

FINAL REPORT

Subject: *Emerald Cities Collaborative Boston Contractor Academy Market Analysis
Economic Data Insight*

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SECTION 1: SUMMARY OF RECOMMENDATIONS

SECTION 2: STUDY TIMELINE & ACTIVITIES

SECTION 3: LABOR MARKET ANALYSIS

SECTION 4: TARGET SERVICE MARKETS

SECTION 5: INTERVIEWS

SECTION 6: STRATEGY RECOMMENDATIONS

APPENDIX A: MAP BOOK

SECTION 1 — SUMMARY OF RECOMMENDATIONS

Through research, outreach, and analysis, Emerald Cities Collaborative Boston (ECC), together with the Metropolitan Area Planning Council (MAPC), have worked to create this Market Study for weatherization and energy efficiency retrofit delivery in the MAPC region, focusing especially on housing eligible for the MA LEAN program. Research included demographic, housing, industry sector, and market potential. This study also incorporates the input of contractors, especially those usually underrepresented in the field, as well as Community Action Agencies, housing developers, and partner organizations. ECC's Regional Contractor's Academy for the Fall 2022 semester also helped inform this study through regularly collected feedback from the students. The market analysis for this endeavor is two-fold. One part analyzes trends in the labor market pertinent to this work, and the other part explores the potential target service markets in the Greater Boston region.

The study researched trends in the labor market as it relates to the energy efficiency upgrades and retrofits of existing residential buildings. This is captured through an analysis of the construction industry. Key findings include:

- Specific trades and occupations that perform energy retrofit work are growing aggressively
- Ancillary construction activities, defined as those necessary to ensure health and safety of residents and to facilitate the installation of energy efficiency measures (i.e., lead paint remediation, asbestos abatement, knob and tube wiring replacement, and structural repairs), are essential to energy upgrades and must be accounted for in the scope of building retrofit work
- Energy retrofit work is complex and multi-faceted due to the age and nature of the housing stock in the greater metropolitan Boston region
- Geospatial application of correlating factors (e.g., income, age of housing unit, education attainment level) can help map potential markets of Mass LEAN eligible households

Through research and interviews, a list of strategy recommendations was developed. These recommendations build upon the existing research on clean energy building retrofits and the strengths of the E-Contractor Academy's (ECA) program. A full breakdown of these recommendations can be found at the end of the study. The recommendations are as follows:

1. Strengthen ECA Alumni Network
2. Labor Upskilling and Services Expansion
3. Build Relationships with CAP Agencies, Mass Save Lead Vendors, and HPCs
4. Entry Points / Leading Services
5. Entry Points through Assistance Programs
6. Outreach: Community / Neighborhood Based
7. Programmatic/Policy
8. Utilize the "Key Opportunity Areas for Energy Upgrades" ArcMap Online Tool

SECTION 2 — STUDY TIMELINE & ACTIVITIES

Emerald Cities Collaborative (ECC) is a national, multi-regional nonprofit that advances a sustainable environment while creating sustainable, just, and inclusive economies with opportunities for all. ECC Northeast develops energy, green infrastructure, and other sustainable development projects that contribute to the resilience of the Boston metropolitan region while fostering equity for low-income communities of color in the green economy. This includes developing the economic infrastructure for family-supporting wages and career paths for residents of such communities, as well as contracting opportunities for women, BIPOC, and persons with disabilities. The E-Contractor Academy’s curriculum focuses on building and applying small business skills to capturing market opportunities in energy efficiency, building electrification, water efficiency, and renewable energy. A crucial component of the work is identifying specific clean energy project pipeline opportunities to increase the market share of Minority, Women, and Disadvantaged Business Enterprises (MWDBE) operating in this retrofit market.

In February 2022, the Massachusetts Clean Energy Center (MassCEC) awarded Emerald Cities Collaborative (ECC) a grant to connect to a pipeline through a scalable model which will reduce the energy burden in Environmental Justice communities and create pathways into the energy retrofit market for MWDBE businesses connected to Environmental Justice communities in Eastern and Central Massachusetts. The objective of the project was to directly connect MWDBEs with projects in the Low Income Energy Affordability Network (“LEAN”) and by extension into the Weatherization Assistance Program (WAP) work managed by CAP agencies and the Mass Save program, through the Massachusetts (“EmPower”) program.

To that end, ECC coordinates the E-Contractor Academy, a six-week training program where small, MWDBE contractors learn program navigation, business, and finance skills to enable them to successfully work on energy efficiency and clean energy projects. This fall the program piloted an E-Contractor Academy for MWDBE contractors on affordable housing retrofits and the Mass LEAN program, WAP, and the Mass Save program. The E-Contractor Academy prepared small MWDBE contractors for the business side of competing for and performing energy efficiency retrofit projects in single-and multi-family residential buildings in Massachusetts.

Together, over one year, MAPC and ECC developed this Market Study encompassing labor market research and target service market analysis to develop strategies to increase the MWDBE’s share of the green energy retrofit market in the Boston region. The intent of this market study is to:

1. Support business expansion of Academy graduates and network participants, through growth in energy efficiency project contracts secured via the Mass LEAN program and the Mass Save program.
2. Help develop a growing energy efficiency labor market that needs more workers and suppliers to keep pace with demand, measured by industry specific employment and wages information at the municipal and regional scales.
3. Increase the percent of public and private energy efficiency projects secured by minority and women-owned contracting firms.

4. Expedite the implementation of energy efficiency projects across the region to decrease carbon emissions and contribute to meeting the region's and the state's net zero carbon emissions targets.

SECTION 3 — LABOR MARKET ANALYSIS

SECTION 3.A: JOBS ANALYSIS

This study focuses on energy efficiency retrofits of existing residential buildings. Energy efficiency retrofits fall under the construction industry and are identified through the use of the North American Industry Classification System or NAICS codes. NAICS codes begin as general 2-digit codes that encompass all industries in the economy. They become more specific with each digit added to the end of the code. The initial research narrowed down the economic analysis to 4-Digit NAICS code subsectors and tracked their trajectory. Subsectors of the industry were then identified based on whether they were potentially relevant to the field of residential retrofit construction to be researched further. This data is then expanded to look at the job market to understand workforce patterns.

Figure 1 below maps the changes in the growth of the economy in the Greater Boston region by industry. The regional economy has grown overall, with the construction industry steadily and consistently outpacing many others. While some larger industries have stagnated or contracted, construction shows a slight upward trend¹.

Figure 1: Long Term Job Trends in the Boston Region²

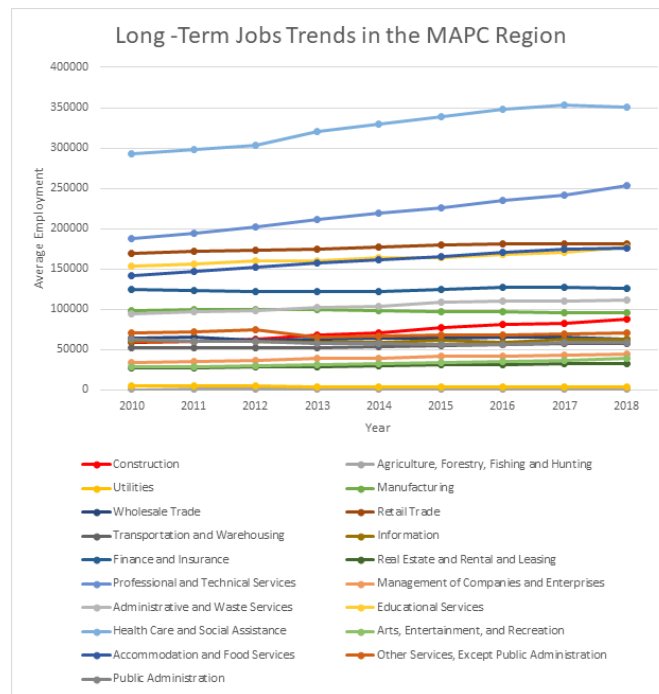


Figure 2 below illustrates that the state's overall economic health is in steady growth. Construction is linked to population trends, which has also steadily continued to grow in the state of Massachusetts. The population grew to 7,029,917 according to the 2020 Census, an increase of

¹ This is the time span for which NAICS 2-digit data is readily available for the Boston (MAPC) region and able to be compared to the state data.

² "Total Annual Average Employment and Wages by Municipality". ES-202 Average Employment and Weekly Wages. Executive Office of Labor and Workforce Development (EOLWD)

7.4% over the last decade. In this same time period, the number of housing units also grew by 6.8%.³ This growth over the past decade signals continued demand in the industry. Construction is a highly localized field with capital investments fixed in geography, making it a reliable anchor of the economy, in contrast to mobile or other fluid industries that can be relocated.

Figure 2: Long Term Job Trends in Massachusetts⁴

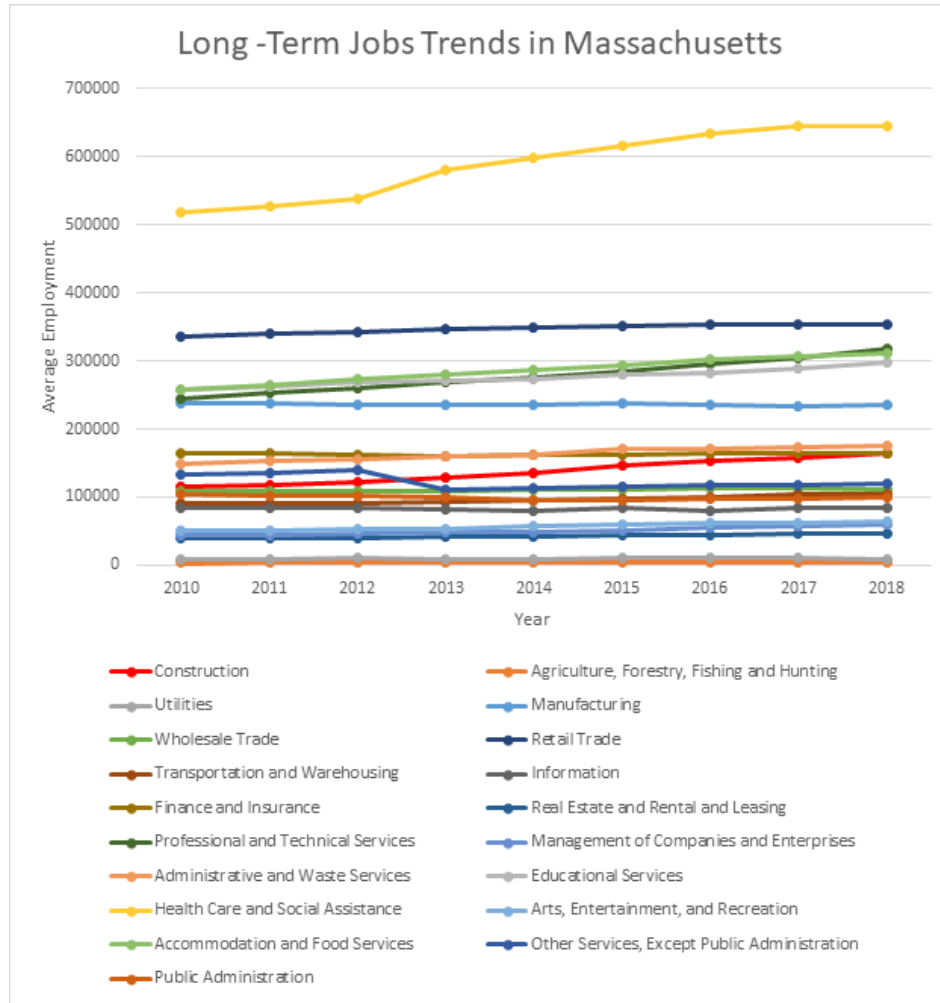


Figure 3 below charts the trends in job openings and labor turnover⁵ for the previous decade in the construction industry at the national level.⁶ While layoffs and discharges have been the leading

³ “Massachusetts Population Grew 7.4% to Over 7 million from 2010 to 2020.” US Census. American Counts Staff. 09/25/2021. <https://www.census.gov/library/stories/state-by-state/massachusetts-population-change-between-census-decade.html>

⁴ “Total Annual Average Employment and Wages by Municipality”. ES-202 Average Employment and Weekly Wages. Executive Office of Labor and Workforce Development (EOLWD)

⁵ Bureau of Labor Statistics. “Job Openings and Labor Turnover Survey”. Retrieved 12/13/22

⁶ The Bureau of Labor Statistics JOLTS data at the state level was not readily available at this level of detail.

cause for separations from the industry, voluntary quits have been a growing share of the reason over the past seven years. The largest portion of the industry is made up of low-skilled hard labor jobs. Coupled with the fact that the industry has an aging workforce as a whole, these are likely factors for the high number of rising voluntary departures from the field. Layoffs and discharges slowly declined over the past decade from nearly 257,000 in 2010 to only 157,000 in 2021. Layoffs spiked in 2020 at the beginning of the Covid-19 pandemic, but the industry quickly recovered and rebounded to record low layoffs by 2021. However, in the same year, quits peaked at 183,000. More people were leaving of their own volition than ever before, despite the ramifications of the Covid-19 pandemic and lockdown. Construction activity was one of the few economic activities deemed safe enough to continue under many jurisdictions' pandemic regulations. With an aging workforce that was more susceptible to the virus however, many of these quits could be attributed to retirement decisions. Layoffs and discharges were rapidly increasing in the years leading up to the pandemic. This exacerbated the labor shortage when workers began voluntarily quitting and the slowdown in layoffs was not enough to remediate the need.

Figure 3: Construction Industry Separations Nationwide⁷

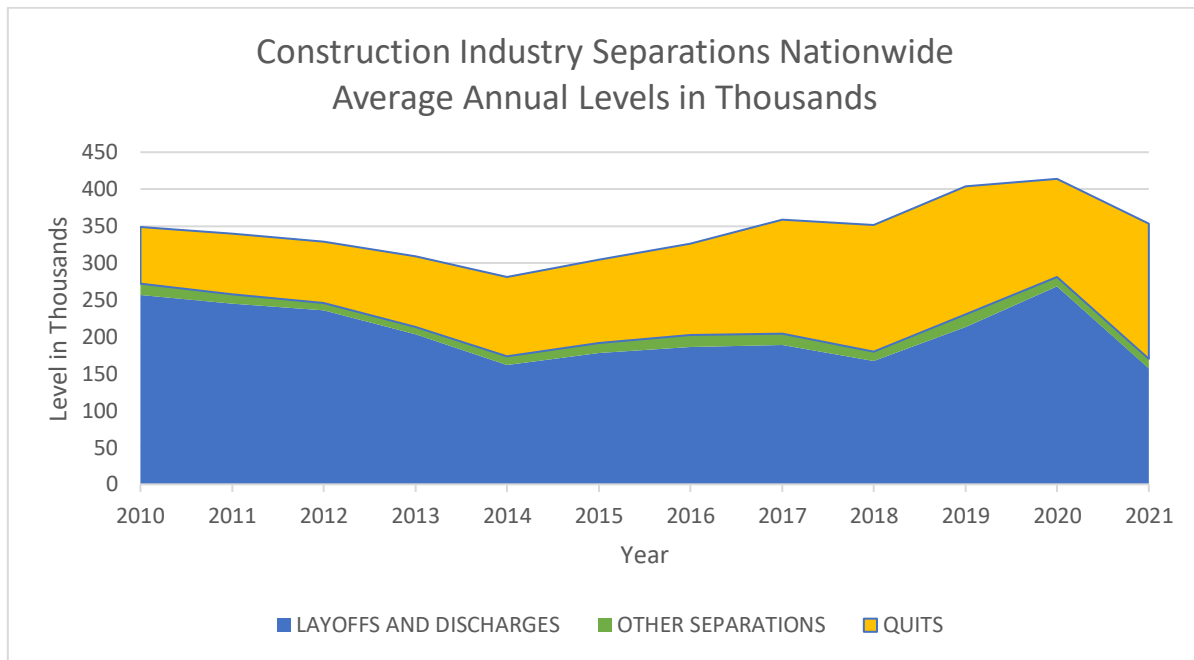


Table 1 Separations (Level in Thousands)⁸

YEAR	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Layoffs And Discharges	257	245	236	203	162	178	186	189	167	213	268	157
Other Separations	15	13	10	10	11	13	16	15	13	17	13	13
Quits	77	82	83	96	108	113	124	154	172	173	133	183
Total Separations	349	340	329	309	281	305	326	358	351	404	414	353

⁷ Bureau of Labor Statistics. "Job Openings and Labor Turnover Survey". Retrieved 12/13/22

⁸ Bureau of Labor Statistics. "Job Openings and Labor Turnover Survey". Retrieved 12/13/22

Figure 4 below depicts the number of hires, job openings, and total separations from the construction industry over the past decade nationwide. The total separations line (red line) below encompasses all reasons- quits, layoffs, discharges, etc. The number of separations and hires (blue line) is almost identical indicating a healthy replacement rate, with slightly more hires than separations. However, the number of unfilled job openings (orange line) has been steadily increasing, with the only downturn occurring during the pandemic. This sharp downturn was likely due to the initial economic shock of the shutdown, but the trend quickly reversed and is on track to outpace the number of hires and total separations, signaling a gap in available labor supply. This gap in demand and supply represents an urgent and opportune moment to prepare underrepresented contractors (MWDBEs) to enter and succeed in the energy retrofit market. The industry is able to fill openings, but has not been able to grow beyond that in terms of its available labor force supply. The demand for these workers is not being met if the industry only replaces and maintains the same overall size in its available workforce. There is demand beyond what the current labor force can handle, even if it is able to maintain the current rate of employment turnover.

Figure 4: Construction Industry Openings and Hires Nationwide⁹

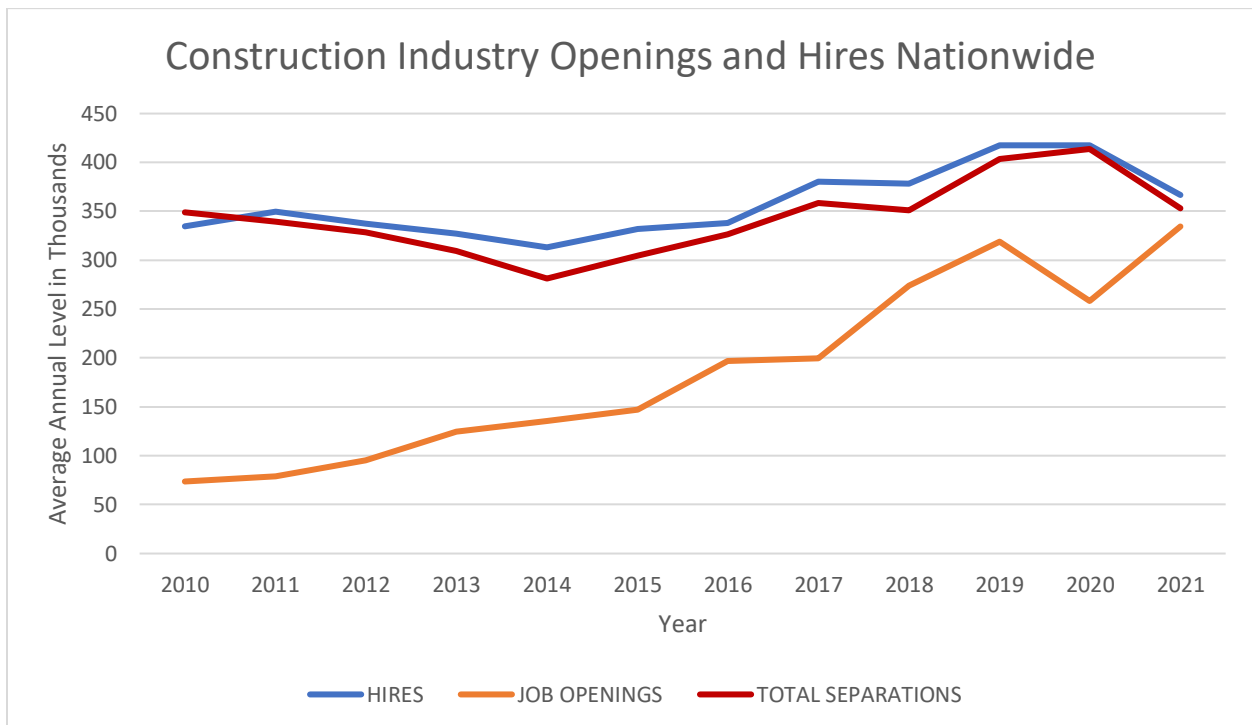


Figure 5 below depicts the average employment in the construction industry in the state of Massachusetts. This trend has been much steadier throughout the years. The only slight decrease was also aligned with the beginning of the Covid-19 pandemic shutdown, when the Massachusetts construction industry lost 11,000 jobs in 2020. This too recovered when the industry added 12,000 jobs the following year. Overall, the construction industry is in steady incline with increasing demand for workers, both in Massachusetts and across the U.S. The construction industry in Massachusetts

⁹ Bureau of Labor Statistics. "Job Openings and Labor Turnover Survey". Construction Industry. Total US, All Areas, All Size Classes. 12/13/2022

appears to be predictably steady and growing at a healthy rate in response to a growing population and demand.

