

# Greater Boston Priority Climate Action Plan

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# Greater Boston Priority Climate Action Plan

## March 2024

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# Acknowledgements

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Action for Boston Community Development, Inc., Action, Inc., All In Energy, Asian Community Development Corporation, Authentic Caribbean Foundation, Cambodian Mutual Assistance Association, Citizens Inn, Conservation Law Foundation, Boston Climate Action Network, Emerald Cities Collaborative, Granite State Organizing Project, Groundwork Somerville, Grow Nashua, Healthcare without Harm, Massachusetts Immigrant and Refugee Advocacy Coalition, Merrimack River Watershed Council, Neighborhood of Affordable Housing, Inc., New England United 4 Justice, Quincy Asian Resources, Roxbury Community College Foundation, The Latino Support Network, Town Green, Transit Matters, and Voices of the Community, and one Indigenous Land and Water Conservationist and Environmental Activist.

## Municipal Advisory Group

Massachusetts: Acton, Arlington, Ashland, Boston, Bridgewater, Brockton, Cambridge, Chelsea, Concord, Framingham, Gloucester, Hudson, Lexington, Lawrence, Lowell, Melrose, Methuen, Natick, Newbury, North Andover, Norwood, Plymouth, Reading, Revere, Salem, Weston, Winchester.

New Hampshire: Derry, Nashua.

*Thank you to additional municipal and community stakeholders, as well as members of the public who attended listening sessions and provided input on the development of the plan.*

# Key Terms and Acronyms

**Comprehensive Climate Action Plan (CCAP):**

A report that provides an overview of the region’s significant GHG sources/sinks and sectors, establishes near-term and long-term GHG emission reduction goals, and provides strategies and identifies measures that address the highest priority sectors to help the grantees meet those goals.

**Greenhouse gas (GHG) Inventory:**

A list of emission sources and sinks, and the associated emissions quantified using standard methods.

**Justice40 Initiative:**

A commitment made by the Biden Administration to ensure 40% of benefits within certain federal investments go towards historically underserved populations- including low-income communities that have been overburdened by pollution and environmental harms.<sup>1</sup> Municipalities containing designated underserved populations are sometimes referred to as “Justice40 communities”.

**Low Income Disadvantaged Communities (LIDACs):**

Federal definition for communities with residents that have low incomes, limited access to resources, and disproportionate exposure to environmental or climate burdens, including air quality, climate change, energy, environmental hazards, health, housing, legacy pollution, transportation, water and wastewater, and workforce development.

**Metropolitan Statistical Area (MSA):**

Federally designated region in the U.S. Census that is used to define specific metropolitan regions based on populous urban center and shared economic and social ties.

**Priority Climate Action Plan (PCAP):**

A narrative report that includes a focused list of near-term, high-priority, and implementation-ready measures to reduce GHG pollution and an analysis of GHG emissions reductions.

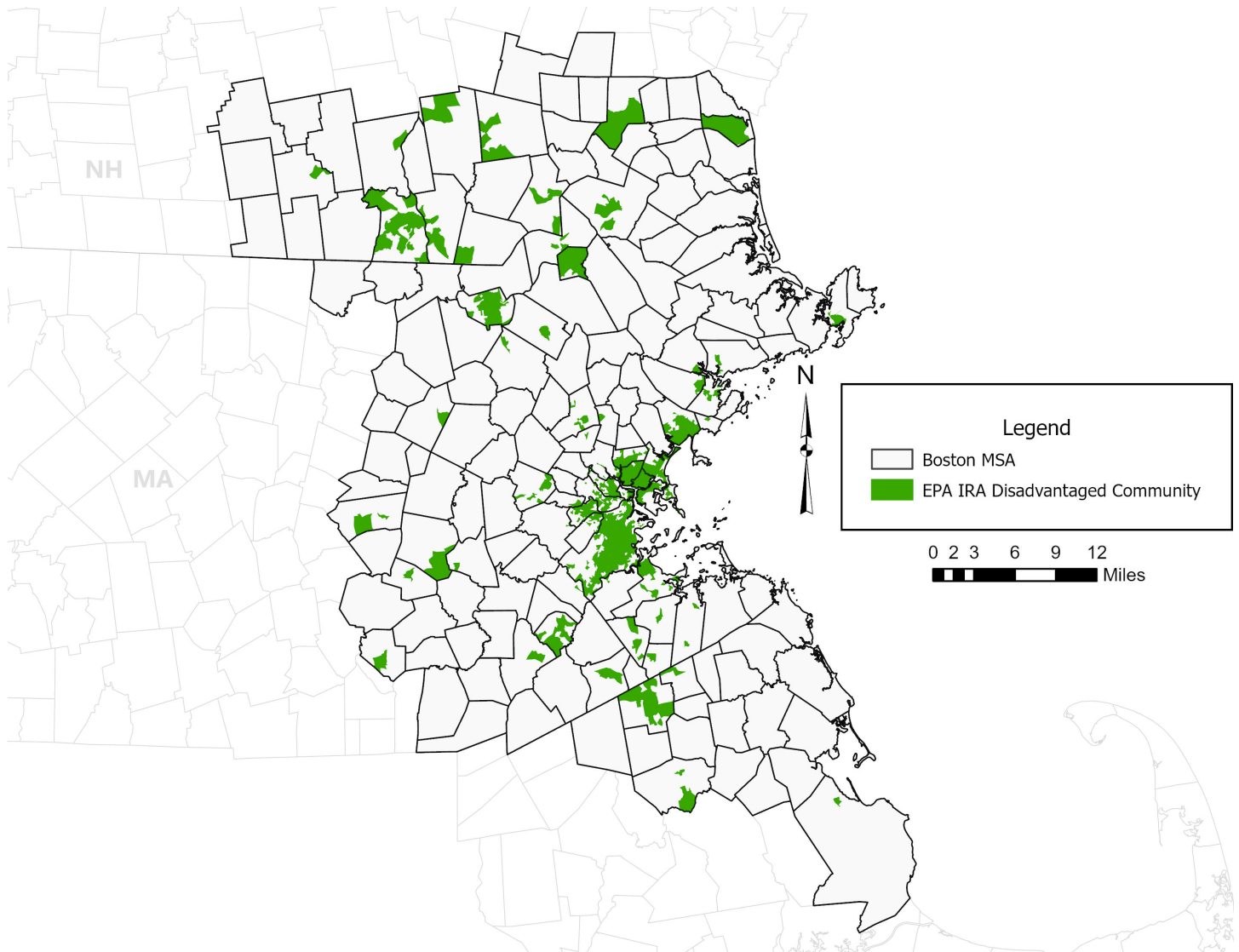
**Regional Planning Agency (RPA) and Regional Planning Commission (RPC):**

An organization that provides technical support for local governments within a specific geographic area, as well as develops regional plans to guide land use, development, and policy for the region.

.....  
1. [Justice40 Initiative | Environmental Justice | The White House](#)

# Executive Summary

This Priority Climate Action Plan (PCAP) is the Greater Boston Region's near-term plan to address the urgent challenge of climate change. The changing climate is already impacting communities across the region, leading to deadly high heat days in the summer, rising sea levels on the coasts, and increasingly frequent and severe inland flooding events from extreme precipitation due to warmer air. Climate risks and impacts disproportionately harm the region's frontline communities – areas where residents have lower-incomes and where communities of color are more likely to live.<sup>1</sup> To counter these risks, we must rapidly reduce the greenhouse gas (GHG) emissions emitted and focus on strategies that ensure an equitable transition to a clean energy future that prioritizes those most vulnerable to climate hazards. Action is needed at all levels to change our electricity generation, buildings, transportation, and consumption and waste systems to be net zero, or free of GHG emissions at a community scale. The PCAP highlights strategies that municipalities, in partnership with regional planning organizations, state agencies, community-based organizations, and private sector can implement to meaningfully mitigate GHG emissions and advance equity in the region. Combined with federal and state policy and funding commitments, regional and local-level climate action can help us realize a safe, healthy, and prosperous future for everyone.



*Figure 2: Map of the Greater Boston Metropolitan Statistical Area and the designated low-income and disadvantaged communities within the region.*



The development of the PCAP was directed by the federal Inflation Reduction Act and funded by the Environmental Protection Agency's (EPA) Climate Pollution Reduction Grant (CPRG) Program. The Metropolitan Area Planning Council (MAPC) led the region's planning effort, in close coordination with the six other Regional Planning Agencies/Commissions serving the region. The PCAP represents the first regional priority plan of near-term climate action and will inform the development of the region's more detailed Comprehensive Climate Action Plan (CCAP), which will be complete by summer 2025.

The Greater Boston Metropolitan Statistical Area (MSA) included in this plan spans across **167 municipalities** and **4.7 million residents** across Eastern Massachusetts and Southern New Hampshire. **Fifty-nine municipalities** within the region encompass federally defined Low-Income and Disadvantaged Communities (LIDAC) census tracts where residents experience disproportionate climate, environmental, health, and economic burdens. The PCAP focuses on implementing climate mitigation solutions in LIDAC communities to ensure the region's most underserved populations are prioritized and benefit from programs and policies designed to reduce climate pollution in the region.

This PCAP builds on existing climate action planning and implementation efforts from within the region, best practices from peer jurisdictions, and detailed input and feedback from key stakeholders. During the planning process, MAPC convened a Municipal Advisory Group and a Justice40 Advisory group to gather input from municipal stakeholders and community-based groups across the region, with a focus on LIDAC communities. Each group met three times over the six-month planning period to provide input and feedback on the plan. Additionally, MAPC held three virtual listening sessions for the region for additional stakeholders and the public to provide input.

## Greenhouse Gas Inventory & Priority Measures:

During the planning process, MAPC developed a regional Greenhouse Gas (GHG) inventory to establish an emissions baseline for the year 2017. This inventory utilized publicly available datasets at the state and municipal level and is the first GHG inventory for the Greater Boston region. The resulting inventory shows that stationary

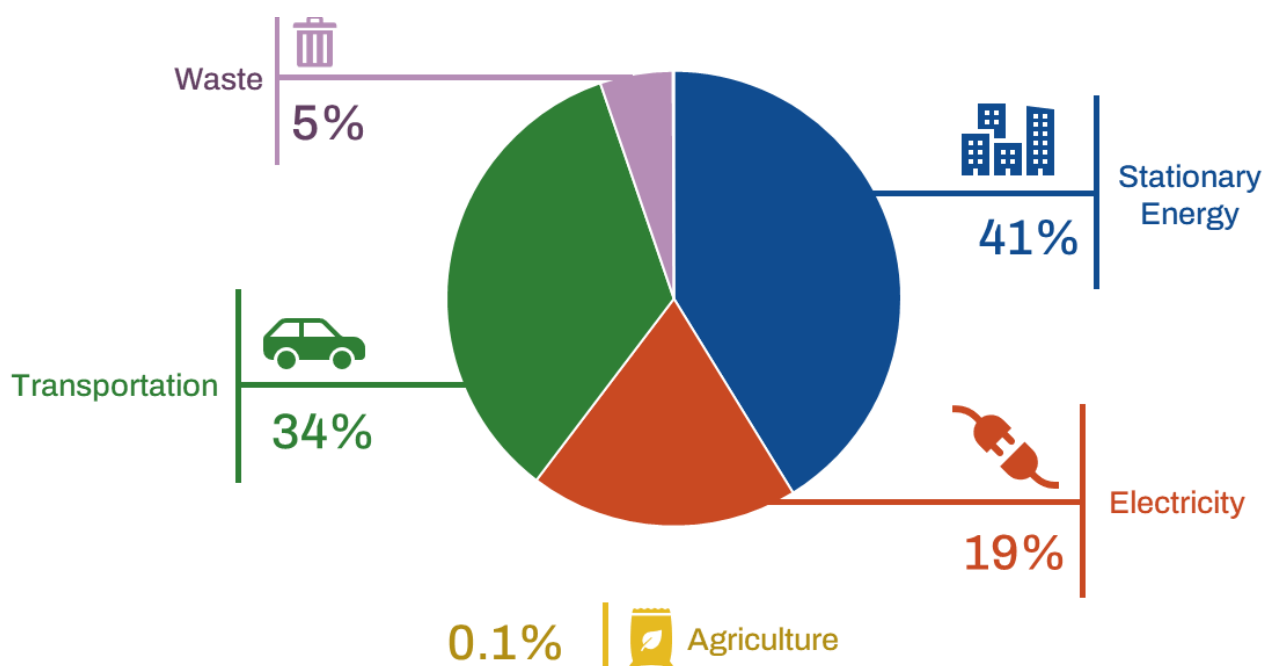


Figure 3: Percentage of GHG emissions by sector within the Greater Boston MSA in 2017.

uses, primarily buildings, make up the majority of emissions in the region at **41 percent**, followed closely by transportation at **34 percent**. Electricity generation is **19 percent** and waste makes up **five percent**.


The PCAP includes eleven priority measures that will reduce GHG emissions in the near-term by 2030 across the four highest polluting sectors in the region: Transportation, Buildings, Electricity Generation, and Waste. Each measure in the plan includes a description of the context and action required, geographic scope, GHG emissions reductions calculations, benefits to federally-designated LIDAC communities, implementing agencies and their authority to implement, implementation timeline, metrics to track progress, availability of other funding to implement the measure, workforce development opportunities, examples of success and ongoing work in the region, and policy priorities to support the measure. These eleven measures are not inclusive of all Greater Boston’s many climate priorities and instead represent a sub-set of measures that are implementation-ready, will lead to substantial GHG emissions reductions by 2030, and will advance equity in the region. The priority measures are summarized in the table below.

## Looking Forward

Completing the PCAP is just the first phase of the Greater Boston Climate Action Plan process. Between March 2024 and August 2025, MAPC will continue to work with the Municipal and Justice40 Advisory Groups to develop a regional Comprehensive Climate Action Plan (CCAP) that will establish emission reduction goals for 2030 and 2050. The CCAP will also include additional GHG reduction measures from the Industry, Agriculture, and Working Lands sectors, as well as additional measures in Buildings, Transportation, Electricity Generation, and Waste.

Taken together, the PCAP And the CCAP will provide a strong strategic framework for driving deep and equity-forward GHG emissions reductions in the region. Regional and municipal leaders, community-based organizations, and the States of Massachusetts and New Hampshire, have already focused on implementation, and will use this plan and previous work to develop policies and programs needed to build a new climate future for the region.

Table 1: Summary of Priority GHG Reduction Measures

|  | Buildings  |   |
|--|--|---|
|  | <b>B1. Building Decarbonization Technical Assistance</b> | Expand and improve technical assistance programs, decarbonization planning resources, and outreach and education efforts.   |
|  | <b>B2. Building Decarbonization Financial Assistance</b> | Expand funding for comprehensive building decarbonization, particularly for affordable housing, renters/landlords, and small businesses; explore creative funding and financing solutions and opportunities to address the intersection of energy, health, and housing. |
|  | <b>B3. Net-Zero Municipal Buildings</b>                  | Develop and implement a plan to decarbonize new and existing municipal buildings; establish technical assistance programs to support municipal decarbonization planning and financing.  |



## Buildings

### B4. District Scale Renewable Thermal Energy Projects

Implement networked geothermal or water-based district heating and cooling projects through municipal ownership and public-private partnerships; support participation of low-moderate income customers.



## Transportation

### T1. Public Transit Access and Affordability

Expand public transit service, increase frequency and reliability of transit services, implement fare free routes and passes, and make stops and stations more accessible.

### T2. Multi-Modal Transportation

Expand multi-modal transportation networks by building, improving, and expanding walking and cycling infrastructure that is safe, well-connected, and accessible.

### T3. Electric Vehicle Affordability

Increase the affordability and accessibility of EVs through EV car share programs, technical and financial assistance to purchase EVs, used EV markets, group purchasing, and education.

### T4. Electric Vehicle Charging

Deploy public EV chargers near multifamily housing and commercial centers, explore charging incentives, and educate potential EV users about charging.



## Electricity Generation

### E1. Renewable Energy Projects

Deploy community shared solar, energy storage, microgrid, and other renewable energy projects; provide technical assistance and support for communities to access incentives and financing to develop renewable energy projects.

### E2. Municipal Aggregation

Adopt municipal aggregation programs, increase the percentage of Class I RECs in program offerings, and implement low-moderate income customer pricing tiers.



## Waste

### W1. Reduce solid waste going to landfills and incinerators

Establish regional composting sites; explore collective procurement of solid waste disposal and recycling services; expand re-use programs

- .....
1. MAPC's Climate Vulnerability Mapping tool shows communities with the greatest exposure, sensitivity, and adaptative capacity to climate change hazards: <https://climate-vulnerability.mapc.org/>.



# 1. Introduction

## 1.1. CPRG Overview

The Climate Pollution Reduction Grant Program (CPRG), authorized under the Inflation Reduction Act and administered by the U.S. Environmental Protection Agency (EPA), funds state and regional governments to develop Climate Action Plans.<sup>1</sup> The Metropolitan Area Planning Council (MAPC) developed this Priority Climate Action Plan (PCAP) for the Greater Boston-Cambridge-Newton, Massachusetts Metropolitan Statistical Area (MSA).<sup>2</sup> MAPC led this planning process in close coordination with the six other Regional Planning Agencies (RPAs) and Regional Planning Commissions (RPCs) that serve the 167 municipalities in the region. Completing the PCAP is the first step of the planning process, which will continue through August 2025 and culminate with developing a Comprehensive Climate Action Plan (CCAP) for the region. Together, the PCAP and CCAP comprise the first-ever **Greater Boston Climate Action Plan (GBCAP)**, which will be used to guide climate action at both the local and regional levels in the near-term (2030) and the long-term (2050).

## 1.2. About the Greater Boston Region

The Greater Boston region defined as part of this plan spans 167 communities across Eastern Massachusetts and parts of Southern New Hampshire. The region is tied together by shared industries, jobs, and transportation networks. For example, 82,000 residents commuted regularly to Massachusetts from New Hampshire for work as of 2018.<sup>3</sup>

### Greater Boston MSA by the Numbers:



Total population: 4.7 million residents<sup>4</sup>



Number of municipalities: 167 included in the PCAP planning area<sup>5</sup>



11th largest MSA in the United States<sup>6</sup>



Most populous cities within the region: Boston, Cambridge, Lowell, Brockton, and Quincy<sup>7</sup>



Nashua is the second most populous city in New Hampshire<sup>8</sup>



Median Household Income: \$104,299<sup>9</sup>

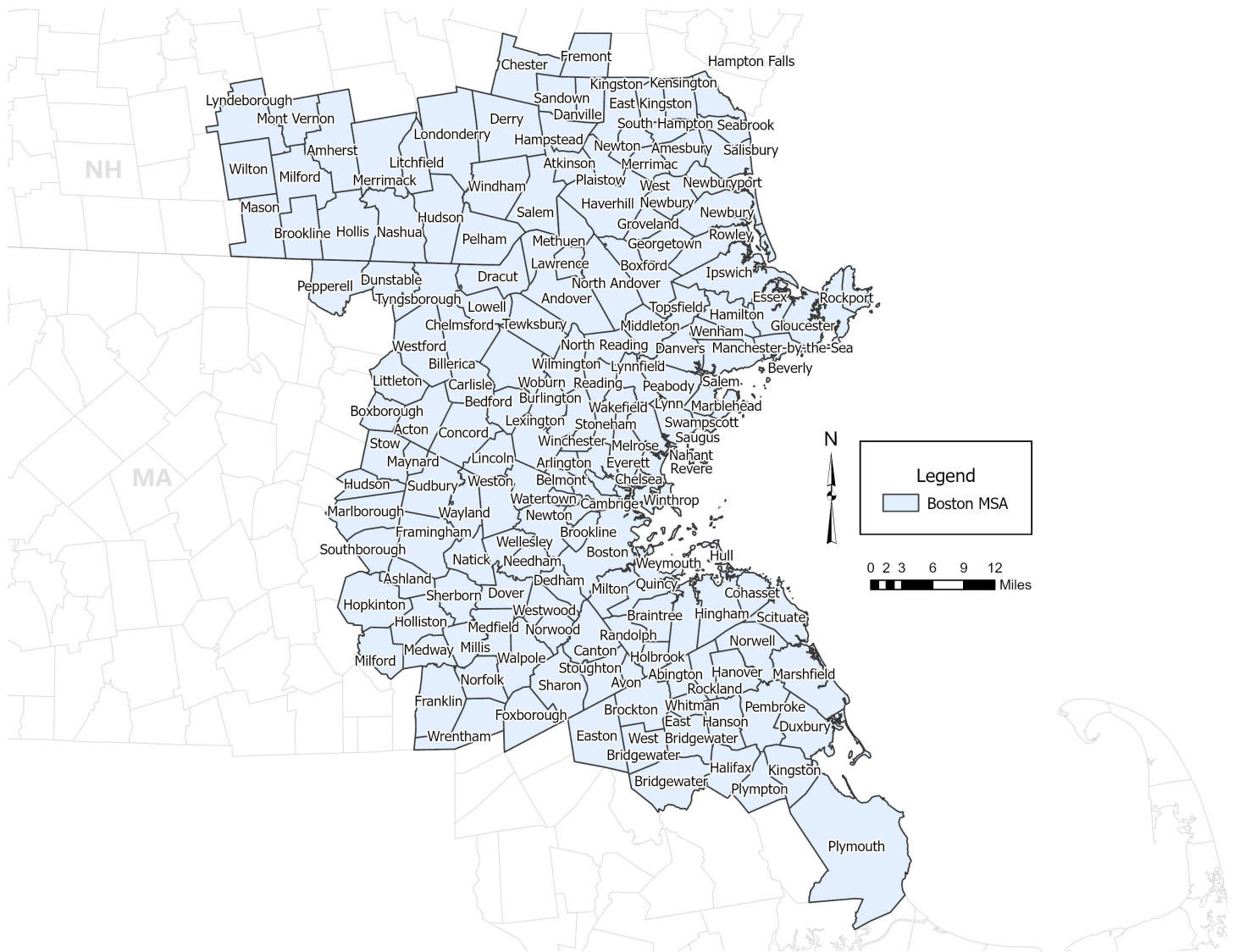


Figure 4: The Metropolitan Statistical Area includes 167 municipalities.

Of the almost two million housing units in the region, approximately 61 percent are owner-occupied and 53 percent of units are single family homes.<sup>10</sup> The region has some of the country's highest rents for metro areas, and nine percent of residents live below the federal poverty line.<sup>11</sup> Within the region, almost 45 percent of renters are housing cost burdened and over half of Black and Latino renters are housing cost burdened.<sup>12</sup> As of 2020, almost one quarter of households had a high energy burden, defined as above six percent of household income, and twelve percent had a severe energy burden, defined as over ten percent).<sup>13</sup> Further, the median energy burden of low-income households in the region is almost four times higher than that of non-low-income households.<sup>14</sup> The subsequent section of this plan provides a more in-depth review of equity challenges and climate burdens in the region.

