incentives	\$36,909,543/ \$44,218,622	\$93,678,210	\$1,287/ \$16,931	\$3,167
BCRs	Electric	1.02/ 2.56	1.37	N/A	N/A
	Gas	1.89/ 1.45	2.00	N/A	N/A

### Data Analysis Challenges and Recommendations

In our effort to compile the performance indicators for **Table 2**, the Consultants encountered several difficulties obtaining segmented multi-family data suitable for analysis. As a result, we are not making any conclusions regarding the relative efficacy or impact of the individual initiatives at this time. The challenges we experienced are described in the following section, with accompanying recommendations to address them.

<sup>14</sup> “Participant” counts are tied directly to metered gas or electric utility accounts. For residential meters participants are closely related to dwelling unit counts, but for commercial meters they might represent part of a building, a whole building, or multiple buildings on a single site.  
<sup>15</sup> The C&I Program tracks “participants” by meter, which could represent an entire building or facility. There is currently no tracking in the C&I program by dwelling unit.  
<sup>16</sup> Cadmus, “Massachusetts Multi-family Market Characterization and Potential Study”, 2012  
<sup>17</sup> *ibid*

## **CHALLENGE 1: LACK OF NEW CONSTRUCTION PLANNING AND DATA TRACKING FOR MULTI-FAMILY BUILDING ACTIVITY INDEPENDENT OF OTHER BUILDING TYPES**

Current practice for new construction planning and data tracking does not capture multi-family building activity independent of other building types on either the C&I side or the Residential side. This makes it virtually impossible to assess the performance of the multi-family new construction segment on its own. As a result, multi-family new construction is not included in the performance summary presented in Table 2. The multi-family high rise new construction initiative represents the first time the residential programs have attempted a performance-based approach. Therefore, it will be particularly important to have this information to allow the PAs and interested stakeholders to capture any lessons learned from implementing that model to determine if it could be transferrable to the retrofit and/or 1-4 unit market.

- **Recommended resolution:** Develop a system to flag and track multi-family projects in the new construction programs for both C&I and Residential, similar to multi-family tracking initiated for retrofit in 2016.

## **CHALLENGE 2: LIMITED PARTICIPANT TRACKING AND INCONSISTENT PARTICIPANT DEFINITIONS**

Participant tracking in the market rate multi-family retrofit initiatives is currently determined only by meter or account. This makes it impossible to translate the impact of C&I funded improvements to individual dwelling units or buildings and makes comparisons between initiatives using the metrics presented in Table 2 difficult. More importantly, the programs may be missing opportunities to capture energy savings and benefits attributable to residents resulting from measures accrued to the C&I program and other potential interactive effects. It also confounds efforts to develop accurate TRC screening and stymies efforts to quantify the population impacted by these programs or to determine the level of benefit attributable to individual ratepayers.

Also, a comparison of savings per participant values derived from the 2013-2015 Term Year Report suggests that inconsistent definitions of “participant” may have been used by the PAs for both the Residential and Low Income Multifamily Initiatives. While one might expect some significant variation in savings depth (e.g., some PAs may be treating more electric heated dwellings), some of the observed values appear to fall outside of the range of reasonable savings per dwelling unit. As a result, efforts to benchmark and assess the performance of the Residential and Low Income Multifamily Initiatives in terms of participation and energy savings depth do not appear possible.

On-going and proposed evaluation work can help assess the potential remedies for these issues, including the Multi-family Program Research study and the potential to use 2017 Residential Customer Profile data as a means of benchmarking existing multi-family buildings based on their physical characteristics. Unique site identifiers would allow vendors and customers to easily access site level information and would simplify and streamline EM&V data access procedures. This was first recommended by the EM&V team in 2012. In the near term, an assessment is needed to determine if all tracking is currently consistent with the definitions included in the 2016-18 Plan. The Consultants and PAs have already begun discussions on this.