Figure 5 Average Employment in Construction in Massachusetts¹⁰

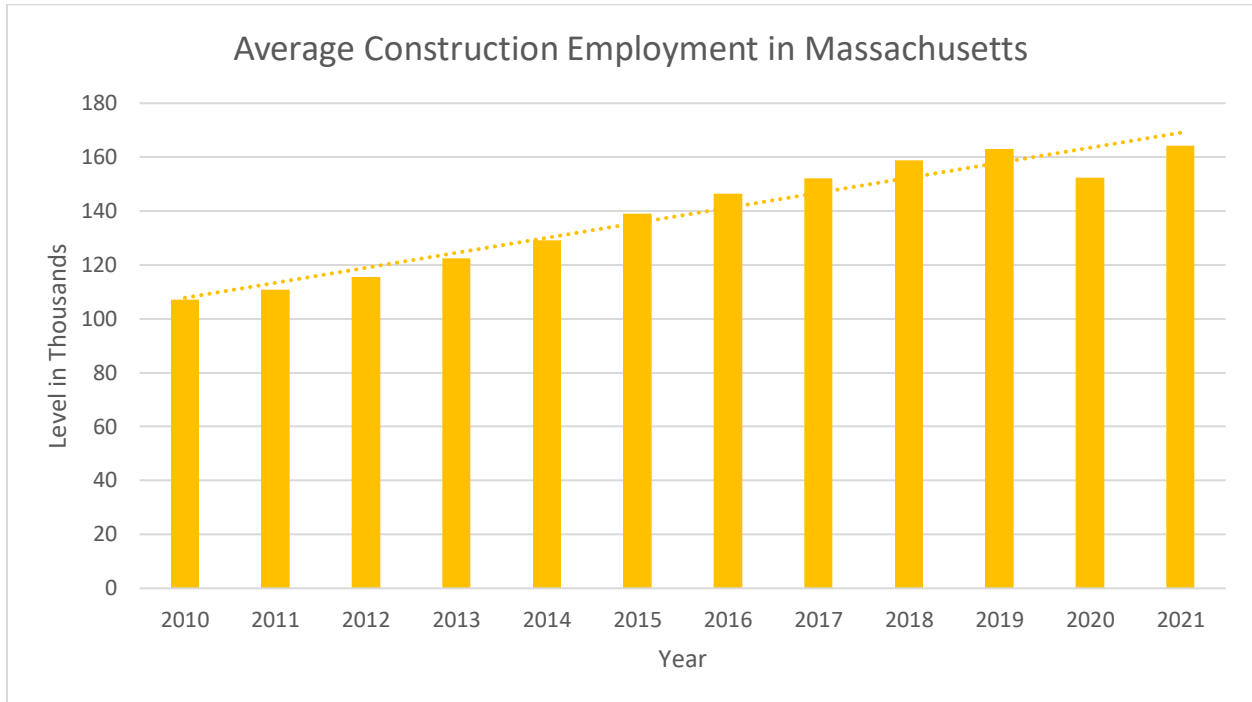


Table 2: Construction Industry Openings and Hires Nationwide¹¹ vs. Average Annual Employment in Massachusetts¹²

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
National												
Hires	334	350	338	327	313	332	338	380	378	418	418	367
Job Openings	74	79	96	124	136	147	197	200	274	319	258	335
Total Separations	349	340	329	309	281	305	326	358	351	404	414	353
Massachusetts												
Average Construction Employment	107	111	116	122	129	139	147	152	159	163	152	164

Political will and direction towards addressing climate change play a role in creating and maintaining funding for programs such as Mass Save and Mass LEAN, which contribute to the overall market demand. Later in this report, Section 4 Target Service Markets explores the rising market demand for heating and cooling technologies. These programs help create resources for people

¹⁰ Bureau of Labor Statistics. “State and Area Employment, Hours, and Earnings”. Construction Industry. Massachusetts, Statewide, All Employees.

¹¹ Bureau of Labor Statistics. “Job Openings and Labor Turnover Survey”. Construction Industry. Total US, All Areas, All Size Classes. 12/13/2022

¹² Bureau of Labor Statistics. “State and Area Employment, Hours, and Earnings”. Construction Industry. Massachusetts, Statewide, All Employees.

to upgrade their dwellings not just as an altruistic responsiveness to climate change, but for personal comfort, health, and individual cost savings. These programs help current property owners implement necessary measures to maintain their existing housing stock in good repair and be competitive with new developments, thus retaining affordable existing housing supply overall. These programs are one component in achieving larger goals related to climate change and housing.

Conclusions:

- The construction industry is growing steadily in Massachusetts and across the country, despite political hurdles in the United States federal and state governments that have delayed implementation of climate change policies.
- National trends show there are abundant job openings in the industry today.
- Trends from the previous decade indicate that demand is high and if it continues, it is projected to grow for construction industry workers.
- Both Massachusetts’ population and economic health have grown over the past decade. Patterns at the national level can be derived to form predictions for the state.

SECTION 3.B: OCCUPATIONS ANALYSIS

As the more urbanized area of the state, the economy of the MAPC region grows at a higher rate than the rest of the Commonwealth. Research into particular subsectors within construction provides insight into the industry’s composition and the growth and decline trends occurring within it. Relevant industry subsectors to include in the study were chosen based on the type of work each job encompasses and whether it directly relates to the clean energy retrofit of existing buildings. One subsector category that is excluded is NAICS 237 Heavy and Civil Engineering Construction, mainly of public sector infrastructure developments as this study’s focus is primarily on privately-owned residential buildings. Subsectors are more specifically weeded out at the NAICS 5-Digit levels to exclude occupations that pertain to new construction activities (e.g., foundation pouring, framing) or are not primarily involved in residential energy work (e.g., painting, flooring, etc.)¹³. NAICS 5-Digit categories that are included in the research encompass work such as roofing, siding, plumbing, HVAC, electrical, drywall, and insulation. These occupations are directly involved with energy retrofit work such as solar panel installation, heating, air conditioning, window upgrades, and weatherproofing.

The table below includes data at the 4-digit NAICS classification level. Retrofits involve workers from across these subsectors listed below, therefore occupations cannot be excluded at the 4-digit level as it is too general and large an umbrella. Table 3 compares the growth of select subsectors in the state to their performance in the MAPC region between 2001 and 2018¹⁴. This time span includes multiple economic shocks and shifts across time, providing a broad perspective of the industry’s resilience. Over this time period, the only subsectors which declined in the region were Residential Building Construction by 1% and “Building Foundation/Exterior Contractors” by 12%. This can be due to the area being saturated, with little room for brand new development, in contrast to the state as new development continued to sprawl out in less congested areas, as well

¹³ Carpentry is included under “Finish Carpentry Contractors (23835)”, but Pipefitters are not included as they fall under the manufacturing industry sector (NAICS 33296).

¹⁴ This is the time span for which NAICS 4-digit data is readily available for the Boston (MAPC) region and able to be compared to the state data.

as likely due to exclusionary housing policies in communities. The Boston region’s housing market is generally a historic one with over 80% of the housing stock constructed before 1990.¹⁵ In the City of Boston, 65% of households are renter-occupied¹⁶. Those households that can afford to purchase a home would tend to purchase an existing older house rather than a newly built one.

Moreover, with a growing population and an increasingly unaffordable housing market, construction may focus increasingly less on new ground-up development and more so on the retrofit of existing buildings, as indicated by the growth in these occupations. Rising costs of both homes and property, rising interest rates, a shrinking middle class, and shrinking purchasing power mean that the pool of homeowners is also growing smaller, and these are especially barriers for first time homebuyers. Coupled with inflation and housing costs rising faster than wages, more adults are living at home with their parents and cost sharing than ever before. In fact, according to a 2020 study published by the Pew Research Center, the majority (over 50%) of young adults in the U.S. now live with their parents for the first time since the Great Depression.¹⁷ Building retrofit construction may be driven by the remodeling and restructuring of existing housing through on-site densification to accommodate multi-generational households. This can include construction to convert formerly uninhabited spaces like basements, attics, and garages into living areas and sleeping quarters, conversion of single-family residences to duplexes, adding on accessory dwelling units, and so on. The growth in these subsectors and occupations reveals that property owners are investing heavily in their existing buildings.

Table 3: Long – Term Greater Boston Region vs. Massachusetts Statewide¹⁸

Change by Percent of Average Employment 2001 – 2018

NAICS Code	NAICS Title	Greater Boston Region Change	Massachusetts State Change
2389	Other Specialty Trade Contractors	69%	62%
2383	Building Finishing Contractors	29%	27%
2362	Nonresidential Building Construction	25%	19%
2382	Building Equipment Contractors	16%	25%
2361	Residential Building Construction	-1%	7%
2381	Building Foundation/Exterior Contractors	-12%	3%

Table 4 takes a look into a much shorter time period- comparing Quarter 1 of 2021 and 2022 of these same subsectors across Massachusetts reveals steady growth, with “Other specialty trade contractors” and “Building equipment contractors” outperforming the construction industry as a whole. This growth, following the devastation of the pandemic, lockdown, and continued economic uncertainty speaks to the steadiness and stability of these sectors.

¹⁵ “2021- Selected Housing Characteristics – All Units.” Table ID DP04. U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates. Generated on 11/14/2021

¹⁶ “Boston, MA Rental Market Trends.” <https://www.rentcafe.com/average-rent-market-trends/us/ma/boston/#:~:text=Boston%2C%20MA%20Occupied%20Housing%20Units&text=176%2C686%20or%2065%25%20of%20the,35%25%20are%20owner%2Doccupied.>

¹⁷ “A majority of young adults in the U.S. live with their parents for the first time since the Great Depression.” The Pew Research Center. Fry, Richard, Passel, Jeffrey S., Cohn D’vera. 09/04/2020. <https://www.pewresearch.org/fact-tank/2020/09/04/a-majority-of-young-adults-in-the-u-s-live-with-their-parents-for-the-first-time-since-the-great-depression/>

¹⁸ “Total Annual Average Employment and Wages by Municipality”. ES-202 Average Employment and Weekly Wages. Executive Office of Labor and Workforce Development (EOLWD)

Table 4: Short – Term Massachusetts Statewide¹⁹

Change by Percent of Average Employment in the First Quarters of 2021 and 2022

NAICS Code	NAICS Title	Jobs Change	Percent Change
2389	Other specialty trade contractors	1 425	9%
2382	Building equipment contractors	3 281	6%
23	Construction	7 164	4%
2362	Nonresidential building construction	690	4%
2361	Residential building construction	539	3%
2383	Building finishing contractors	386	2%
2381	Building foundation and exterior contractors	214	1%

From research and feedback, it was determined that the following subsectors listed below were most relevant for further research into energy efficiency retrofit professions at the 5-Digit NAICS codes level. The 3-Digit NAICS 237 sector, which is heavy and civil engineering construction predominantly led by the public sector, was excluded as a whole. Electricians, plumbers, HVAC technicians all fall under NAICS Code 2382 Building Equipment Contractors, which added 3281 jobs to the commonwealth’s economy in just one year.

In an effort to sift through the data to understand economic trends at the most precise level of analysis of utility to this market study, the project team reviewed and decided upon which occupations to include and which occupations to exclude at the more detailed NAICS 5-digit levels of research, listed in Table 5 here:

Table 5: NAICS Categories²⁰

Included		Excluded	
23611	Residential Building Construction (includes remodelers)	23811	Poured Concrete Foundation and Structure Contractors
23816	Roofing Contractors	23812	Structural Steel and Precast Concrete Contractors
23817	Siding Contractors	23813	Framing Contractors
23821	Electrical Contractors and Other Wiring Installation Contractors	23814	Masonry Contractors
23822	Plumbing, Heating, and Air-Conditioning Contractors	23815	Glass and Glazing Contractors
23831	Drywall and Insulation Contractors	23819	Other Foundation, Structure, and Building Exterior Contractors
23835	Finish Carpentry Contractors	23829	Other Building Equipment Contractors
23839	Other Building Finishing Contractors	23832	Painting and Wall Covering Contractors
		23833	Flooring Contractors
		23834	Tile and Terrazzo Contractors
		23891	Site Preparation Contractors

¹⁹ “Total Annual Average Employment and Wages by Municipality”. ES-202 Average Employment and Weekly Wages. Executive Office of Labor and Workforce Development (EOLWD)

²⁰ Services such as lead and asbestos abatement fall under NAICS Code 562 “Waste Management and Remediation Services”, which fall outside of the construction industry category.

Table 6 below provides a review of the selected subsectors’ performance over the ten-year period between 2011 and 2021, which proves healthy and robust growth in every group of retrofit-related occupations. The Massachusetts economy added over 35,000 jobs that are all directly relevant to residential building energy retrofit. The need for this trained workforce exists beyond the additional demand induced through the state’s climate goals. This demand will only be compounded with new legislative and regulatory climate actions in the state, such as the Next Generation Climate Roadmap Bill, the Act Driving Clean Energy and Offshore Wind, and the Clean Energy and Climate Plan, and further fueled by newly available federal funds from the Inflation Reduction Act and the Infrastructure Investment and Jobs Act, as well as the subject grant awarded here.

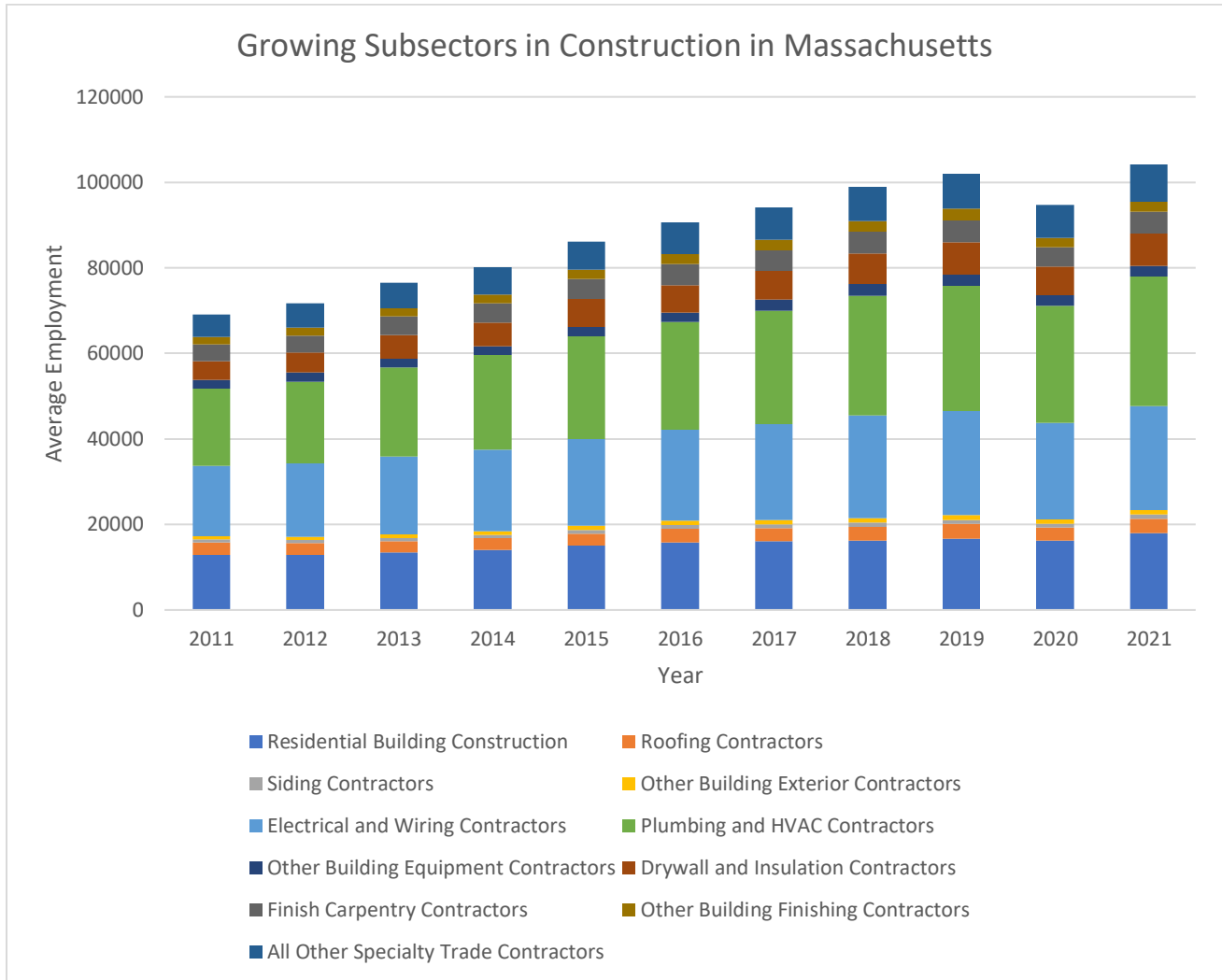
Table 6: Growth Within the Construction Industry 2011 – 2021 In Massachusetts²¹

NAICS CODE	NAICS Title	Difference	Change
23831	Drywall and Insulation Contractors	3190	73%
23822	Plumbing and HVAC Contractors	12134	67%
23899	All Other Specialty Trade Contractors	3447	66%
23817	Siding Contractors	325	49%
23821	Electrical and Wiring Contractors	7854	48%
23819	Other Building Exterior Contractors	320	40%
23611	Residential Building Construction	5101	40%
23839	Other Building Finishing Contractors	571	32%
23835	Finish Carpentry Contractors	1201	31%
23829	Other Building Equipment Contractors	500	25%
23816	Roofing Contractors	420	15%

The construction industry in the state as a whole has grown over the past decade and is projected to continue to grow, although at a slower rate than in the past few years. As seen in Figure 6 below, the subsectors comprising the biggest part of this growth trend are Plumbing and HVAC Contractors and Electrical and Wiring Contractors, all occupations relevant to energy efficiency retrofits. Both occupations make up the largest share of the selected occupations and have continuously expanded. These occupations have higher thresholds for entry into licensure than the other occupations as well.

²¹ “Total Annual Average Employment and Wages by Municipality”. ES-202 Average Employment and Weekly Wages. Executive Office of Labor and Workforce Development (EOLWD)

Figure 6: Construction Subsectors²²



By 2021, the average annual weekly wages in the Boston region for these construction subsectors were 34% higher than the corresponding national wages for those fields. Table 8 provides a comparison between the regional and the national average weekly wages. The lucrative wages offered here not only help increase the earning power of the local workforce, but it also creates built-in workforce stability and retention as people are more likely to stay in the area rather than seek opportunities elsewhere. This also indicates that demand is higher than the availability of skilled labor for these trades. Figure 7 depicts the steady growth in wages experienced in the select construction subsectors over the past five years.

²² Bureau of Labor Statistics. "Quarterly Census of Employment and Wages". Series ID 20221117152433_f1e776. Retrieved 11.14.2022

Figure 7: Average Weekly Wages in Select Construction Subsectors 2016 – 2021

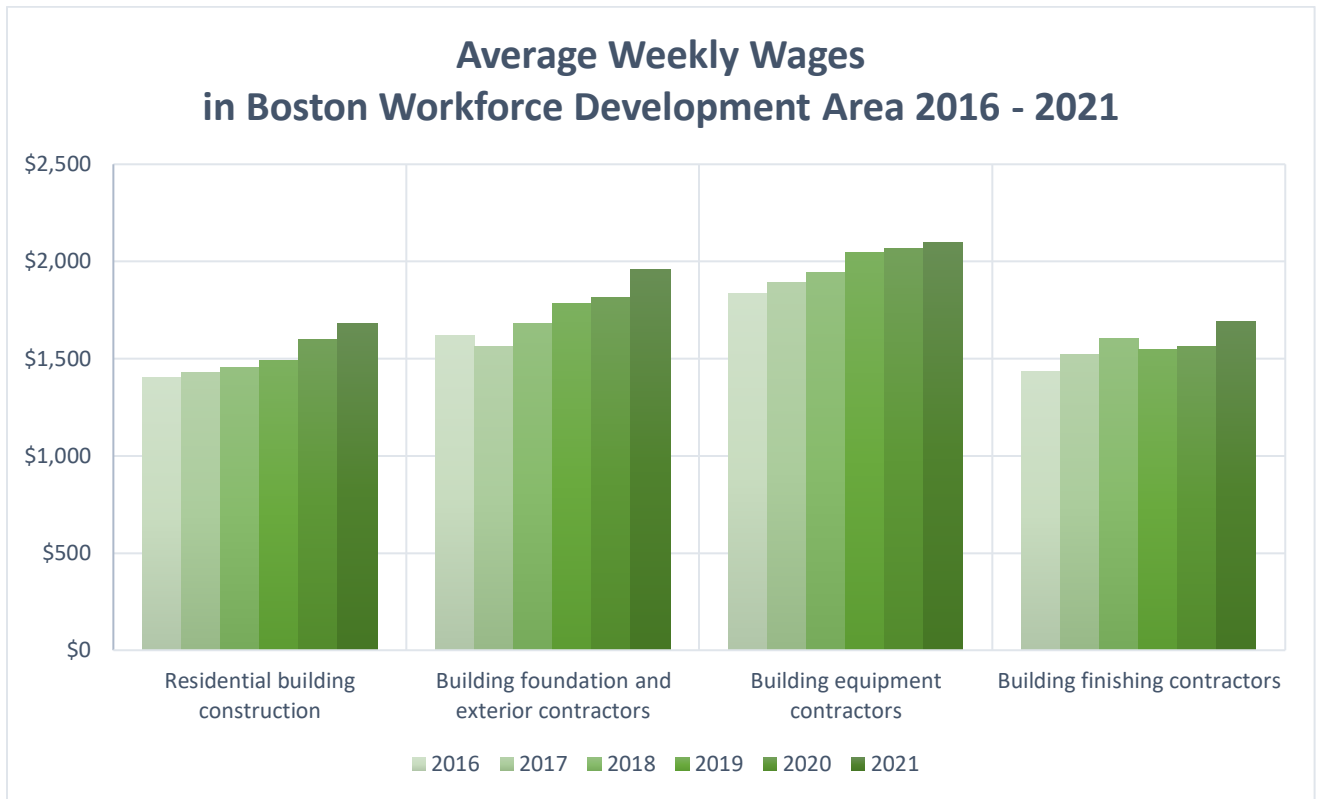


Table 7: Average Weekly Wages in Boston Vs. Nationwide in 2021

NAICS	DESCRIPTION	NATIONAL 2021	BOSTON 2021	DIFFERENCE
2361	Residential Building Construction	\$1,270	\$1,680	24%
2381	Building Foundation and Exterior Contractors	\$1,156	\$1,957	41%
2382	Building Equipment Contractors	\$1,341	\$2,098	36%
2383	Building Finishing Contractors	\$1,090	\$1,693	36%
Average				34%

Conclusion:

- Occupations working directly in building retrofits are leading the growth in the construction industry at both the state and regional level.
- Wages for occupations related to building retrofit work have steadily grown and are higher in the Greater Boston region than in the rest of the country.
- Construction workers are in demand for building retrofit in the Greater Boston region and can help drive the region’s economic growth.
- Construction relating specifically to building retrofits is a robust and growing subsector of the region’s construction industry and makes up much of the work within it.

SECTION 3.C: INDUSTRY DEMOGRAPHICS

The national construction industry demographics indicate a field that is full of opportunities for equitable economic growth across the target populations of this study- namely Women, Minority, and Disadvantaged Business Enterprises. Data research at the national level from the Bureau of Labor Statistics spanning the past two decades (2003 – 2020) found stark racial and gender disparities apparent in the construction industry²³. The differences were more pronounced than only entry into the field and upward mobility into management roles. Disparities were found in the type of labor, wages, union representation, and worker age.