Within the region:

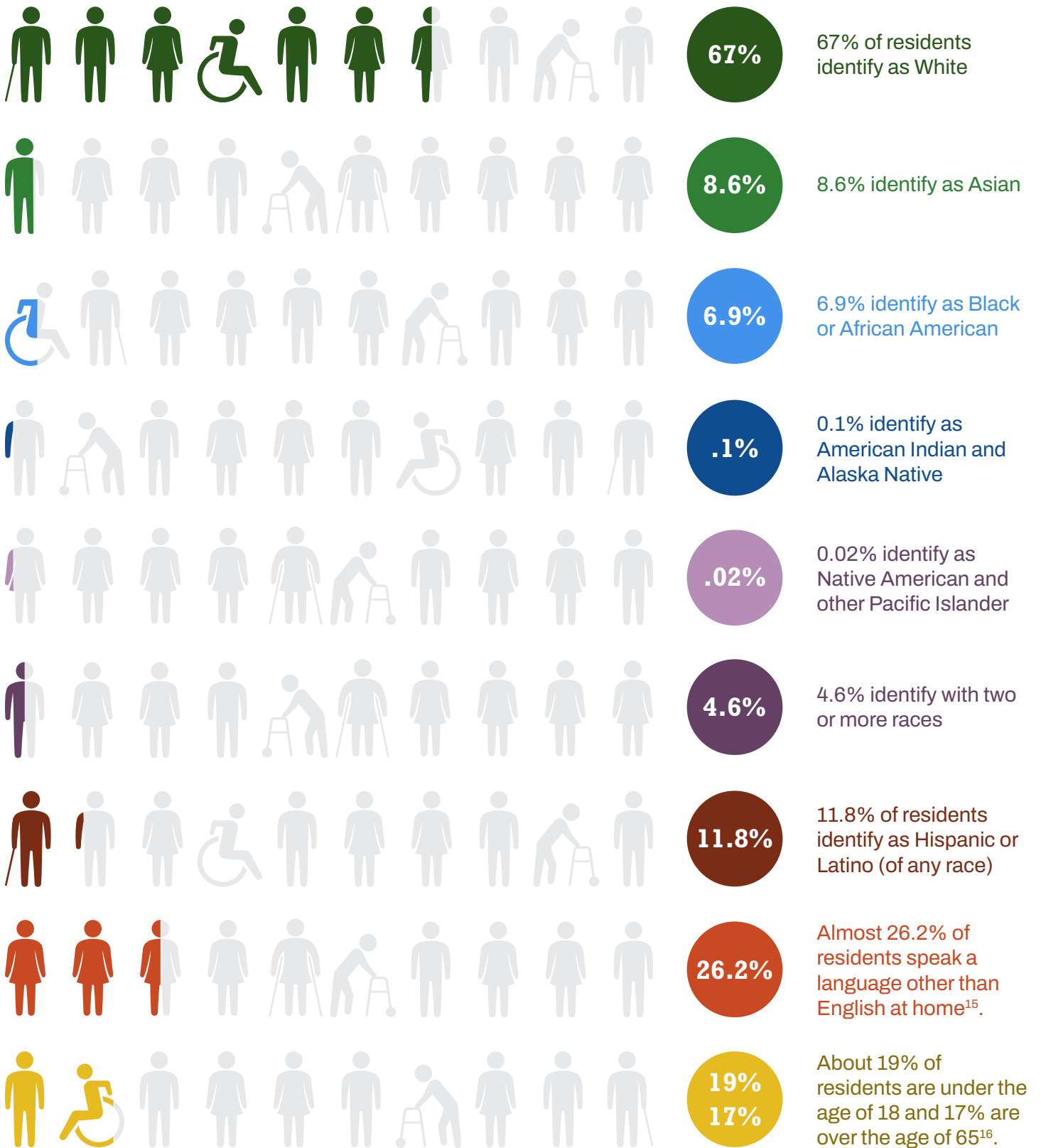


Figure 5: Demographic Data

Source: Race and ethnicity data is from the 2020 U.S. Census.<sup>17</sup> Age and language data is from the 2022 ACS 1-Year Survey.<sup>18</sup> Note: The percentage of Native American community members is often undercounted when not considering community members identifying with more than one race.<sup>19</sup>

The region is located on the ancestral and unceded lands of the Massachusett, Wampanoag, Pennacook, and other Native peoples who have lived and continue to live in what is now known as Eastern Massachusetts and Southern New Hampshire.<sup>20</sup> These communities have rich oral traditions that have preserved their histories and connections to the land.

The Commonwealth of Massachusetts recognizes the sovereignty and enduring presence of two federally recognized tribes: the Mashpee Wampanoag Tribe, who have inhabited parts of Massachusetts and Eastern Rhode Island, and the Wampanoag Tribe of Gay Head Aquinnah, who have lived at Aquinnah and across what is now called Martha's Vineyard.<sup>21</sup> Massachusetts also recognizes the Hassanamisco Nipmuc Band as a state-recognized tribe.<sup>22</sup>

Additionally, there are tribal groups whose identities and cultural heritage persist independently of federal or state recognition. For example, New Hampshire does not have state or federally-recognized tribes but is home to indigenous communities such as the Abenaki, who have historical ties to the region.<sup>23</sup> The Native peoples of this region continue to contribute to its cultural and historical landscape and are integral to the future development of the region.



Figure 6: Native American tribal territories in Southern New England in about 1600.

Source: [Wikimedia Commons - File:Tribal Territories Southern New England.png - Wikimedia Commons](#).

## 1.3. Climate Progress to Date

Communities in Greater Boston are planning for and implementing climate mitigation and adaptation projects, policies, and programs. Twenty-eight municipalities within the region have either completed or are working on local climate or net zero action plans and others are incorporating climate considerations into broader comprehensive planning efforts. Most Massachusetts municipalities in the region have also received the state's "Green Communities" designation based on their efforts to plan for municipal energy reductions, fleet electrification, and more.<sup>24</sup> Municipalities in Greater Boston are increasingly embracing a regional planning approach. For example, the Massachusetts cities of Chelsea, Revere, and Winthrop recently collaborated on their net zero planning efforts: the *North Suffolk Zero Carbon Action Plan* outlines a regional roadmap to reduce GHG emissions, improve public health, and address longstanding equity concerns across sectors.<sup>25</sup>

Both Massachusetts and New Hampshire are actively participating in the CPRG planning effort at the state level. Massachusetts also released its Clean Energy and Climate Plans for 2025/2030 and 2050 in 2022,<sup>26</sup> and accompanying Decarbonization Roadmap analyses, to define how to meet its statutory obligations to reduce GHG emissions.<sup>27</sup>

### Local Examples of Climate Leadership and Innovation

Communities are also actively implementing GHG reduction measures, including adopting the Massachusetts Stretch and Specialized Energy codes, accelerating renewable electricity usage through municipal aggregation programs, expanding electric vehicle charging infrastructure. Eight communities in the region are participating in a fossil-fuel free demonstration pilot, which will require most new construction and major renovations to be fossil fuel-free for heating and cooling.<sup>28</sup> Municipalities are pursuing innovative programs and pilot projects such as:



With funding from the investor-owned utilities Eversource and National Grid, Framingham and Lowell, Massachusetts, are piloting networked geothermal systems that will aim to affordably heat and cool residential and commercial buildings.<sup>29</sup>



The City of Nashua, New Hampshire, recently enrolled 8,000 residents in the Nashua Community Power Program, the first municipal aggregation program of its kind in New Hampshire.<sup>30</sup>



The City of Boston adopted a Building Emissions Reduction and Disclosure Ordinance for large buildings,<sup>31</sup> is supporting clean energy workforce development through the PowerCorpsBos<sup>32</sup> and the Good Jobs Metro Boston Coalition,<sup>33</sup> and is in the process of electrifying its 750 school buses.<sup>34</sup>

### Centering Equity and Environmental Justice in Climate Action

As a result of long-term advocacy by community-based organizations and Environmental Justice (EJ) advocates, as well as growing internal reflection on the role of local land use and policies in shaping existing inequities, municipal governments are increasingly working to center equity throughout climate planning processes. Some local governments are also seeking to improve



their community engagement through collaborative governance models that identify actions that benefit EJ communities. For example, local governments in the MetroWest region of Greater Boston have hired multilingual community liaisons from or with strong ties to EJ-designated neighborhoods to lead conversations about climate risks, identify community solutions, and develop resources, such as climate emergency preparedness materials like magnets and flyers.<sup>35</sup>

The approach taken in this plan recognizes that residents in Low-income and Disadvantaged Communities (LIDAC) are most often impacted first and worst by climate change and climate pollution. This plan also refers to Justice40, which is a commitment made by the Biden Administration to ensure 40 percent of benefits within certain federal investments go towards historically underserved populations. More information on LIDAC communities can be found in the subsequent section of this plan.

## 1.4. About the Priority Climate Action Plan

The PCAP identifies near-term, implementation ready, priority measures that will reduce GHG emissions and advance equity priorities in Greater Boston. According to the regional GHG inventory, the Buildings, Transportation, Energy Generation, and Waste sectors make up 99.9 percent of emissions (see Section 3). The PCAP focuses on key strategies, defined interchangeably in this plan as measures, to reduce emissions from these four sectors to address most of the region's emissions.

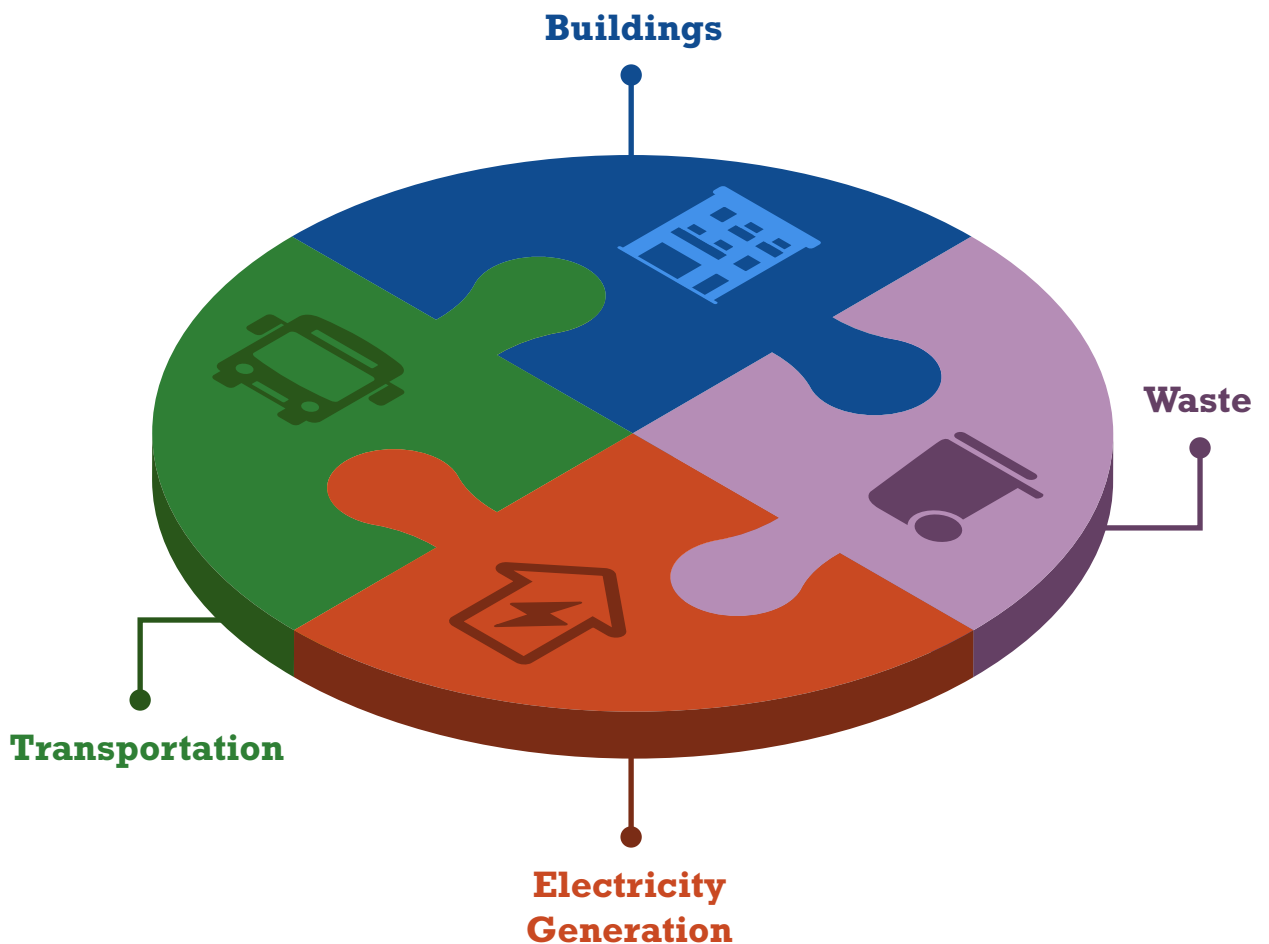






Figure 7: Framingham Cochituate Rail Trail. Photo by Weston & Sampson

The PCAP includes:



An **inventory of the region's GHG emissions** from the stationary energy, electricity, transportation, waste, agriculture, and natural and working lands sectors in 2017.



**Eleven priority GHG emissions reduction measures** across the buildings, transportation, energy generation, and waste sectors.



**Each measure includes** a brief description, geographic scope, GHG emissions reductions calculations, co-benefits and LIDAC benefits,<sup>36</sup> implementing agencies and their authority to implement, implementation timeline and milestones, metrics to track progress, availability of other funding to implement the measure, workforce development opportunities (as applicable), examples of success and ongoing work in the region, and federal, state, and local policy priorities to support the measure.

The PCAP draws on previous and ongoing climate work in the region and the expertise, best practices in the field, and experience of municipal and regional leaders, community-based organizations, and residents who have been working on climate and sustainability issues for many years. Local and state climate action plans served as a starting point for the GHG reduction measures considered for the PCAP. Several rounds of input from the plan's RPA/RPC Steering Committee, Municipal Advisory Group, Justice40Advisory Group, and public listening sessions helped prioritize and refine the measures to have the greatest impact on GHG reductions and equity.



## Development of Priority GHG Reduction Measures

During the fall of 2023, MAPC compiled a database of existing climate action plans and net zero action plans from within the region, which collectively include hundreds of actions that municipalities can take to reduce GHG emissions. MAPC utilized this database to create an initial list of 70 potential municipal and regional-level measures across the Buildings, Transportation, and Energy Generation sectors. Additional input on measure development was collected during a public listening session and from the Municipal Advisory Group. The project team then evaluated measures on the list based on ability to implement within five years, magnitude of GHG emissions reduction, and prominence of equity and co-benefits. Measures that did not meet these criteria were removed from the list, resulting in 25 measures.

MAPC created a prioritization matrix to rank each of the 25 measures across a set of criteria based on equity and co-benefits, input from the Advisory Groups, and the evaluation criteria from the CPRG Implementation Grant Notice of Funding Opportunity shaped the remaining criteria. The prioritization matrix included nine criteria and each measure was scored on a scale of 1-3 for each of the nine criteria:

1. GHG Emissions Reductions by 2030
2. GHG Emissions Reductions by 2050
3. Reduces Harmful Pollutants
4. Ability to be Implemented within five years
5. Leads with Equity
6. Reduces Cost of Living
7. Reduces Environmental and Climate Burdens
8. Creates Economic and Job Benefits
9. Improves Community Resilience to Climate Impacts

The RPA/RPC Steering Committee then reviewed the scores to determine the top ten priority measures to include in the PCAP. During this process some measures were combined or integrated into other measures. Based on input from advocates, community members, and municipal staff leaders, a priority measure from the waste sector was also developed, evaluated, and included in the PCAP.



Figure 8: Lowell, Massachusetts. Photo by Weston & Sampson

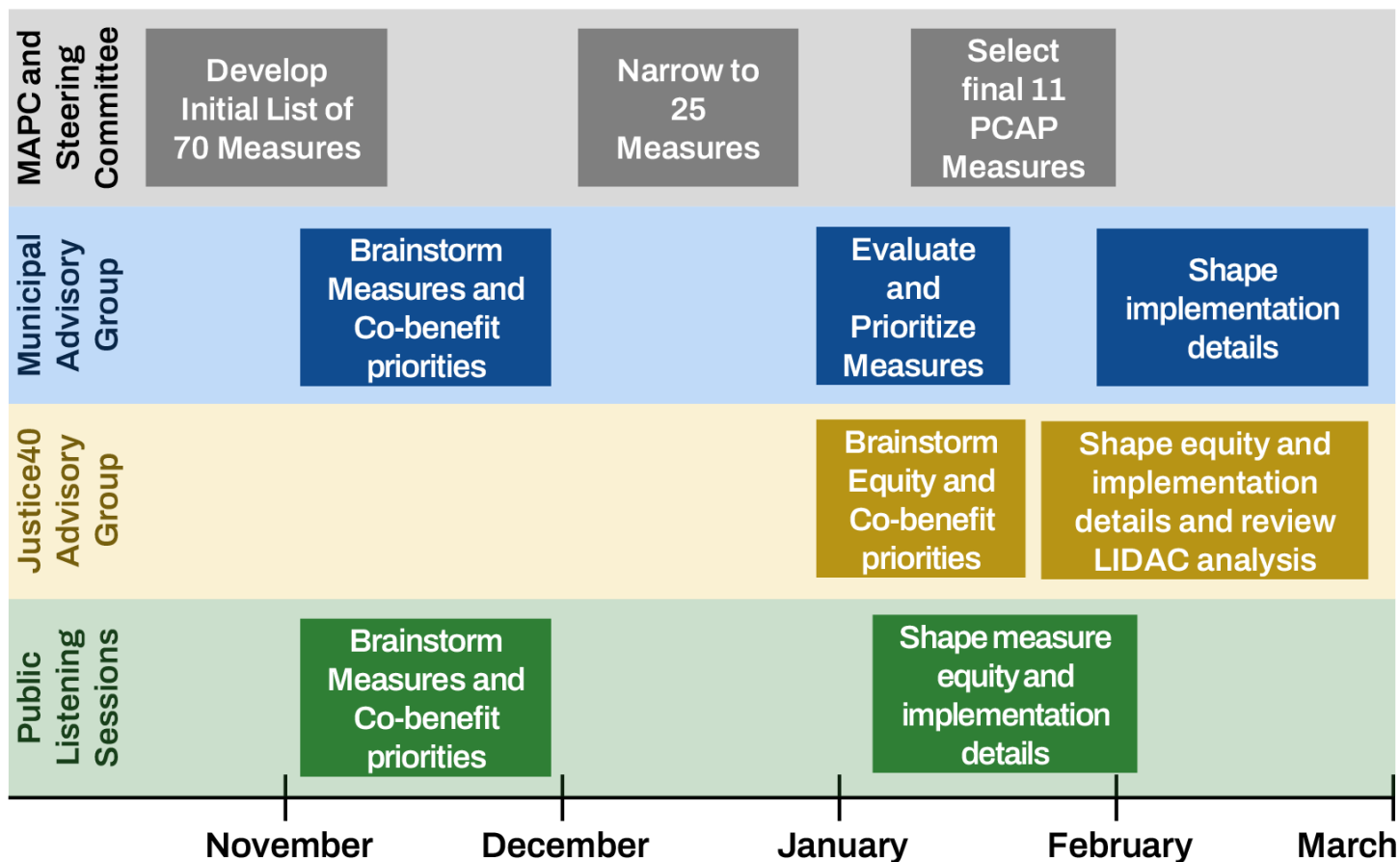


Figure 9: GHG Reduction Measure Generation and Stakeholder Engagement timeline

## Stakeholder Engagement

### *Steering Committee and Advisory Groups*

The measure development process was led by MAPC in partnership with the RPA/RPC Steering Committee, the Municipal Advisory Group, and the Justice40 Advisory Group. The RPA/RPC Steering Group met virtually four times and the Municipal and Justice40 Advisory Groups each met virtually three times to provide input on initial measure development, share feedback that shaped the criteria used for prioritization, and give greater depth and details to the implementation and analysis of the priority measures. Feedback from advisory group meetings is summarized in Appendix E.

**Table 2: Summary of Steering Committee and Advisory Groups**

| Group   | Role  | Participants   |
|---|---|--|
| <b>Regional Planning Agency/Commission (RPA/RPC) Steering Committee</b> | Advise the development of the plan, analyses, and measure development. Lead engagement with communities within each RPA/RPC's region. Support outreach for Advisory Groups. | Metropolitan Area Planning Council (MAPC), Old Colony Planning Council (OCPC), Merrimack Valley Planning Commission (MVPC), Northern Middlesex Council of Governments (NMCOG), Rockingham Planning Commission (RPC), Southern New Hampshire Planning Commission (SNHPC), and Nashua Regional Planning Commission (NRPC). |
| <b>Municipal Advisory Group</b>   | To provide input and feedback on the development of priority measures, co-benefits, and implementation.   | 29 municipalities, including 11 LIDAC communities, from across the MSA. <sup>37</sup>  |
| <b>Justice40 Advisory Group</b>   | To provide input and feedback on the development of priority measures, co-benefits and implementation.  | 25 non-profits, community-based organizations, and individual advocates from across the MSA. <sup>38</sup>   |

### ***Justice40 Advisory Group***

MAPC convened the Justice40 Advisory Group to gather feedback on the plan from service providers, non-profits, and community-based organizations that represent residents in their respective LIDAC community service areas. The Justice40 Advisory Group's involvement in the process helps to amplify the voices of those who have often been underrepresented and ignored in planning processes, strategy development, and funding allocation. Recruitment for the Justice40 Advisory Group was done through the public listening session, online methods such as email and social media, and via existing relationships and networks. More than 50 organizations and individuals submitted an expression of interest and were selected based on several key factors including geographic/community representation, non-profit or community-based organization status, and ability to participate. Many of the organizations received a participant cost stipend to support their time.