- **Recommended resolution:** Provide unique site identifiers within the PAs data systems to enable services tracking at the facility level that can be correlated to buildings and dwelling units across sectors. Review the Consultants’ depth of savings comparisons for the electric and gas Residential and Low Income Multi-family Initiatives. Each PA should then confirm how they are defining “participant” and that the definitions are consistent with those in Appendix P in the Three-Year Plan. If the definitions are not consistent with those in the Plan, the PA should describe how they will revise the definition accordingly and the timeframe in which they will do so. It is expected that all 2016 Residential and Low Income Multi-family Initiative reporting will be done consistent with the participant definitions in the Plan.

## **CHALLENGE 3: BCR MODELS AND INITIATIVE LEVEL TOTAL RESOURCE COST TEST DO NOT ACCURATELY REPRESENT THE MULTI-FAMILY MARKET OPPORTUNITY**

Benefit cost ratios in multi-family market rate retrofits are marginally cost-effective under the current rule set. However, the current BCR models and initiative level Total Resource Cost (TRC) test required by the DPU do not

accurately represent the opportunity presented by this cross-sector market segment when taken in total. Building physics do not distinguish by meter type, and many potential multi-family improvement measures will produce benefits that are interactive and can impact both the commercially and residentially metered energy consumption. Tracking costs and savings by fuel and sector (i.e., meter type) is a necessary accounting exercise to align program efforts with rate-payer funding streams. However, disaggregating the benefits this way is not representative of the actual overall impact, nor is it indicative of the true costs and benefits the customer will experience. For this reason, it would be preferable, and more meaningful for planning and evaluation, to develop a blended BCR which assesses the performance of the multi-family retrofit initiative encompassing both the residential and commercial sides for costs and savings. Such an approach to the initiative level screening would not only provide a more realistic perspective on the BCRs, but might also enable greater flexibility in the determination of eligible measures and measure packages, resulting in improved capacity to generate cost-effective, building specific, custom offers. Additionally, the continued segregation of HVAC program planning and results tracking from whole building initiatives remains problematic for being able to capture the full value of whole building initiatives.

→ **Recommended resolution:** Review existing BCR inputs and consider alternative approaches for determining cost-effectiveness. Alternative approaches of determining cost-effectiveness and assessing program performance to consider include:

- Recognizing costs and savings accruing to both the C&I sector and the Residential sector using a BCR model that includes both sectors. This blended BCR could be used for program planning and overall impact assessment in a more meaningful way than the accounting by sector that is currently required.
- Recognize costs and savings for all programs interacting with the building, including HVAC and behavioral.
- Develop an alternative sector-blind multi-fuel metric that encompasses whole building impacts to more accurately demonstrate the value of the services provided to multi-family buildings.

A special work group should be formed to explore potential options and the projected impact as well as the process for DPU approval and whether it might be appropriate to pursue as part of a pilot for 2017-2018.

#### **CHALLENGE 4: RECENT IMPACT EVALUATION RESULTS FOR MULTI-FAMILY MARKET RATE RETROFIT SHOW LOW ELECTRIC REALIZATION RATES AND BROAD PRECISION RANGES FOR ELECTRIC AND GAS**

Realization rates from the most recent draft impact evaluation for multi-family market rate retrofit are extremely low when evaluated for electric only (24% electric realization rate compared to 87% for gas based on a current draft study) and the precision ranges for both electric and gas realization rates are profoundly broad (+/-49% for electric and +/-64% for gas). Given the rigor applied to the data selection including only those facilities with complete data and a period of 1-year or less for measure installation, it is not clear what is causing such low statistical precision. One possible explanation is that the low analytical precision is simply indicative of a very wide range of results achieved over the sample set of projects analyzed.<sup>18</sup> This would imply that the actual results achieved through the multi-family retrofit effort are widely variable and inconsistent from project to project. For planning purposes in the 2016-18 program cycle and until better data is available, the PAs have adopted a placeholder 60% realization rate for the market rate multi-family retrofit initiative. This value is based on previously evaluated low income multi-family retrofit data.