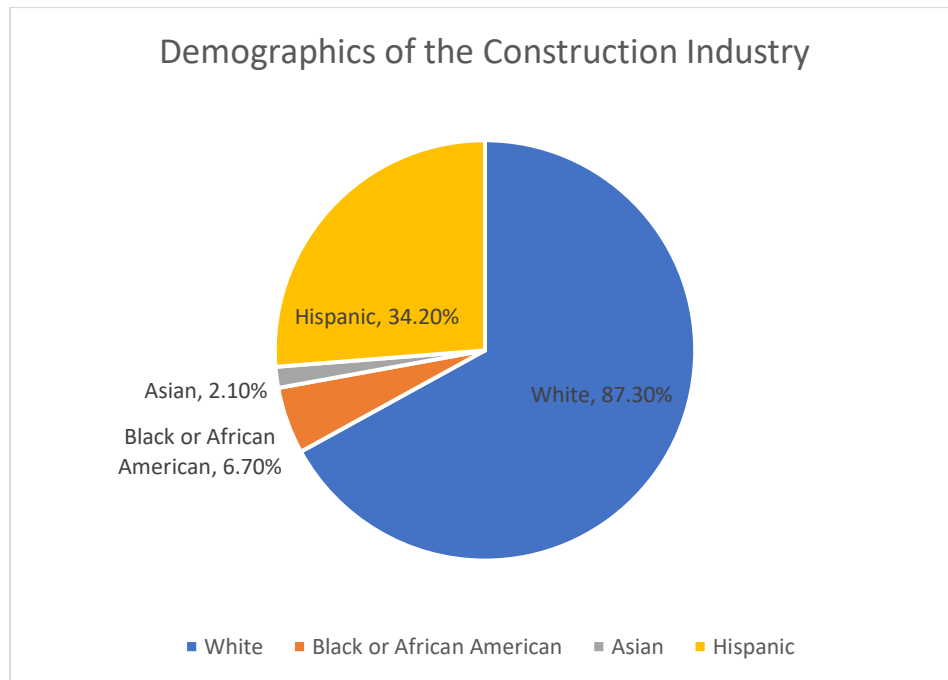
The construction industry provides employment with relatively low barriers to entry in terms of education requirements and relatively high family-supporting wages. The industry can serve as a lucrative pathway to economic prosperity for individuals.

Table 8 and Figure 8 depict the racial and gender composition of the construction industry across the United States.

Table 8: Demographics of People Employed in the Construction Industry Nationwide²⁴

Race/Gender	White	Black Or African American	Asian	Hispanic Or Latino	Women
Percent Of Construction Workforce	87.3%	6.7%	2.1%	34.2%	10.9%

Figure 88: Demographics of People Employed in the Construction Industry Nationwide

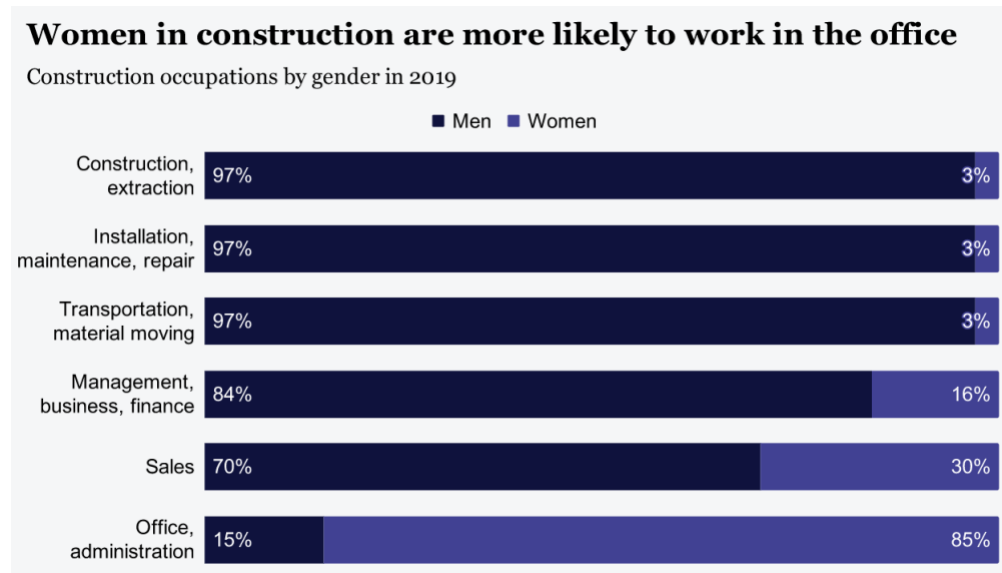


²³ Demographics data at the state level was not readily available.

²⁴ “Labor Force Statistics from the Current Population Survey.” Bureau of Labor Statistics Household Data Annual Averages. 18. Employed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity. <https://www.bls.gov/cps/cpsaat18.htm>

A further breakdown of women occupied in the construction industry is shown in Figure 9 below. Approximately 85% of administrative jobs are held by women versus a meager 3% of construction, extraction, installation, maintenance, repair, or materials transportation.

Figure 9 Distribution of Women in Construction Industry Occupations²⁵



Key demographic highlights²⁶:

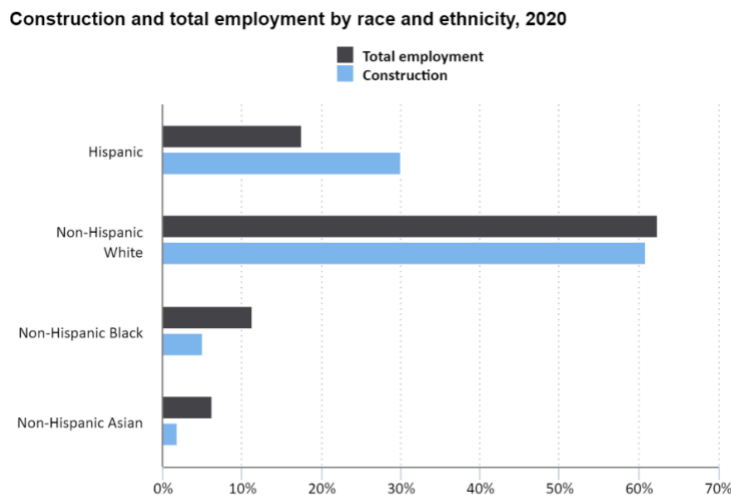
- Women make up only 10.9% of the construction industry workforce.
- Hispanic workers make up 34% of the workforce. This population is overrepresented in this field as they made up only 17.6% of the entire employed workforce across all industries in 2020. Hispanic workers are also more likely to be employed in labor or low-skilled roles such as painters and paperhangers rather than trades such as HVAC installation, plumbers, electricians, etc. Hispanics accounted for 46.7% of construction laborers and 52.5% of painters and paperhangers, considerably higher than their share of those employed in the construction industry (30.0%). Relative to their share of the employed, Hispanics were underrepresented among construction managers (14.3%) and managers other than construction managers (14.4%). Despite comprising 30% of the entire construction workforce, Hispanic workers make up less than 10% of management, business, and financial operations occupations. 76.3% of Hispanic construction workers and 61.7% of Black construction workers are employed in direct construction and extraction occupations.
- Black and Asian workers only made up 6.7% and 2.1% respectively of the total industry workforce.
- 25.3% of construction workers are foreign born, this group earns less than their native-born counterparts.

²⁵ Construction Dive. Zachary Phillips. December 7, 2020. Nearly 40% of women working in construction hold office support roles, study shows

²⁶ U.S. Bureau of Labor Statistics. "The Construction Industry: Characteristics of the Employed, 2003–20". *Spotlight on Statistics*. April 2022. <https://www.bls.gov/spotlight/2022/the-construction-industry-labor-force-2003-to-2020/home.htm>

- Although the population overall is aging, this trend is more pronounced in the construction industry where the percentage of workers over 55 years old has doubled in the past two decades to 22.7% and this trend is projected to continue. Asian workers are more likely to be over 55 years old; 33% of Asian workers were over 55. 28% of White workers were over 55 and 21% of Black workers were over 55. Only 12% of Hispanic workers were over 55, perhaps an indication of longevity in the career and either ability to retire or need to after decades of hard labor
- Youths 16 – 24 made up only 9.4% of the industry, this age group is underrepresented in the industry compared to their overall participation in the workforce
- While overall union membership has declined, White workers are more likely to be union members
- 25% of construction workers are self-employed. This industry provides potential to the workforce for upward social mobility through competitive wages, a culture of entrepreneurship, and wealth building opportunities through scale.
- As national demographics shift, barriers to entry for people of color and women must be addressed in order to develop a more robust and resilient construction labor force.

Figure 109: Construction and Total Employment by Race and Ethnicity, 2020²⁷



Click legend items to change data display. Hover over chart to view data.
Source: U.S. Bureau of Labor Statistics.



Conclusions:

- **Groups including Black, Asian, and women workers are underrepresented in the field; further research and efforts may benefit from focus on barriers to entry into the construction industry field.**
- **Efforts need to be concentrated at initial entry for many of these underrepresented groups.**
- **Given the large representation of Hispanic workers already in the industry, training for upskilling and upward career mobility, especially into self-employment and entrepreneurship, could present opportunity for greater vertical diversification.**

²⁷ U.S. Bureau of Labor Statistics

- **The industry’s labor force is aging, and people are exiting the field in large numbers. This trend represents strong possibility for entry and upward mobility for MWDBEs.**

Section 3.D: Review of Pertinent Studies – State Initiatives

The ECC’s equity-led approach in its Academy is a much-needed step to address the racial and gender gaps in the construction industry. These disparities are seen here in the Commonwealth of Massachusetts and the consequential economic ramifications continue to reproduce the racial and gender wealth gap. The Massachusetts State Auditor’s report referenced below sheds light on the number of unfulfilled public works contracts that had been dedicated for procurement by MWDBEs. The gap between available opportunities and the shortfall in MWDBE contractors bidding on them shows that the ECC Academy is fulfilling an instrumental role between nominal policy and effective implementation. This can be applied here to the opportunities available in the Mass LEAN and Mass Save programs and the dearth of MWDBEs that are eligible vendors qualified to provide these services.

Official Audit Report – Issued February 23, 2022, of the Division of Capital Asset Management and Maintenance²⁸

In 2021, the Massachusetts State Auditor’s office released a report of the Division of Capital Asset Management and Maintenance (DCAMM), which is the state agency responsible for major public construction and real estate for the state of Massachusetts. The report analyzed public works contracts awarded to private companies between January 1, 2019, through December 31, 2020. Construction contracts are subject to state guidelines for workforce participation goals:

- 15.3% of the hours of construction work performed should be done by minority workers
- 6.9% of the hours of construction work performed should be done by female workers

During the audit period, the study found that:

- 120 (95%) of the 127 construction contracts did not meet the women’s workforce participation goal:
- 78 (61%) of the 127 construction contracts did not have any hours worked by women
- 81 (64%) of the 127 contracts did not meet the minority workforce participation goal
- 36 (28%) of the 127 contracts did not have any hours worked by minorities

The study highlights that despite stringent public procurement contracting requirements and direct involvement by the public agencies, racial and gender gaps in the workforce remain prevalent. These policies could provide a path for MWDBE’s to enter the industry and carve out a piece of the existing demand to be directed solely to MWDBEs beyond what the market demand produces. This shortfall between available projects ready for distribution and available labor force to take them on signifies the value of the mission of ECC’s E-Contractor Academy. Furthermore, the data shows that certain minority groups- namely Hispanic workers, are already active in the construction industry but are not advancing in the field. Upstream efforts are needed to help certain minority groups (Women, Black/African American, and Asian workers) overcome barriers to entry to the construction industry. A different strategy is needed to make adjustments to help incumbent minority workers, namely Hispanic workers, to advance in the field they are already in or potentially shift

²⁸ Commonwealth of Massachusetts Office of the State Auditor, Suzanne M. Bump. Official Audit Report of the Division of Capital Asset Management and Maintenance for the period January 1, 2019, through December 31, 2020. Issued February 23, 2022.

to a licensed trade. The challenges facing each minority group are unique and the respective strategies must be tailored to those unique needs.

Conclusions:

- **Some policies are in place that are intended to diversify the construction industry in Massachusetts.**
- **MWDBEs are not receiving the share of dedicated public contracts set aside for them.**
- **The Mass LEAN program does not have explicit MWDBE employment goals for contractors and does not collect demographic data on the contractors they employ or their share of jobs or dollar value.**
- **This failure highlights the need for expansion of programs such as ECC’s E-Contractor Academy to help MWDBE contractors understand how to navigate the process and become eligible to receive work contracts, such as those through Mass LEAN and Mass Save.**

SECTION 4: TARGET SERVICE MARKETS

This research study aims to understand the market demand for energy upgrades and identify the most likely geographic locations for energy upgrades through Mass LEAN. To this end, multiple factors were explored that contribute to the likelihood of successful intervention in a specific neighborhood. One part of this target service market analysis looks at housing structure characteristics such as the year the housing unit was constructed, the type of fuel source it uses for heating, and the type of cooling system installed. Analyzing these three factors individually provides insight into the potential work that needs to be performed and the market opportunities therein. The second part of this target service market analysis uses demographic data to understand the geographic areas of potential Mass LEAN-eligible residents. Combining these factors can help guide outreach strategies and efforts.

Section 4.A: Space Heating and Cooling

One of the aims of this study is to understand the scope of the market for energy efficiency retrofits in existing structures in the MAPC region, both in subsidized affordable housing and naturally occurring affordable housing. Commercial and residential buildings are responsible for 29% of carbon dioxide emissions in the United States.²⁹ In residential buildings, 38% of those emissions are created by space heating and cooling. Heating and cooling technologies are some of the most energy-intensive uses in buildings. To make the greatest impact on both energy usage and costs, residential energy efficiency efforts must prioritize the conversion of the energy type used for heating homes by shifting a building’s reliance from traditional inefficient fuels, particularly oil and propane, and also natural gas, to more efficient and potentially renewable resources such as electricity. This can be achieved through the installation of air-source heat pumps and other renewable heating and cooling technologies, including ground source heat pumps.

²⁹ “Decarbonizing U.S. Buildings.” Climate Innovation 2050. Center for Climate and Energy Solutions. Jessica Leung. July 2018. <https://www.c2es.org/wp-content/uploads/2018/06/innovation-buildings-background-brief-07-18.pdf>

On July 8, 2022, the U.S. Department of Energy (DOE) awarded Emerald Cities Collaborative approximately \$2 million from Weatherization Assistance Program³⁰ funds to focus on the installation of air-source heat pump technology in combination with the traditional components of full-scale weatherization measures. One geographic target for this project is the Gateway Cities, which face social and economic challenges. Gateway Cities are midsized urban centers that anchor regional economies around the state. The Legislature defines 26 Gateway Cities in the Commonwealth, which are Attleboro, Barnstable, Brockton, Chelsea, Chicopee, Everett, Fall River, Fitchburg, Haverhill, Holyoke, Lawrence, Leominster, Lowell, Lynn, Malden, Methuen, New Bedford, Peabody, Pittsfield, Quincy, Revere, Salem, Springfield, Taunton, Westfield, and Worcester.³¹ A Gateway City (under Chapter 23A Section 3A) is a municipality with:

- a population greater than 35,000 and less than 250,000;
- median household income below the state average; and
- rate of educational attainment of a bachelor’s degree or above, which is below the state average.³²

Per the DOE, “Heat pumps reduce electricity use for heating by approximately 50% compared to electric resistance heating such as furnaces and baseboard heaters. High-efficiency heat pumps also dehumidify better than standard central air conditioners, resulting in less energy usage and more cooling comfort in summer months. Air-source heat pumps have been used for many years in nearly all parts of the United States, but until recently they have not been used in areas that experienced extended periods of subfreezing temperatures. However, in recent years, air-source heat pump technology has advanced so that it now offers a legitimate space heating alternative in colder regions.³³”

Within the Mass Save and the Mass LEAN programs, a request for a heat pump will initiate an energy audit. This will identify building envelope retrofits such as insulation and sealing as prerequisites to heat pump installation, if those improvements have not already been made. Therefore, analyzing how buildings are climate controlled is a path to identify the potential for building retrofit interventions with high rates of return. Leading with heating and cooling technologies will have the most energy and cost savings benefits to the residents since it will also include insulation and air sealing. It also means that those high-demand, high-growth, and high-wage occupations identified in Section 3.B are needed, including building equipment contractors specializing in plumbing, HVAC, electrical, and wiring. It may also produce tasks requiring drywall and insulation, finishing, and carpentry contract work. Focusing on buildings that could use heating or cooling upgrades captures the main task of climate control, as well as any additional tasks triggered by that. By beginning with the more intense task, it creates a package approach for collaborative reciprocity between contractors, resulting in more efficient homes as a whole. Therefore, research into the landscape of heating and cooling technologies in homes is more productive than, for example, trying to understand the landscape of window upgrades performed or just insulation installed.

³⁰ Weatherization Assistance Program Enhancement and Innovation Selections. State and Community Energy Programs. <https://www.energy.gov/scep/wap/weatherization-assistance-program-enhancement-and-innovation-selections>

³¹ “About the Gateway Cities.” <https://massinc.org/our-work/policy-center/gateway-cities/about-the-gateway-cities/#:~:text=The%20Legislature%20defines%2026%20Gateway,%2C%20Springfield%2C%20Taunton%2C%20Westfield%2C>

³² Section 3a. The Massachusetts Legislature. <https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter23A/Section3A>

³³ Heat Pump Systems. U.S. Department of Energy. <https://www.energy.gov/energysaver/heat-pump-systems>

Conclusions:

- **The largest portion of energy consumption by a building is due to its climate control equipment; this energy consumption is also greatly influenced by the efficiency of a building’s envelope.**
- **Making climate control technology more efficient and combining with weatherization is key to reducing a building’s energy consumption and cost.**
- **Using energy upgrades to heating and cooling technologies as the entry point for building retrofits can be an effective intervention strategy with high projected rates of return.**

Section 4.B: Heating Fuel Type

This section looks at the type of energy sources used by housing units in the region to capture the potential market for conversion and upgrades. By starting with heating source, the study casts a wide net for the potential market needs for energy upgrades. This data encompasses all parts of a county if any of it falls within the MAPC region: Bristol, Essex, Middlesex, Norfolk, Plymouth, Suffolk.

Based on 2021 ACS data, Table 8 and Figure 11 provide a breakdown of heating sources in the region. The most popular energy source for heating was utility natural gas which heated 57% of all units. Moreover, 22% of households in the region, or roughly 417,503 households, still rely on oil for their heating needs (see Figure 11). This is a large segment of the population that is dependent on an expensive, energy-intensive, and hard-to-deliver fuel type. There exists great market potential to convert buildings heated by fuel oil, kerosene, and liquid propane to heat pump systems. These buildings make up nearly 25.2% of the entire residential stock in the region. The conversion of oil to heat pumps is one of the most cost-effective energy retrofits as well as one of the most energy-saving, particularly with the Commonwealth’s Mass Save program incentives. The rate of return through this conversion is high both in terms of its implementation as well as long-term benefits for the residents. This study reveals that there is a large untapped market for energy efficiency retrofits based on the number of housing units heated by delivered fuels alone. The large number of housing units still reliant on inefficient heating fuel sources sheds light on the long path ahead in order to meet the ambitious climate goals of the Commonwealth. The Mass Save program also incentivizes air source heat pump conversions for households currently heated by natural gas. This data of the potential market and the state’s dedicated funding programs towards these initiatives indicate growing potential of opportunities for contractors via the Mass Save and Mass LEAN programs.

Figure 1110: Household Heating by Fuel Type³⁴

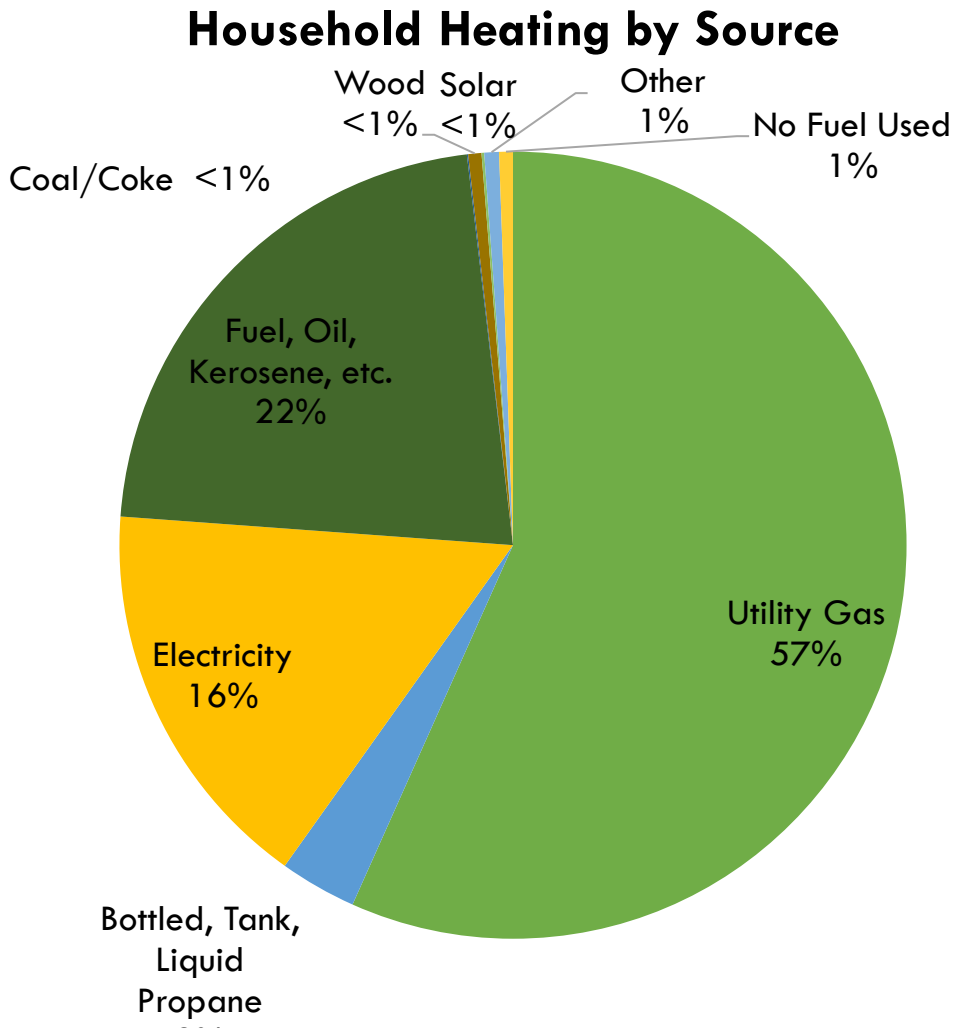


Table 9: Number of Households Using Each Fuel Source Type

Utility Gas	Bottled, Tank, Liquid Propane	Electricity	Fuel, Oil, Kerosene, etc.	Coal/Coke	Wood	Solar	Other	No Fuel Used
1,077,432	60,119	310,107	417,503	1,014	10,328	2,060	11,473	10,733
56.7%	3.2%	16.3%	22.0%	0.1%	0.5%	0.1%	0.1%	0.6%

³⁴ “2021- Selected Housing Characteristics – All Units.” Table ID DP04. U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates. Generated on 11/14/2021

The contractors in the Regional Contractor’s Academy are mainly small business owners that are learning to navigate the energy retrofit market, become eligible vendors in the Mass Save and Mass LEAN programs, and build their customer relations and client base in this field of work. The size of the projects that they are comfortable working in is typically single-family homes and two-to-four-unit multifamily buildings. Table 9 below breaks down the number of buildings by housing typology in each county to provide an estimate of the potential demand.