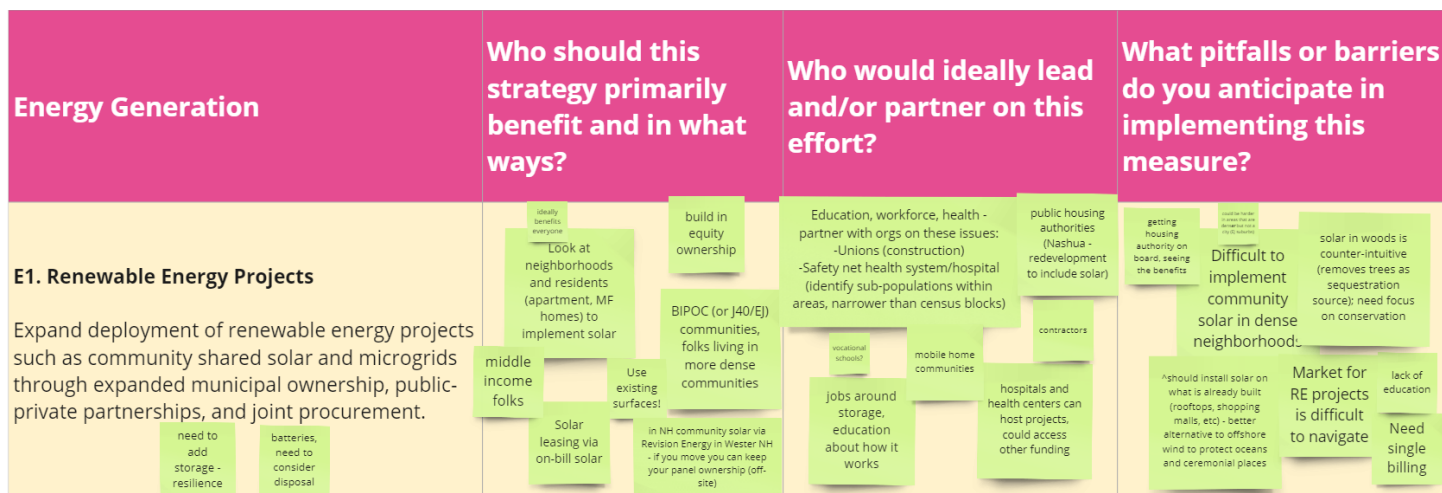


Figure 10: Virtual whiteboard activity snapshot of a draft energy generation measure and feedback from the Justice40 Advisory Group relating to the questions posed through the lens of equity.

## Public Listening Sessions

MAPC hosted three virtual listening sessions open to all community members in the region. MAPC conducted outreach to municipal contacts, community-based organizations, utility representatives, and others, to share this opportunity to learn about the process and provide feedback. During the November 2023 meeting, MAPC introduced the CPRG program, and provided an overview of the PCAP and CCAP, and Advisory Group opportunities. Additionally, participants shared their key challenges and priorities in the buildings, electricity, and transportation sectors during breakout discussions (see Figure 12). Following the meeting, MAPC incorporated these insights into the larger list of greenhouse gas reduction measures. Feedback from the second and third listening sessions is summarized in **Appendix E**.

At the second and third virtual listening session, held in late January 2024 once during the day and once during the evening, MAPC provided an update on the PCAP development process, the draft priority measures, and presented initial Greenhouse Gas Inventory results and methodology. Participants then shared thoughts and ideas on potential barriers, key partners, enabling actions, and existing related projects for each measure in facilitated breakout groups. See **Appendix E** for a full summary of what participants shared during the second public listening sessions.

MAPC staff also attended several public listening sessions conducted by the state of New Hampshire for the state's climate action plan (also funded through CPRG). New Hampshire RPCs also provided summaries of feedback shared during listening sessions.

|                        | Priorities for the Next 5 Years  | Barriers  |
|------------------------|--|---|
| Electricity Generation | <ul style="list-style-type: none"> <li>Renewable energy content in municipal aggregation</li> <li>Solar + storage</li> <li>District energy</li> <li>Solar on municipal rooftops and parking lots</li> <li>Promotion of low-income community solar</li> <li>Resilience hub</li> </ul>   | <ul style="list-style-type: none"> <li>Stakeholder buy-in for electrification</li> <li>Need for rate reform</li> <li>Low Mass Save participation</li> <li>Confusion about incentives</li> <li>Infrastructure</li> <li>Grid electrification</li> <li>Old building stock, deferred maintenance</li> </ul>   |
| Transportation         | <ul style="list-style-type: none"> <li>Public charging stations, curbside charging</li> <li>Charging accessible to low-income residents</li> <li>Affordable EV Car share</li> <li>Fare-free buses</li> <li>Municipal fleet electrification, including school buses</li> <li>Last-mile solutions to commuter rail</li> <li>Outreach and education about EVs</li> <li>Advocacy for MBTA expansion</li> </ul>   | <ul style="list-style-type: none"> <li>Supply chain</li> <li>Funding, challenging incentive structures</li> <li>EVs in Cold weather</li> <li>Affordability of EVs</li> <li>Procurement laws related to EVs</li> <li>Collaboration with utilities</li> </ul>   |
| Buildings              | <ul style="list-style-type: none"> <li>Deep energy retrofits</li> <li>Affordable housing decarbonization</li> <li>Weatherization for low-income households</li> <li>Advocacy for Mass Save reform</li> <li>Building Performance standards, energy disclosure</li> <li>Educational campaign on residential electrification</li> <li>Building Electrification</li> <li>Adoption of updated building codes</li> <li>Heat pump adoption + heat pump coach</li> </ul> | <ul style="list-style-type: none"> <li>Local grid capacity</li> <li>Energy burden for low-income ratepayers, green gentrification and displacement concerns</li> <li>Community resistance</li> <li>Funding for implementation</li> <li>Lack of training for contractors on new codes</li> <li>Split incentives at multifamily properties</li> <li>High cost of retrofits, deferred maintenance</li> </ul> |

Figure 11: Summary of priorities and barriers identified during the first public listening session.

## Coordination with the States and Other MSAs

Throughout the planning process, MAPC participated in bi-weekly meetings with the Massachusetts Governor's Office of Climate Innovation and Resilience, the Southeastern Regional Planning and Economic Development District (Providence MSA lead), and the Central Massachusetts Regional Planning Commission (Worcester MSA lead) to coordinate and share best practices on PCAP development and stakeholder engagement. MAPC also met with the New Hampshire Department of Environmental Services to learn about their state plan development process and additional priorities of stakeholders in New Hampshire.



# Section Endnotes



Click for more  
information!

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## 2. Climate Justice in the Region and LIDAC Analysis

The Greater Boston Metropolitan Statistical Area (MSA) as defined in this plan comprises **167 municipalities**, many that are home to communities that are identified as Low-Income and Disadvantaged Communities (LIDAC) by the federal government. These communities hold significant historic and industrial importance, symbolizing the region's enduring involvement in the history of immigration in America. Today, LIDAC communities are places rich with diverse culture, languages, community organizations, local businesses, institutions, history, arts, and more. They add to the tapestry of the area's heritage and play an integral role in shaping the collective identity of the region.

In an effort to be as inclusive and accurate as possible when identifying the LIDAC communities, multiple data sources were used to gain a comprehensive understanding of the region. The project team used three screening tools: the Climate and Economic Justice Screening Tool (CEJST)<sup>1</sup>, the Environmental Justice Screening and Mapping Tool (EJScreen)<sup>2</sup>, and the EPA Inflation Reduction Act (IRA) Disadvantaged Communities designation. These tools identify LIDAC communities by assessing indicators for categories of burden: air quality, climate change, energy, environmental hazards, health, housing, legacy pollution, transportation, water and wastewater, and workforce development.

Within the Boston MSA, **49 municipalities in Massachusetts** and **ten municipalities in New Hampshire** include at least one census tract designated as a LIDAC community according to the EPA IRA Disadvantaged Community designation, shown in green in Figure 14. A total of **474 census tracts** in the region are LIDAC communities, which represents **42 percent** of census tracts within the MSA. A detailed list of the specific census tracts designated as LIDAC communities can be found in Appendix C.



Figure 12: Cochituate Rail Trail in Framingham, Massachusetts. Photo by Weston & Sampson

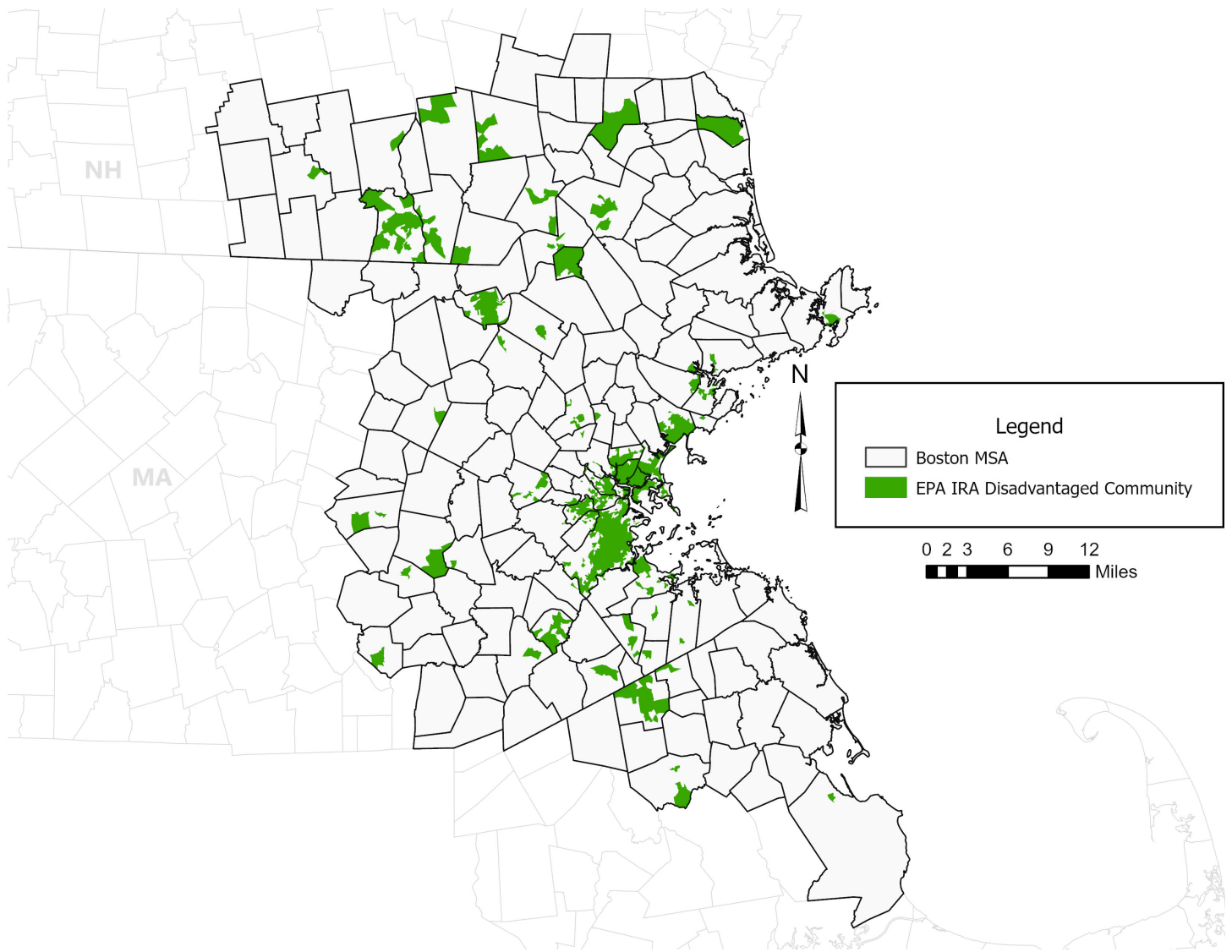


Figure 13: Map of the Greater Boston MSA's LIDACs.

In Massachusetts, LIDAC communities have a more specific definition compared to the state's Environmental Justice designation, which is based on income, race, and language isolation. All LIDAC communities are considered Environmental Justice communities, but not all designated Environmental Justice communities are classified as LIDAC communities.



**“Environmental justice is at the heart of our climate efforts. Our administration is committed to securing clean air and water for every resident and ensuring the benefits of our clean energy transition are distributed in an equitable way.”**

- MA Governor Maura Healey.



## 2.1. Climate Impacts and Risks on LIDAC Communities

The EPA defines Environmental Justice (EJ) as the fair treatment and meaningful involvement of all people, regardless of their background, in decisions and activities that affect the environment and human health.<sup>3</sup> Integrating EJ principles into climate planning and policy is crucial for safeguarding communities disproportionately affected by various environmental burdens, especially in the context of climate change.

In addition to historic and present impacts of environmental pollution on LIDAC communities, these communities are also often exposed to the “first and worst” of the impacts of climate change. In the region, the primary climate impacts include an increase in the frequency and intensity of extreme precipitation events, coastal flooding due to sea level rise and storm surge, and more frequent extreme heat events. While climate change affects all residents, low-income and communities of color tend to bear a disproportionate burden of these impacts. Social, economic, and political factors can make it more difficult to adapt to and recover from climate change.<sup>4</sup>

### Increases in Extreme Precipitation

The region is expected to experience increases in extreme precipitation events. Over the last decade, rainfall records have been broken worldwide, with one in four records being attributed directly to climate.<sup>5</sup> The northeast region is experiencing the largest increase in the number of extreme precipitation days in the US, and this trend is expected to continue.<sup>6</sup>

Figure 16 shows the expected increases in precipitation between 2030 to 2070 in the region. An increase in the frequency and severity of extreme precipitation events can overwhelm stormwater drainage infrastructure or overflow rivers and stream resulting in inland or riverine flooding. Flooding can result in injury or loss of life, property damage, indoor mold growth, disruption of utility or essential services (e.g., medical care), temporary or permanent housing displacement, and water pollution, particularly in areas with combined sewer overflows.



Figure 14: Flooding in Boston. Photo by Weston & Sampson



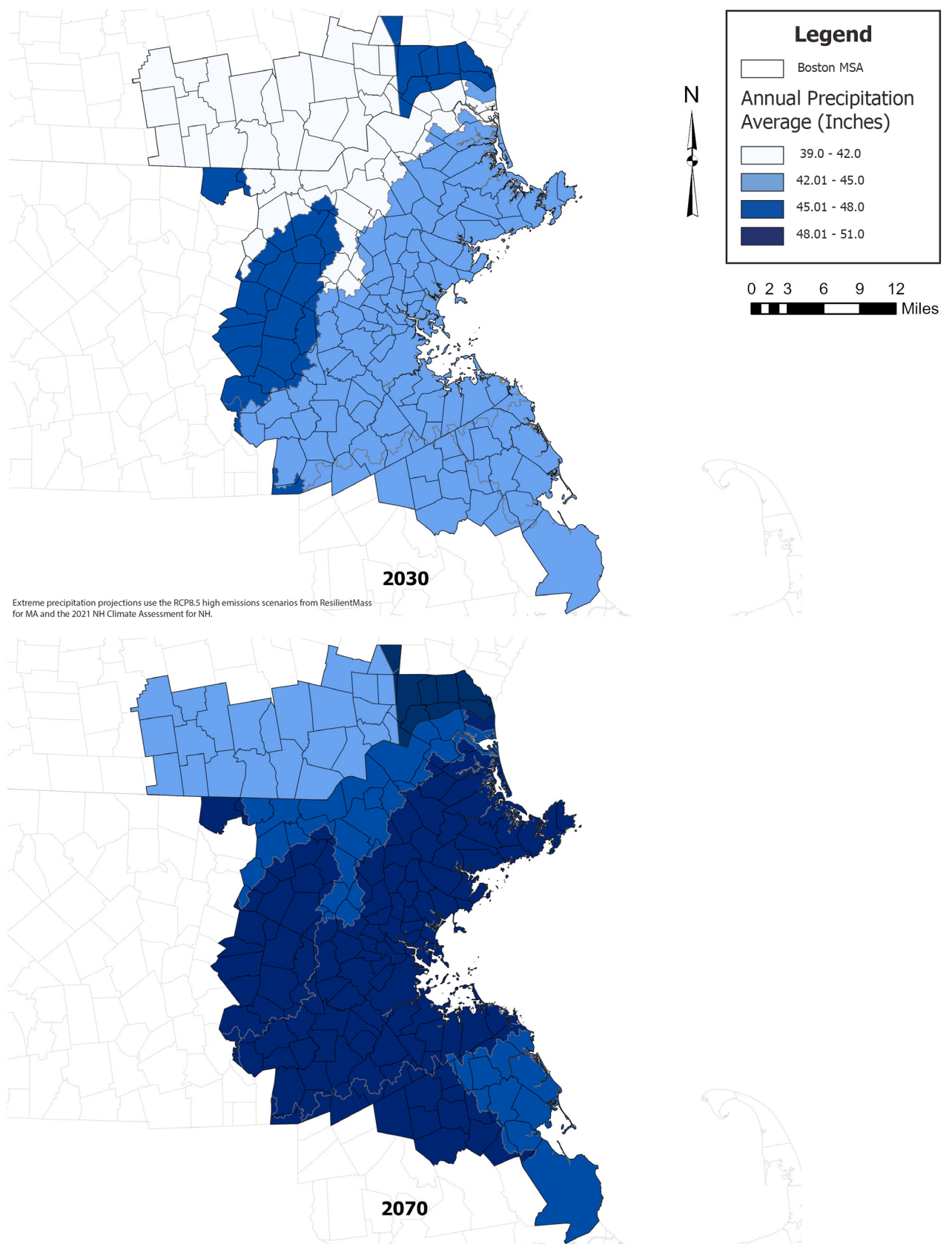


Figure 15: Projected increases in precipitation in 2030 and 2070.

Source: Massachusetts precipitation data was sourced from ResilientMass<sup>7</sup> operated by the MA EOEAA. New Hampshire precipitation data was sourced from the 2021 NH Climate Assessment<sup>8</sup>.

## Sea Level Rise and Storm Surge in Coastal Communities

The region also faces rising sea levels and increased intensity of storm events, leading to higher tides and more frequent coastal flooding. As shown in Figure 17, the probability of coastal flooding ranges from 0.1 percent to 2 percent in 2030 and 2 percent to 50 percent and in some cases 100 percent in 2070. The likelihood of coastal flooding is particularly high in Newburyport, greater Boston, and the Marshfield and Plymouth regions. The impact from these storms and floods can be significant on both regional and local scales. Like the impacts of extreme rainfall, coastal flooding can also result in risk to public health and safety, property damage, and service disruptions. Coastal flooding can exacerbate erosion along the coastline, increasing vulnerability to future storm events, and forcing existing structures to relocate, permanently close, or undergo costly flood protection measures. Preparing for and recovering from coastal flooding requires significant time and resources, which are lacking in many communities.

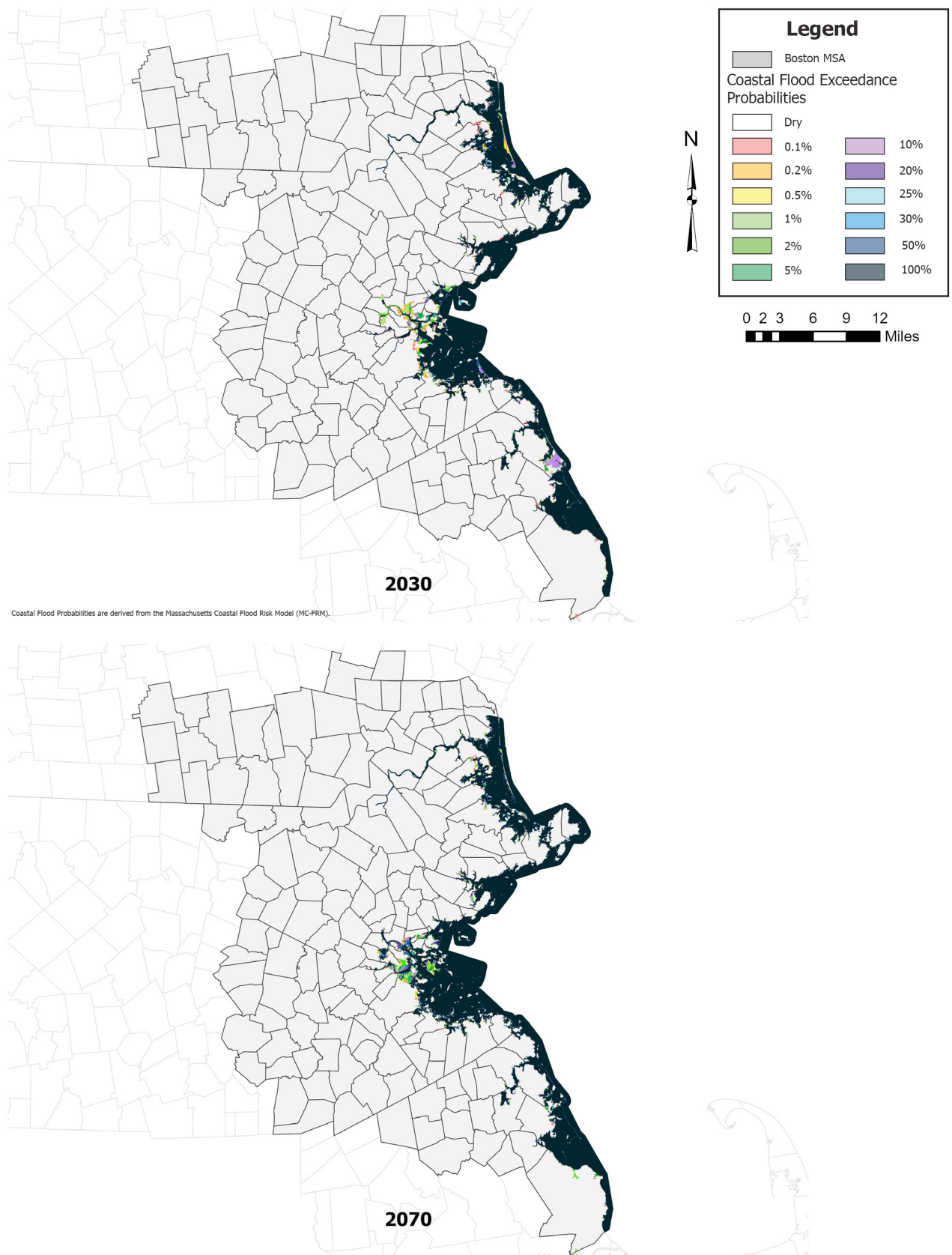
## Increases in Extreme Heat

The region is expected to experience increases in extreme heat (days over 90 degrees) and longer duration heat waves (3+ days of consecutive extreme heat), as well as warmer springs and fall seasons. By 2030, the region will experience 12-27 days of extreme heat annually and by 2080, upwards of 80 days over 90 degrees. Average daily temperature in the region will increase by between 2.5-3°F by 2040.<sup>10</sup> This is particularly evident in densely populated areas with less green space or tree cover, where the urban heat island effect disproportionately impacts LIDAC communities.<sup>11</sup> The region has already felt the effects of these changes and is likely to experience further rises in extreme heat, such as more days with temperatures exceeding 90 degrees, longer duration heat waves (three or more consecutive days of extreme heat)<sup>12</sup>, and warmer spring and fall seasons. Figure 18 shows the change in the number of days over 90 degrees Fahrenheit for the Greater Boston MSA from 2030 to 2070.

Extreme heat is the leading cause of weather-related deaths in the United States, and this phenomenon is worsened by the urban heat island effect. Extreme heat worsens air pollution and causes adverse health impacts, primarily in older adults, young children, people with chronic illnesses, and those disproportionately exposed to heat, such as outdoor workers and unhoused populations. Extreme heat can also strain the electricity grid, posing a risk of brownouts, and damage building and transportation infrastructure (e.g., train tracks warping, asphalt softening).