→ **Recommended resolution:** Conduct additional review to determine the root cause(s) associated with low realization rates for electric savings and broad precision bands associated with the realization rate analysis for both electric and gas in market rate multi-family retrofit. The

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<sup>18</sup> There are other possible reasons for low realization rates and low precision. The billing analysis may not yet be able to match measures claim by unit to the correct account; and thus not correctly accounting for savings. Other possibilities are that hours of use and or delta watts are lower than assumed, that many retrofits are being done in coordination with renovation while units are unoccupied; and/or that some units treated are not occupied 12 months of the year.

Evaluation Team is currently conducting ride-alongs and interviews to try to explain the low realization rate. The PAs are also more rigorously tracking all measures so that data will pin point unit number, location, and remove lamp wattage, something that was not in place for data studied in the impact evaluation. Additional possible areas to pursue include:

- Mining existing data on a measure level to determine if some measures under-perform others in practice that are not accurately reflected in current BCR calculations.
- Reviewing analysis on a building/site/project level to determine if there are trends in observed performance by common factors such as region, PA, vendor, measure type, building or facility type, etc.
- Consider tightening rules and procedures for in-field measure eligibility, installation practices, and data capture to better ensure projected savings are realized (e.g. responding to anecdotal reports of replacing CFLs with LEDs).
- Considering alternative program designs, including performance based approaches that hold vendors and/or building owners accountable for achieving projected results (e.g., some programs offer performance based kicker incentives if savings are validated by consumption data one year post-installation).

#### **CHALLENGE 5: BCR CALCULATIONS FOR SEVERAL PAS INCLUDED NEGATIVE PARTICIPANT COSTS IN THE MARKET RATE RETROFIT PLAN FOR 2016-2018**

Negative participant costs occur when a low Net-to-Gross (NTG) factor is applied to the BCR and the incentives are higher than the adjusted incremental measure cost. This gives the appearance that the program is not only giving measures away, but paying participants to take them. The PAs doing this (National Grid electric and gas, Eversource electric and gas, and Columbia Gas) are not actually paying participants to accept energy savings measures, as these figures might suggest if taken literally. However, the accounting practices used to apply net-to-gross (NTG) factors lead us to these planning figures. In reality, it is most likely a signal that the measures are reaching a point of market transformation and/or the incentive levels are set too high for the current market conditions. The Consultants have expressed concern to the PAs that a negative participant cost generated by this calculus could be an indicator that incentive levels may be too high. Also, upon reviewing the cost and benefit data and BCR inputs, additional questions arose regarding the cost assumptions and NTG factors used for lighting measures as noted below.

- **Recommended resolution:** PAs assess further and implement a solution that eliminates negative participant costs. This should include a re-assessment of eligible measures and incentive levels to inform potential modifications to incentive structures:
- Review eligible measures with high free-ridership to determine if they should continue to be offered, including identification of secondary benefits that might justify continuing these offers.
  - Review incentive levels for measures with negative participant costs to determine if adjustments are needed.
  - Review lighting costs and incentive levels in BCR models to determine if cost discrepancies between single family lighting and multi-family lighting are accurate and justified.
  - Review NTG assumptions for light fixtures. For example, the current TRM carries the same NTG factor of 0.82 for multi-family lighting fixtures and bulbs, but it seems unlikely that there are as many free riders for fixtures as there are for bulbs in multi-family buildings.

#### **Continuous Improvement Opportunities**

Although the primary purpose of this study was to provide an overview of the current multi-family programs in Massachusetts, it is one piece of the on-going and future work related to this market. As previously mentioned, the Consultants completed a report in February 2015 reviewing the existing multi-family retrofit initiative and

provided recommendations for continued enhancements. While several of those recommendations are being implemented in the 2016-2018 plan period, several remain unaddressed and merit further consideration as the PAs work to address cost-effectiveness challenges for this segment and capitalize on remaining opportunities. Challenges listed above that are related to these efforts are listed numerically in parentheses following each item. See <http://ma-eeac.org/wordpress/wp-content/uploads/MA-EEAC-Consultant-Team-Multifamily-Retrofit-Report.pdf> for additional information.