Table 10: Number of Units Heated by Oil³⁵

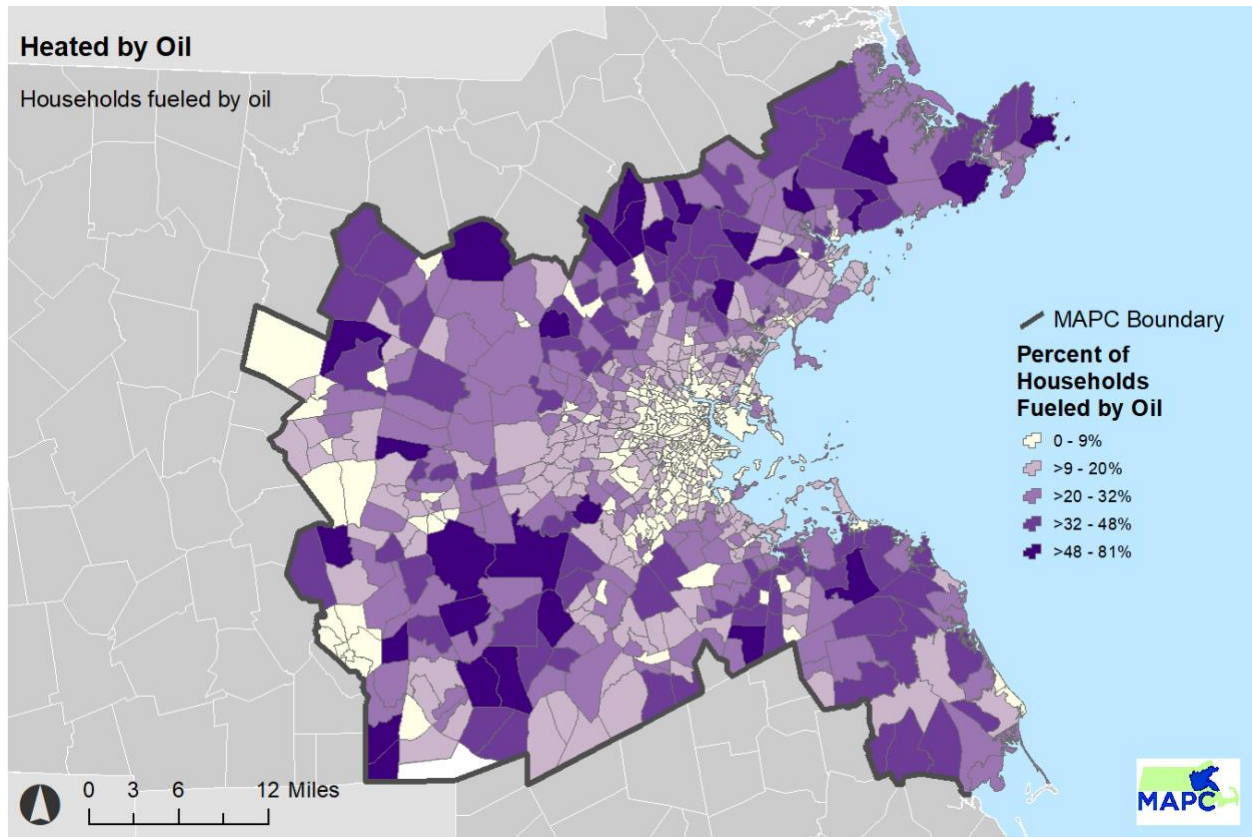
County	1-Unit	2-4 Unit	5-9 Units	10-19 Units	20+ Units	Total
Bristol County	41,702	7,844	2,315	1,480	2,217	55,557
Essex County	47,880	11,306	2,835	2,185	5,163	69,369
Middlesex County	85,661	19,675	4,338	5,144	12,172	126,990
Norfolk County	48,921	6,913	3,057	2,643	6,682	68,215
Plymouth County	53,000	5,603	1,711	1,520	2,384	64,218
Suffolk County	7,736	11,111	2,595	1,942	5,113	28,497
Total	284,900	62,451	16,850	14,914	33,730	41,2847

Single Family Residential homes are a more easily accessible market as the contractor only needs to interact with a single resident, who is more likely to be the homeowner and direct decision maker. In situations where the residents are renters, it is also a more direct relationship to build in contrast to large multifamily apartment complexes that may be owned by multiple owners or corporations and are harder to reach. This single and small multifamily market could be an entry point for building a portfolio of experience in retrofits. Based on the above data, there are approximately 346,351 units which are in buildings with fewer than 5 units that depend on oil for heating. These can be an entry target market for new contractors for the installation of heat pumps.

In the map in Figure 12 below, the darker purple areas indicate areas of high concentrations of homes reliant upon oil and represent high-opportunity areas for heat-pump installation. Nearly 22% of households in the region are heated by oil, an expensive, energy-intensive, and hard-to-deliver fuel type.

³⁵ This table does not include mobile homes, RVs, boats, etc. The previous table does include these housing typologies. Hence, the slight difference in numbers.

Figure 12 11Households Heated by Oil



Conclusions:

- **A large portion of housing units in the region are heated by inefficient fuel sources that make them eligible for energy upgrades.**
- **Many of these units are in housing typologies where contractors of the ECC Academy feel comfortable working.**
- **There is a high need for heat pump installation delivery in the region and it would be beneficial for vendors to take advantage of becoming eligible to work through Mass LEAN.**

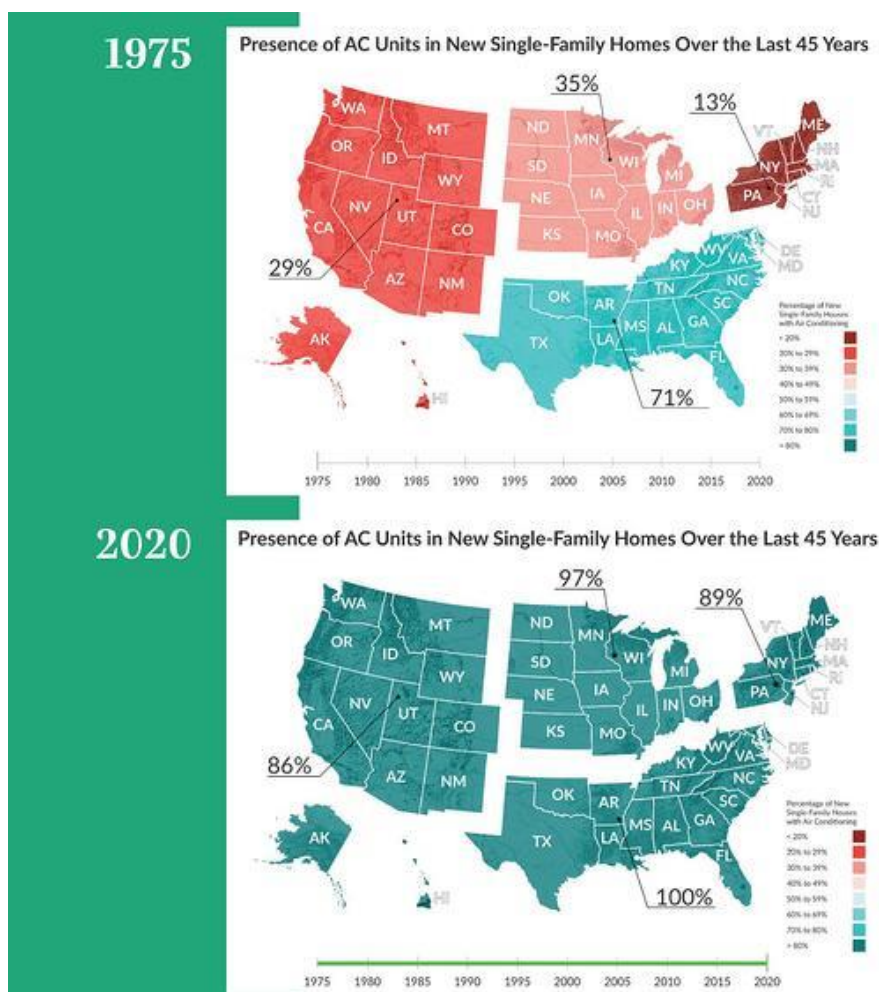
Section 4.C: Air Conditioning

With more extreme seasons and climate events, there is a visible growing need and demand for air conditioning, especially in places that did not historically need it. While the dangers of extreme cold weather events are widely known, extreme heat waves can also pose great risks such as heat exhaustion, dehydration, and heat stroke. These are dangerous and life-threatening to everyone, and vulnerable populations such as the elderly and children are at higher risk. These threats are also greater to people living in older buildings with few or no upgrades against the elements.

While heating is an amenity that landlords are required to provide tenants by law³⁶, no such laws exist for air conditioning.

Furthermore, in the Northeast United States in particular, air conditioning has been a less common amenity.³⁷ In 1975, only 13% of newly built homes in the region included air conditioning, a stark contrast to the southern United States where that number was already 70%. By 2020 however, 89% of newly built single-family homes in the Northeast included air conditioning. This trend is seen nationwide as 95% of single-family residences had some type of air conditioning, up from 46% in 1975³⁸. The northeast led this trend as it saw the biggest jump in air-conditioned units over the past 45 years.

Figure 1312: Presence of AC Units in New Single-Family Homes³⁹



³⁶ "Home Heating Help for Tenants." City of Boston. <https://www.boston.gov/departments/311/home-heating-help-tenants#:~:text=If%20you're%20a%20tenant,September%2015%20to%20June%2015>

³⁷ Presence of Air Conditioning in U.S. Homes Over the Last 45 Years, Shown in One Timeline Graphic." Adam Graham. June 22, 2021

³⁸ "Most American Homes Now Have Some Air Conditioning." Green Builder. Alan Naditz. <https://www.greenbuildermedia.com/blog/most-american-homes-now-have-some-air-conditioning> 09/14/2021

³⁹ Source: <https://www.fixr.com/blog/2021/06/22/presence-of-air-conditioning/>

Figure 14 below illustrates the number of homes by the year they were built and the type of air conditioning they have installed in them. Nearly 100% of all units have some sort of air conditioning installed, either singular room air conditioners or central air conditioning. In the mid-1970s, central air conditioning gained popularity and outpaced reliance on room units. Another entry point for contractors is the installation of new central air conditioning in new units, but more so conversion of homes from single room AC units to centralized air. Older homes utilizing inefficient cooling systems are another viable market for deep energy upgrades.

Figure 1413: Portion of Houses with AC by Year Built⁴⁰ in the Boston-Cambridge-Newton, MA-NH Metro Area

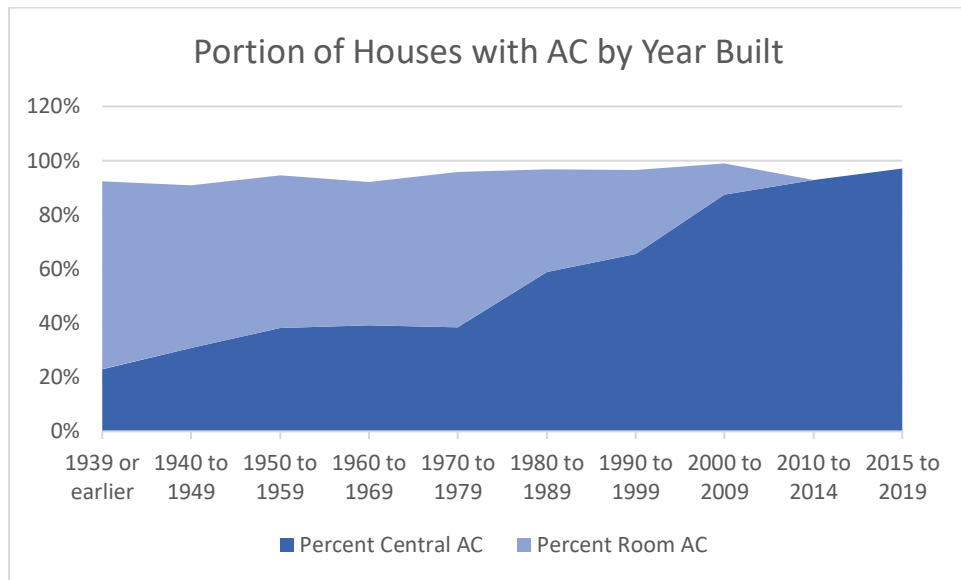


Table 11 below breaks down the number of residential structures by housing typology as well as the type of air conditioning they have installed. The numbers are in thousands of housing units. An estimated 77% of small multifamily buildings of two to four units and 64% of buildings of five to nine units rely on room air conditioning. That is a total of 309,700 small multifamily residential buildings that could be a market for conversion to ducted or mini-split heat pump systems. The data also revealed that approximately 50% of single-family houses, or roughly 508,900 units, also still rely on room air conditioning. The numbers decline in larger multifamily buildings that are more likely to be utilized as central air conditioning.

Table 11: Portion of Houses with AC by Housing Typology⁴¹ in the Boston-Cambridge-Newton, MA-NH Metro Area

	1 Unit	2 To 4 Units	5 To 9 Units	10 To 19 Units	20+ Units
Central Air Conditioning	499.3 (50%)	72.0 (23%)	37.7 (36%)	67.4 (53%)	163.2 (65%)
Room Air Conditioning	508.9 (50%)	244.1 (77%)	65.6 (64%)	60.6 (47%)	86.0 (35%)

⁴⁰ “2021 Boston — Heating, Air Conditioning, and Appliances — All Occupied Units”. Boston-Cambridge-Newton, MA-NH MSA (2013 OMB definition). U.S. Census Bureau, American Housing Survey. Generated On: 01/26/2023, 10:39 PM

⁴¹ “2021 Boston — Heating, Air Conditioning, and Appliances — All Occupied Units”. Boston-Cambridge-Newton, MA-NH MSA (2013 OMB definition). U.S. Census Bureau, American Housing Survey. Generated On: 01/26/2023, 10:39 PM

Air conditioning is slowly becoming a necessity in parts of the country that did not formerly need it. With increasing average temperatures due to global warming, this will likely become not only an expectation of residents looking for housing but may even become a legislative regulation. Home cooling also has a market beyond residents that are trying to conserve energy. It is seen as an element of comfort for which people are willing to pay. This market needs less convincing as those residents and owners may be taking the initiative themselves to seek out and hire contractors. Social consciousness has also been raised in recent years around both indoor and outdoor air quality with recent events such as extreme yearly wildfires and the Covid-19 pandemic. Residents are motivated to improve their own quality of life through comforts such as air conditioning. This market can be an entry point for building envelope weatherization as contractors work to install more efficient cooling technologies. HVAC equipment has a life span of roughly 15 years and carries the added risk of being a “replace upon failure” situation, potentially leaving residents without cooling until they can hire an available HVAC technician. It may also need to be replaced with “like for like”, which can lock in fossil fuels and other harmful chemicals like R-22 Freon for another 15 years. This is also an opportunity for intervention and incorporation of other energy efficiency upgrades.

Conclusions:

- **The demand for air conditioning has grown in the region over the past few decades.**
- **Nearly every household has some form of air conditioning today.**
- **Air conditioning has high energy consumption and there is market demand for conversion of homes from single-room AC units to central air, presenting opportunities for contractors to capture this demand outside of energy upgrade work and address it through- or in combination- with energy efficient upgrades. Within the LEAN program, heat pumps offer a cost-effective way to install home cooling, though when used for home heating, the operating costs may not be cost competitive with natural gas heating under current conditions.**

Section 4.D: Age of Housing

The year a residential structure was built provides useful information as to the type of internal infrastructure it may have, the types of upgrades it might need, and the additional factors obstructing its improvement. To understand potential markets for Mass LEAN customers, this report builds on the previous studies included in the Section 4.F literature review of this report. Those studies explore correlating common characteristics amongst residents who were eligible for Mass LEAN yet did not participate in the benefits. Studies found certain common correlations of potentially eligible residents and have identified housing age as a key indicator to understand the potential for eligibility in Mass LEAN programs.

The 2020 Nonparticipant Customer Profile Study completed for the LEAN program summarized: “For the additional ACS variable correlations, low and moderate-income, renters, multifamily, limited English language, natural gas heating, and urban status all tend to cluster together. By definition when looking at block group statistics, this clustering indicates an underlying geographical commonality. There are essentially areas around the state, generally urban ones, where people

who tend to fall into all of these categories live, and the housing stock there tends to be rented, multifamily housing, constructed before 1950.⁴²

Conclusions:

- **The year a building was constructed often means correlating attributes that can predict the package of services it will need for a building retrofit'**

Section 4.E: Ancillary Scope of Work

When a housing unit applies for the Mass LEAN program, a certified building energy auditor from the relevant CAP agency inspects the property to identify all eligible energy efficiency measures. The Scope of Work is then shared with relevant contractor(s) who provide the retrofit work as Mass LEAN vendors for the CAP agency. The direct energy upgrade tasks may require barrier remediation to be completed prior to or alongside the retrofits. These triggers can include the presence of lead paint, asbestos, knob and tube wiring, roof issues, etc. that need to be addressed before energy retrofit work can commence. The year a structure was built can help predict the type of services that may be needed.

1950 – Correlation to Mass LEAN Eligibility

The studies referenced below found that multifamily residential structures built prior to 1950 that are heated by natural gas are more likely to house low- and moderate-income residents that meet the income thresholds for Mass LEAN incentives.⁴³ This can be further enriched by layering data on languages spoken at home.

1978 – Lead

The federal government enacted a comprehensive ban on lead-based paint in 1978. At that time, the Consumer Product Safety Commission prohibited the sale of lead-based paint. Homes that are built prior to 1978 are highly likely to contain lead-based paint and the likelihood increases with the age of the home⁴⁴ in a direct positive correlation. Approximately 24% of the homes built between 1960 and 1977 are likely to contain lead-based paint; 69% of the homes built between 1940 and 1959 are likely to contain lead-based paint, and 87% of the homes built prior to 1940 are likely to contain lead-based paint. Furthermore, with older homes and paint, exposure is more likely due to factors such as cracked or peeling paint, deterioration dust, and disturbance through repairs. Therefore, any energy retrofit work such as window upgrades must include lead testing, and possibly lead remediation. Contractors must be trained not only in the energy aspects of their work, but would also benefit from lead remediation and deleading training and certification, or from partnering with vendors who offer this service.

1990 – Asbestos

Like lead-based paint, the ban on asbestos also took many years, legislative actions, and court rulings to finally implement. The bans went through many phases as they were sometimes applied

⁴² Residential Nonparticipant Customer Profile Study (MA19X06-B-RESNONPART; “NPA”). DNV GL for Massachusetts Program Administrators (PAs) and Energy Efficiency Advisory Council (EEAC) Consultants. February 6, 2020.

⁴³ Residential Nonparticipant Customer Profile Study (MA19X06-B-RESNONPART; “NPA”). DNV GL for Massachusetts Program Administrators (PAs) and Energy Efficiency Advisory Council (EEAC) Consultants. February 6, 2020.

⁴⁴ Protect Your Family from Sources of Lead. Environmental Protection Agency. 05/26/2022.

<https://www.epa.gov/lead/protect-your-family-sources-lead#:~:text=If%20your%20home%20was%20built,states%20banned%20it%20even%20earlier.>

narrowly and sometimes overturned. In 1990, the EPA generally prohibited the spray-on application of materials containing more than 1% asbestos to buildings, structures, pipes, and conduits unless certain conditions specified.⁴⁵ Therefore, buildings built prior to 1990 are likely to have asbestos present. Any retrofit activities performed in these structures may need to account for this added task of asbestos abatement to the scope of work. It may be beneficial for contractors to understand the regulations and requirements and build their professional networks to provide additional services through their network partners. This helps relieve the burden from potential customers and can strengthen a contractor’s portfolio.

In the subject counties in the MAPC region, there are an estimated 1,639,432 housing units that were constructed before 1990, comprising 81% of the entire housing stock. Of these, 1,444,848 housing units were constructed before 1979, or 72% of the entire housing stock. This indicates that these units are highly likely to need additional professional contracting services. The approximately 1.6 million units built before 1990 are more likely to contain asbestos in their building materials and the 1.4 million units built before 1979 are likely to contain lead-based paint. Depending on the scope of retrofits for these properties, contractors must be able to provide these added services of lead and asbestos testing and abatement. These specialties in turn require additional certifications. A layered service package offering may be helpful for the contractor’s marketability. Funding for energy upgrades and retrofits must also take into account additional costs for such services as the presence of lead or asbestos may be an obstacle for residents and contractors to completing energy-related work.