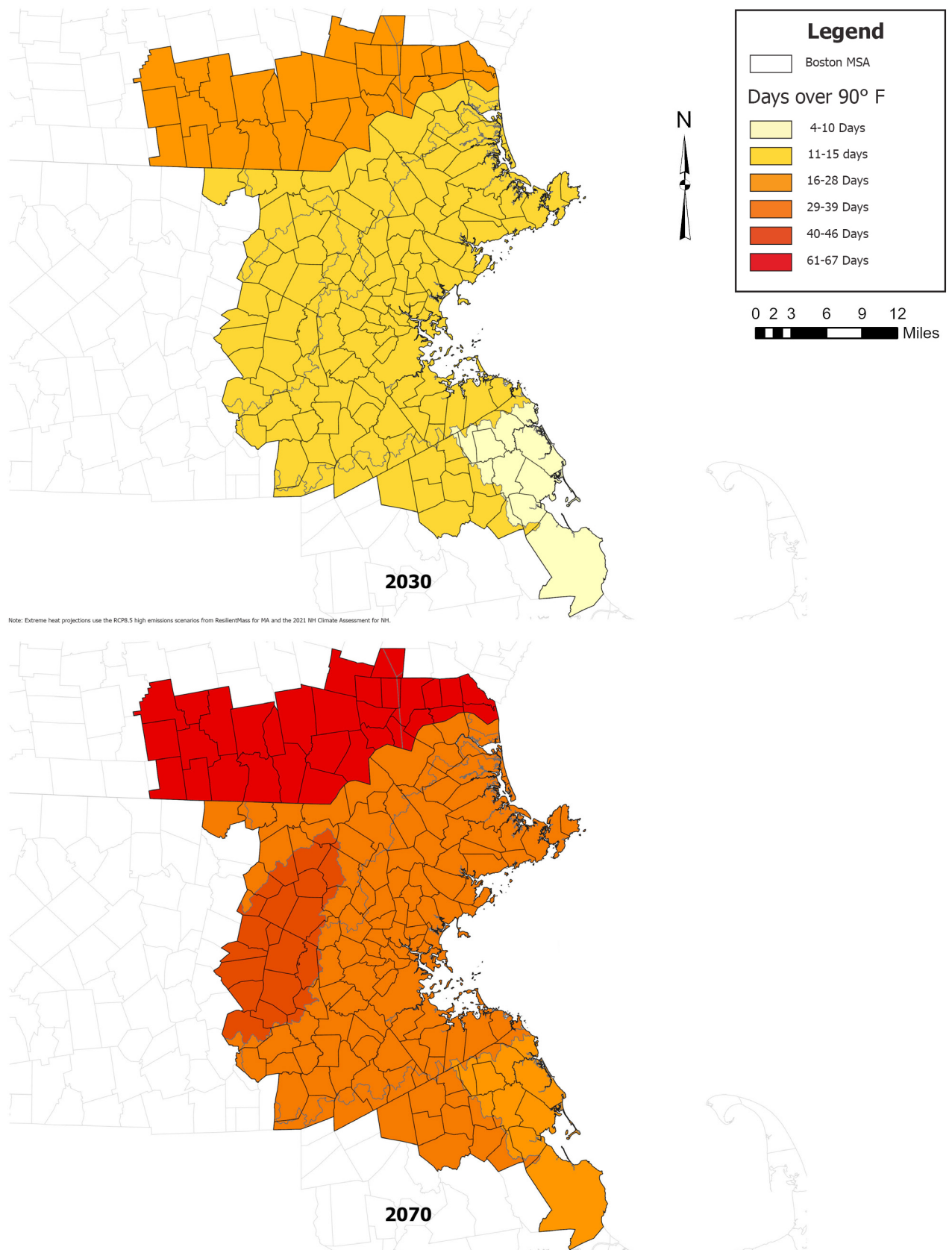
## Air Quality Risks

Poor air quality from climate pollution poses a risk to LIDAC communities, particularly those in the inner core of the Greater Boston region. Diesel particulate matter (DPM), a pollutant emitted by diesel truck engines and exhaust, is a key concern. Recognized by organizations like the EPA and World Health Organization (WHO) as "carcinogenic to humans" due to over 40 potential cancer-causing compounds, prolonged exposure to DPM presents severe public health risks<sup>13</sup>. Figure 19 shows the DPM levels in the Greater Boston MSA. Communities near busy roads, such as major highways or urban centers, face heightened exposure to these harmful particulates. In the outer suburban and rural areas of the MSA, DPM is at lower concentration levels. As expected, the highest concentrations are within and around the City of Boston, where the population is the densest, though levels across the MSA still fall within the acceptable range defined by EPA.



*Figure 16: Massachusetts Coastal Flood Risk Model for the Greater Boston MSA.*

*Source: Massachusetts CZM Coastal Risk Flood Model Viewer<sup>9</sup>.*



*Figure 17: Projected increases in days over 90 degrees in 2030 and 2070.*

*Source: Massachusetts heat data was sourced from ResilientMass<sup>8</sup> operated by the MA EOEEA. New Hampshire heat data was sourced from the 2021 NH Climate Assessment<sup>9</sup>.*



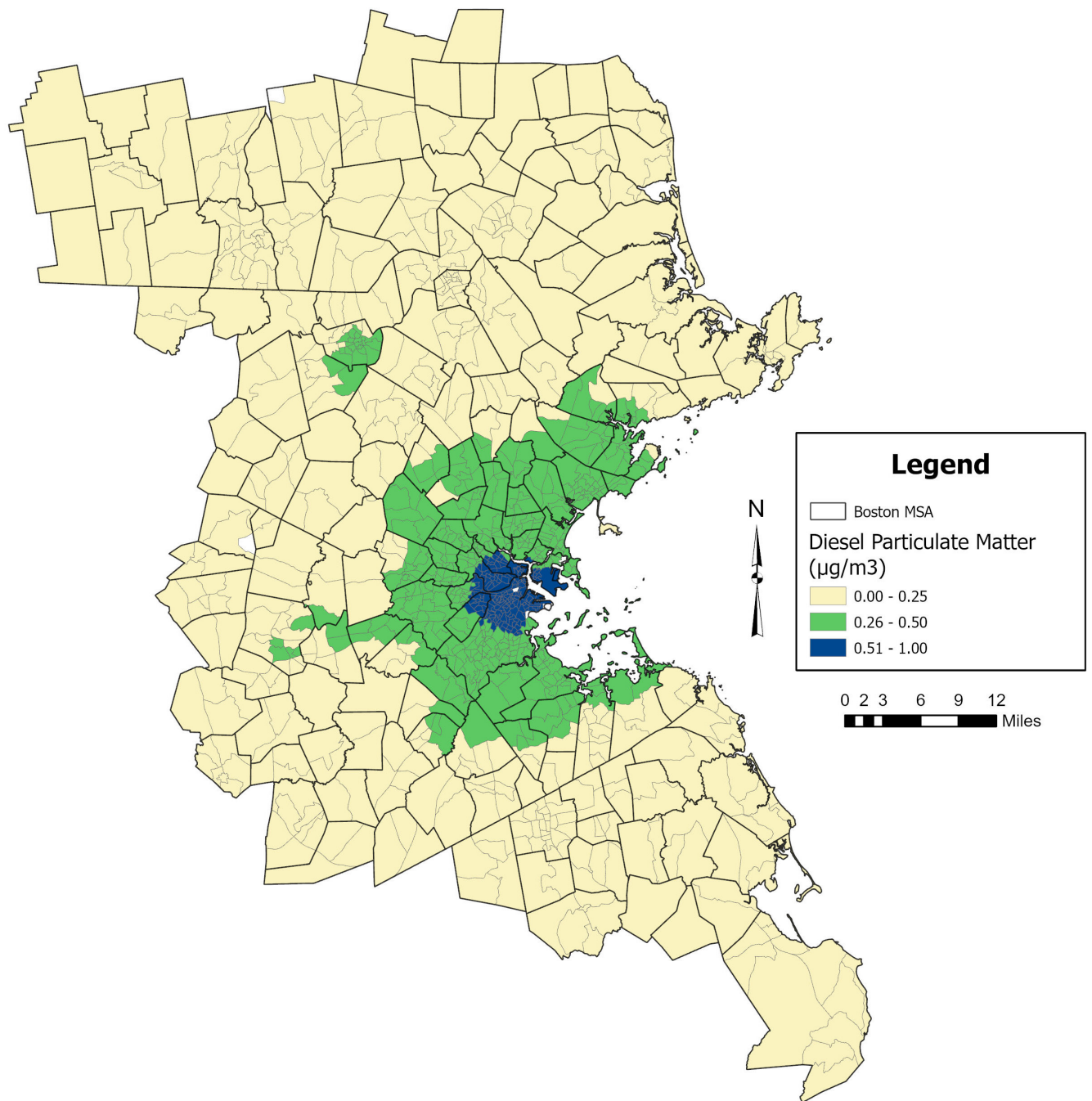


Figure 18: Diesel particulate matter level in air in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ).

Source: EJScreen<sup>14</sup>

Additional air quality risks in the MSA can be examined using the EPA AirToxScreen assessment tool. It utilizes the Air Toxics Respiratory Hazards Index to quantify the combined non-cancer respiratory risk posed by various air toxics, based on EPA-established concentration levels. A hazard index of one or lower suggests that adverse non-cancer health effects from these air toxics are improbable over a lifetime of exposure. Shown in Figure 20, the air toxics hazards respiratory index for the Boston MSA is below an index concentration of one, with the most common concentration remaining below an index indicator of 0.3. With continued efforts to reduce GHGs within this plan, this index can remain at low risk for the MSA.

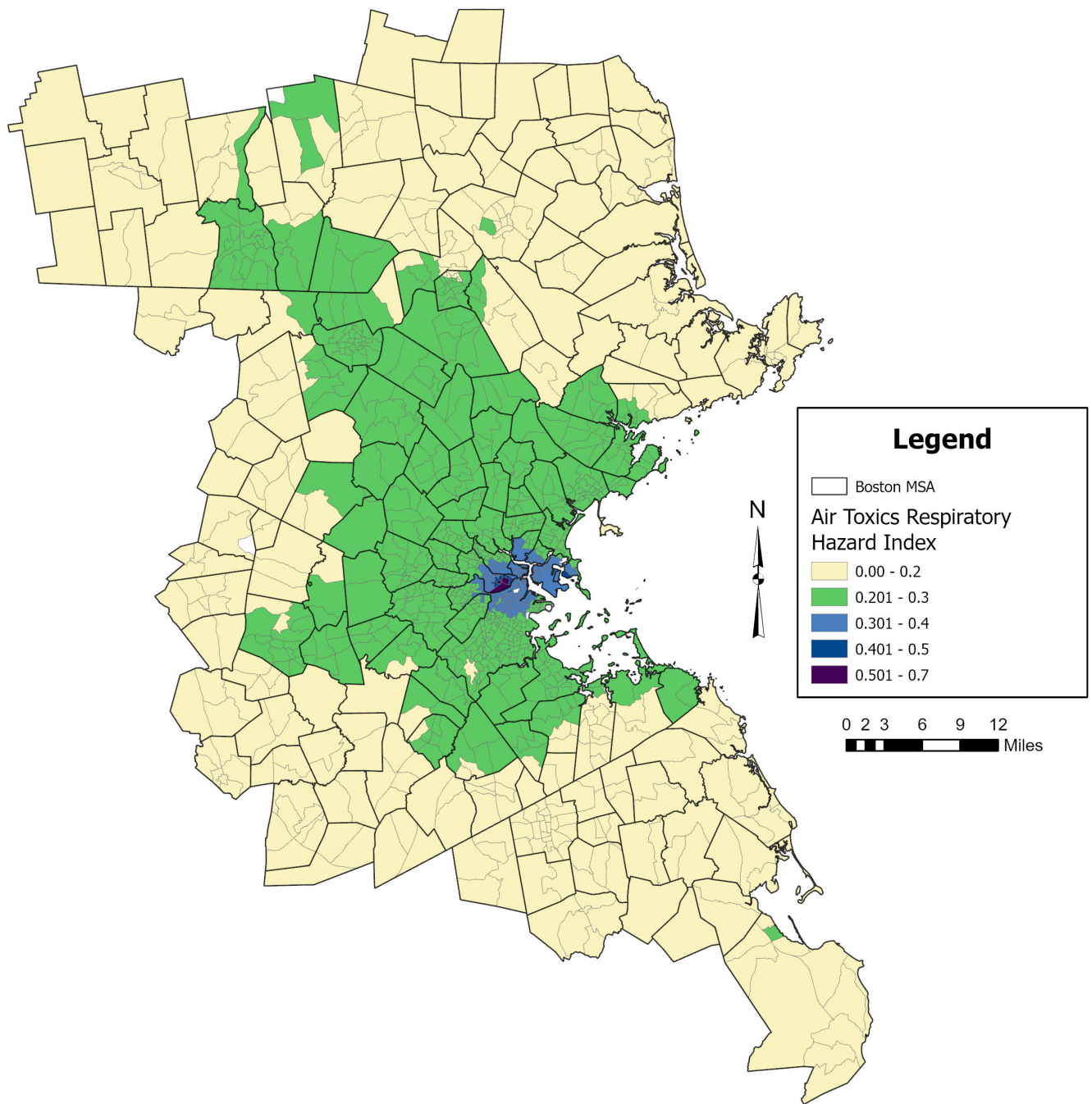


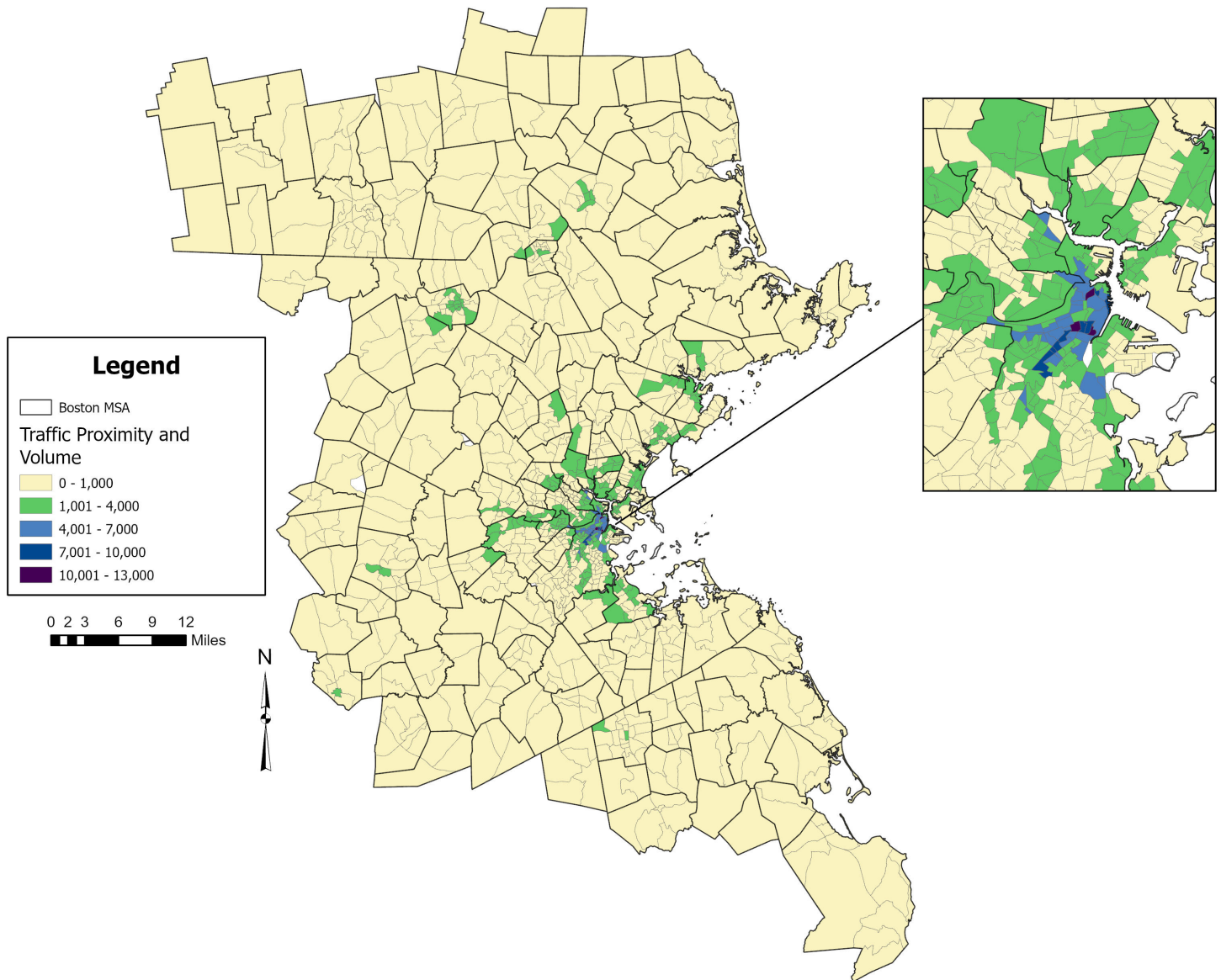
Figure 19: Air Toxics Respiratory Hazard Index.

Source: EJScreen<sup>15</sup>.

Like the effects of DPM, constant exposure to heavy traffic and internal combustion engines (ICE) can pose risks to human health. In addition to emitting GHGs, ICE vehicles emit carbon monoxide, nitrogen oxides, hydrocarbons, and particle matter. People who live near major roads have increased incidence and severity of health problems such as increased asthma onset and aggravation, cardiovascular disease, impaired lung development, and premature death.<sup>15</sup> Figure 21 displays the traffic proximity and volume, which the EPA calculates as the average number of vehicles per day on major roads within 500 meters of the census tract (or the nearest one beyond



500 meters), divided by distance in meters<sup>15</sup>. These emissions levels are higher in denser areas with more traffic and can also be exacerbated by the lack of public transportation in areas and the need for driving a personal vehicle. The areas within the Greater Boston MSA with high vehicle counts largely coincide with those designated as LIDAC communities.



*Figure 20: Traffic Proximity and Volume.*

*Source: EJScreen<sup>15</sup>.*

## 2.2. LIDAC Benefits Framework

The project team developed a LIDAC Benefits Framework based on input from the Municipal and Justice40 Advisory Groups. The framework focuses on five priority categories of benefits that could result from the measures in this plan beyond reducing GHG emissions. In addition to stakeholder input, the benefits encompass the Justice40 Initiative categories of investment: climate change, clean energy and energy efficiency, clean transit, affordable and sustainable housing, training and workforce development, remediation and reduction of legacy pollution, and the development of critical clean water and wastewater infrastructure. The LIDAC Benefits Framework was used in the project team's GHG reduction measures prioritization process to ensure the measures prioritized equity and public health benefits.

### The five categories of measure benefits evaluated in this plan are:



Leads with Equity



Reduces Cost of Living



Reduces Environmental and Public Health Burdens



Creates Economic and Job Benefits



Improves Community Resilience to Climate Impacts

### **Leads with Equity**

MAPC defines equity is defined as “the condition of fair and just inclusion into a society. Equity will exist when those who have been most marginalized have equal access to opportunities, power, participation, and resources and all have avenues to safe, healthy, productive, and fulfilling lives. It requires restructuring deeply entrenched systems of privilege and oppression that have led to the uneven distribution of benefits and burdens over multiple generations.”<sup>16</sup>

Centering equity in climate planning, programs, and policies should involve four dimensions of equity defined by the Urban Sustainability Directors Network: procedural equity, distributional equity, structural equity, and transgenerational equity. Procedural equity means ensuring that those who have been historically impacted by climate change and environmental harms have meaningful voice, representation, agency, and priority in engagement and decision-making processes. Distributional equity means ensuring that those who have been historically impacted

by climate change and environmental harms receive proportionally more benefit from clean energy programs or policies and proportionally less harm. Structural equity means examining and changing the clean energy systems (e.g., government programs, energy facility siting processes) that are currently inequitable and privilege some members of society over others. Finally transgenerational equity means evaluating how energy decisions made today (e.g., repairing natural gas infrastructure or the full lifecycle of clean energy products) will impact future generations and acting to mitigate future harms today.<sup>17</sup>

### Example Outcomes:

- **Recognize the current characteristics of inequity** in our communities as a baseline to improve upon and measure and track progress during implementation.
- **Empower historically marginalized people and communities to lead and benefit** from the measures while working towards procedural, distributional, structural, and transgenerational equity.

## Reduces Cost of Living

Greater Boston has a very high cost of living for housing, energy, transportation, and food costs. A combination of factors contributes to the rising cost of housing in the MSA, including population growth outstripping supply, restrictive local zoning and permitting processes that block housing construction, high construction costs, speculative investment, an outdated housing stock, and a backlog in housing production. The risk of displacement is a real concern and is exacerbated by the region's continuous housing shortage and rising costs. Households in the LIDAC communities also tend to face disproportionately high energy costs, largely attributable to older buildings with inefficient equipment.<sup>18</sup> At the same time, transportation costs are higher for these households due to longer commute times, limited access to public transportation, and having fewer remote or hybrid work options.



Figure 21: Cambridge, Massachusetts. Photo by Weston & Sampson





Figure 22: MBTA Green Line Extension. Photo by Weston & Sampson

### Example Outcomes:

- **Increase housing access while reducing displacement risks** by expanding funding and support for housing assistance programs and renter protections.
- **Reduce energy costs by implementing energy efficiency measures in buildings**, adopting municipal aggregation, installing renewable energy, and pursuing net zero building retrofits.
- **Educate landlords, homeowners, and renters about the health and financial benefits** of living and working in energy efficient environments.
- **Increase transit affordability and accessibility** by expanding access to public transit, making public transit more affordable, increasing multi-modal transportation and micro-mobility options, and making electric vehicles and charging more affordable, accessible, and convenient.
- **Limit food waste** to reduce household expenses and environmental and climate burdens.
- **Improve healthy food access** while reducing GHG emissions by increasing accessibility to locally grown products.

## Reduces Environmental and Public Health Burdens

Polluting industries are often located within LIDAC communities, leading residents to experience higher levels of air, soil, and water pollution. These neighborhoods are also more likely to host other pollution-intensive land uses such as landfills, waste and combustion sites, Superfund and brownfield sites, and be closer to major roads and highways and trucking routes.<sup>19</sup> LIDAC communities also often experience the urban heat island effect and extreme heat, due to less green space, reduced tree canopy, and less access to indoor cooling compared to other communities.<sup>20</sup> Environmental and climate burdens also place a mental health and stress burden on the populations experiencing those conditions.

### Example Outcomes:

- **Improve indoor air quality** by reducing volatile organic compounds (VOCs) and related pollutants, while increasing access to improved ventilation systems and cooling.
- **Improve neighborhood air, soil, and water quality** through zoning, increasing public transit and multimodal options, green streets<sup>21</sup>, progressive stormwater management, brownfield remediation, and other municipal policies.
- **Reduce urban heat island and extreme heat effects** by increasing parks and green space, tree cover, splash pads, and reflective paving and rooftops.
- **Bolster social infrastructure** through provision of communal green and gathering spaces and car-free urban areas.