- Leverage in-unit measures to overcome the “split incentive” problem and motivate building owners to invest in whole building improvements. (3,5)
- Continue efforts to mitigate the dichotomy between the incentive structures and levels available to residential meters and commercial meters for this market segment (A blended BCR might help resolve this issue). (1,3,5)
- Provide opportunities to obtain escalating incentives for greater achievement of savings possibly including provisions for a performance based offer such as that available for low rise new construction. (4,5)
- Supplement or modify the existing Energy Action Plan report to be more customer-oriented and less program-centric by providing an executive summary that includes a cost benefit analysis from the customer’s perspective. (4,5)
- Enhance efforts to engage building operators in saving energy for their buildings by including low cost and no cost measures operations and maintenance measures in Energy Action Plans that building owners and managers can implement immediately. Offer a building operator training that is specific to multifamily building managers and staff that covers the specific issues they are faced with instead of combining them with commercial buildings which function significantly differently from residential buildings. (4)
- Incorporate the use of energy benchmarking for multi-family buildings to assist in program lead triage, marketing and outreach, to support the sales process, and enable building operators to better manage their energy resources over time. (3,4)

## MULTI-FAMILY MARKET CONSIDERATIONS LOOKING FORWARD

### Special Considerations for the Low Income Market

Massachusetts’ low income multi-family retrofit program is widely regarded as an exemplary program for many reasons including its comprehensive “one stop shop” approach for building owners and innovations such as the recently completed benchmarking effort. While it is beyond the scope of this document to fully assess the delivery of the low income multi-family program, there are a few special situations that merit consideration for further review and assessment. Some questions for consideration follow:

- **Capacity and Pipeline** – Are the current budgets and infrastructure sufficient to meet current demand for services, particularly given the tight rental housing market described earlier in this document? In recent years low income customers in Boston may have received electric-related services immediately but experienced wait times of up to a year for gas related services due to budgetary constraints. Gas budgets have been increased for 2016-2018, and program activity should be monitored to assess whether the increase is sufficient to keep up with demand.
- **On-going use of Benchmarking Data** – In follow-up to the 2013 benchmarking study, the Low Income Multi-family program initially used this data effectively to prioritize the buildings with the greatest energy savings potential. Building owners have responded positively to being able to track their improved performance after completing retrofits through the program. How can this data continue to be used over the longer term? What aspects of the benchmarking approach might be transferrable to the market rate multi-family segment?

## Opportunities for Further Development

As the multi-family market is a continued area of interest for the Council, there remain opportunities to pursue additional energy-related interventions in multi-family buildings. For example, combining energy efficiency and renewable energy (on site generation) improvement packages could increase the short and long-term value proposition to multi-family customers. Such combined efforts could increase participation rates and contribute to meeting the state's climate change goals at the same time. Additionally, as the PAs explore options for demand response over the coming years, the multi-family market represents an opportunity to both reduce peak load and manage the load curve, particularly in buildings with air conditioning and/or electric heat or hot water. As the programs continue to evolve and planning for the next three-year cycle begins, it will be worth exploring these issues in greater detail for the multi-family market segment.

## SUMMARY AND NEXT STEPS

When this research project was originally conceived, the Consultants felt it was important to allow the new multi-family program enhancements and designs some time to germinate in the market before implementing additional changes that may prove disruptive or confusing. However, as we began the work to compile basic information about the program it became apparent that improvements in data collection and management are needed to provide an accurate picture of the various programs and their performance. We have recommended specific steps above to address these challenges.