Conclusions:

- **If a building was constructed before 1940, it is most likely to contain lead.**
- **If a building was constructed before 1990, it is most likely to contain asbestos**
- **Residents who are eligible for Mass LEAN benefits but have not participated in the program are likely to reside in buildings constructed prior to 1950.**
- **Combining these layers of data can point to areas in the region with high occurrence of all three to show where energy upgrade work will trigger the need for additional services, such as the abatement of lead and asbestos.**
- **There are funding sources available for lead and asbestos remediation.**
- **Building retrofit contractors need to collaborate with these other service providers to provide efficient and holistic delivery of services.**

Section 4.F: Review of Pertinent Studies - Target Markets

The research herein builds on the findings from existing relevant studies conducted in the previous five years. Some of the key findings from those studies are summarized below. They helped form the basis for the geospatial analysis to map out the neighborhoods in the region that are most likely to be ripe markets for energy upgrades provided through Mass LEAN and Mass Save. The studies outline criteria for both housing characteristics for the buildings in need, as well as demographic characteristics of eligible residents that may not be participating in the incentive programs available to them. These findings are then applied in the mapping criteria in the GIS interactive mapping tool ancillary to this report.

⁴⁵ “EPA Actions to Protect the Public from Exposure to Asbestos.” Environmental Protection Agency. 07/18/2022.

Residential Nonparticipant Customer Profile Study

Nonparticipant Customer Profile⁴⁶ Key Takeaways:

- Households residing in multifamily structures built prior to 1950 were less likely to participate
- Respondents expressed distrust in government, landlords, and suspicion of free offers
- Respondents self-identified as low-income
- Existing data was obscure in measuring participation, effectiveness, and savings. Utilizing addresses to count retrofits overstates multifamily structure participation as sometimes it fails to distinguish the retrofit of a single unit from an entire structure. Counting participation by account numbers is also an unreliable measure as the same unit can have many account numbers with tenant turnover, the same account number can be transferred to a new location, and so forth. Fragmented, varying data collection points by various providers leaves the available data difficult to interpret and use. ACS data is more trustworthy and used for most studies.
- Often ancillary services are needed alongside energy retrofit scope of work, such as cleaning a unit for elderly residents, removing outdated “knob and tube” electrical wiring, or addressing asbestos abatement or lead paint presence
- “For the additional ACS variable correlations, low and moderate-income, renters, multifamily, limited English language, natural gas heating, and urban status all tend to cluster together. By definition when looking at block group statistics, this clustering indicates an underlying geographical commonality. There are essentially areas around the state, generally urban ones, where people who tend to fall into all of these categories live, and the housing stock there tends to be rented, multifamily housing, constructed before 1950.”
- Moderate income non-participants are likely to reside in census tract with a higher participation rate, be homeowners, and report awareness of Mass Save.

Residential Nonparticipant Market Characterization and Barriers Study

Nonparticipant Characteristics⁴⁷ Key Takeaways:

Nonparticipants are more likely than participants to:

- Live in rental units in buildings with fewer than 10 units; buildings with 3 – 9 units are toughest to reach
- Only have a high school education or no secondary school degree
- Be low-to-moderate income households
- Have limited English proficiency
- Report lower awareness of Mass Save
- Are harder to reach, even with greater effort and financial incentives
- Were harder to reach even via door-to-door outreach due to missing information (unit numbers, etc.)
- Be renters who did not feel like investing in a property they did not own
- Cited more urgent needs that required their attention such as utility turnoffs, food, and well-being
- If moderate income and residing in census tracts with higher levels of overall program participation, non-participants had more awareness of the program.

⁴⁶ Residential Nonparticipant Customer Profile Study (MA19X06-B-RESNONPART; “NPA”). DNV GL for Massachusetts Program Administrators (PAs) and Energy Efficiency Advisory Council (EEAC) Consultants. February 6, 2020

⁴⁷ Residential Nonparticipant Market Characterization and Barriers Study. ILLUME, Cadeo, Navigant for The Electric and Gas Program Administrators of Massachusetts Part of The Residential Evaluation Program Area. 2019

- If participating in another public assistance program, this had no bearing on participation in Mass Save
- This study focused on moderate-income households; it did not map building structure age but relies on tested and reliable correlating data points.

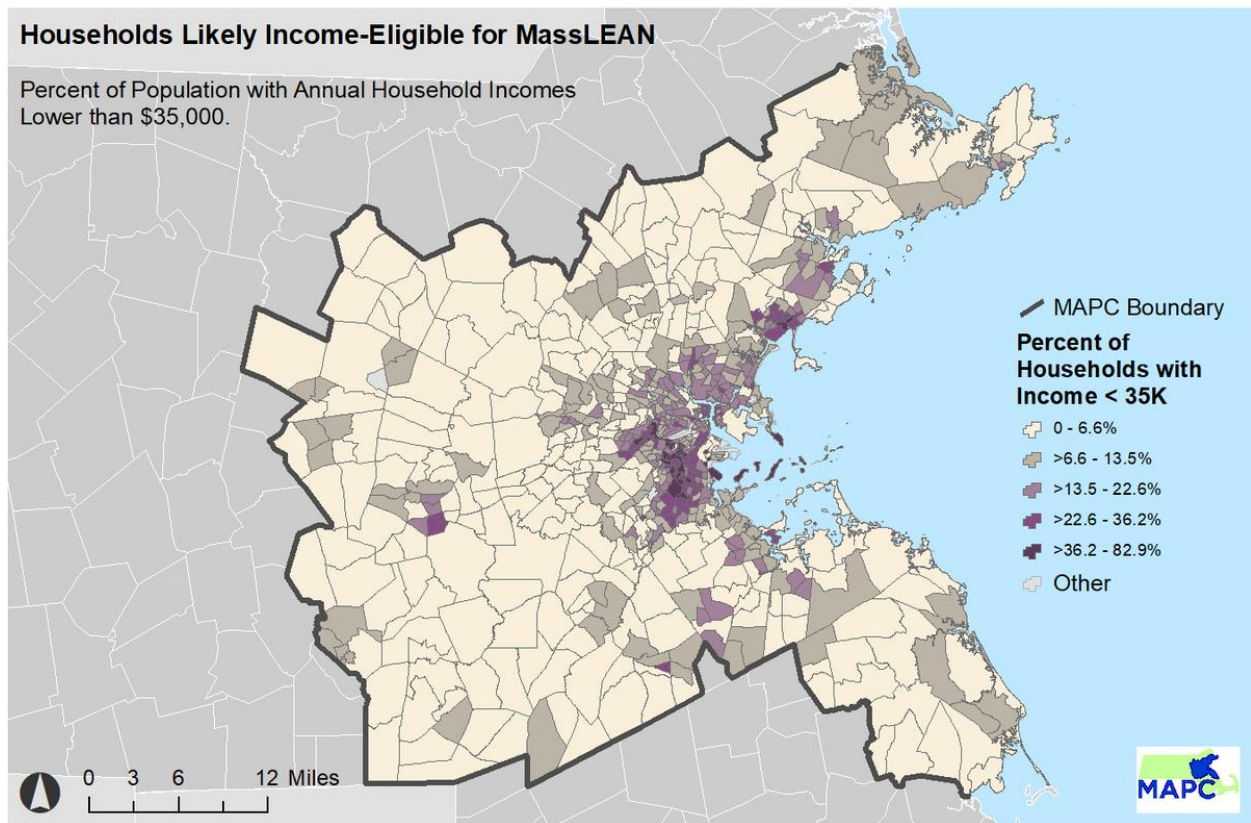
Deep Energy Retrofits Market in The Greater Boston Area

Deep Energy Retrofits Market Study Key Takeaways⁴⁸:

- Most communities in the MAPC region meet the Green Criteria and are part of the Green Communities Program.
- Contractors are facing supply chain issues and are impacted by globalized supply chain issues
- There is greater integration of computerized systems, smart software controls, and artificial intelligence in building operations and maintenance

In the map in Figure 14 below, the areas in dark purple indicate high concentrations of residents with annual household incomes lower than \$35,000. This is below the income threshold requirement for a one-person household to qualify for Mass LEAN. These areas indicate high rates of opportunity for contractors wishing to expand Mass LEAN service to new customers.

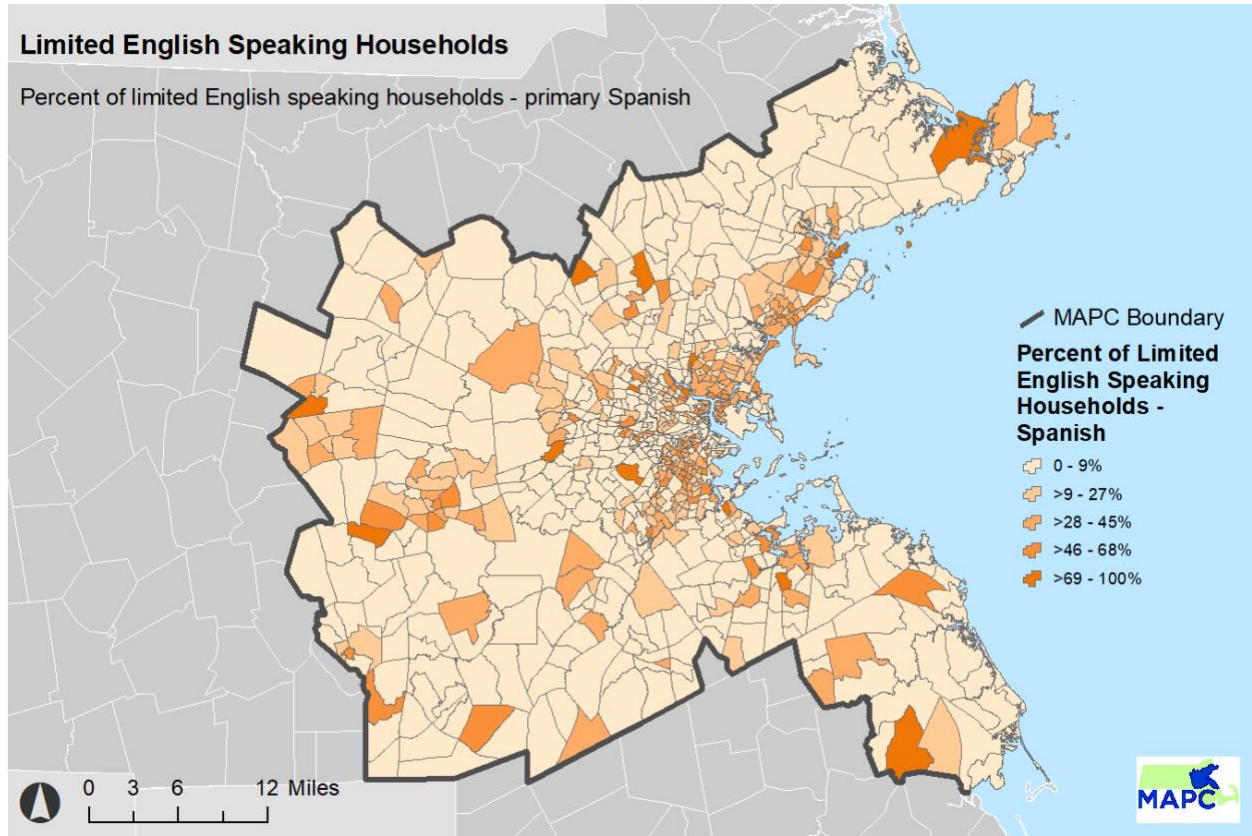
Figure 1514 Households Likely Income-Eligible for Mass LEAN



⁴⁸ Deep Energy Retrofits Market in The Greater Boston Area. Cadmus. Commissioned by the Netherlands Enterprise Agency. Ministry of Foreign Affairs. 13 October 2020.

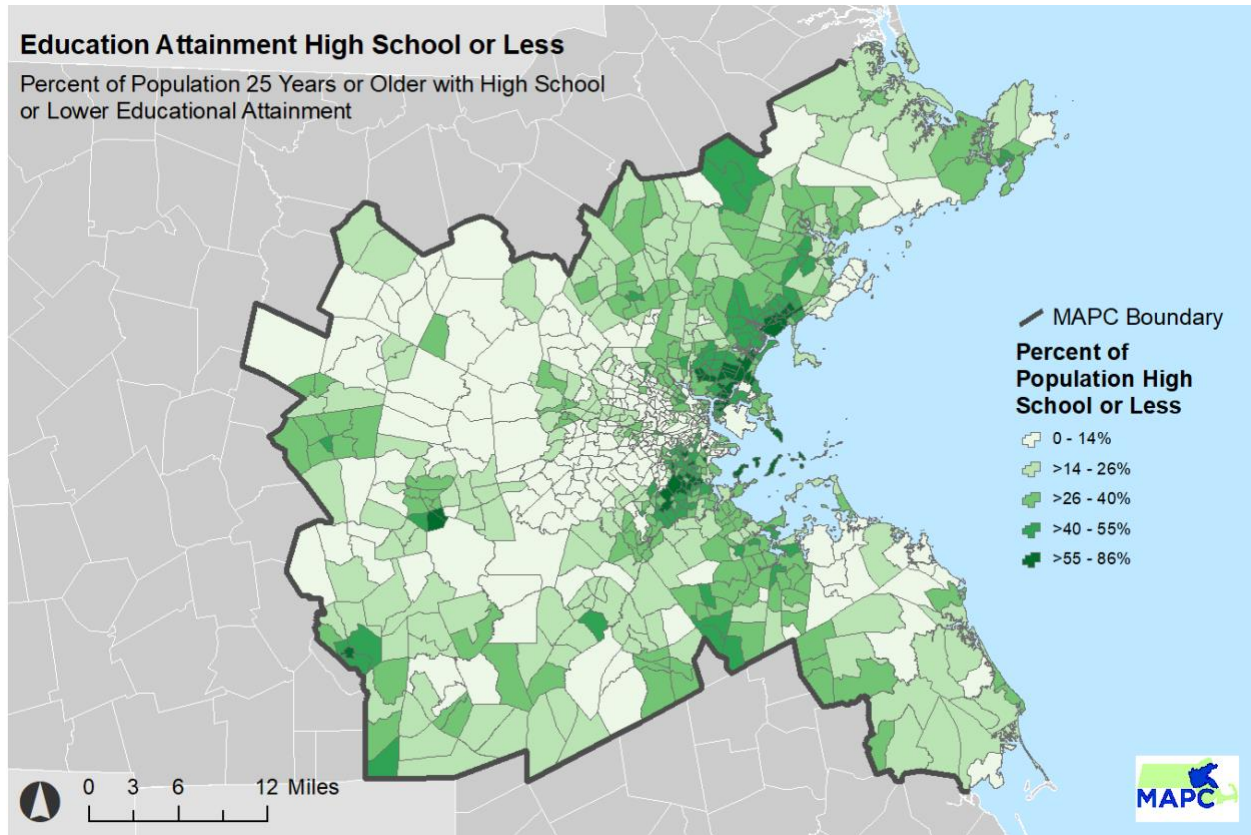
One of the hardest to reach populations are non-native English speakers. The map in Figure 15 represents areas of population concentration of households where the primary language spoken at home is not English. The areas in darker orange have high rates of non-English speaking households.

Figure 1615 Limited English-Speaking Households



Another segment of the population with a high correlation to being eligible for Mass LEAN are those with an education level defined by the U.S. Census Bureau as “High school diploma or less.” The areas in darker green indicate high concentrations of residents with low formal education levels. This is a population that is highly likely to be eligible for Mass LEAN and one that could benefit highly from its offerings.

Figure 1617 Educational Attainment



Conclusions:

- Previous studies have made findings that point to areas and populations missing out on Mass LEAN and Mass Save benefits.
- Geospatially mapping the demographic data points can help show concentrations of residents with high likelihood of Mass LEAN eligibility.
- Outreach strategies can be developed to be culturally cognizant of these demographic factors in order to be more effective.

SECTION 5 — INTERVIEWS

This section summarizes key takeaways from a series of interviews conducted with stakeholders to collect qualitative information on the MA LEAN program. The purpose of these interviews was to augment the market analysis with qualitative insights into the nuances of the LEAN program, such as challenges of the program, demand, and the degree to which it is being met, the diversity and experience of contractors participating in the program, and advice for new contractors entering the field. Over the past two months, MAPC staff interviewed a diverse group of individuals, listed in the Table below.

	Name	Affiliation	Stakeholder Type
1	Abel Vargas	Valley Home Insulation	Contractor
2	Brian Beote	Action Inc.	CAP Agency
3	Jason Pruess	Self Help	CAP Agency
4	Jamie Parr & Mark LaPan	South Middlesex Opportunity Council	CAP Agency
5	Angela McCabe	Boston Private Industry Council Workforce Development	Mass Hire
6	Christina McPike	Winn Companies	Housing Developer & Owner
7	Marylene Marcelino	Eversource	Utility
8	Gabe Shapiro	All In Energy	Nonprofit

The following sub-sections highlight the key themes and topics that emerged from interviews.

Program Demand

Interviewees discussed the demand they are seeing from customers and their ability to meet that demand.

Feedback from CAP agencies:

- The busy season for energy retrofit work is from the beginning of November to mid-March. Typically, business quiets down by April, but last year there was an unexpected increase in demand for heat pumps in the summer, likely due to high temperatures and heat pumps offering the best LEAN-funded route for home cooling.
- Due to the high cost of energy this winter, some CAP agencies are getting an overwhelming number of calls – up to 1,000 a day – indicating an increase in demand. The pace at which demand can be met varies by agency. Most CAP agencies could add additional contractors to their roster, particularly those who specialize beyond weatherization (e.g., electricians, roofers, plumbers, those with niche specialties such as chimney specialists or those trained to work with asbestos siding, etc.). One noted that they do not need additional capacity, but they did onboard three new auditors so expect demand to increase in the near future as the new auditors bring in more work.
- Several CAP agencies noted having a backlog of projects into April, particularly where barrier mitigation is needed. One interviewee pinpointed the demand for electricians causes delay, their agency approximately 60 projects waiting for specialized electricians who can remove knob and tube wiring, and the wait time can be up to a year.
- One CAP agency shared that they feel they have saturated their service areas and are now focusing on more challenging projects with barrier remediation (e.g., asbestos, mold, knob-and-tube wiring, etc.).

- One CAP agency anecdotally shared that they completed 200-240 weatherization projects and 500 heating system projects in 2022. A majority of projects are done on single-family homes and duplexes.

Feedback from other stakeholders:

- Stakeholders have acknowledged that there is significant opportunity in this field, and the challenge of meeting demand is not due to insufficient funding, but rather a capacity issue, in hiring and training.
- From the stakeholder perspective, one of the primary obstacles is audit capacity, as there are not enough people available to conduct audits, which is further complicated by the seasonal nature of the work. The Community First Partnership is piloting allowing market-rate vendors to do the initial audit for low-income households, which may partly alleviate the capacity issue. This is the approach taken by the HPC model in Mass Save.

Challenges Experienced with LEAN Program

Interviewees were asked to describe any challenges they are facing with the LEAN program.

Feedback from CAP agencies:

- **Technical challenges.**
 - Two notable technical challenges were identified: removing knob-and-tube wiring and roof repair challenges. 1) the labor-intensive and invasive nature of rewiring homes with knob and tube wiring has resulted in a strong backlog of work. The limited availability of skilled electricians willing to do this work has compounded the issue, as demand for the service continues to outstrip capacity. 2) the shortage of roofing contractors who can repair leaking roofs at a reasonable price. CAP agencies noted that roofing companies struggle more with the LEAN background check requirements.
 - Contractors face challenges regarding barriers to perform services, such as presence of mold or asbestos. While these barriers may increase the time and complexity of the repairs, funding is available to resolve these barriers.
- **Hiring challenges.**
 - One CAP agency noted that contractors are facing challenges with hiring weatherization workers for the rates that they can afford to pay. This field is not always recognized as a desirable career path as it is not very lucrative at the entry-level, and also challenging work, even as it offers robust advancement and entrepreneurship opportunities for those who stick with the work. Despite these difficulties, many contractors would like to expand their businesses but are unable to do so due to the difficulty of finding skilled workers for the established rates.
 - Difficulty with potential crew members passing the required background check to work on the LEAN program is also a notable hiring challenge. The background check is discussed further under the *Advice for Contractors Navigating LEAN* section.

Feedback from other stakeholders:

- **Uncertainty in customer drop off.**

- Stakeholders are unsure at what stage potential customers drop off and why. They feel that the process is still a black box with limited visibility into the details.
- The marketing and customer acquisition strategy for people of color must be tailored and takes investment. One stakeholder shared an anecdote of a contractor who sent mailers to predominately people of color – 30 people responded and only two followed through with actual jobs. More data and study on job completion rates by the CAP agencies and Mass Save after outreach would be helpful for understanding barriers to weatherization.
- **Reaching underserved and non-English speaking populations.**
 - There is a need to raise awareness about the LEAN program in multiple languages – given many residents’ primary language is not English. To address these challenges, the program and its actors must invest in bilingual staff and materials to support customers at each phase of the project. To date, audits have only been conducted in English. The program should also include strategies for outreach and community engagement that can help to build trust and increase awareness among non-English speaking populations. The limited availability of bilingual staff is a notable capacity constraint and opportunity area.
 - To better reach renters, program administrators are working on a “Renters Plan” that will aim to increase access of energy efficiency services to renters.
- **Limited training resources or information about the field for job seekers.**
 - Aligned with the comment above regarding hiring, there are not enough training providers or pre-training actors in the field. One career center interviewed noted that they do not have clean energy coaches because they do not have sufficient information about the field. The lack of information, job readiness programs, and technical career resources is a significant deterrent to job seekers.

Advice for Contractors Navigating LEAN

MAPC asked interviewees what advice they have for new contractors in navigating the LEAN program. Below is a compilation of their responses.

Feedback from CAP agencies:

- **Just get your foot in the door.**
 - Interviewees advised participating in Mass Save in general, whether in the LEAN program, market-rate program, or both. It is best to get started in any program and start building relationships and gain experience. Additionally, it is practical to build a hedging base of non-program work as well, which can help contractors to balance their workload and maintain steady revenue streams outside of program work. One CAP agency noted that many contractors work in LEAN as a second stream of work but make more income from market work.
 - Several CAP agencies noted that the best way to join the vendor list is to reach out directly to the program managers at each CAP agency.
- **Find a niche and develop partnerships to add services.**
 - Interviewees suggested contractors find a niche in the field and build partnerships with one another to add more services to their offerings. Services such as certifications in handling asbestos siding or bath fan installations are in high

demand but there are fewer vendors in this space. CAP agencies noted that they send these jobs to the contractors in this niche.