## Creates Economic and Job Benefits

Residents in LIDAC communities tend to have less access to higher education, work in service-sector and blue collar jobs, and experience lower wages and higher levels of unemployment and job instability.<sup>22</sup> Some LIDAC communities in Greater Boston were historically industrial centers for the region that have undergone economic transitions and the loss of manufacturing and other places of employment.<sup>23</sup> Additional technological advances in automation and the rise of artificial intelligence may further change the workforce and job availability. GHG measures can create good job opportunities that offer living wages, benefits, and advancement opportunities in the climate or green sector that specifically benefit people living and working in LIDAC communities.

### Example Outcomes:

- **Provide local sustained pathways to employment** through targeted workforce training and wraparound services in the climate sector for women, people of color, previously incarcerated individuals, and English as a Second Language communities.
- **Provide good job opportunities** by working with climate and clean energy employers to offer apprenticeships and job opportunities to LIDAC community residents.



Figure 23: Solar maintenance and repair training. Photo by Weston & Sampson





Figure 24: Flooding in Lynn, Massachusetts. Photo by Weston & Sampson

- **Expand municipal and regional partnerships with educational institutions, non-profits, and businesses** to collectively plan for future clean energy job market needs, provide training and apprenticeships, and foster an ecosystem of opportunity.
- **Incentivize green business ownership opportunities and union labor** to facilitate upward economic mobility, economic stability, and job security.

## **Improves Community Resilience to Climate Impacts**

As described earlier in this section, LIDAC communities are likely to be located in areas facing increased climate risks such as flooding, drought, severe storms, and extreme heat. Investments in these communities in preparedness and resiliency are essential for mitigating the devastating and unequal effects of extreme climate events.

### **Example Outcomes:**

- **Reinforce physical resilience** to the effects of extreme events by providing resources and infrastructure to protect vulnerable populations from climate impacts.
- **Create energy resilience** via local renewable power generation and backup battery power.
- **Enhance social resilience** with proactive preparedness programs and training.
- **Expand access to quality housing** with high performance residential standards for resilience.
- **Expand access to transportation options** and ensure that evacuation routes are known and accessible.
- **Promote the control of and access to land and resources** for Indigenous communities.

In the GHG Reduction Measures section, each priority GHG reduction measure is evaluated across these five benefit categories described above. The LIDAC Benefits Analysis section includes the icon for each relevant benefit category, along with a short description of the specific benefits that are expected with the implementation of the measure.



# Section Endnotes



Click for more  
information!

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# 3. Greenhouse Gas Inventory

A baseline greenhouse gas (GHG) emissions inventory is the first step towards understanding the effectiveness of emissions reductions and measuring progress toward net-zero goals and targets. The emissions associated with activities occurring within Greater Boston were quantified for the year 2017. 2017 was selected not only for being a relatively recent year independent of COVID-19 impacts with high quality, publicly available data, but also because 2017 maintains consistency with MAPC's existing Community GHG Inventory Tool, designed for and used by dozens of communities in Massachusetts.<sup>1</sup>

This inventory builds upon and streamlines MAPC's GHG Inventory Tool and resources from EPA and NH entities, to leverage what communities are familiar with and maintain data quality. In the CCAP, the GHG inventory will be expanded and updated to a more recent year.

GHG emissions are measured in units of metric tons of carbon dioxide equivalent (MTCO<sub>2</sub>e) or millions of MTCO<sub>2</sub>e (MMTCO<sub>2</sub>e). Global warming potentials for methane and nitrous oxide are used to normalize these greenhouse gases to CO<sub>2</sub>, in accordance with the methodology from the IPCC's Fifth Assessment Report. The following equation is generally used to calculate emissions:

$$\begin{array}{|c|} \hline \text{Activity Data} \\ \text{(e.g., kWh, gallons)} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Emissions Factors} \\ \text{(e.g., MTCO}_2\text{e/kWh,} \\ \text{MTCO}_2\text{e/gallon)} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Emissions} \\ \text{(MTCO}_2\text{e)} \\ \hline \end{array}$$







This GHG emissions inventory includes a comprehensive set of emissions sources from Stationary Energy, Electricity, Transportation, Waste, Agriculture, and Natural and Working Lands. The sector of emissions sources, key data that informed emissions calculations, and the emissions in MMTCO<sub>2</sub>e can be found in Table 3.



The MSA as a whole, including residential, commercial, and municipal activities, was responsible for emitting

**41.9 MMTCO<sub>2</sub>e in 2017.**

**Table 3: GHG Emissions Inventory Sectors, Key Data, and Resulting Emissions**

| Sector  | Key Data  | Subsector                                | Emissions (MMT CO <sub>2</sub> e) |
|---|---|--|-----------------------------------|
| <br><b>Stationary Energy</b>             | Residential and commercial/ institutional usage (natural gas, fuel oil), off-road equipment   | Residential Buildings                    | 9.0                               |
|   |   | C/I Buildings & Manufacturing Industries | 8.8                               |
|   |   | Construction                             | 0.5                               |
| <br><b>Electricity</b>                   | Residential & commercial / institutional usage, transmission and distribution losses<br>( <i>investor-owned utilities, municipal utilities, and community aggregation</i> ) | Residential Buildings                    | 2.9                               |
|   |   | C/I Buildings & Manufacturing Industries | 5.6                               |
| <br><b>Transportation</b>                | Passenger vehicles, commercial vehicles, public transportation ( <i>bus, rail, ferry</i> )  | On-road (and MBTA Ferries)               | 15.1                              |
|   |   | Rail                                     | 0.2                               |
| <br><b>Waste</b>                       | Landfilled and incinerated waste, composted and anaerobically digested waste, wastewater  | Waste                                    | 2.3                               |
| <br><b>Agriculture</b>                 | Commercial fertilizer usage   | Fertilizer                               | 0.03                              |
| <br><b>Natural &amp; Working Lands</b> | i-Tree carbon sequestration based on canopy   | Carbon Sequestration                     | -2.5                              |
| <b>Total Net Emissions (MMT CO<sub>2</sub>e)</b>  |   |  | <b>41.9</b>                       |



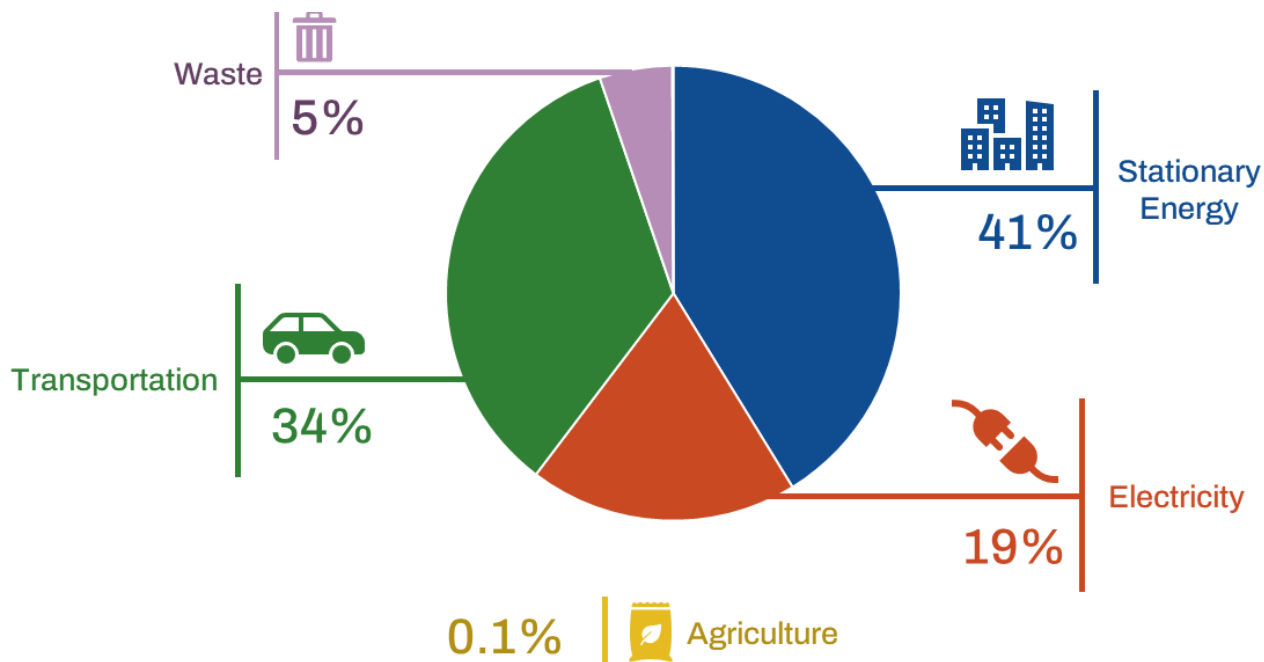


Figure 25: 2017 GHG Emissions by Sector

The distribution of 2017 GHG emissions inventory results by sector and subsector are summarized in Figures 26 and 27. The three largest emitting sectors in Greater Boston are buildings, transportation, and electricity. The three largest subsectors are commercial & industrial buildings and manufacturing industries, residential buildings, and passenger vehicles. These results compare favorably to the Massachusetts statewide 2017 emissions inventory of approximately 73 MMT CO<sub>2</sub>e, which identified transportation (42%), buildings (27%), and electricity (19%) and the highest emitting sectors.<sup>2</sup>

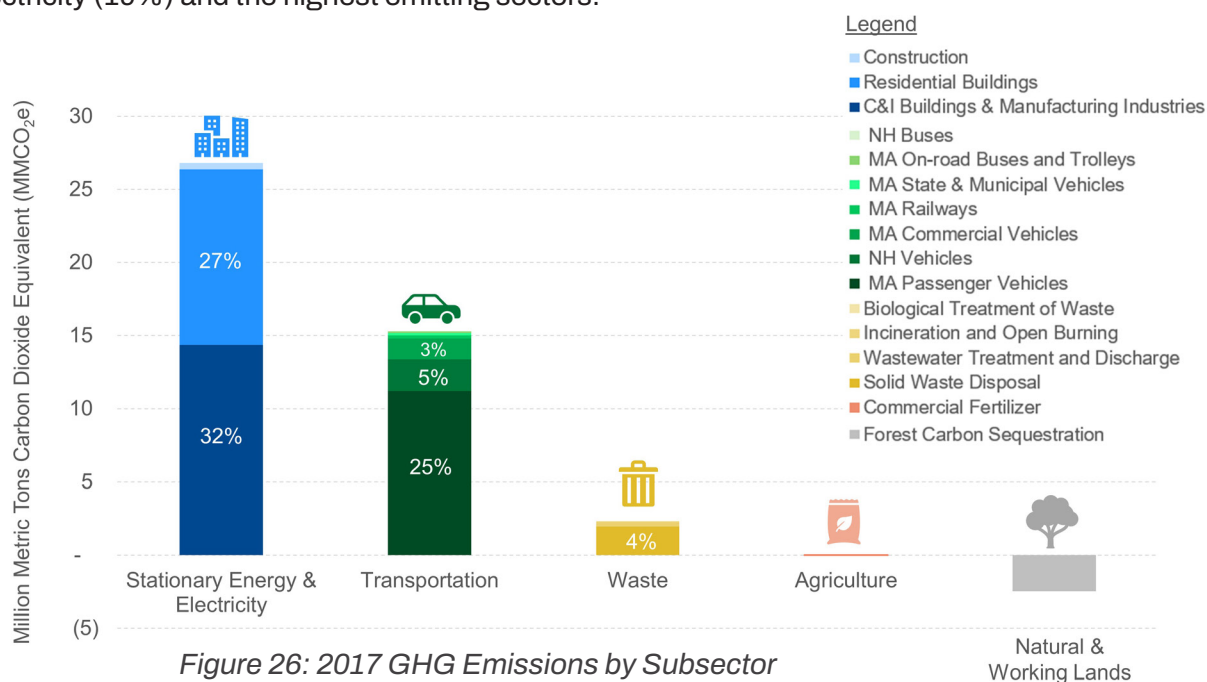


Figure 26: 2017 GHG Emissions by Subsector

Additional information about data sources and methodology can be found in Appendix A.

# Section Endnotes



Click for more  
information!

1. <https://www.mapc.org/resource-library/community-ghg-inventory-resources/>
2. MA Decarbonization Roadmap. <https://www.mass.gov/info-details/ma-decarbonization-roadmap>



*Figure 27: Cushing Memorial Park in Framingham, Massachusetts. Photo by Weston & Sampson*



# 4. Greenhouse Gas Reduction Measures

The Greater Boston PCAP includes 11 GHG reduction measures across the Buildings, Transportation, Energy Generation, and Waste sectors. These 11 measures are not inclusive of all of Greater Boston's many climate priorities but represent a sub-set of measures that are **implementation-ready**, will lead to **GHG emissions reductions by 2030**, and will **advance equity** in the region.

## Each GHG Reduction Measure includes the following information:










-  **Description of the Measure**, including relevant background information and specific actions that municipalities, groups of municipalities, regional government agencies, and partners can take to implement the measure.
-  **Geographic Scope** of where the measure can be implemented.
-  **GHG Emissions Reductions through 2030 and 2050** that can be realized by implementing the measure.
-  **LIDAC Benefits Analysis** that identifies the co-benefits of the measure (*described in Section 2.1.2*).
-  **Implementation Details**, including the **Lead and Partner Implementing Agencies**, an analysis of **Authority to Implement**, the **Implementation Timeline and Milestones**, and **Metrics to Track Progress**.
-  **Other Funding Available** that could support implementation of the measure. The measure descriptions include the name of the funding, and further detail can be found in Appendix C.
-  **Workforce Development Opportunities** that would support implementation of the measure, as applicable.
-  **Examples of Successful Projects or Programs in the Region** similar or related to the measure.
-  **Policy Priorities** or keys to successful implementation and realization of benefits of the measure.

Table 4 summarizes Greater Boston's 11 priority measures and the subsequent sections include further details on each measure.



Figure 28: Buildings in Boston. Photo by Weston & Sampson

Table 4: Greater Boston's Priority Measures



## Buildings

|   |   |
|---|---|
| <b>B1. Building Decarbonization Technical Assistance</b>    | Expand and improve technical assistance programs, decarbonization planning resources, and outreach and education efforts.   |
| <b>B2. Building Decarbonization Financial Assistance</b>    | Expand funding for comprehensive building decarbonization, particularly for affordable housing, renters/landlords, and small businesses; explore creative funding and financing solutions and opportunities to address the intersection of energy, health, and housing. |
| <b>B3. Net-Zero Municipal Buildings</b>                     | Develop and implement a plan to decarbonize new and existing municipal buildings; establish technical assistance programs to support municipal decarbonization planning and financing.  |
| <b>B4. District Scale Renewable Thermal Energy Projects</b> | Implement networked geothermal or water-based district heating and cooling projects through municipal ownership and public-private partnerships; support participation of low-moderate income customers.  |



## Transportation

|  |  |
|--|--|
| <b>T1. Public Transit Access and Affordability</b> | Expand public transit service, increase frequency and reliability of transit services, implement fare free routes and passes, and make stops and stations more accessible. |
|--|--|





## Transportation

### T2. Multi-Modal Transportation

Expand multi-modal transportation networks by building, improving, and expanding walking and cycling infrastructure that is safe, well-connected, and accessible.

### T3. Electric Vehicle Affordability

Increase the affordability and accessibility of EVs through EV car share programs, technical and financial assistance to purchase EVs, used EV markets, group purchasing, and education.

### T4. Electric Vehicle Charging

Deploy public EV chargers near multifamily housing and commercial centers, explore charging incentives, and educate potential EV users about charging.



## Electricity Generation

### E1. Renewable Energy Projects

Deploy community shared solar, energy storage, microgrid, and other renewable energy projects; provide technical assistance and support for communities to access incentives and financing to develop renewable energy projects.

### E2. Municipal Aggregation

Adopt municipal aggregation programs, increase the percentage of Class I RECs in program offerings, and implement low-moderate income customer pricing tiers.



## Waste

### W1. Reduce solid waste going to landfills and incinerators

Establish regional composting sites; explore collective procurement of solid waste disposal and recycling services; expand re-use programs



Figure 29: Platform for the Green Line Extension. Photo by Weston & Sampson



Figure 30: Station for the Green Line Extension. Photo by Weston & Sampson

## 4.1. Buildings

GHG emissions from the buildings sector result from onsite fuel combustion, electricity used in buildings, and the lifecycle and construction of new buildings. Most energy in buildings is used for space heating and cooling, ventilation, hot water, cooking, and lighting. **The buildings sector is the highest emitting sector in Greater Boston, responsible for 58 percent of total emissions.** Within the buildings sector, Residential (Res) buildings account for 48 percent of emissions and Commercial, Institutional, and Manufacturing (C/I/M) buildings account for 52 percent of emissions. Approximately 64 percent of emissions result from on-site fuel combustion (47 percent natural gas and 16 percent fuel oil). The remaining 36 percent of emissions are attributable to electricity usage in buildings.

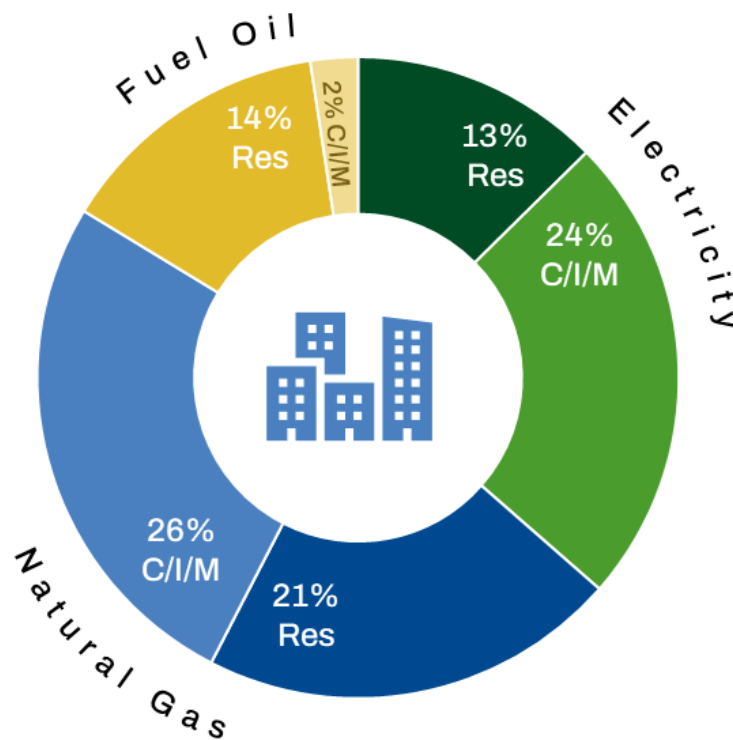


Figure 31: Breakdown of Buildings Sector GHG Emission by Fuel and Building Type in 2017.

In addition to contributing to climate change, emissions from the buildings sector significantly impact the health of occupants and community members. Fossil fuel appliances in homes, businesses, schools, and other buildings emit carbon monoxide (CO), nitrogen oxide (NO<sub>x</sub>), particulate matter (PM), and other pollutants, which increases the likelihood that occupants develop or exacerbate existing respiratory illnesses. For example, gas stoves can contribute to increased asthma risks, and appliances vented outdoors can impact community members' respiratory, cardiovascular, and nervous system health.<sup>1</sup> As a result of racist housing policies such as redlining, highway and industrial siting in predominantly low-income communities of color, continuing disinvestment, and other factors, people of color in the United States have twice the exposure to outdoor particulate matter (PM 2.5) from residential gas combustion as White people.<sup>2</sup> Removing onsite combustion by electrifying heating, cooking, and other fossil fuel-powered appliances can improve indoor air quality.<sup>3</sup>

U.S. households living in low-income multifamily buildings and older buildings, which tend to be less energy efficient, pay a higher percentage of their household's gross income on energy.<sup>4</sup> The median energy burden (defined as percentage of income spent on energy) of low-income households in Greater Boston is 10.3 percent, compared to the overall median household energy burden of 3.1 percent. Approximately 32 percent of Black households and 30 percent of Hispanic households pay over 6 percent of their income for energy, which is considered a high energy burden.<sup>5</sup>

In Massachusetts, strides have been made to address building emissions in new construction and major renovations through the state's Stretch Energy Code and Specialized Energy Code, which are based on the 2021 International Energy Conservation Code (IECC) with Massachusetts-specific modifications. The Specialized Code, which had already been adopted by 24 municipalities within the region as of December 2023, will help facilitate all-electric new construction and set communities on the path toward net zero and healthier buildings.<sup>6</sup> In 2022, New Hampshire adopted the 2018 IECC.<sup>7</sup>

The region faces continuing challenges, including barriers to reducing emissions from the existing building stock, addressing split incentives to decarbonize renter-occupied units, and updating grid infrastructure to enable electrification. The states, municipalities, RPAs/RPCs, and regulators will need to work to address these technical and financial barriers for communities to scale up building electrification.



**The priority buildings measures in this plan aim to reduce emissions by:**

(B1) providing technical assistance for building decarbonization,

(B2) developing financial assistance for building decarbonization,

(B3) supporting net zero municipal buildings, and

(B4) developing district scale renewable thermal energy projects for heating and cooling buildings.



# Buildings

## *B1. Building Decarbonization Technical Assistance*



Comprehensive decarbonization of existing buildings is a complex process and requires detailed planning and coordination. Many barriers further complicate retrofitting buildings, including lack of knowledge of decarbonization measures and potential costs, building ownership, uncertainty about technology performance, unclear or limited pathways to obtain financial incentives, and physical and structural barriers (e.g. roof replacement). Building owners often receive confusing or conflicting information from service providers and encounter challenges understanding and accessing incentive programs, which can limit interest in or ability to move forward.

Existing incentive programs, such as Mass Save and New Hampshire Saves (NHSaves) utility programs, provide significant incentives for some decarbonization measures but have historically underserved renters, low-to-moderate income households, and affordable housing.<sup>8</sup> Nonparticipants tend to have lower trust in programs perceived as government led, fear of energy scams, and prioritize immediate needs over long-term investments.<sup>9</sup> Municipalities seeking to engage historically underserved populations in decarbonization efforts must confront the impact of discriminatory policies and predatory programs. Municipalities must also build trusted, long-term relationships with community-based organizations who are already delivering services (e.g. fuel assistance) and may be able to connect residents more effectively with programs. Additionally, multifamily buildings (particularly affordable housing) with large numbers of renters have limited agency to pursue decarbonization, and engagement with landlords has historically been challenging.

### **Municipalities, coalitions of municipalities, and RPAs/RPCs should:**

1. Deliver building decarbonization technical and planning assistance to building owners, especially multifamily and affordable housing owners, through establishing new efforts (e.g. energy coaching, community liaisons, community-based outreach programs).
2. Coordinate with and build on existing technical assistance efforts (e.g. community action agency programs, Mass Save Community First Partnership, NH Saves), resource platforms, and communities of practice, such as the forthcoming Massachusetts Building Decarbonization Clearinghouse and New England Onsite Energy Assistance Partnership.
3. Use key communication pathways to conduct outreach on the various benefits of building decarbonization and incentive program opportunities, as well as increase enrollment in subsidized electricity rates and heating assistance programs.