We have also identified focus areas that are needed to secure a strong future for multi-family retrofit efforts in particular. Multi-family performance indicators such as participation rates, close rates (proposed vs. contracted measures), program costs, cost to participate, depth of savings, and project cycle times would support ongoing review and assessment by the Council and other stakeholders. In addition, EM&V work has indicated to the Consultants that the very existence of the electric multi-family retrofit is in jeopardy due to cost-effectiveness challenges that may or may not be reflective of the actual benefit to rate-payers. These challenges are not likely to be solved by incremental changes. Therefore, we recommend that the PAs and Consultants take the following near-term actions:

1. The PAs should develop basic performance indicators for all multi-family initiatives. Multi-family program data should be collected and managed in a way that allows for accurate tracking and assessment of these indicators.
2. Ongoing efforts to understand cost-effectiveness challenges should be a collaborative effort between the Consultants and PAs. This cross-sector effort should include a bigger picture assessment of alternative program designs and approaches to measuring cost-effectiveness as well as additional program expansion and enhancement opportunities.

This overview should help illustrate how complex the multi-family sector is. At the same time, it presents some exciting opportunities to serve the PAs' customers and evolve approaches to cost-effectiveness calculations and program design. We welcome the input of the Council on this effort and look forward to working with the PAs to address it.

## APPENDIX A: SUMMARY OF MULTI-FAMILY EVALUATION STUDIES

### 2016: Planned/In Progress

#### MULTIFAMILY IMPACT EVALUATION

**Goal:** Provide program level realization rates for both electric and gas overall for 2013 for all PAs.

**Status:** The study attempted to complete analysis for all PAs with limited results; specifically, the data were incomplete for many properties. Only National Grid could identify all of the residential and commercial accounts connected to a program property, and the analysis was redesigned to just look at National Grid properties. Completed draft memo of results for both gas and electric studies is now in final review. For electric measures, the facility-level difference-in-difference method gives a realization rate of 24% with a precision of  $\pm 49\%$  at the 90% confidence interval for the electric savings claimed from energy efficiency measures installed in participant facilities. For gas measures, the analysis estimated a realization rate of 86% without interactive and 87% with interactive. The precision of evaluated savings, at the 90% confidence interval, is  $\pm 64\%$ .

#### MULTIFAMILY HIGH RISE IMPACT EVALUATION

**Goal:** Determine the appropriate baseline for High Rise Multifamily buildings prevailing practices based on non-participating buildings.

**Status:** The study is planned to be finalized in October 2016. It performed site visits for 17 multifamily buildings and collected data on the insulation, windows, air infiltration, HVAC, domestic hot water, duct leakage and lighting in common and tenant spaces and compared levels to the code.

#### MULTIFAMILY PROGRAM IMPROVEMENT STRATEGIES

**Goal:** Identify actionable strategies and innovations to improve the multifamily program performance, realization rates, and overall program cost-effectiveness for both the residential and commercial sectors.

**Status:** Final Stage 3 plan is close to approval. Study is scheduled to be completed by May 2017.

#### CENSUS OF MASSACHUSETTS MULTIFAMILY AND CONDO PROPERTIES

**Goal:** Provide a quick but detailed study of the unique characteristics and challenges of the condominium market and identify possible program design opportunities to improve condominium service delivery for the Massachusetts PAs.

**Status:** Final Stage 3 plan is close to approval. Study is scheduled to be completed by August 2017.

### Completed

#### 2015: MASS SAVE MULTIFAMILY PROGRAM PROCESS EVALUATION

**Summary:** The evaluation sought to assess and monitor the program's evolution as an integrated offering since the last round of program evaluation was conducted; examine barriers to participation, the effectiveness of program operations, and customer experience; and review PA and vendor tracking data to assess whether these data would sufficiently support a planned future impact evaluation.