- **Take time to get to know your CAP agency.**
 - The CAP agencies encouraged contractors to make time to meet with personnel at their CAP agency and fully understand the needs regarding paperwork (e.g., photo requirements during and after a project). They emphasized that understanding and completing paperwork accurately and efficiently is important for success in the program and avoiding callbacks, which slows down progress. Taking time to do this will make a contractor stand out from others who are too busy or do not know how to complete the paperwork accurately.
 - When a new contractor joins a CAP agency, they are typically shadowed on their first 2-4 projects to ensure quality work and all necessary steps and paperwork are completed. If these jobs are completed well, the CAP agency will send more jobs to the firm.
- **Communicate well and build confidence.**
 - Good communication and paying close attention to detail is key to building confidence and providing the best service possible. It is essential to be responsive quickly, even if it requires going back to a job to address something not previously handled. The interviewees also recommended having conversations with those inspecting the work to fully understand what their expectations are. CAP agencies and Mass Save providers can also facilitate these relationships and feedback cycles to help ensure MWDBE contractor success.
 - It is necessary to effectively communicate with the CAP agencies throughout the entire process, from scheduling to completion, and to properly communicate any issues with clients. Interviewees also emphasized the importance of having experienced team members who are able to troubleshoot challenges and properly use equipment.
- **Be aware of the background check requirement.**
 - Some interviewees noted hearing concern about LEAN's background check requirements, and the challenge in passing all crew members, which can sometimes cause a worker supply issue. This was noted particularly for roofers. They also noted it is important to be proactive about the background check, as it is the contractor's responsibility to follow up and ensure that the process is moving forward. They acknowledged that some contractors may find the process expensive, but not excessively so – likely a few hundred dollars per crew member.
 - If someone on a contractor's team does not pass the background check, the firm can still participate in the LEAN program, but that individual will not be able to work on the project.
 - Of note, background checks are not required for DOE-funded weatherization work. This indicates that the LEAN program requirements may be more stringent than necessary and pose additional barriers to entry for people of color, who are more likely to have interacted with the legal system than their white peers.
 - Interviewees were unsure if there is a time limitation for any items on record in the background check. Marijuana convictions are not included.
- **Payment can take time.**
 - Several interviewees noted anecdotally that payments may take a while to process since a post-work inspection is first required in the LEAN program, and to be patient while awaiting reimbursements. The market-rate Mass Save program does not require work inspections prior to payment, and instead conducts random

inspections, and this is an area for policy improvement to help contractors make payroll.

Feedback from other stakeholders:

- **Build reputation with customers through high quality work.**
 - The interviewees advised contractors to focus on building trust with customers and providing excellent customer service. They recommended getting testimonials and referrals to establish a positive reputation and create “evangelists” from customers.
 - Contractors should satisfy their customers and resolve any problems quickly and effectively while making the customer feel heard. Because the program has experienced poorer quality providers in the past, it is important to differentiate from them.
 - The interviewees also suggested working with personal networks to make introductions to potential customers who they know and trust.
 - Another suggestion was to build relationships with community groups, local institutions, or the municipality to co-brand with contractors, thereby increasing recognition and reputation.
- **Be cautious of growing too quickly.**
 - Contractors must be cautious of growing too quickly, as it can be challenging to find the right balance of having enough work without becoming overwhelmed.
 - They suggested establishing partnerships with others in the field who they can pass on overflow work.
 - They also warned against having negative evangelists or a reputation of doing bad work.
 - The interviewees acknowledged that while downtime can be challenging, it is imperative to avoid taking on more work than can be handled to prevent damaging the contractors’ reputation.
- **Invest in a CRM system.**
 - Invest in a CRM system and systemize data to serve more customers. One interviewee shared an anecdote about a contractor who went through growing pains before receiving a grant to support transitioning from a spreadsheet system to a Salesforce system. They received more leads than they needed in their first year and passed them on to other home performance contractors.
- **Have an energy modeler on staff.**
 - Because LEAN only covers energy-saving projects, having an energy modeler on staff would help demonstrate energy performance and facilitate the administrative process with LEAN, particularly for larger projects in multifamily buildings. An energy modeler does not need as sophisticated modeling as a design-build firm, but even minimal energy modeling skills on Excel would add a layer of energy performance expertise in-house. This can also help with pitches and estimate the benefits that will come with upgrades and getting the customer on board. The interviewee suggested that investing in this capability internally is a smart move, and they do not believe any firm currently offers it.
- **Be mindful of the new era of energy efficiency.**

- Interviewees encouraged contractors to be conscious of the new era of energy efficiency, and not to focus on basic techniques of the last decade (e.g., air sealing). One interviewee expressed concern for the older building stock that has not yet been retrofitted with boiler upgrades would make the mistake of doing these projects now as opposed to next era upgrades, such as heat pump conversions.

Diversity & Types of Contractors

MAPC asked interviewees about the diversity of the contractors they work with, specifically if there are any demographics that are underrepresented in the program, such as women- and people of color-owned contractors, or skill sets.

- **Women- and People of Color-owned businesses.**
 - Interviewees across the board shared that the contractor pool they work with is predominantly white and male-dominated, especially at the leadership level. There are very few women- and people of color-owned firms in the field. The crews, or subcontractors, of these fields tend to be more diverse. One interviewee estimated that approximately 80% of the crew they interact with is white, while 20% is Hispanic, and nearly 100% are men. They noted Black people are typically underrepresented in the field. Anecdotally, interviewees have identified 1-2 woman-owned or co-owned business.
 - CAP agencies do not currently track the diversity of their contractors but are aiming to have more equity metrics in their reporting to capture this information. In their interview, Eversource shared plans to require more reporting on contractor diversity and language access in the future, given the limited data available.
 - Another interviewee stressed that women- and people of color-owned firms need social capital to navigate the systems.
- **Diversity in contractor type and skills.**
 - There is a need for more contractors with skills in heat pumps and electricians (particularly ones familiar with knob-and-tube wiring), while there is a solid bench of weatherization technicians. They also noted that there are not many home performance contractors and that roofers are harder to find, the latter likely due to background check requirements.

Contractor Onboarding, Timeline, & Project Assignment

MAPC asked interviewees to share more about contractor recruitment and project assignment. Below is a compilation of their responses.

Feedback from CAP agencies:

- **Onboarding Process.**
 - CAP agencies shared that it is most common for contractors to directly reach out to them to engage in the LEAN program. Once a connection has been made, the firm must complete the necessary onboarding components (e.g., all licenses and certificates such as insurance coverage, worker’s compensation, a Certificate of Good Standing with the Commonwealth; criminal background check and motor vehicle background check for each crew member; etc.). Then the CAP agency meets with the firm to discuss the specifics of the program (e.g., requirements of the program, details on the specific measures that are compensated, etc.).

- After this step, the firms are placed on an informal probation where they get shadowed by CAP agency staff on the first few jobs to ensure quality of the service. Once the contractors perform well and build trust with the CAP agency, they enter their job pool. CAP agencies mentioned that many contractors they have interacted with were already familiar with the program by previous work with other CAP agencies or Mass Save.
- **Project Assignment.**
 - Project assignment varies somewhat by CAP agency and is based on a combination of logistical needs and the skill sets and qualifications of contractors. Geographic preferences also play a role, with some contractors willing to travel farther for jobs and others preferring to stay closer to their central location. An important factor in assigning projects is the relationship developed between the CAP agency and the contractors, as they understand the preferences of each contractor for both job types and geography.
 - One CAP agency shared that they send out jobs in batches of 3-4, with pre-work available for contractors to complete ahead of time. The CAP agency keeps a dashboard of which contractors have work scheduled, ensuring everyone is kept busy and there is no stacking or lack of work. CAP agencies have noted that all contractors in their region are kept busy, despite the variety of contractor types (i.e., some are sole proprietors, others have large crews).
 - Regarding referrals, contractors who bring in their own clients will typically be able to lead the project and perform the work if they have the technical competency. However, if a contractor is not certified to perform a specific task, such as identifying weatherization needs after assessing a heating system, the CAP agency will refer the client to another contractor who has the necessary certification and expertise via a warm hand-off.
- **Timeline.**
 - The timeline for LEAN program projects varies significantly based on home type, condition, and project need, as well as the CAP agency. For single family homes, it can typically take 2-4 weeks to get an audit, but during busy times the wait can be several months.
 - Once there is a work scope, a contractor is typically onsite to perform work within 2-4 weeks. In emergency heating situations, however, one CAP agency shared that someone can be there the same day, including overnight and on weekends, and a new heating system can be installed within 24 hours. For multi-family homes, the timeline can vary significantly.
 - If there are no major repairs or overhead requests, a simple project can be turned around quickly and assigned within a few days to a week of the audit. However, if there are issues like the need for asbestos removal or mold abatement, the timeline may be an additional 2-3 weeks, depending on the contractor's schedule. One CAP agency shared that 60-70% of their projects have pre-weatherization barriers that need to be addressed.
 - Weatherization, heating repair, and replacements typically occur in November through mid-March, while the heat pump program is also often utilized in July and August for cooling needs.
 - Knob and tube wiring was noted as a particular barrier that could cause long delays in projects. One CAP agency shared wait times of up to one year to find electricians willing to remove knob and tube wiring from homes.

Contractor Training and Workforce Development

Some interviewees offered insight into workforce development in this field and information about their own trainings. Below is a summary of their feedback.

- **Training Needs.**
 - One-on-one concierge support is preferable to larger summits for training contractors. Contractors may need more direct guidance on how to fill out paperwork and to successfully navigate the Mass Save and LEAN bureaucracies successfully.
- **Diversity.**
 - Private Industry Councils (PIC) are working with the City of Boston to promote and provide women and people of color with training opportunities via their Workforce Training Fund and the Workforce Competitive Trust Fund. They work with as many diverse employers as possible to expand their exposure and noted an interest from their clients and that their staff need to know more about clean energy job opportunities to help advise on that pathway.
- **SMOC's Green Jobs Academy.**
 - One CAP agency operates its own energy efficiency training academy, providing training for installers and auditors, as well as other requirements such as OSHA and LEED certifications. The Academy is a paid service, but SMOC has grant funding to support low-income individuals attend as well. The training is mostly focused on energy auditing, but also includes quality control, crew chief, air sealing, and soft skills such as resume writing.
 - Contractors often reach out to SMOC to hire recent academy graduates.
 - Recruitment is done through hiring a recruiter, word of mouth, cold calling, and working with Mass Hire or SMOC's internal workforce development team. However, more resources and dedicated time are needed for recruitment as sometimes SMOC has to cancel classes due to low enrollment.

SECTION 6 — STRATEGY RECOMMENDATIONS

Based on the results from the market study, along with input from interviews conducted with CAP agencies, housing developers, contractors, and partner organizations, a set of recommended strategies and actions were developed. Recommended strategies focus on building and expanding the ECC's E-Contractor Academy as it supports a diverse contractor base in the energy efficiency upgrade field. The strategies focus on assisting the E-Contractor Academy graduates to enter and grow in the energy upgrade market as Mass Save and LEAN providers, develop a robust ecosystem of MWDBE small businesses, and enhance outreach to target populations. Through research and interviews, a list of strategy recommendations was developed. These recommendations build upon the existing research on clean energy building retrofits and the strengths of the E-Contractor Academy's program. The E-Contractor Academy serves contractors, primarily those who identify as minorities and women, to help them build their knowledge in the energy upgrade sphere and grow their businesses. They are provided with business and program skills to help them navigate different regulatory requirements to become eligible for programs like Mass LEAN and Mass Save. The state and federal government are providing funding to retrofit the residences of low-income households. The academy is taking a two-fold approach: 1) in ensuring that the populations most in need are able to take advantage of these funded services and 2) that contractors and workers historically excluded based on race and gender can have a fair chance to obtain these jobs and these funds.

1: Strengthen Alumni Network from this and past E-Contractor Academies

Build and maintain a strong alumni network to help graduates make connections and expand the reach and longevity of the academy. Recommendations here are similar to ECC's growing contractor support and business development program which includes a) training, b) connections to pipelines of projects, c) support from business professions such as accountants, database providers, marketers, strategy consultants, insurance providers and others, and d) access to small business financing.

- a. Maintain a regularly updated mailing list of both physical and email addresses to send out regular messaging to keep alumni updated about the Academy and the contractor support services provided by ECC and its allies.
- b. Bring back graduates as guest lecturers at events and classes.
- c. Build mentorship opportunities by connecting current enrollees with graduates with more experience in the field.
- d. Host networking events where alumni can share stories to continue to shed light on the value added by the academy to the alumni's businesses.
- e. Send out periodic surveys to track how graduates are performing, changes in the field, receive feedback in order to update the academy's curriculum and services accordingly.
- f. Create an open database that graduates can use to collaborate with fellow alumni to provide services to clients, capturing ancillary scopes of work and expanding the package of services a contractor is able to provide.
- g. Explore possibilities for alumni contractors of the program to provide mentorship and build subcontractor relationships with new graduates in synergistic fields.

2: Labor Upskilling and Service Expansion

Help contractors expand the range of services they are able to offer to customers either through additional trainings and certifications and/or through partnerships with other specialty contractors

- a. Expand training and certifications in ancillary services so that contractors can provide a layered suite of services to clients.

- b. Connect contractors to access state funding to perform ancillary work (e.g., asbestos and lead abatement, replacing knob and tube wiring, etc.).
- c. Encourage contractors to build their network to provide a comprehensive package of services in collaboration with partners.
- d. Facilitate a reciprocal referral program between contractors to strengthen partnerships.
- e. Continue to expand curriculum to include knowledge around legal contracts, corporate structuring, and partnerships.
- f. Incorporate additional resources to expand knowledge about small business loans, forgivable loans, tax incentives and credits, etc.
- g. Survey alumni network to understand unmet niche demands contractors may be facing in the market.

3. Build Relationships with CAP Agencies, Mass Save Lead Vendors, and HPCs

Contractors should focus on building relationships and trust with CAP agencies, Mass Save lead vendors, and Home Performance Contractors (HPCs), the latter for subcontracting opportunities.

- a. Reach out directly to the LEAN program managers at CAP agencies to join their vendor list and apply to participate as a vendor.
- b. Focus on building relationships with the CAP agency and other Mass Save program administrators. Take time to meet key LEAN program staff at the CAP agencies and understand their systems, paperwork needs, communications, and work style preferences.
- c. Carve out a focus area for work and build relationships and partnerships with other home performance contractors in order to provide a more holistic range of services in a company's offerings. For example, services such as certifications in handling asbestos siding or bath fan installations are in high demand but there are fewer vendors in this space.
- d. Always complete paperwork accurately and on time.
- e. Continue to communicate clearly and effectively with the CAP agency and other partners from the scheduling of jobs through completion.

4: Market: Entry Points/Leading Services

Leverage opportunities for entry into the market through the prioritization of the installation of heating and cooling technologies.

- a. Identify and prioritize opportunities for the installation of heat pumps.
- b. Conduct outreach to potential customers who may want to convert from singular room AC units to central air conditioning.
- c. Partner with insulations contractors, or provide that service as well, to find opportunities for collaboration by combining weatherization services.
- d. Generate leads through upgrades perceived to improve quality of life rather than leading with energy savings benefits (heat pumps, AC units, appliances, etc.).
- e. Conduct hyper-local outreach in specific neighborhoods.

5: Outreach: Entry Points Through Assistance Programs

CAP agencies can find opportunities for outreach by identifying and expanding outreach to target populations that are currently utilizing services from other assistance programs.

- a. Connect with other social service providers (WIC offices, food banks, health clinics)) to increase outreach and awareness to likely target populations.
- b. Create and distribute outreach material (brochures, posters, social media collaborations) to other social service providers to raise awareness to households utilizing other assistance programs (i.e., SNAP, housing assistance).

- c. Work with service providers to identify and serve households at risk of utility shut-off due to nonpayment.
- d. Connect with school districts with high rates of free and reduced lunch service to conduct outreach to parents who may qualify.

6: Outreach: Community/Neighborhood-based

Contractors can increase efficiency and efficacy of outcomes by utilizing geospatial demographic data to apply a community-based outreach approach to areas with high potential for Mass LEAN eligibility.

- a. Utilize ArcMap Online tool to identify areas with high potential for Mass LEAN eligibility.
- b. Partner with community-based organizations, cultural centers, and non-profit organizations to connect to target populations.
- c. Connect with tenants' rights groups to expand awareness of the program.
- d. Provide incentives to customers who provide successful referrals to other participants.
- e. Participate in landlord training events hosted by local municipalities, housing agencies, etc. to expand outreach and awareness.
- f. Take a block-by-block approach to energy upgrades by increasing efforts in hyperlocal geographies (within same apartment complex, on the same block, etc.) where contractors see success in obtaining new customers.
- g. Leverage word-of-mouth networking to increase outreach in neighborhoods.
- h. Participate in local events such as farmer's markets, health fairs, and city events by hosting booths.

7: Programmatic and Policy

Advocate for programmatic and policy changes to better understand and overcome barriers in the energy upgrade and construction industry.

- a. Mass LEAN can increase transparency and efficacy by establishing one comprehensive database to track energy retrofits with a uniform tracking method of upgrades performed and by whom.
- b. Lower the threshold for Mass LEAN full-building retrofit eligibility for multifamily buildings of two to four units from 50% low-income residents to 25% low-income residents. A similar lower threshold could be considered for larger multifamily buildings.
- c. Revisit and reconsider program reimbursement rate more often, especially when market conditions and costs are changing rapidly due to inflation and other supply chain or market pressures, to ensure that rates being offered allow contractors to stay in business.
- d. Reconsider the reimbursement timeline for LEAN projects to be more in line with the market rate program. Rather than delaying payment until after every project is inspected, the LEAN program could follow the same route as the market rate program, providing payments after projects are complete and conduct frequent and random inspections to ensure quality work afterward. This would enable more MWBDE businesses to participate in the program and help to ensure their successful cash flow.
- e. Conduct diversity audits of Community Action Agencies staff, especially in inspections staff, to build internal cultural competence and linguistic diversity within the organization.
- f. Reconsider the extent of background check requirements as a qualification to be a Mass LEAN contractor; align requirements with federal Weatherization Assistance Program.
- g. Advocate to eliminate immigration status as a qualifier for drivers' license requirement at the national level.
- h. Establish small business loans or grants programs to assist newcomers to this field.

- i. Develop a reporting system for both Mass Save and Mass LEAN to regularly log and share data on the number and percentage of MWDBE contractors in their contractor networks, the number and percentage of projects done by MWDBE contractors, and the total dollar value and percentage of total budget of project work done by MWDBE contractors.

8: Utilize the "Key Opportunity Areas for Energy Upgrades" ArcMap Online Tool

- a. Use the maps developed for this study to guide contractors to areas with the highest likelihood of households that qualify for Mass LEAN participation.
- b. Work with the alumni database to create an active outreach campaign grounded in geographic strategy.
- c. Distribute and train contractors on using the tool effectively.
- d. Collect data on where contractors are finding success in performing energy upgrades, whether they utilize Mass LEAN incentives, and track upgrades performed in detail.



APPENDIX A: MAP BOOK TOOL

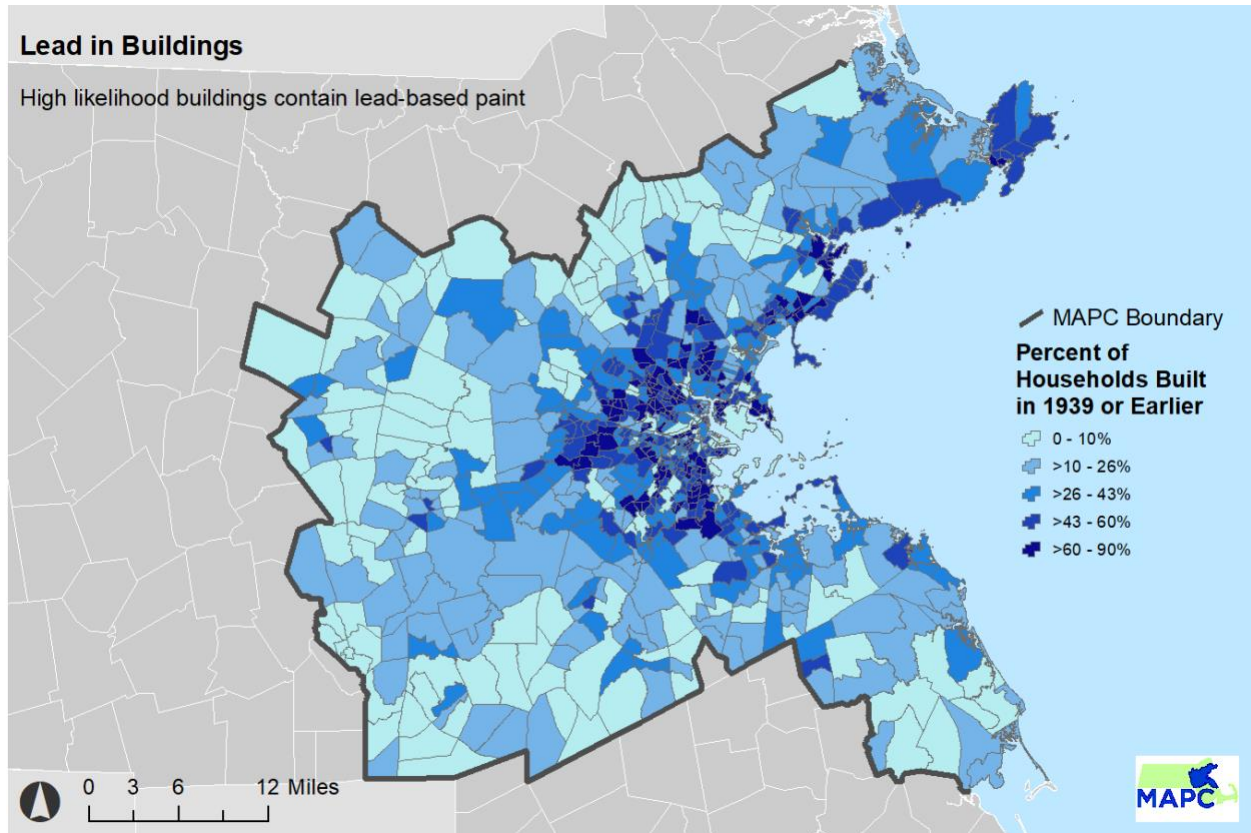
Building upon previous studies, the findings in this report helped create a geospatial analysis of criteria that are relevant to creating high impact through building retrofits as measured through the populations served, energy conserved, and financial savings captured. The maps below show data on housing characteristics of the built environment as well as the demographic characteristics of the population. The map layers are based on different factors to indicate high concentrations of households with characteristics to inform and guide contractors and CAP agencies to conduct more effective and efficient outreach by targeting areas for potential energy efficiency retrofit work:

- Layers with data on household characteristics such as income, reliance on public assistance, language access, and education attainment levels all represent characteristics found in populations of residents that qualify for Mass LEAN programs.
- Map layers with data on building characteristics such as the heating fuel source or the presence of lead or asbestos, are meant to provide information on the potential needs, and thereby inform the scope of work a contractor can anticipate.
- Layers with data about housing typology (i.e., number of units in a structure), whether a unit is renter occupied, the tenure of the resident, and the language spoken at home, are meant to help contractors and CAP agencies conduct more effective outreach.