### **Geographic Scope:**

This measure is applicable in all municipalities. Additional resources should be directed and tailored to LIDAC communities, particularly in communities with high rental rates and language access needs.



### **GHG Emissions Reductions** **270,875 to 320,125 MTCO<sub>2</sub>e/year**

The estimated emissions reductions are based on a 10-30% increase in energy savings based on Mass Save incentive data. See Appendix B for additional information.





# Buildings

## *B1. Building Decarbonization Technical Assistance*



### LIDAC Benefits Analysis

- **Reduces Cost of Living:** Reduces household energy costs.
- **Reduces Environmental and Public Health Burdens:** Improves indoor air quality; Can improve mental health by reducing stress and anxiety associated with energy costs.
- **Creates Economic and Job Benefits:** Opportunity to increase local jobs and training programs.



### Implementing Agencies and Partners

- Municipalities, municipal light plants,
- RPAs/RPCs
- Public housing authorities and privately-owned subsidized housing developers/owners
- Utility program administrators and regulators overseeing energy efficiency programs
- State agencies, such as Massachusetts Clean Energy Center
- Building trade unions and training institution partners
- Local and regional community-based organizations



### Implementation Timelines

- **Year 1-2:** Work with state and regional agencies and utilities to identify existing building decarbonization technical assistance accessible to building occupants and owners; develop supplemental local or regional technical assistance programs; identify local partners to support technical assistance, outreach, and education efforts, especially to environmental justice/LIDAC communities.
- **Year 2-3:** Implement technical assistance programs; consider targeting specific sectors with different outreach strategies.
- **Year 3+:** Refine technical assistance based on lessons learned from engagement and new technical assistance platforms; broaden reach through additional partners and sectors.



### Metrics to Track Progress

- Participation of low- and moderate-income residents in building decarbonization programs facilitated by municipal engagement
- Number and strength of partnerships
- Expansion of local/regional technical assistance to support building decarbonization
- Residents and businesses engaged by technical assistance programs



# Buildings

## *B1. Building Decarbonization Technical Assistance*



### Other Funding Available

- **Federal:** Home Energy Rebates and Home Electrification and Appliance Rebate Programs, Building Codes Implementation for Efficiency and Resilience Program
- **MA:** MassCEC EmPower Massachusetts, MassCEC Building Electrification and Transformation Accelerator, Mass Save Community First Partnerships and technical assistance studies
- **NH:** NH Saves Programs



### Workforce Development Opportunities

Municipal and regional programs can support workforce development through establishing project labor agreements such as local hiring/labor, apprenticeship programs, and use of prevailing wages. Municipalities can coordinate with training providers, community-based organizations, and technical assistance programs to emphasize job and training opportunities. When hiring vendors, service providers, or energy coaches, municipalities can prioritize hiring that represents community demographics, including bilingual staff.



### Examples of Success in the Region

- **Mass Save's Community First Partnership:** Thirteen municipalities in the MSA participate in the program, which provides funding and assistance to municipalities and community-based organizations conducting outreach, marketing, and education related to energy efficiency programs.<sup>10</sup>
- **Decarbonization technical assistance and coaching:** Municipal-led programs include Electrify Cambridge and regional volunteer-led initiatives HeatSmart Alliance.



### Policy Priorities

- **State:** (1) Include decarbonization assessments, Community First Partnership expansion, and other offerings in the 2025-2027 Mass Save Three-Year Plan; (2) Launch the Massachusetts Decarbonization Clearinghouse; (3) Approve enabling energy efficiency ratepayer funds to support fuel switching in New Hampshire.
- **Municipal:** (1) In Massachusetts, adopt the Stretch Energy or Specialized Energy codes.



# Buildings

## *B2. Building Decarbonization Financial Assistance*



Building decarbonization requires significant investments, including weatherization, electrification of heating and cooling, and installation of on-site renewables. Retrofitting renter-occupied buildings is especially challenging, largely due to the disincentive for landlords to invest in improvements because the tenant receives the cost savings through lower energy costs. Older buildings often require non-energy investments such as removing asbestos, replacing knob and tube wiring, and repairing old roofs prior to weatherization and energy efficiency upgrades, greatly increasing costs and challenges for retrofits. These challenges are particularly prominent in public housing and privately-owned subsidized housing, where capital budgets are limited and must be balanced with other maintenance needs.

Existing decarbonization and energy efficiency programs (e.g. Mass Save, NHSaves, municipal light plant incentives) partially address financial barriers, but renters, residents with lower educational attainment, and low- and moderate-income residents are less likely to benefit from some of these programs.<sup>11</sup> Furthermore, current levels of funding are insufficient to enable cost-effective, deep decarbonization. Greater outreach, technical assistance, and targeted incentives can encourage adoption in priority demographics. Municipal light plants also have opportunities to increase incentives for building decarbonization.

### **Municipalities, coalitions of municipalities, and RPAs/RPCs should:**

4. Expand and refine existing financial assistance programs to broaden support for comprehensive decarbonization approaches and increase accessibility (e.g. on-bill financing, increased support for moderate income customers, additional funding and coordination for pre-weatherization barriers, streamlined incentive process)
5. Establish limited financial assistance programs to target underserved sectors, including renters/landlords serving low- and moderate-income residents, affordable housing, low- and moderate-income homeowners, and small businesses. Ensure programs include mechanisms to avoid tenant displacement, such as affordability covenants, when upgrades are made.<sup>12</sup>
6. Explore opportunities for regional actions that can provide additional financial assistance (e.g. regional carbon offset funds tied to building performance standard compliance) and reduce costs (e.g. joint procurement programs)
7. Identify and coordinate opportunities to combine building decarbonization financial and technical assistance with funding for health and pre-weatherization barriers.



### **Geographic Scope**

This measure is applicable to all municipalities in the MSA, with a focus on affordable and rental housing in LIDAC communities. Opportunities may vary depending on utility territory.



### **GHG Emissions Reductions 320,125 to 369,375 MTCO<sub>2</sub>e/year**

The estimated emissions reductions are based on a 30-50% increase in energy savings based on Mass Save incentive data. See Appendix B for additional information.



# Buildings

## *B2. Building Decarbonization Financial Assistance*



### LIDAC Benefits Analysis

- **Leads with Equity:** Improves access to incentives and financing for low- and moderate-income households.
- **Reduces Cost of Living:** Reduces energy costs for households and businesses.
- **Reduces Environmental and Public Health Burdens:** Improves indoor air quality; Can improve mental health by reducing stress and anxiety associated with energy costs.
- **Creates Economic and Job Benefits:** Opportunity to increase local jobs and training programs.



### Implementing Agencies and Partners

- Municipalities, municipal light plants
- Public housing authorities and privately-owned subsidized housing developers/owners
- RPAs/RPCs
- Utility program administrators and regulators overseeing energy efficiency programs
- State agencies, such as Massachusetts Clean Energy Center
- Trade unions and training institution partners
- Local and regional community-based organizations, social service providers



### Implementation Timelines

- **Year 1-2:** Identify gaps in building decarbonization financial assistance programs within municipalities or across multiple municipalities working together; identify opportunities to develop local or regional programs; for municipal utilities, review incentives relative to programs from other jurisdictions and consider opportunities to align existing programs with local decarbonization goals.
- **Year 2-3+:** Design and implement financial assistance programs and seek available funding.



### Metrics to Track Progress

- Increase in delivery of financial assistance and building decarbonization measures to low- and moderate-income households and small businesses
- Establishment/expansion of local and regional decarbonization financial assistance programs
- Increase in municipal outreach and relationship building with community-based organizations
- Number of residents and businesses that received financial assistance for decarbonization
- Square footage or number of affordable housing units retrofitted/rehabilitated





# Buildings

## *B2. Building Decarbonization Financial Assistance*



### Other Funding Available

- **Federal:** Home Energy and Home Electrification and Appliance Rebate Programs, Energy Efficiency and Conservation Block Grant Program, Solar for All, Inflation Reduction Act Tax Credits, US HUD Green and Resilient Retrofit Program (GRRP), Greenhouse Gas Reduction Fund, Weatherization Assistance Program, US Dept. Of Treasury Capital Magnet Fund
- **MA:** Mass Save Programs, Weatherization Assistance Programs (Income-Eligible LEAN Deep Energy Retrofit, Low- and Moderate-Income Decarbonization Program) MassCEC Equity Workforce Planning and Capacity Grants, Commonwealth Corporation Workforce Training Fund Program, HousingWorks Sustainable and Green Housing Initiatives, Affordable Housing Trust Fund, MassHousing Climate Ready Housing Program, MassHousing Neighborhood Stabilization Program
- **NH:** NH Saves Programs



### Policy Priorities

- **State and Federal:** (1) Expand the electric grid capacity from transmission to site-level distribution (through Electric Sector Modernization Plans and other efforts); (2) Increase funding for Mass Save programs for low- and moderate-income customers, renters, and other underserved groups through the Energy Efficiency Advisory Council and Three-Year 2025-2027 Mass Save Plan; (3) Launch the Massachusetts Decarbonization Clearinghouse; (4) Create new energy affordability programs; (5) Develop financial assistance for weatherization-barriers in New Hampshire and expand the Massachusetts' LEAN program eligibility and impact; (6) Increase funding for affordable housing retrofits, including MassHousing, Housing Works, and HUDs Green and Resilient Retrofit Program.



### Workforce Development Opportunities

Financial assistance programs typically do not directly fund workforce development but can contribute to increases in opportunities for contractors/tradespeople to deliver weatherization, HVAC, and other measures, and facilities management staff.



### Examples of Success

- Massachusetts Community Climate Bank: will provide \$50 million in seed funding to attract private and public capital for the retrofit of low- and moderate-income housing in the state.<sup>13</sup>
- Inflation Reduction Act's Home Efficiency and Home Electrification Appliance Rebate Programs: are expected to deliver approximately \$180 million to Massachusetts and New Hampshire to support whole-building energy retrofits and electrification respectively.<sup>14</sup>



# Buildings

## *B3. Net-Zero Municipal Buildings*



Municipal buildings offer a clear pathway for GHG reductions because municipalities own their buildings and can model and inspire similar action by others in the community and invite the public to see elements of their updated buildings. Across the country, schools are among the top energy consumers in the public sector and decarbonization measures also offer significant health and resilience benefits to students (e.g. air quality, cooling in extreme heat).<sup>15</sup> Through a 20 percent reduction in energy use at local government buildings nationwide, local governments could save almost \$4 billion annually, potentially reducing costs for taxpayers.<sup>16</sup>

### **Municipalities, coalitions of municipalities, and RPAs/RPCs should:**

1. Develop and implement plans (through the Massachusetts Climate Leader Communities certification or otherwise) to transition new and existing municipal buildings to net zero buildings through weatherization, building electrification, and renewable energy deployment. Prioritize decarbonization of municipal buildings serving LIDAC communities.
2. Establish a regional or state technical assistance program (prioritizing LIDAC communities) and municipal community of practice to support decarbonization transition planning (e.g. retro commissioning studies, decarbonization audits, renewable energy site evaluation) and implementation, including legal support on tax credits and direct pay assistance and support to identify financial instruments to reduce the cost of electrification.



### **Geographic Scope**

This measure is applicable in municipalities throughout the MSA. Public buildings located in and serving LIDAC communities should be prioritized, and technical assistance should be prioritized to support communities with limited resources.



### **GHG Emissions Reductions**

**39,933 to 59,900  
MTCO<sub>2</sub>e/year**

The estimated emissions reductions are based on a municipal building energy reduction of 10% to 15%. See Appendix B for additional information.



# Buildings

## *B3. Net-Zero Municipal Buildings*



### **LIDAC Benefits Analysis**

- Reduces Environmental and Public Health Burdens: Improves indoor air quality and can reduce heat stress/exposure in buildings open to the public.
- Creates Economic and Job Benefits: Building retrofits provide increased training and opportunities for good jobs; Lowers energy bills for municipalities, saving on costs and reducing long-term maintenance.
- Improves Community Resilience to Climate Impacts: Improves resilience of community facilities often used for emergency shelters, cooling centers, and other critical services; Allows buildings to maintain heating and cooling longer in the case of a power outage.



### **Implementing Agencies and Partners**

- Municipalities
- RPAs/RPCs
- Massachusetts Public School Districts, New Hampshire School Boards and New Hampshire Public Charter Schools
- State agencies, such as Massachusetts School Building Authority, Massachusetts Clean Energy Center
- Utility program administrators
- Community-based organizations
- Trade unions, training institutions



### **Implementation Timelines**

- **Year 1-2:** Municipalities complete decarbonization roadmaps (in Massachusetts, as part of the state's Green Communities Climate Leader Communities Program) and RPAs/RPCs develop a related community of practice for municipalities to share challenges and learnings.
- **Year 3:** Municipalities and RPAs/RPCs work with partners to launch a dedicated technical assistance program for municipalities.



### **Metrics to Track Progress**

- Increase in square feet and number of net zero municipal buildings
- Increase in square feet and number of net zero municipal buildings in LIDAC communities
- Technical assistance delivered to municipalities with LIDAC communities



# Buildings

## B3. Net-Zero Municipal Buildings



### Workforce Development Opportunities

Municipalities should adopt clean energy procurement and contracting policies to encourage the hiring of Minority and Women-Owned Business Enterprises (e.g. MWBE companies in Mass Save's Heat Pump Installer Network) and reduce barriers to equitable access to municipal contracts.<sup>17</sup> Municipalities may also partner with vocational training programs, post-secondary institutions, or non-profit led programs. The City of Boston, for example, is coordinating its new net zero mandate for municipal buildings with efforts to support existing training programs and create its own training like PowerCorpsBOS.<sup>18</sup>



### Other Funding Available

- **Federal:** Energy Efficiency and Conservation Block Grant Program, Grant Funding to Address Indoor Air Pollution at Schools, Community Facilities Direct Loan and Grant Program, Elective Pay for Tax Credits
- **MA:** Community Compact Program, Mass Save Programs, Green Communities Climate Leader Communities, Massachusetts Green Communities, Massachusetts School Building Authority, Energy Performance or Energy Service Contracts
- **NH:** Community Development Finance Authority's Clean Energy Fund, Community Facilities Energy Assessment Grants, Energy Performance or Energy Service Contracts



### Policy Priorities

- **State:** (1) Adopt a statewide Building Performance Standard in Massachusetts; (2) Provide additional funding for green and healthy school construction and renovations; (3) Provide additional funding to support the new Climate Leaders program in Massachusetts; (4) Adopt an updated energy code in New Hampshire and continue strengthening the Stretch and Specialized codes during update cycles in Massachusetts.
- **Municipal:** (1) Massachusetts municipalities opt-in to the Stretch Energy Code or Specialized Energy Code; (2) Adopt policy that requires new municipal buildings and schools to be high performance net zero or near net zero buildings.



### Examples of Success in the Region

- **Massachusetts Green Communities Program:** recognizes municipalities that commit to implementing a series of energy reduction measures (e.g. fuel-efficient vehicle policy, plan for 20 percent energy reduction at municipal facilities).
- **New Hampshire Department of Energy:** Offers a range of grants, rebates, and revolving loans for counties, municipalities, and schools.<sup>19</sup>





# Buildings

## *B4. District Scale Renewable Thermal Energy Projects*



In the Greater Boston region, most heating systems in buildings are fueled by natural gas and delivered fuels like propane and oil. Many residential buildings lack cooling, despite increased incidence of extreme heat. In addition to building electrification technologies that serve individual buildings, there is growing interest in and development of networked thermal energy systems, including networked geothermal and district energy. Networked systems can be a cost-effective way of providing heating and cooling to multiple buildings within a neighborhood or district using heat pumps and a common thermal energy resource (e.g. communal geothermal ground loop). Networked geothermal systems serving diverse building types with different heating and cooling usage patterns can deliver improved efficiency compared to individual systems (limiting added grid demand compared to multiple individual systems)<sup>20</sup> and use existing public rights-of-way for ground loops and connections (limiting impacts to individual properties).<sup>21</sup> Water-based district energy systems may also use waste heat, such as from sewers or data servers, to improve the system's efficiency.

As networked system efforts expand under enabling legislation and recent regulatory orders,<sup>22</sup> municipalities have many opportunities to facilitate development of thermal networks, including conducting feasibility studies, coordinating with utility/other system owners on system planning, engaging building owners to participate in projects under development, prioritizing development in LIDAC communities, exploring opportunities for connecting municipal buildings to networked systems, hosting system infrastructure on municipal properties, and owning networked systems.

### **Municipalities, coalitions of municipalities, and RPAs/RPCs should:**

8. Pilot, accelerate, and facilitate networked geothermal or water-based district heating and cooling projects in key neighborhoods.
9. Explore municipal ownership and public-private partnership structures to accelerate project development
10. Establish support for low- and moderate-income customers to participate in and benefit from networked thermal projects.



### **Geographic Scope**

Thermal networks can serve districts across the entire MSA, though projects will deliver the most benefits compared to individual heat pump systems in districts with medium- to heavy-building density with diverse building loads.



### **GHG Emissions Reductions**

**1,468 to 2,935 MTCO<sub>2</sub>e/year**

The estimated emissions reductions are based on 5-10 new networked geothermal projects coming online by 2030. See Appendix B for additional information.



# Buildings

## *B4. District Scale Renewable Thermal Energy Projects*



### LIDAC Benefits Analysis

- **Reduces Cost of Living:** With program design to support low- and moderate-income households, can reduce household energy burden.
- **Reduces Environmental and Public Health Burdens:** Improves indoor air quality and local air quality by reducing on-site combustion of fossil fuels; reduces heat stress for residents from high heat days.
- **Creates Economic and Job Benefits:** Project development can provide increased training and opportunities for good jobs.
- **Improves Community Resilience to Climate Impacts:** Systems that provide cooling reduce heat stress for residents.



### Implementing Agencies and Partners

- Municipalities and School Districts
- Utilities
- District energy or geothermal installers and contractors
- Local non-profits
- Financers
- State agencies, such as Mass Clean Energy Center, Massachusetts Department of Energy Resources, New Hampshire Department of Environmental Services, New Hampshire Department of Energy



### Implementation Timelines

- **Year 1-2:** Project scoping, design and engineering, financing/funding, regulatory approval (if needed), and permitting.
- **Year 2-4:** Project construction
- **Year 3-5:** Project commissioning and operation



### Metrics to Track Progress

- Number of buildings or square footage served by networked geothermal systems
- Number of residents in LIDAC communities served by district thermal projects



# Buildings

## *B4. District Scale Renewable Thermal Energy Projects*



### Other Funding Available

- **Federal:** Residential Clean Energy Tax Credit, High-Efficiency Electric Home Rebate Program
- **MA:** Community Compact, MassCEC Kickstart Massachusetts



### Workforce Development Opportunities

Construction of networked geothermal systems brings together a variety of skilled trades, from HVAC and electrical infrastructure installation to borehole drilling and installation of piping for the ground loop. In particular, the engagement of gas utilities in replacing gas pipelines with networked geothermal systems can enable their workers to be retrained to support installation of networked geothermal ground loop piping.



### Policy Priorities

- **State:** (1) Engage legislators in New Hampshire to pass legislation to allow municipalities and utilities to own district geothermal networks and sell services to customers; (2) in Massachusetts, encourage the Department of Public Utilities to expedite approval of future utility-owned networked geothermal projects upon completion of initial pilots; (3) Provide funding to support networked geothermal projects owned and operated by municipalities and/or community-based organizations.
- **Municipal:** 1) Update and adopt zoning and land use policies to encourage density and mixed energy load requirements suitable for district thermal projects; (2) Require feasibility studies for networked renewable and thermal energy systems in projects larger than a certain size or during special permit approval processes.



### Examples of Success in the Region

- **Massachusetts Networked Geothermal Pilots:** Two networked geothermal pilot projects are under development in Framingham<sup>23</sup> and Lowell<sup>24</sup> in Massachusetts. Eversource and National Grid broke ground on these projects in 2023, and they are expected to be operational in 2024/2025.

# Section Endnotes



Click for more  
information!

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## 4.2. Transportation

The transportation sector encompasses all types of movement of people, goods, and services throughout the region. In Greater Boston, the main modes of transportation are private vehicles, commercial vehicles, public transit, cycling, and walking. Robust and equitable transportation and mobility networks are critical for Greater Boston residents to access the places where they live, work, and play.

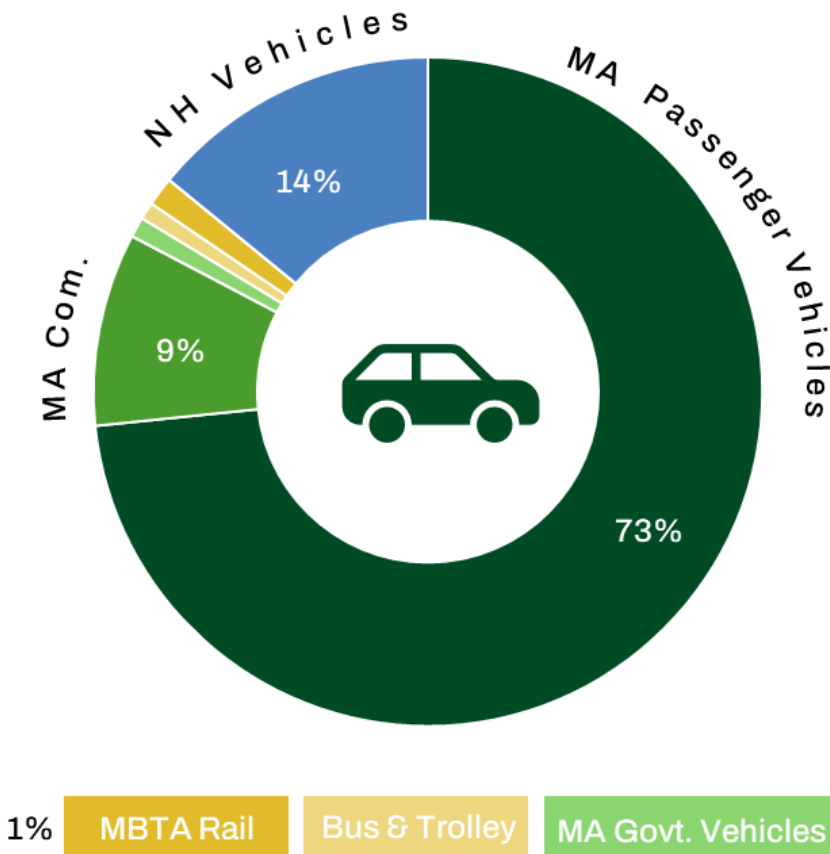


Figure 32: Percentage of transportation emissions by subsector in 2017.