**Conclusions:** The report presents the four key recommendations most critical for the PAs and EEAC to focus on in order to improve the program and achieve deeper and broader savings: 1) The PAs and EEAC should consider creating a role for a single point of contact for each project; 2) The program tracking systems should also be improved to allow for a holistic view of multifamily properties across PAs, fuels and programs. Specifically, the report recommends the PAs consider creating unique premise IDs for multifamily properties and separately tracking multifamily C&I from the rest of the C&I sector; 3) Improvement of the energy assessment process can be achieved through the training of auditors in completing a comprehensive job including a review of all the systems in common areas and major systems within in unit areas and 4) The evaluators believe a billing analysis

is a feasible approach to determining savings among participating accounts for an impact evaluation. The report notes that of the seven recommendations from the 2012 process evaluation, one was achieved, four were ongoing, and two were not achieved (comprehensive multifamily marketing and outreach plan and track program participation through unique premise IDs). It includes a number of other and more detailed considerations for the PAs as well.

#### **2015: LOW-INCOME MULTIFAMILY IMPACT EVALUATION**

**Summary:** The evaluation sought to achieve broad objectives of verifying energy impacts and improving transparency and consistency in savings estimation methods.

**Conclusions:** The report presents a summary of deemed savings values. Through billing analysis of 217 facilities, the team estimated an average savings of 126 therms per unit or 21% of pre-retrofit natural gas consumption. Compared to the initiative ex ante estimates, the billing analysis results represent an average statewide realization rate of 80%, indicating that the initiative is achieving 80% of the reported natural gas savings. The majority of projects that received natural gas efficiency measures to reduce heating consumption also received efficient lighting measures. Separating out the lighting interactive effects on the heating load should increase the realization rate to somewhere between 83% and 89%. The team estimated a statewide realization rate of 97% for common area lighting measures, verifying that auditors are accurately estimating annual energy savings.

#### **2013: RESIDENTIAL NEW CONSTRUCTION PROGRAM INCREMENTAL COST STUDY**

**Summary:** The study report provides estimates of the incremental costs per square foot involved in building high efficiency homes that meet the criteria of the 2013 MA Residential New Construction Program. Incremental costs above the costs of typical homes being built outside the program are estimated for single family (SF), low-rise multifamily buildings of three or fewer stories (MF 1-3), and mid- to high-rise multifamily buildings of four stories or more (MF 4+) for each of the incentive options offered by the program.

**Conclusions:** Estimated incremental costs vary among the incentive options, particularly for homes in the SF attached building sector. The variation is due to both the kinds of measures that were implemented to satisfy the option requirements and the degree to which the measures were enhanced. Incremental cost per square foot for single family attached homes range from \$1.03 to \$5.61; multifamily with no master meter range from \$0.10 to \$1.50; multifamily with master meter gas range from \$0.08 to \$1.48; and MF 1-3 overall ranged from \$0.60 to \$3.10.

#### **2012: MASSACHUSETTS RESIDENTIAL NEW CONSTRUCTION FOUR TO EIGHT STORY MULTIFAMILY PILOT INTERVIEWS**

**Summary:** The Four to Eight Story Multifamily New Construction Pilot was introduced in 2010 to address the needs of mid-rise multifamily buildings. NMR conducted fourteen interviews with the pilot's sponsors, implementers, and participants with completed projects, examining the pilot's goals and objectives, the process of signing up and completing verification, outreach and the timing of projects served, the measures covered, the measures installed, barriers to energy efficient multifamily new construction, and satisfaction.

**Conclusions:** Participants reported high overall satisfaction. From the implementer's perspective, the initial participation process in a similar program could be improved by providing an interactive project tool that would allow the customer user to enter the measure inputs and see the savings and incentives right away. The pilot's implementers and participants both pointed out the advantages of a performance based system. Timing remains an issue. Ideally, program engagement should occur during the conceptual design phase of a new project if it aims to provide technical assistance in considering all applicable energy efficiency measures.