These different layers were all incorporated to develop the interactive mapping tool that is complementary to and builds on the research presented in the market study prepared for Emerald Cities Collaborative. **The interactive map, which is accessible [here](#)**, has all of these layers of data that can be turned on and off to display information geospatially across the MAPC region.

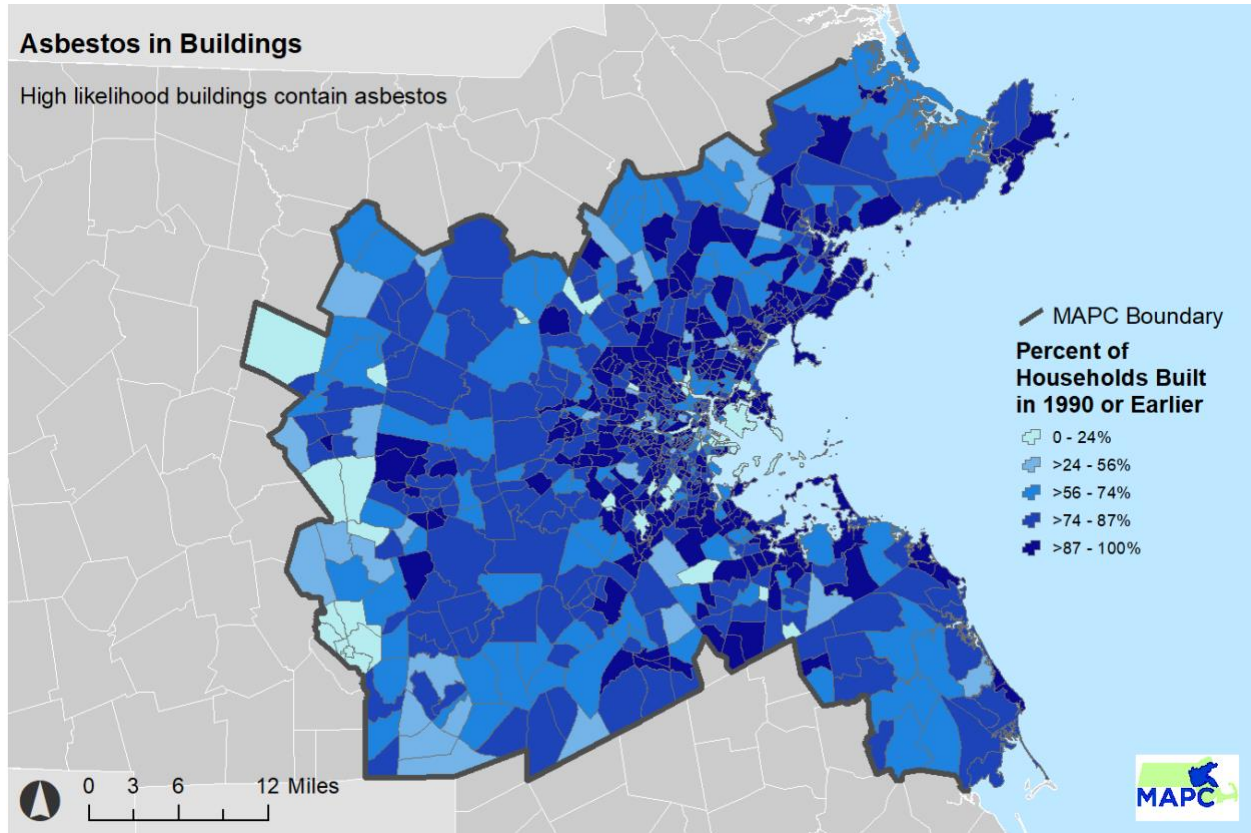
Map 1: Lead in Buildings

Structures built prior to 1940 have an over 87% likelihood of containing lead-based paint. The darker blue areas of the map indicate census tracts (neighborhoods) that have a high concentration of residential buildings built before 1940, and therefore likely needing de-leading services.



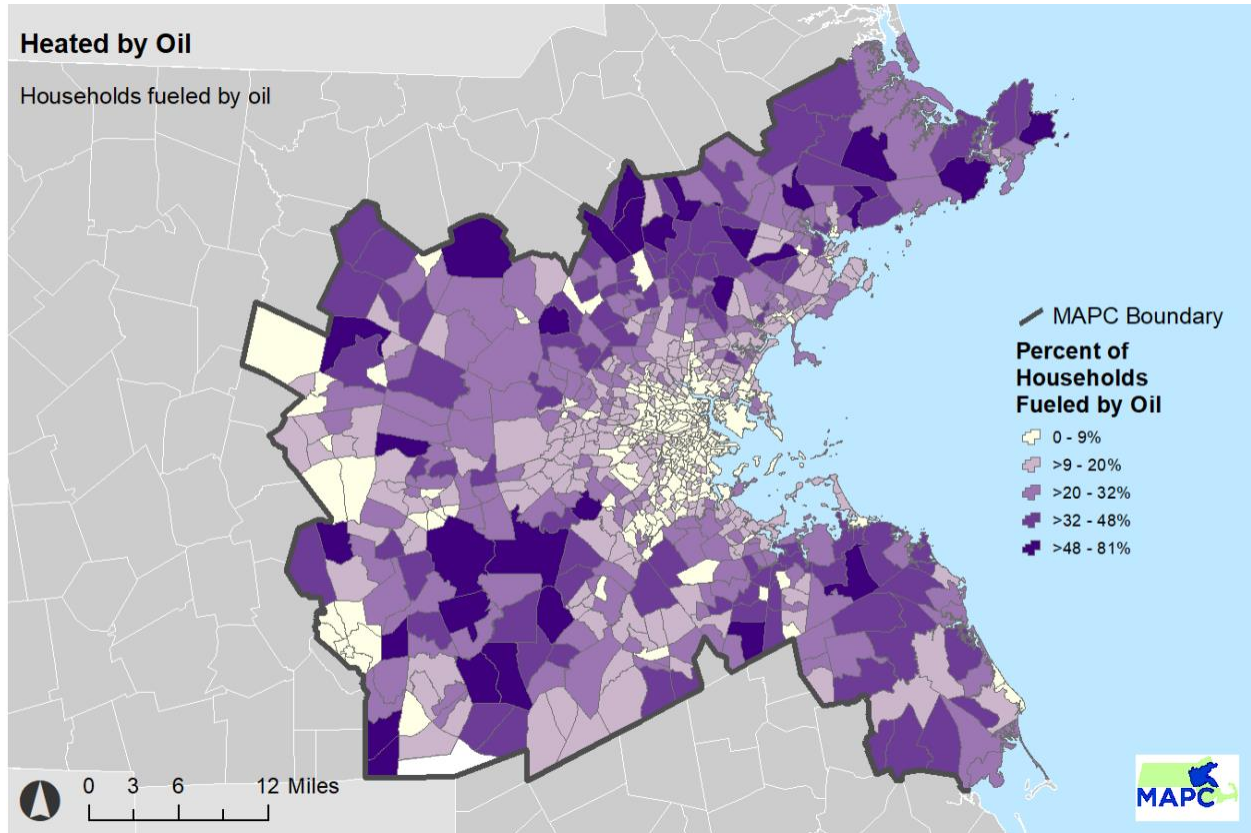
Map 2: Asbestos in Buildings

Structures built prior to 1990 have an 81% likelihood of containing asbestos in their building materials. Over 80% of the MAPC region's housing stock was constructed before 1990. The areas in the deepest blue have the highest concentration of housing stock likely requiring asbestos abatement.



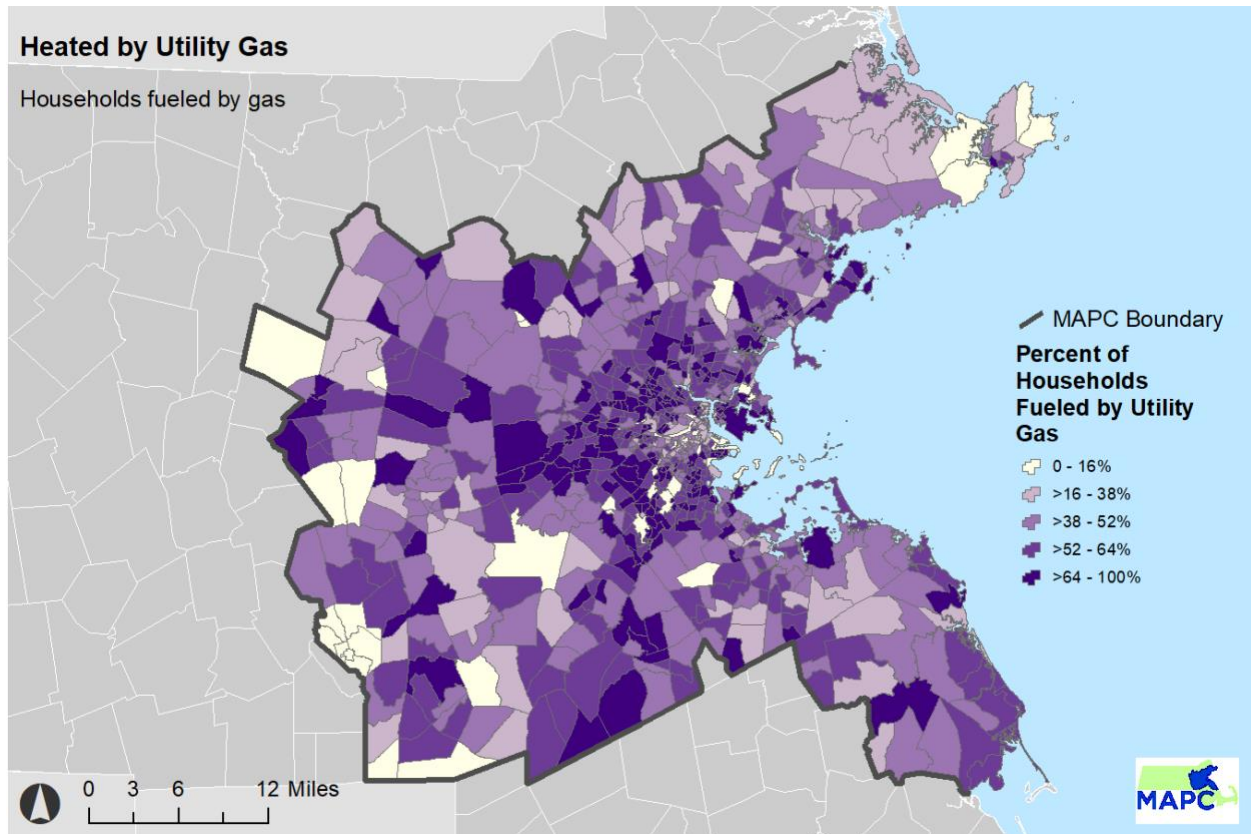
Map 3: Households Heated by Oil

Nearly 22% of households in the region are heated by oil, an expensive, energy-intensive, and hard-to-deliver fuel type. The darker purple areas of the map indicate areas of high concentrations of homes reliant upon oil and represent high-opportunity areas for heat-pump installation.



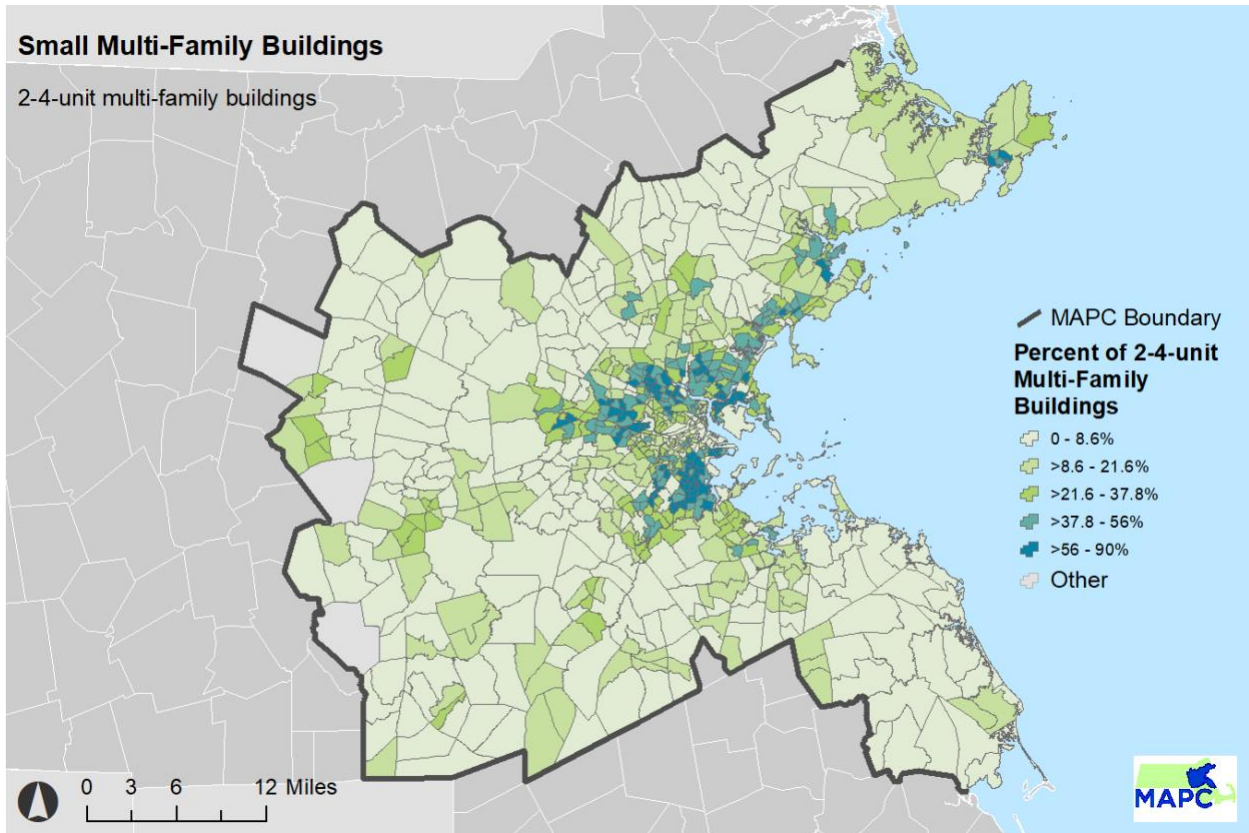
Map 4: Households Heated by Utility Gas

The Mass Save program incentivizes air source heat pump conversions for households currently heated by natural gas. Multifamily residential structures built prior to 1950 that are heated by natural gas are more likely to house low- and moderate-income residents that meet the income thresholds for Mass LEAN incentives. The darker purple areas indicate areas in the region with high concentrations of homes heated by gas.



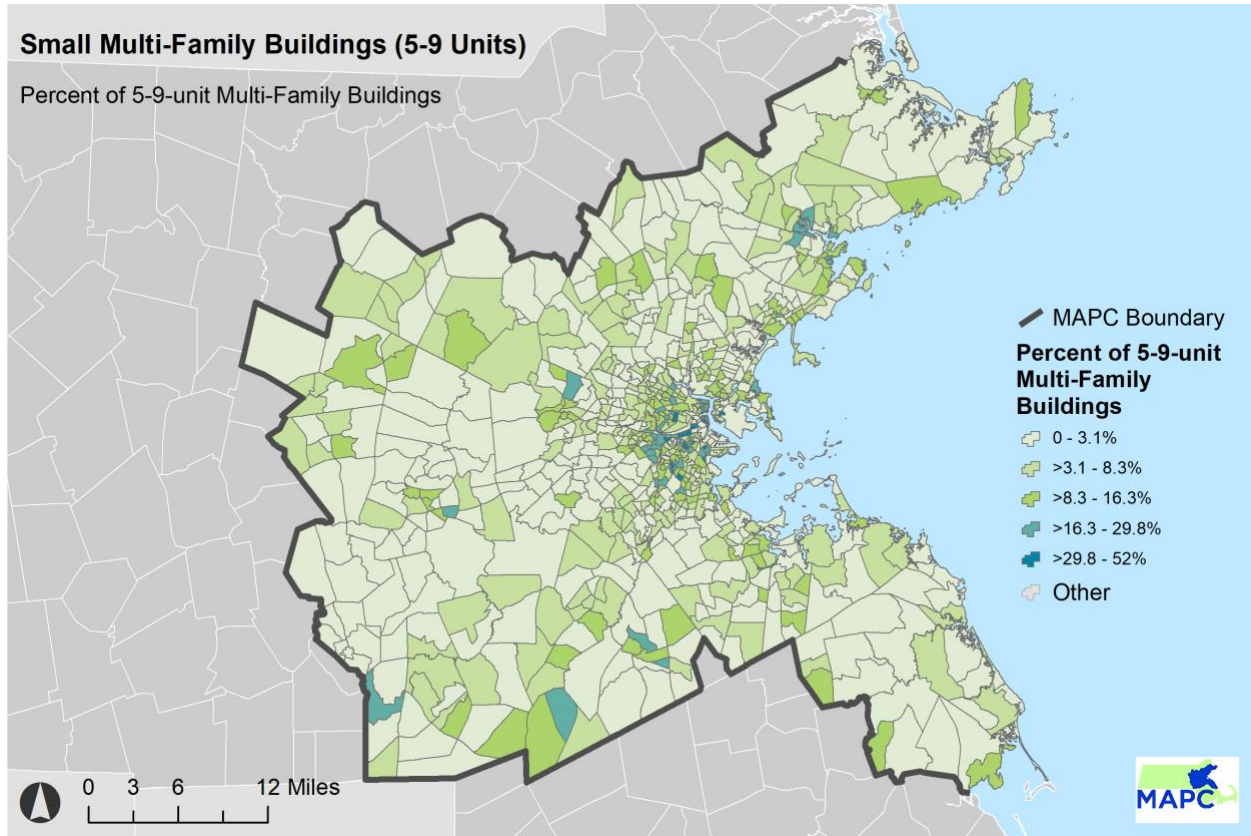
Map 5: Small Multi-Family Buildings (2-4 Units)

The areas in blue indicate neighborhoods with high concentrations of residential building structures of two to four units each. This is a target market building typology for MWDBE contractors.



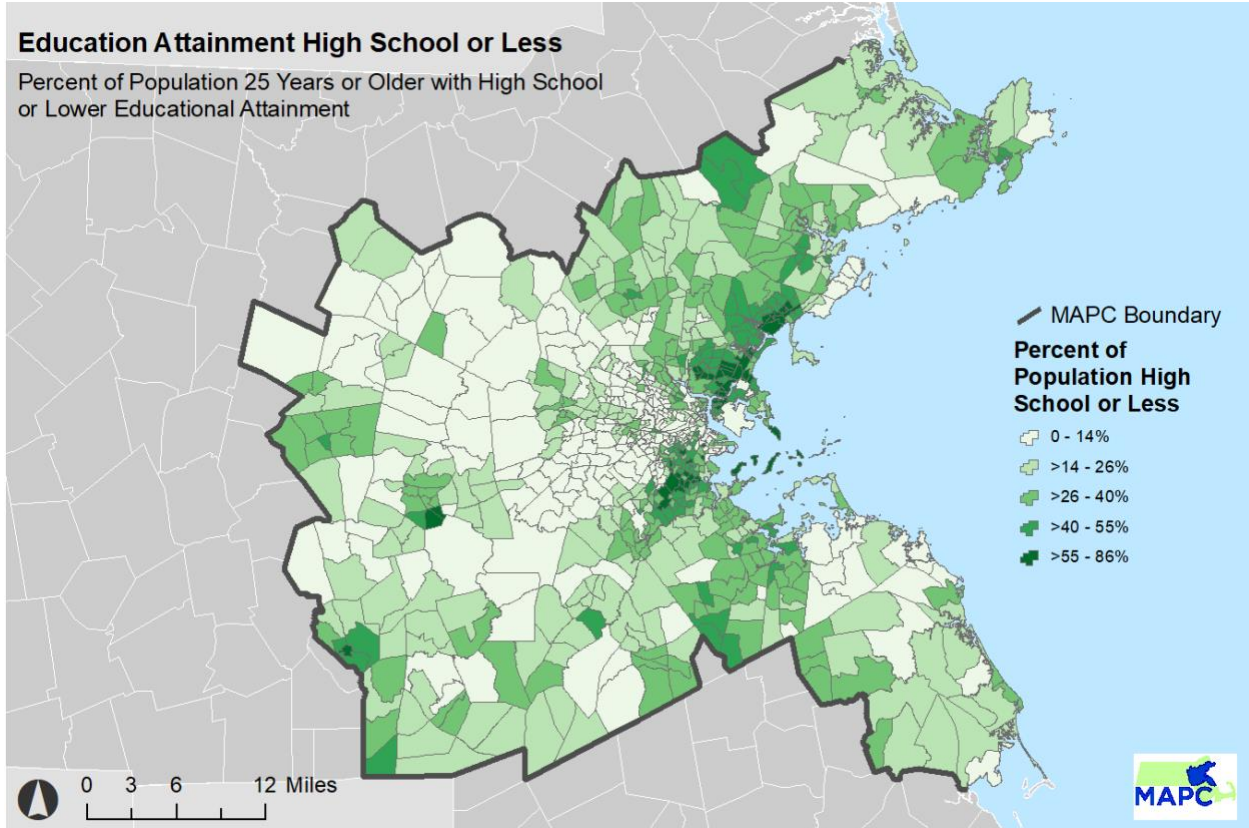
Map 6: Small Multi-Family Buildings (5-9 Units)

The areas in deeper green and blue indicate neighborhoods with high concentrations of residential building structures of five to nine units each. This represents areas that MWDBE contractors with greater capacity can target as they scale up.