GHG emissions from the transportation sector largely result from combustion of fossil fuels in passenger, commercial, and public vehicles. Fuel combustion also results in harmful air pollutants, such as particulate matter (PM) and carbon monoxide (CO), which lead to adverse human health effects such as asthma. Decades of urban segregation and highway expansion in the region have resulted in higher rates of exposure to traffic-related pollution and related health impacts in low-income communities and communities of color.<sup>25</sup> The map in Figure 21 shows the traffic proximity across the region, which closely aligns with the map of LIDAC communities.

**Transportation is the second highest emitting sector in Greater Boston, responsible for approximately 37 percent of the region's total emissions.** As Figure 33 shows, passenger vehicles are responsible for most transportation-related emissions.



The priority transportation measures in this plan aim to reduce emissions from passenger vehicles through two key mechanisms:

(T1, T2) shifting trips away from private vehicles and toward alternative, cleaner modes of transportation, and

(T3, T4) converting fossil fuel-powered vehicles to electric vehicles and building out charging infrastructure.



# Transportation

## *T1. Public Transit Access and Affordability*



Public transit access and affordability are key equity and climate issues in Greater Boston. The Massachusetts Bay Transit Authority (MBTA) and nine Regional Transit Agencies (RTAs) provide critical public transit across Greater Boston via bus, subway, light rail, commuter rail, and ferry.<sup>26</sup> Improving public transit reduces reliance on private vehicles, which currently account for approximately 85 Percent of transportation-related emissions, and enables the development of healthier, walkable communities with denser housing development.

Expanding and improving public transit access and service in communities that are currently underserved or not served at all provides vital access to resources, services, and economic opportunities, while reducing the transportation cost burden for those who need it most. Public transit must also be affordable and accessible to all residents. Buses disproportionately serve minority and low-income riders.<sup>27</sup> Reducing bus fares and improving bus service will therefore primarily benefit people of color, low-income households, and people without cars or micro-mobility options (i.e., bikes, e-bikes, bike share, scooters).

### **Municipalities, the MBTA, and RTAs in Greater Boston should:**

1. Improve public transit service throughout Greater Boston by advocating for and funding the extension of key and feeder bus, light rail, and commuter rail routes, increasing the frequency and run time of service, creating municipal transit services, and coordinating with Transportation Management Associations (TMA) to expand services and fill gaps in transit options.
2. Decarbonize and electrify bus transit while maintaining reliable service.
3. Increase frequency and reliability of buses by creating and expanding dedicated bus lanes, transit signal priority, level boarding and other bus priority treatments, and improving driver facilities.
4. Implement fare free or reduced fare routes and/or passes on key routes in underserved areas served by the MBTA and RTAs within the MSA and determine which fare-free routes and route groups are most successful.
5. Make transit stops more accessible by implementing sidewalk improvements, benches, ramps, elevators, shade structures, lighting, multi-lingual signage, safe cycling infrastructure, bicycle storage, bike share stations, and restrooms.



### **Geographic Scope**

The MBTA, RTAs, and municipal partners should expand services and introduce new and/or continue existing free or reduced fare routes and bus infrastructure improvements and should prioritize areas that are currently underserved or not served by public transit.



### **GHG Emissions Reductions**

**134,298 to 268,596 MTCO<sub>2</sub>e/year**

The estimated emissions reductions reflect avoided passenger vehicle gasoline usage from increased use of public transportation. See Appendix B for additional information.



# Transportation

## *T1. Public Transit Access and Affordability*



### LIDAC Benefits Analysis

- **Leads with Equity:** Enables transportation self-sufficiency for frontline populations traditionally more dependent on public transit such as the youth, seniors, people with disabilities, and people of color.
- **Reduces Cost of Living:** Reduces transportation cost burdens.
- **Reduces Environmental and Public Health Burdens:** Improves local air quality by reducing single occupancy vehicles and trips.
- **Creates Economic and Job Benefits:** Improves economic opportunities by increasing access to job centers, education, and other key institutions; Increases access to essential services; Reduces overall commuting time for riders.



### Implementing Agencies and Partners

- MBTA and Regional Transit Authorities
- Municipalities
- Transportation Management Associations
- Non-profit and community-based organizations
- Massachusetts and New Hampshire legislatures and departments of transportation
- RPAs/RPCs



### Implementation Timelines

- **Year 1-2:** Plan route expansion, infrastructure improvements, and fare free program
- **Year 2:** Obtain approval and funding
- **Years 3+:** Operate, evaluate, and continue making improvements



### Metrics to Track Progress

- Ridership – rates of ridership, number of new riders, number of riders that take transit instead of passenger vehicles
- Rider cost savings, boarding and transit times, reliability and variability improvements
- Increase in coverage/area served
- Percentage of population with access to 15-30 minute service





# Transportation

## *T1. Public Transit Access and Affordability*



### Other Funding Available

- **Federal:** All Stations Accessibility Program, Better Utilizing Investments to Leverage Development (BUILD) Transportation Grants Program, Capital Investments Grant Program, Enhanced Mobility of Seniors and Individuals with Disabilities, Low or No Emissions Grant Program, Mobility, Access and Transportation Insecurity (MATI) Program, Public Transportation Innovation Grant
- **MA:** Community Transit Grant Program, Complete Streets Program, Community Development Block Grant, Regional Transit Innovation Grant, Shared Streets and Spaces Program, State Transportation Improvement Program (STIP)
- **NH:** Statewide Transportation Improvement Program (STIP)



### Examples of Success in the Region

- **Bus Rapid Transit:** In City of Boston, a dedicated bus lane runs along the center of Columbus Avenue.<sup>29</sup> Within the City of Everett there are bi-directional dedicated bus lanes on Broadway during peak commuting times serve 10,000 passengers<sup>30</sup>
- **Fare Free Bus pilots and Programs:** Several regions have fare free routes including in Merrimack Valley<sup>31</sup>, Brockton<sup>32</sup>, and Boston<sup>33</sup>



### Workforce Development Opportunities

Workforce shortages are already a barrier to operating existing routes, which makes expanded service even more difficult to implement.<sup>28</sup> Training programs, assistance obtaining commercial driver's licenses, more accommodating work schedules, and higher wages are needed to fill workforce gaps.



### Policy Priorities

- **State and Federal:** (1) Increase funding and mandates for the MBTA and Regional Transit Agency (RTA) transit electrification; (2) Substantially increase funding for the MBTA and RTAs to address maintenance backlogs, expand routes, improve frequency, reliability, and ridership, increase fleets, and subsidize fares.
- **Municipal:** (1) Update zoning codes to encourage transit-oriented-development; (2) Implement public transit priority on streets; (3) Utilize resources to electrify RTA fleets; (4) Implement walking and cycling infrastructure to access stations/stops.



# Transportation

## *T2. Multi-Modal Transportation*



Multi-modal transportation systems prioritize walking, biking, micro-mobility (i.e., e-bikes, bike share, scooters) and public transit as the main modes of travelling to and from work, school, home, recreation, and commercial centers. Non-vehicle mobility options that are safe, accessible, and well-connected reduce car dependency, which leads to lower GHG emissions, and increase community health and economic opportunity. Multi-modal transportation networks should be planned at a regional scale to ensure people can move within and across the region to access jobs, services, resources, and community.

**Municipalities, RPAs/RPCs, and the MBTA and RTAs should work together to improve and expand multi-modal transportation networks by:**

1. Building, improving, and expanding infrastructure to support multi-modal transportation – including, but not limited to sidewalks, ramps, crosswalks, protected bike lanes, multi-use paths and trails, bike racks, benches, bikeshare facilities – at or near commercial and job centers, schools, parks, bus and rail stations, and along key regional corridors.
2. Connecting the infrastructure to public or shared modes of transportation, including micro-mobility, ride-share services, and public transit stations with secure bike storage or the ability to carry bikes onto public transit.
3. Educating communities about these alternate transit options through interactive maps and other wayfinding tools, multi-lingual signs and instructions, and micro-mobility campaigns.



### **Geographic Scope**

Multi-modal transportation can be developed and expanded everywhere in the region, but is particularly important in denser areas, commercial centers, near transit stops, along key corridors and trails, and in communities with low rates of car ownership, sparse transit options, and where safer infrastructure is needed.



### **GHG Emissions Reductions**

**2,166 to 4,332  
MTCO<sub>2</sub>e/year**

The estimated emissions reductions reflect avoided passenger vehicle gasoline usage from increased use of pedestrian and bicycle infrastructure. See Appendix B for additional information.



# Transportation

## *T2. Multi-Modal Transportation*



### LIDAC Benefits Analysis

- **Leads with Equity:** Enables transportation self-sufficiency for frontline populations traditionally more dependent on public transit such as the youth, seniors, people with disabilities, and people of color.
- **Reduces Environmental and Public Health Burdens:** Can improve mental health by reducing anxiety associated with transportation needs and reducing social isolation; Contributes to physical health through increased activity; Improves safety for all road users; Increases access to recreation and opportunities for movement.
- **Creates Economic and Job Benefits:** Improves economic opportunities by increasing access to job centers, education, and other key institutions; Reduces overall commute time.
- **Improves Community Resilience to Climate Impacts:** Strengthens the connectivity of communities and access to services and critical facilities.



### Implementing Agencies and Partners

- Municipalities
- RPAs/RPCs
- RTAs and MBTA
- Community members and community-based organizations
- State agencies that own land, such as Massachusetts Department of Conservation and Recreation, New Hampshire Department of Natural and Cultural Resources, and state transportation agencies
- Private property owners



### Implementation Timelines

- **Years 1-2:** Community engagement, planning studies, educational campaigns, micro-mobility pilots/expansion
- **Years 3-5:** Infrastructure improvements



### Metrics to Track Progress

- Miles of sidewalks, bike lanes, and trails installed and/or improved
- Number of bike/scooter/e-bike-share users



# Transportation

## T2. Multi-Modal Transportation



### Other Funding Available

- **Federal:** Neighborhood Access and Equity Grant Program, Safe Streets and Roads for All (SS4A) Grant Program, Advanced Transportation Technologies and Innovative Mobility Deployment, Congestion Mitigation and Air Quality Improvement (CMAQ) Program, The Transportation Alternatives (TA) Set-Aside, Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grant Program
- **MA:** Complete Streets Program, Shared Streets and Spaces Grant Program, Municipal Vulnerability and Preparedness Program
- **NH:** Complete Streets Program



Figure 33: Bus rider, photo from Adobe Stock



### Examples of Success in the Region

- **Bruce Freeman Rail Trail:** 25-mile route that connects Lowell, Chelmsford, Westford, Carlisle, Andover, Concord, Sudbury, and Framingham.<sup>34</sup>
- **Electric Blue Bikes:** In 2023, the bike share program launched ebikes in Metro Boston with reduced pricing for income eligible members.<sup>35 36</sup>
- **Reimagine Broadway:** City of Everett and community partners installed multilingual wayfinding and mobility hubs alongside bus rapid transit.<sup>37</sup>



### Policy Priorities

- **State and Federal:** (1) Increase funding for bike share programs and infrastructure.
- **Municipal:** (1) Update zoning codes to support transit-oriented-development (increased density near transit, mixed-use requirements, transportation demand management); (2) Remove parking minimums and/or adopt parking maximums; (3) Adopt and enforce Complete Streets policies.





# Transportation

## *T3. Electric Vehicle Affordability*

**i** Passenger vehicles are responsible for approximately 85 percent of the total emissions in the region. One strategy to reduce emissions from personal vehicles is to transition to low emission vehicles, including electric vehicles (EVs), plug-in-hybrid electric vehicles (PHEVs), extended-range EVs, and mild hybrid EVs. A major barrier to switching to EVs from traditional internal combustion engine (ICE) vehicles is the higher upfront cost of EVs, which presents a greater burden for low- and moderate-income households. Moreover, due to the newness of the EV market, there are limited options to purchase used vehicles, which are typically more affordable than new vehicles.

State and federal governments offer incentives to reduce the cost of EVs, largely through tax incentives and rebates, but these are often not enough to make the cost of EVs the same as ICE vehicles.

**To increase the affordability of EVs in the region, municipalities, RPAs/RPCs, and community-based organizations should:**

1. Create and support EV car share programs, prioritizing locations at or near affordable multifamily housing and in neighborhoods that are underserved by public transit and lack available off-street parking.
2. Expand technical and financial assistance programs to help residents and small businesses purchase EVs, including deeper vehicle subsidies, especially for low- and moderate-income residents, alternatives to rebates and tax credits, and low-cost financing.
3. Support the growth of a used EV market through platforms that help residents find used EVs, as well as subsidies and financial assistance for used EVs, including battery refurbishment and repair.
4. Explore group purchasing opportunities for municipalities and residents to purchase EVs at lower negotiated prices.
5. Educate vehicle buyers and sellers about EVs, EV charging, the benefits of EVs, and available incentives.



### Geographic Scope

These programs can be implemented throughout Greater Boston, but priority should be given to neighborhoods in LIDAC communities and where public transit is non-existent, not accessible, or insufficient.



### GHG Emissions Reductions

**269,427 to 538,854 MTCO<sub>2</sub>e/year**

The estimated emissions reductions reflect a portion of the MA vehicle electrification goals. See Appendix B for additional information.



# Transportation

## *T3. Electric Vehicle Affordability*



### LIDAC Benefits Analysis

- **Leads with Equity:** Provides benefits that focus on low- and moderate-income households.
- **Reduces Environmental and Public Health Burdens:** Improves outdoor air quality.
- **Creates Economic and Job Benefits:** Reduces the transportation cost burden; Expands access to economic opportunities and services that are only accessible by car.



### Implementing Agencies and Partners

- Municipalities
- RPAs/RPCs
- Education institutions and job training centers
- Community-based organizations and non-profits
- Car dealers, banks and financiers, tax preparers
- EV Carshare organizations and companies
- Affordable housing developers and owners



### Implementation Timelines

- **Year 1:** Plan EV car share networks and programs, plan financial and technical assistance programs and education campaigns, start organizing bulk buy program
- **Years 2+:** Build out EV car share locations, roll out financial and technical assistance programs and education campaigns, pilot bulk buy program



### Metrics to Track Progress

- Number of EVs purchased or leased by low- to moderate-income households
- Average cost of EV after incentives/subsidies
- Number of car share locations in LIDAC neighborhoods and neighborhoods unserved or underserved by transit
- Number of unique drivers using shared vehicles and number of bookings



# Transportation

## *T3. Electric Vehicle Affordability*



### Other Funding Available

- **Federal:** Tax Credits for New Clean Vehicles, Alternative Fuel Infrastructure Tax Credit
- **MA:** MOR-EV Rebate Program



### Workforce Development Opportunities

Mechanics and auto technicians must be trained in EV repair for a variety of vehicle types. Programs, such as the Benjamin Franklin Cummings Institute of Technology EV Repair Program,<sup>38</sup> can be expanded across technical colleges and vocational schools.



### Examples of Success in the Region

- **Car Share:** Good2Go is a non-profit that operates ten vehicles at seven car share locations in Boston<sup>39</sup>; Good2Go also operates an Ambassador Program, which matches community members to drive seniors, disabled, or unlicensed neighbors in exchange for driving credits.<sup>40</sup>
- **EV Education:** Recharge MA hosts EV test drive events at workplaces, universities, and community events<sup>41</sup>, Drive Electric NH hosts educational events and expos<sup>42</sup>, Gloucester community dinners exploring the opportunities and challenges of purchasing and leasing EVs.
- **EV Incentives:** Massachusetts' MOR-EV program offers rebates up to \$4,500 for lease or purchase of a new or used EV. Income qualifying applicants are eligible to receive an additional \$1,500 rebate for the lease or purchase of a new or used EV.<sup>43</sup>



### Policy Priorities

- **State and Federal:** (1) Increase subsidies for EVs for low-income households and small businesses; (2) Improve communication about programs with consumers to encourage greater uptake of EVs and use of programs.



# Transportation

## T4. Electric Vehicle Charging



Sparse charging infrastructure is a major barrier to widespread adoption of electric vehicles (EVs). The ability to charge EVs is particularly limited for renters, residents of multifamily buildings, and residents who do not have dedicated or off-street parking spaces. To adopt EVs, these residents need guaranteed access to public, convenient, and affordable charging options near their homes and workplaces.

### **Municipalities and RPAs/RPCs in Greater Boston should:**

1. Develop a regional EV charging network strategy, with a focus on public, curbside, overnight charging, particularly near multifamily housing and commercial centers. Work with electric vehicle supply equipment (EVSE) companies and utilities to build and operate the charging infrastructure.
2. Explore EV charging incentives and cost reduction programs to make charging equitable and accessible to low-to-moderate-income drivers and renters, such as reduced electricity rates, free charging at affordable housing sites, or pre-paid debit cards for charging stations.
3. Educate residents about how to use EV chargers and clearly communicate the rules and guidelines for using public chargers.



### **Geographic Scope**

EV charging infrastructure is particularly important where off-street parking is limited, in neighborhoods with high proportions of renters and/or limited transit access, and in commercial centers. Municipalities and RPAs/RPCs should identify and prioritize building public charging infrastructure in these areas.



### **GHG Emissions Reductions**

**65,936 to 131,873  
MTCO<sub>2</sub>e/year**

The estimated emissions reductions are based on electrification of a portion of the vehicles owned by people living in multifamily buildings of 3 or more units. See Appendix B for additional information.





# Transportation

## *T4. Electric Vehicle Charging*



### LIDAC Benefits Analysis

- **Leads with Equity:** Decreases the barriers to owning an EV.
- **Reduces Cost of Living:** Can reduce transportation cost burden.
- **Reduces Environmental and Public Health Burdens:** Improves outdoor air quality.
- **Creates Economic and Job Benefits:** Provides job opportunities for electricians and contractors installing EVSE.



### Implementing Agencies and Partners

- Municipalities
- RPAs/RPCs
- Public and affordable housing owners and developers
- Private property owners
- Electricians and installers
- Utilities



### Implementation Timelines

- **Year 1-2** – Conduct outreach to plan charging station locations and contract with EVSE companies
- **Years 3+** – EVSE companies build out and operate charging infrastructure, municipalities pilot charging cost reduction programs



### Metrics to Track Progress

- Number of public charging stations
- Number of charging sessions at public charging stations
- Number of EVs owned or leased by renters or residents of multifamily buildings



# Transportation

## T4. Electric Vehicle Charging



### Other Funding Available

- **Federal:** Charging and Fueling Infrastructure Grant Program, Energy Storage Demonstration and Pilot Grant Program, Advanced Transportation Technologies and Innovative Mobility Deployment, National Electric Vehicle Infrastructure Formula Program, Congestion Mitigation and Air Quality Improvement (CMAQ) Program, Transportation Infrastructure Financing and Innovation Act (TIFIA)
- **MA:** Community Compact Program, MassEVIP Public Access Charging Incentives



### Workforce Development Opportunities

Building and maintaining public charging infrastructure requires licensed electricians. Existing electrician training programs should integrate EVSE training and new programs should be developed to train electricians to build, operate, and maintain charging stations. Public charging stations should include project labor agreements and work with unions to build a pipeline of qualified electricians who have successfully completed the Electric Infrastructure Training Vehicle Program to serve the growing EV charging needs of the region.<sup>44</sup>



### Examples of Success in the Region

- **Curbside Charging:** Melrose installed pole-mounted EV chargers throughout the city<sup>45</sup>; Cambridge has a pilot permit program to allow residents who do not have access to off-street parking to charge EVs across an authorized sidewalk area.<sup>46</sup>
- **EV Charging Installation Trainings:** Benjamin Franklin Cummings Institute of Technology, MassBay Community College, and the Automotive Career Development Center (ACDC) offer relevant EV programs.



### Policy Priorities

- **State:** (1) Adopt time-of-use (TOU) rates for vehicle charging with equity structure; (2) Remove restrictions on pole-mounted charging; (e) Streamline procurement for construction and servicing of EVSE.
- **Municipal:** (a) Adopt local ordinance that defines the terms and requirements associated with EV charging across public right of way; (2) Streamline permitting and inspections for EVSE installation aligned with the building and electrical codes; (3) Set deployment goals at priority locations for equitable on-street charging.

# Section Endnotes



Click for more  
information!

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## 4.3. Electricity Generation

Electricity generation emissions in the Greater Boston MSA come primarily from the combustion of fossil fuels like natural gas and oil, as well as other sources like waste-to-energy incinerators, biomass, and landfill gas. Generation sources include those within the region and sources that power the regional ISO-New England grid. Much of the power consumed in the MSA is imported from elsewhere in the Northeast. Over 95 percent of emissions from this sector come from electricity consumed in residential, commercial, and industrial buildings, with the remainder used to power electric vehicles (EVs) and rail transit.

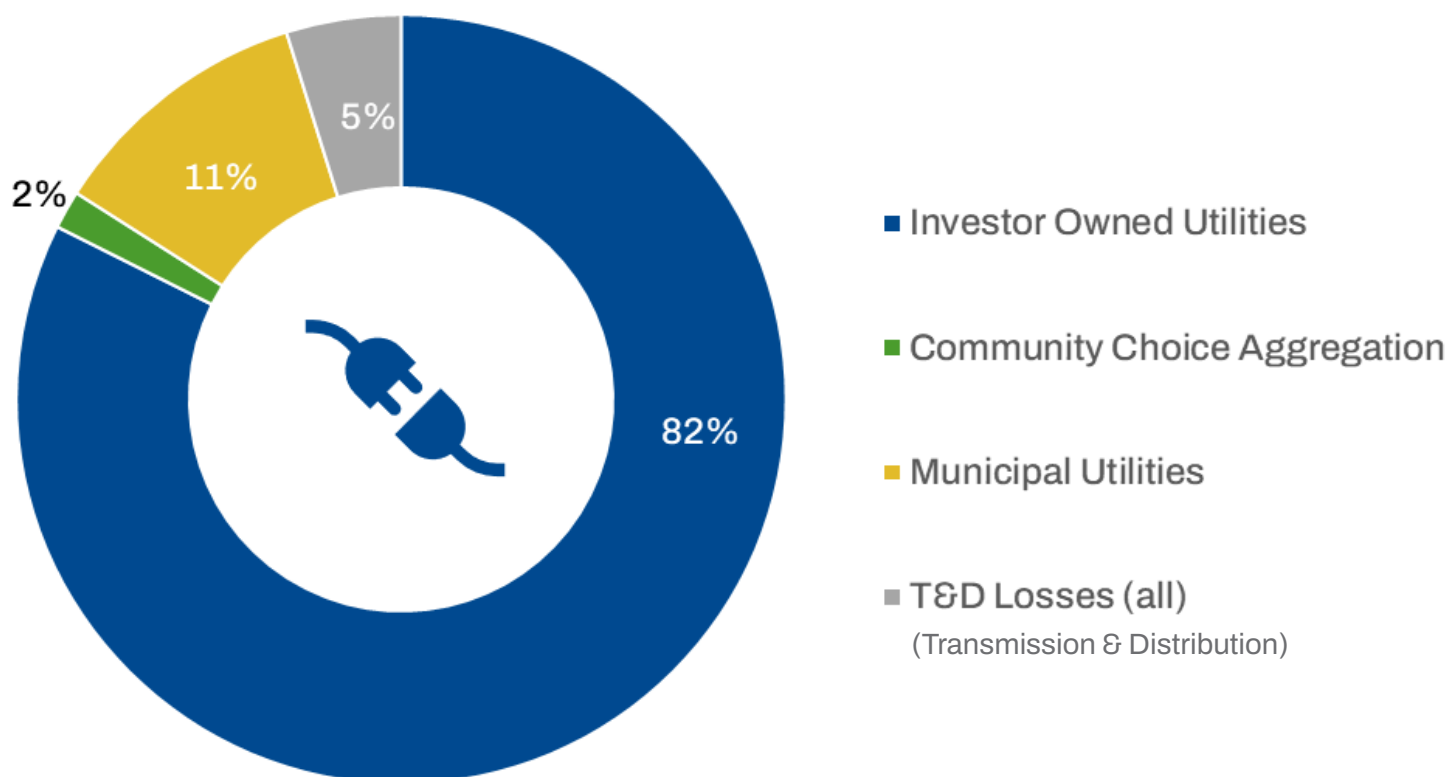


Figure 34: Proportion of kWh Usage by Electric Utilities and Programs in 2017 in Greater Boston.