#### **2012: MASSACHUSETTS MULTIFAMILY PROGRAM IMPACT ANALYSIS**

**Summary:** This impact analysis had two primary objectives for the multifamily program activities of the Massachusetts Program Administrators (PAs). First, the goal of the impact work is to provide a set of savings approaches (i.e., algorithms and deemed values) that can be used by all PAs (statewide) in future program years. Second, the analysis collected information to inform program attribution, including the measurement of installation rates, persistence, free ridership, and spillover.

**Conclusions:** For each program measure, the study provides information similar to that provided in the TRM, detailing the recommended algorithm, required inputs to be collected during implementation, and underlying assumptions (to calculate algorithm-based assumptions) or deemed values. In general, evaluators also conclude that the multifamily program is experiencing excellent installation and persistence rates, though ensuring that programmable thermostats are used to their full capabilities after installation is a challenge. Free ridership also appears to be well under control at a rate of 18% at the program level. “Like program” spillover among property managers has been low. Participant data is tracked differently by each PA, and there are significant gaps in the types of program information being collected and tracked.

#### **2012: MASSACHUSETTS 2011 LOW INCOME PROGRAM PROCESS EVALUATION**

**Summary:** This report summarizes the process evaluation of the 2011 Low Income Single-Family (LISF) and Low Income Multifamily Retrofit (LIMF) programs.

**Conclusions:** The Team’s evaluation revealed numerous ways in which the Low Income Program is succeeding and identified opportunities for improving processes and outcomes. For the Multifamily program, the evaluators provided four recommendations: 1) The LIMF Advisory Committee should encourage more standardization across PAs by developing standardized project screening criteria or a tool to determine savings and cost effectiveness for both gas and electric projects; 2) Identify one single representative program to remain involved with during the entire participation process with building managers; 3) Update program materials, including the Program Guide, and clarify the role of each PA’s branded benchmarking software tool; and 4) Develop data formats to track program savings and administer the program more consistently.

#### **2012: MASSACHUSETTS MULTIFAMILY MARKET CHARACTERIZATION POTENTIAL STUDY**

**Summary:** This study assessed the potential energy-efficiency savings available in Massachusetts’ multifamily buildings, including a market characterization and estimation of technical, economic, and achievable potentials.

**Conclusions:** Results of the study for electricity indicate that 2.8 million MMBtu of technically feasible, electric energy-efficiency potential will be available by 2030. Once screened for cost-effectiveness, this technical potential translates into an economic potential of 1.8 million MMBtu. Should all of this cost-effective potential be deployed, the result would be a 14% reduction in 2030 forecast energy consumption. For gas, results indicate that 7.0 million MMBtu of technically feasible, natural gas energy-efficiency potential will be available by 2030. This technical potential translates to an economic potential of 5.2 million MMBtu.

#### **2012: MASSACHUSETTS MULTIFAMILY PROGRAM PROCESS EVALUATION**

**Summary:** This report summarizes the process evaluation of the 2011 Multifamily Program.

**Conclusions:** Although streamlining of the Multifamily Program participation process has greatly improved, a lack of awareness of the program and of what the program can offer was reported as a significant barrier to participation in the program. In the coming years, increasing program goals will likely require the Multifamily Program to seek out new opportunities for energy savings. On average, Multifamily Program participants were highly satisfied with almost all aspects of the program. Property managers and tenants expressed a need for follow-up technical assistance on some of the measures installed through the program. The evaluators provided seven recommendations: 1) Develop a comprehensive statewide Multifamily Program marketing and outreach plan; 2) Continue to simplify the process for property managers; 3) Consider the costs, benefits, and appropriate incentives for additional standard program measures; 4) With each programmable thermostat, leave behind easy to understand programming instructions in multiple languages; 5) Research and test program design and financing options with the aim of both increasing program participation and increasing savings from each property; 6) Provide materials (technical specifications, instructions) and websites for program participants to obtain technical information on measures and ensure that participants understand that they can contact the MMI for technical support; and 7) Track program participation with unique identifiers for the building/facility (facility ID) and participating tenant units (unit #s and/or electric and gas account numbers for individually metered units).