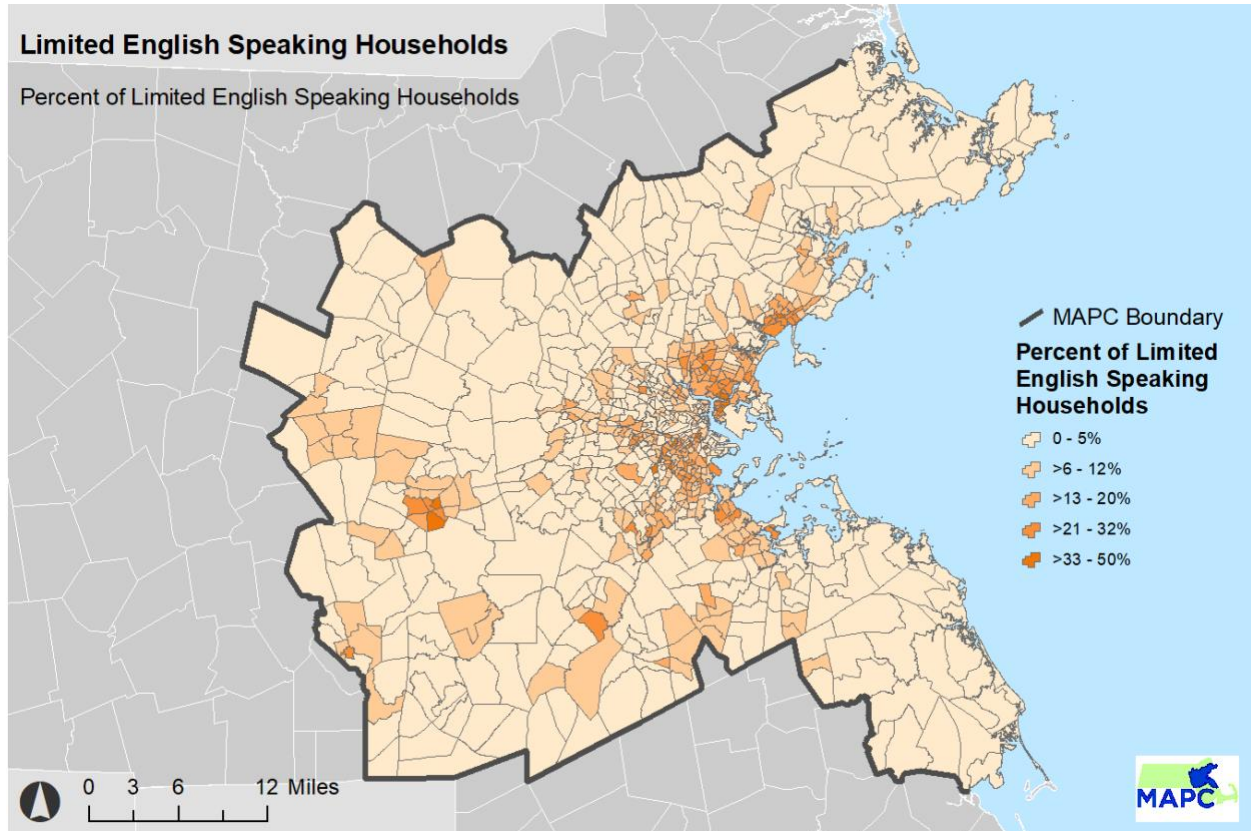
Map 7: Educational Attainment High School or Less

Another segment of the population with a high correlation to being eligible for Mass LEAN are those with an education level defined by the U.S. Census Bureau as “High school diploma or less.” The areas in darker green indicate high concentrations of residents with low formal education levels. This is a population that is highly likely to be eligible for Mass LEAN and one that could benefit highly from its offerings.



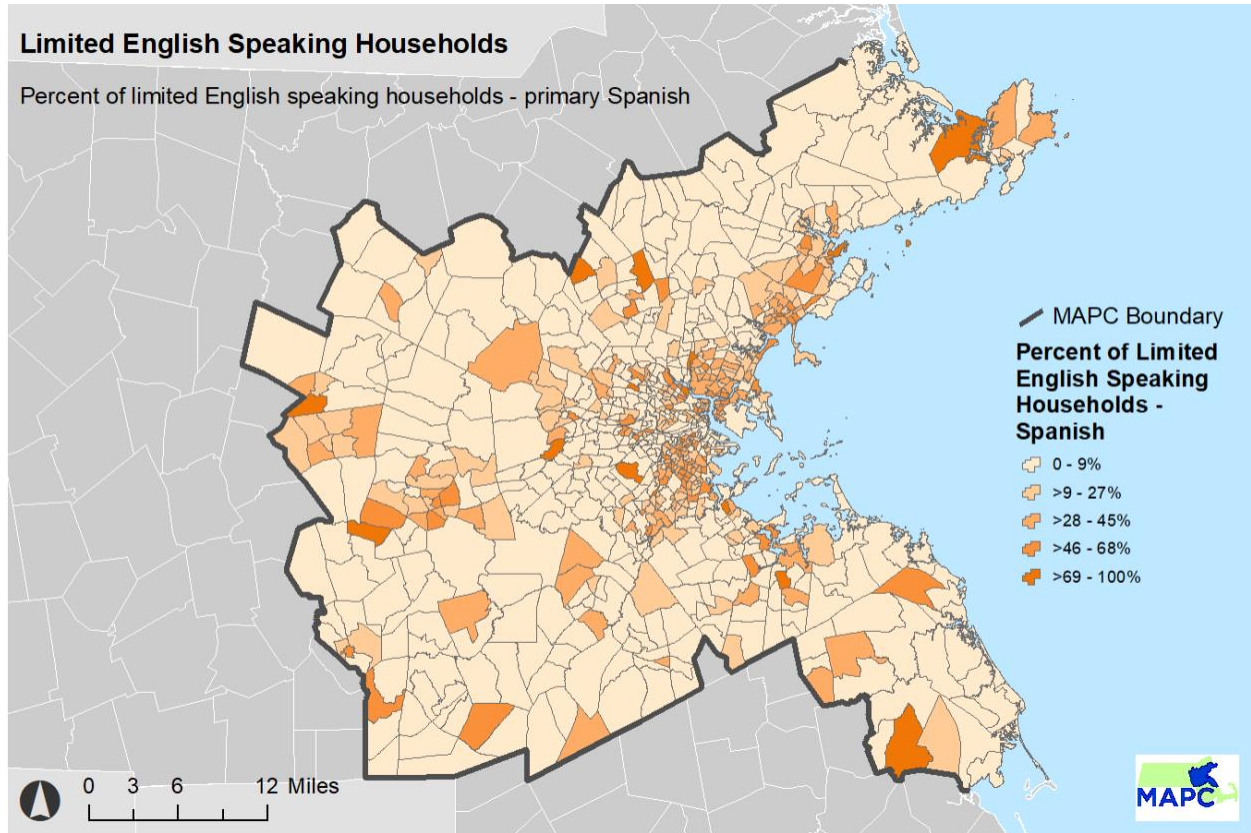
Map 8: Limited English-Speaking Households

One of the harder to reach populations are non-native English speakers. This map represents areas of population concentration of households where the primary language spoken at home is not English. The areas in darker orange have high rates of non-English speaking households.



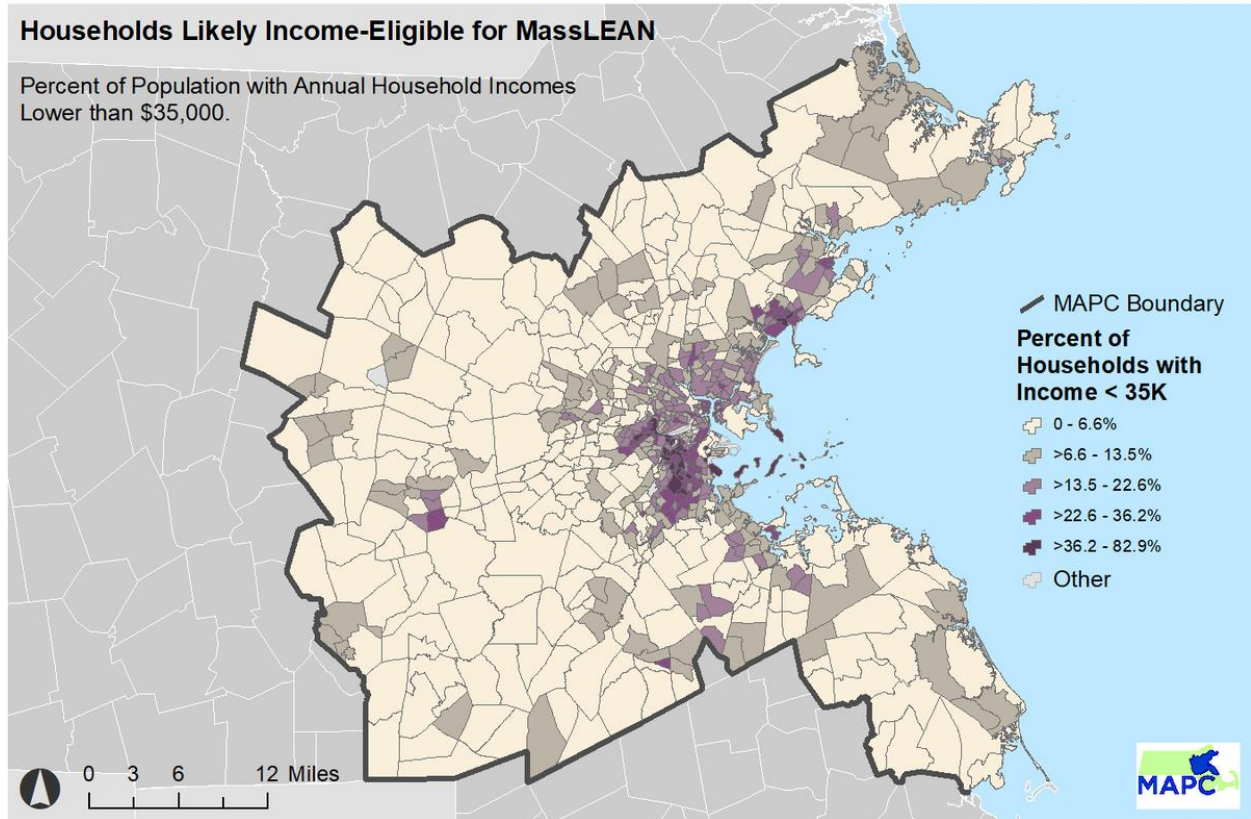
Map 9: Limited English-Speaking Households, Primary Language Spanish

The areas in darker orange indicate concentrations of households with non-English speaking household where the primary language spoken at home is Spanish. This can inform outreach strategies and language needs.



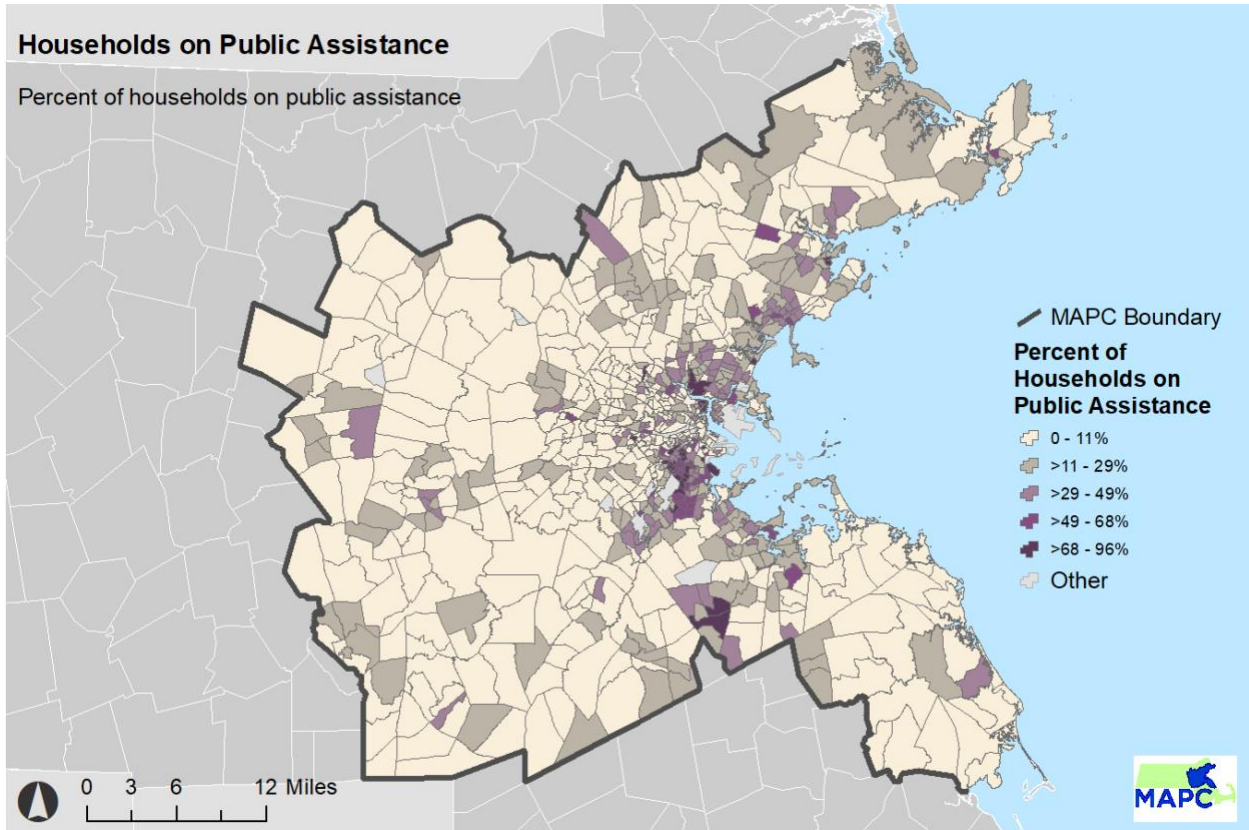
Map 10: Households Likely Income-Eligible for Mass LEAN

The areas in dark purple indicate high concentrations of residents with annual household incomes lower than \$35,000. This is below the income threshold requirement for a one-person household to qualify for Mass LEAN. These areas indicate high rates of opportunity for contractors wishing to expand Mass LEAN service to new customers.



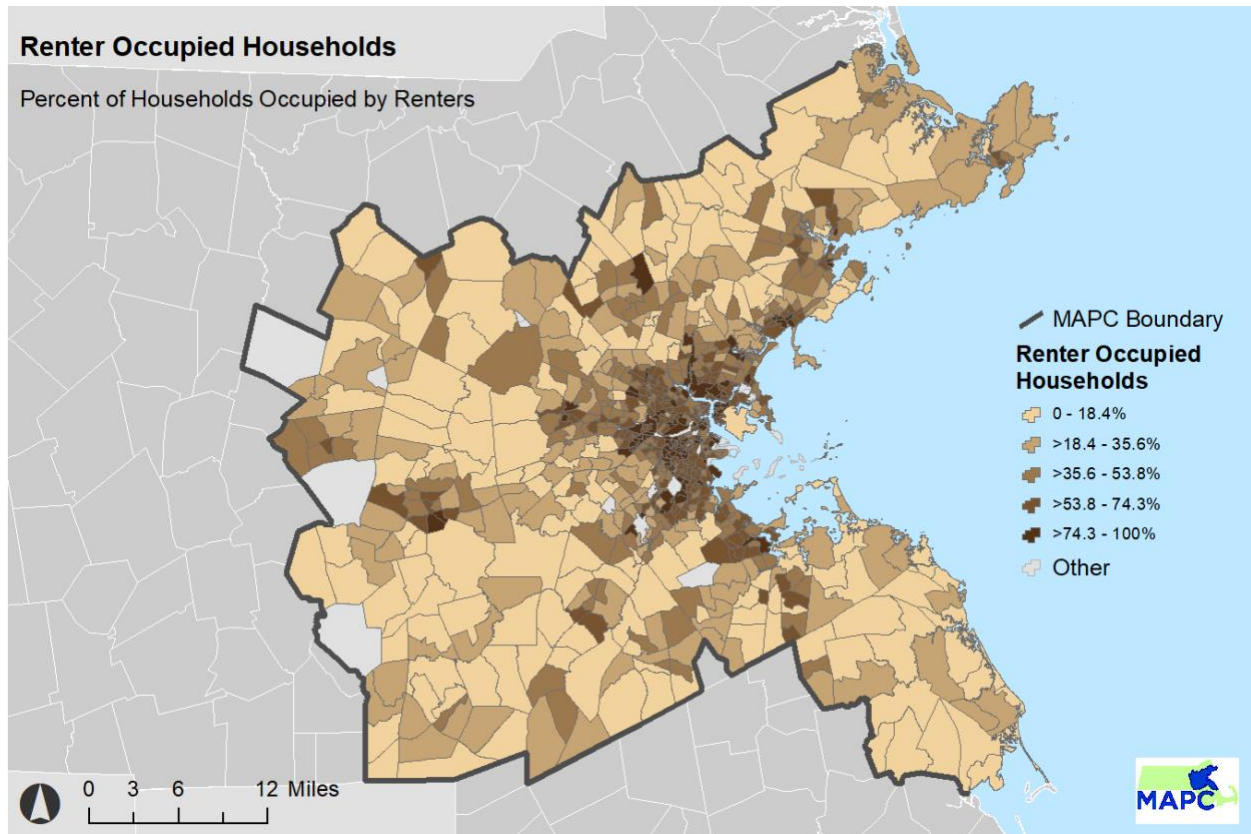
Map 11: Households on Public Assistance

The areas in dark purple indicate high concentrations of residents who are recipients of some other form of public assistance, e.g., SNAP, housing assistance, etc. This is a population with a high likelihood of Mass LEAN income eligibility, has an understanding and some built trust in government programs, and may be motivated to go through the process to benefit from the program. These areas indicate high rates of opportunity for contractors wishing to expand Mass LEAN service to new customers.



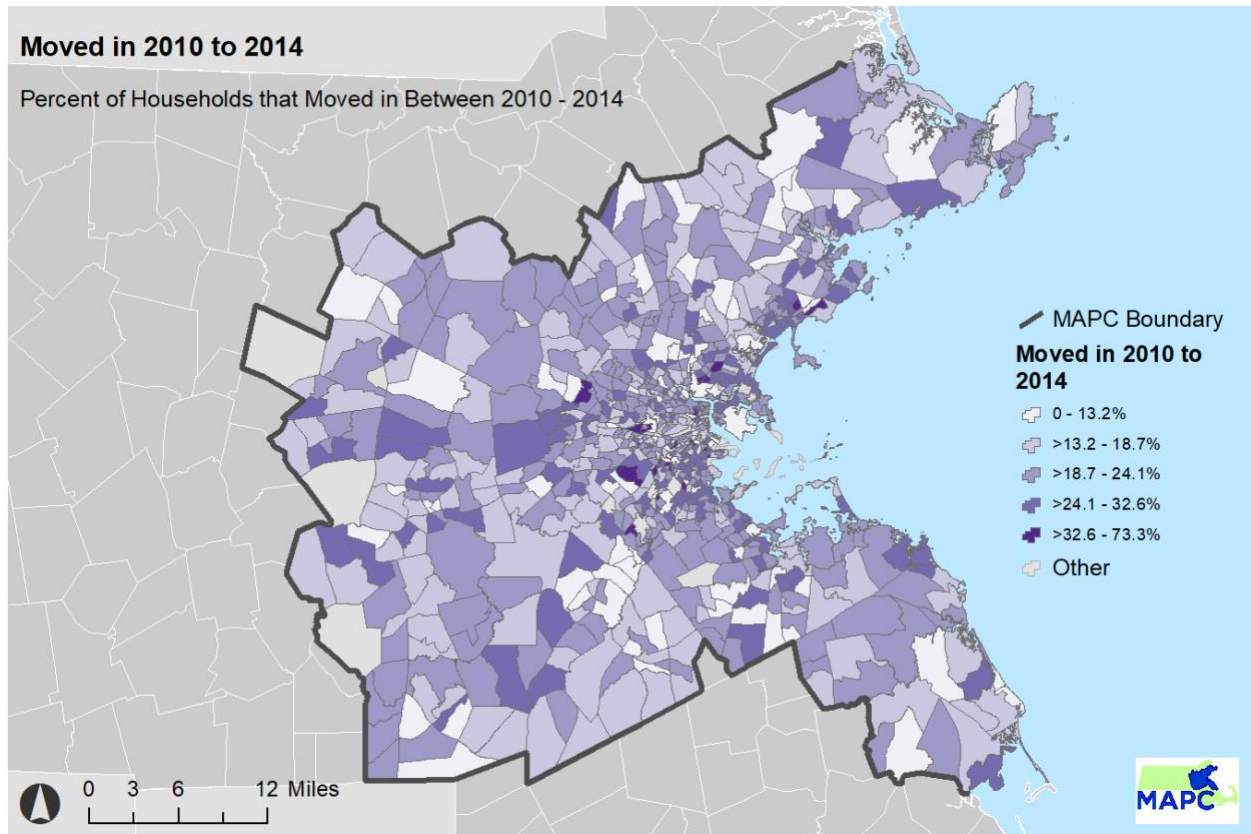
Map 12: Renter-Occupied Households

The areas in darker brown indicate concentrations of high renter-occupied households. This population may be eligible for Mass LEAN but may not feel empowered or motivated to make the time commitment investment in building retrofits for a structure they do not own. Outreach efforts need to address renters' immediate concerns and communicate immediate cost savings benefits, and also interface with landlords to secure permission for upgrades.



Map 13: Occupants Moved into Current Residence between 2010-2014

The areas in deeper purple indicate concentrations of long-term residents, approximately 10 years of tenure, in the same location. This area indicates high opportunity for intervention as the residents, even if they are tenants, may feel more inclined and empowered to make building retrofit upgrades and potentially have relationships with their landlords that could help facilitate those upgrades.



Map 14: Occupants Moved into Current Residence between 2015-2018

The areas in deeper purple indicate concentrations of mid-term residents (approximately 6 years) of tenure in the same location.