Across the region, most electricity is supplied by Investor-Owned Utilities (IOUs). Renewable Portfolio Standard (RPS) policies and other standards establish renewable electricity generation requirements for electricity sold that increase annually. While the RPS varies between New Hampshire and Massachusetts, in 2017 the requirements were less than 20 percent of sales.<sup>47</sup> Since 2017, both states have greatly increased requirements, established new standards, and broadened eligible technologies. In 2023, the New Hampshire RPS obligation was 24.3 percent (including 14.1 percent Class I RECs), and the Massachusetts combined new Clean Energy Standard (CES) and RPS obligation was 35.2 percent (including 22 percent Class I RECs).<sup>48 49</sup> Electricity supplied through community choice aggregation programs must comply with all standards that apply to IOUs. While not subject to the RPS, in Massachusetts, the Next Generation Climate Roadmap bill does require municipal light plants to supply 50 percent of its electricity from non-carbon emitting sources by 2030 and to be net zero by 2050.<sup>50</sup> In 2017, municipal utilities reported that anywhere from 8 percent to over 85 percent of their electricity came from renewable energy sources.<sup>51</sup>



Figure 35: Solar, photo from Adobe Stock

Renewable electricity generation is accounted for using Renewable Energy Certificates (RECs). One REC is created when an eligible renewable energy source generates one megawatt-hour (MWh) of electricity for the grid. A REC represents the environmental (e.g. non-energy) benefits of the energy generated. MA Class I RECs are from commercial renewable energy operations built after 1997 in New England that generate electricity using solar photovoltaic, solar thermal electric, wind energy, small hydropower, landfill methane and anaerobic digester gas, marine or hydrokinetic energy, geothermal energy, and eligible biomass fuel.<sup>52</sup> Most entities within the Greater Boston region purchase Renewable Energy Certificates (RECs) from sources outside the MSA for a significant portion of their renewable energy.<sup>53</sup>

**Electricity Generation is the third highest emitting sector in Greater Boston, responsible for approximately 19 percent of the region's total emissions.** Decarbonizing electricity generation is critical to not just reducing GHG emissions from generation, but also enabling building and vehicle owners to transition off fossil fuel combustion by using appliances and vehicles powered by low-carbon electricity.



**The priority electricity generation measures aim to reduce emissions by:**

- (E1) Developing renewable energy projects, and
- (E2) adopting municipal aggregation.



# Energy Generation

## *E1. Develop Renewable Energy Projects*



Deployment of renewable energy projects has expanded rapidly over the past decade, with nearly four gigawatts of new solar PV installed in Massachusetts and New Hampshire from 2013-2023. However, barriers remain to enabling further deployment of renewable energy projects, specifically community shared solar (CSS), energy storage, and microgrids. Ensuring that the benefits of solar and renewable energy technologies are accessible to a diverse range of residents, including renters, people of color, and low-and-moderate income households has remained challenging.

As with siting any new energy infrastructure, medium- and large-scale renewable energy projects should aim to protect cultural heritage and sacred sites, maintain green and open space, and mitigate impacts and risks, particularly to LIDAC communities. Municipalities must also balance these concerns in the development process by communicating key needs and requirements to developers and project partners to ensure projects can be developed efficiently. When municipalities are project partners or owners, they are better able to integrate community benefits and engagement into development processes, such as by establishing Community Benefits Agreements or requiring program shares for low-moderate income residents.

### **Municipalities, MLPs, and RPAs/RPCs should:**

1. Expand access to community shared solar projects and benefits by leasing public land (including capped landfills, brownfields, under-utilized plots, parking lots, or municipal rooftops) and require affordable or no-cost shares local low-income subscribers.
2. Serve as anchor off-takers for community shared solar projects or microgrids to help establish new projects.
3. Increase deployment of solar and solar plus storage projects through municipal ownership and public-private partnerships.
4. Provide technical assistance, capacity, and support to municipalities to reduce barriers to renewable energy development including streamlining zoning and permitting, accessing incentives and financing, and training and education for municipal staff.



### **Geographic Scope**

The actions in this measure can be implemented across the MSA, although location-specific siting analysis will be needed to better understand solar potential, land use concerns, and interconnection and grid capacity constraints and opportunities.<sup>54</sup>



### **GHG Emissions Reductions**

**206,160 to 269,049  
MTCO<sub>2</sub>e/year**

The estimated emissions reductions were calculated based on the average percent increase in total community solar capacity in the MA portion of the MSA. See Appendix B for additional information.



# Energy Generation

## *E1. Develop Renewable Energy Projects*



### LIDAC Benefits Analysis

- **Reduces Cost of Living:** Community shared solar can lower household energy bills.
- **Reduces Environmental and Public Health Burdens:** Opportunity to utilize brownfields and remediate contaminated sites. Reduced outdoor air pollution as renewable energy projects offset natural gas generation.
- **Creates Economic and Job Benefits:** Job opportunities for solar installers, electricians, and related services.
- **Improves Community Resilience to Climate Impacts:** Battery storage and smart inverters can be designed to island buildings during a grid outage and pair with emergency back-up power, particularly critical community facilities.



### Implementing Agencies and Partners

- Municipalities and Municipal Light Plants
- RPAs/RPCs
- Solar developers and installers; solar financiers and lenders; community shared solar companies
- Utilities
- Non-profits and community-based organizations
- State agencies including Mass Clean Energy Center, Massachusetts Department of Energy Resources, New Hampshire Department of Environmental Services



### Implementation Timelines

- **Year 1-2:** Project scoping, design and engineering, financing/funding, and permitting.
- **Year 2-4:** Project construction
- **Year 3-5:** Project commissioning and operation

*Note: Phases of the project depend on the complexity of the project.*



### Metrics to Track Progress

- MW of new solar developed
- MW of battery storage deployed
- Number of residents/customers served by community share solar
- Number of income-eligible customers served
- Energy bill savings delivered to income-eligible customers





# Energy Generation

## *E1. Develop Renewable Energy Projects*



### Other Funding Available

- **Federal:** Energy Storage Demonstration and Pilot Grant Program, Solar for All, Inflation Reduction Act Programs
- **MA:** Community Compact, Municipal Vulnerability Preparedness
- **NH:** Renewable Energy Fund, Residential Renewable Electrical Generation Program, Commercial and Industrial Solar Incentive Program



### Workforce Development Opportunities

Renewable energy installation can provide jobs to solar installers, electricians, and related services. Municipal-led or partnership projects can require or promote local workforce hiring, apprenticeship programs, prevailing wage requirements, and utilizing minority and women owned business in procuring renewable energy contractors through project labor agreements.



### Examples of Success in the Region

- Chelsea Community Microgrid: the City is working with community partners to develop a virtual microgrid<sup>55</sup>
- Acton Boxborough Regional School District: Douglas and Gates Elementary School achieved net zero with an Energy Intensity Unit (EUI) of 23. This project includes solar plus storage and geothermal.<sup>56</sup>



### Policy Priorities

- **State:** (1) Provide technical support to navigate interconnection approval processes and infrastructure upgrades; (2) Continue exploring approaches to make distributed generation interconnection-related upgrades proactively and allocate costs across project developers and load customers (i.e., MA's Capital Investment Program<sup>57</sup>); (3) Allow for on-bill programs or bill credits to make community shared solar more accessible and straightforward for customers.



# Energy Generation

## *E2. Adopt Municipal Aggregation*



In Massachusetts and New Hampshire, the electricity supply market is deregulated and enables municipalities to act as electricity suppliers to procure electricity on behalf of local residences and businesses. When municipal aggregation programs<sup>58</sup> are established, customers on basic service from an IOU and not already under contract with another third-party supplier are automatically enrolled. Most residential and small commercial customers enrolled in aggregation programs stay with the default offering rather than opt out. Larger commercial entities often have separate competitive electricity supply contracts.

Electricity supplied through municipal aggregation programs must comply with renewable electricity standards (e.g. Renewable Portfolio Standards, Clean Energy Standards), and programs typically offer opportunities to optionally enroll residents and businesses in products that exceed state renewable energy requirements with differing percentages of renewables (e.g. minimum requirements, 100 percent Class I renewables).<sup>59</sup> By increasing renewables used in the default supply, municipalities can significantly increase renewable electricity usage across the community, putting communities on a path towards 100 percent renewable electricity more rapidly than required under the laws of both states. While most programs serve one municipality, a regional approach that serves multiple municipalities is also an option. The first aggregation program in the country, Cape Light Compact, was established in 1997 to serve 21 towns on Cape Cod, Martha's Vineyard, and Dukes County.<sup>60</sup>

Though municipal aggregation programs are not guaranteed to deliver cost savings relative to utility-provided electricity supply, over the past five years, municipal aggregation programs with higher renewable electricity content on average delivered savings relative to basic service.<sup>61</sup> Municipalities should consider developing program structures that provide support to low- and moderate-income customers and ensure that the program offers opt-in pricing tiers equivalent to basic service to ensure affordability and mitigate potential cost increases to residents with high energy burdens.

### **Municipalities, along with support from RPAs/RPCs, should:**

1. Establish and adopt new programs in their communities, if they do not yet participate, with support from their RPA/RPC or non-profit organizations. Municipalities can evaluate default products with higher renewable electricity content than required under the RPS.
2. Work with their aggregation broker to increase the percentage of Class I RECs in their default program offering over time and develop a pathway towards to 100 percent renewable electricity by 2030.



### **Geographic Scope**

This strategy applies to every municipality in the MSA that is served by an IOU.<sup>62</sup> Municipalities served by municipal light plants do not participate in aggregation programs but can choose to source up to 100 percent of its electricity supply from renewable sources.



### **GHG Emissions Reductions**

**Residential:** 910,169 to 1,441,100  
MTCO<sub>2</sub>e/year

**Commercial:** 1,006,074 to 1,341,431  
MTCO<sub>2</sub>e/year

The estimated emissions reductions are based on an increase in municipal aggregation in 63 communities. See Appendix B for additional information.



# Energy Generation

## *E2. Adopt Municipal Aggregation*



### LIDAC Benefits Analysis

- **Reduces Cost of Living:** Reduces energy bills when programs can offer better rates than utility basic service; Reduces energy insecurity for vulnerable residents by providing stable prices with longer contract terms.



### Implementing Agencies and Partners

- Municipal governments (City Council or Town Meeting approval is required)
- Counties (New Hampshire only)
- RPAs/RPCs
- Massachusetts Department of Public Utilities (DPU) and New Hampshire Public Utilities Commission (PUC)
- Massachusetts Department of Energy Resources and New Hampshire Department of Energy



### Implementation Timelines

- **Year 1:** Conduct initial research on aggregation, authorize program development at city council/town meeting, solicit an energy broker to support program implementation, develop aggregation plan and approve internally.
- **Year 2:** Submit aggregation plan to DPU or PUC for review
- **Year 2-3+:** Upon approval, issue a request for proposals (RFP) for competitive supplier, execute supply contract, conduct outreach to notify customers around program, and begin automatic enrollment
- **Future years:** review metrics and benefits delivered to-date, explore opportunity to increase share of renewables in default option.



### Metrics to Track Progress

- New municipalities begin municipal aggregation by 2030
- Municipalities offer default program options with 100 percent renewable electricity supply by 2030
- Municipalities that provide support for low-income customers



# Energy Generation

## *E2. Adopt Municipal Aggregation*



### Other Funding Available

- Municipal aggregation programs do not have a direct cost for municipalities beyond the staff time needed to start a program. Brokers who run the programs for municipalities are paid by suppliers via a small surcharge, typical \$0.001 per kWh of electricity consumed in the program.



### Examples of Success in the Region

- As of 2023, over 167 municipalities in Massachusetts have established municipal aggregation programs (out of 302 served by an IOU), 54 of which have default options that have 5 percent more renewable electricity than required under the RPS.<sup>63</sup> Several of these communities already have aggregation programs that source over 80 percent of electricity from renewables. Two New Hampshire municipalities are developing community choice aggregation programs.
- Boston Community Choice Electricity: is the largest program in Massachusetts, with a default option that includes 39 percent renewable energy, with an option to opt-up to 100 percent renewable energy sourced from New England area.<sup>64</sup>
- Nashua Region Electricity Supply Aggregation: has been in place since 2012 which includes nine municipalities and six school districts.<sup>65</sup>



Figure 36: Beverly Electric School Bus Charging, photo from MAPC



### Policy Priorities

- **State:** (1) Pass legislation to end third party predatory energy supply contracts<sup>66</sup>; (2) Streamline the process and approval time for new municipal aggregation programs and changes to existing programs.



# Section Endnotes



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information!

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## 4.4. Waste Measures

**The collection, processing, and disposal of waste accounts for 5 percent of Greater Boston's GHG emissions.** As shown in Figure 36, solid waste disposal accounts for 85 percent of emissions, followed by wastewater treatment and discharge at 12 percent, 3 percent to incineration and open burning. Emissions generated through waste-to-energy incineration within the boundary of the MSA are included in the electricity generation sector and not in the waste sector of the GHG Inventory.<sup>67</sup> In 2017 approximately 4,000,000 tons of waste were disposed in the region, equal to an average of 0.8 tons, or 1,600 pounds, per person annually. Almost 80 percent of all waste was disposed within the region. Just under 36,000 tons (less than 1 percent of the total waste) were composted.

Solid waste produced in the MSA was equivalent to



1,679 lbs. per person in 2017

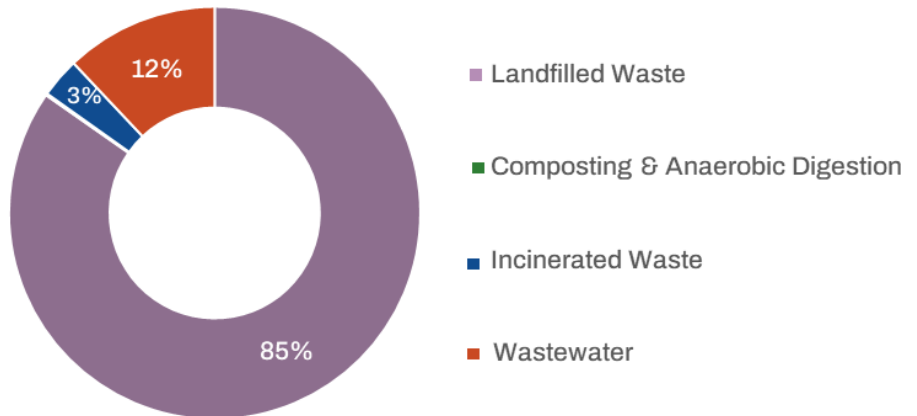


Figure 37: GHG Emissions from the Waste Sector in 2017. Note that biological treatment of waste includes composting and anaerobic digestion and emissions generated by waste-to-energy incineration are included in the electricity generation sector.

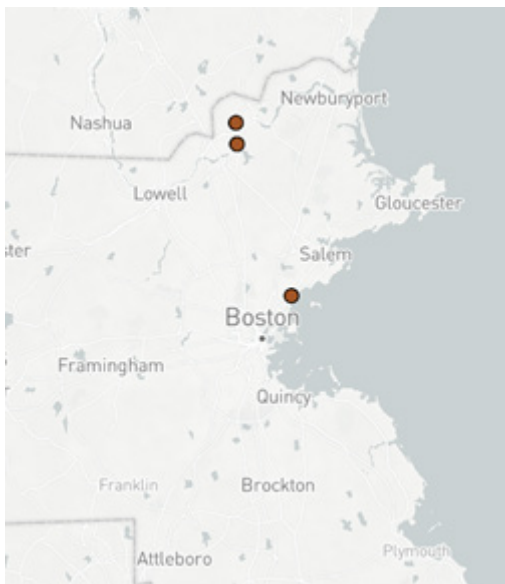


Figure 38: Three waste-to-energy incinerators are in the Greater Boston MSA, including Saugus, Haverhill, and North Andover.<sup>68</sup>

Although waste makes up a small percentage of overall GHG emissions, processing solid waste emits other harmful pollutants such as nitrous oxide (NO<sub>x</sub>), carbon monoxide (CO), methane, particulate matter and fly ash, heavy metals, PFAS, and dioxins into local air and waterways. Due to limited land fill capacity, Massachusetts burns more household waste per capita than any other state and has the third highest number of waste incinerators.<sup>69</sup> As shown in Figure 37, there are three waste combustion facilities within the region that are located near Environmental Justice communities (Haverhill Resource Recovery Facility, Wheelabrator North Andover, and Wheelabrator Saugus).<sup>70</sup> Also, waste transportation contributed to heavy-duty vehicle emissions within communities receiving waste.<sup>71</sup>



*Figure 39: Waste, photo from Adobe Stock*

In 2021, the Massachusetts Department of Environmental Protection (DEP) released the 2030 Solid Waste Master Plan for the Commonwealth. It set a state-wide goal of reducing solid waste disposal by 30 percent by 2030, and 90 percent by 2050.<sup>72</sup> In 2022, the New Hampshire Department of Environmental Services (DES) adopted its Solid Waste Management Plan, with mandates from the state's General Court to reduce disposal of municipal solid waste and construction and demolition debris 25 percent by 2030 and 45 percent by 2050.<sup>73</sup> Several local governments have also adopted zero waste plans or include waste in their Climate Action Plans.



**The priority waste measure focuses on reducing GHG emissions and harmful pollutants by:**

(W1) reducing solid waste going to landfills and incinerators.





# Waste

## *W1. Reduce Solid Waste Going to Landfills and Incinerators*



Support municipal implementation and regionalization of programs and infrastructure that divert solid waste, including organic waste and recyclables, from landfills and incinerators. Solid waste disposal and single-stream recycling is increasingly expensive for municipalities and can be confusing for residents. Multi-municipal or regional solutions to establish or expand composting, material reuse and repair programs, and improve recycling will be critical to reducing solid waste. At the same time, municipalities can use education and policies to reduce consumption and encourage reuse and recycling of materials. Local government can help support both states in meeting their waste reduction goals, as well as educating residents and enforcing existing waste disposal bans<sup>74</sup> and assisting residents with alternatives that comply with state regulations.

### **Municipalities, RPAs/RPCs, and the states should work together to:**

1. Expand existing sites and establish new regional composting sites that can serve more customers for curbside and institutional composting. Municipalities may explore public-private partnerships or lease public land to support composting sites.
2. Explore and encourage municipal collaboration and shared services on solid waste disposal and recycling procurement to achieve better outcomes and economies of scale. Ensure that vendors can recycle significant amounts of what is collected and pair with consumer education and outreach programs to increase participation and reduce consumption.
3. Enforce state and local waste bans and regional programs to support responsible recycling of textiles, mattresses, and other materials banned from landfills.
4. Develop local government procurement requirements and sustainable purchasing policies and mandates to support solid waste reduction goals.
5. Partner with non-profits, schools, and libraries to establish a variety of waste diversion programs including re-use and repair programs, textile donations and recycling, and library of things projects.



### **Geographic Scope**

The actions within this measure can be implemented across the region.



### **GHG Emissions Reductions**

**36,967 to 55,450  
MTCO<sub>2</sub>e/year**

The estimated emissions reductions are based on goals in MA 2030 Solid Waste Master Plan. See Appendix B for additional information.



# Waste

## *W1. Reduce Solid Waste Going to Landfills and Incinerators*



### LIDAC Benefits Analysis

- **Reduces Environmental and Public Health Burdens:** Reduces emissions from co-pollutants, such as volatile organic compounds (VOCs), hazardous air pollutants (HAPs), and other air toxics that can endanger the physical and mental health of residents near landfills or incinerators. May reduce the transportation emissions associated with waste collection.
- **Creates Economic and Job Benefits:** Can reduce waste disposal costs for municipalities and consumers; New composting programs can provide economic opportunities.



### Implementing Agencies and Partners

- Municipal Government
- Massachusetts Department of Environmental Protection (MADEP) or New Hampshire Department of Environmental Services (NHDES)
- Waste haulers, compost service providers, non-profits
- RPAs/RPCs



### Implementation Timelines

- **Year 1-2:** Regional planning and project scoping for composting site, planning and contract bidding and negotiation for regional recycling contracts
- **Year 2-3:** Design and engineering, financing/funding, and permitting of new composting sites as applicable.
- **Year 3-4:** Construction and implementation

*Note: Phases of the project depend on the complexity of the specific project.*



### Metrics to Track Progress

- Tons of organic waste diverted from landfills and incinerators
- Tons of organic waste composted
- Tons of waste recycled and/or reused



# Waste

## *W1. Reduce Solid Waste Going to Landfills and Incinerators*



### Other Funding Available

- **Federal:** Solid Waste Infrastructure Recycling Program; Consumer Recycling Education and Outreach Program
- **MA:** Efficiency and Regionalization Grant Program; Sustainable Materials Recovery Program (SMRP) Municipal Grants; SMRP Recycling Dividends Program (RDP); Reduce, Reuse, Repair Micro-Grants; Recycling and Reuse Business Development Grants.
- **NH:** Unlined Municipal Landfill and Incinerator Closure Grant Program; Municipal Recycling and Storage Equipment Grants.



### Workforce Development Opportunities

Composting, recycling, and repair programs can create more jobs than waste incinerations and landfills on a per 10,000 ton basis.<sup>75</sup> New and expanded services and programs can create local jobs, and municipal-led or partnership programs can establish requirements for local hiring and community benefits agreements.



### Examples of Success in the Region

- **Curbside composting:** Many municipalities offer curbside composting through public-private partnerships, private composting haulers, or local non-profits including Salem, Lexington, Natick, Hamilton, Nashua, and the Seacoast of New Hampshire.



### Policy Priorities

- **State and Federal:** (1) Implement state solid waste plans and goals through sufficient budgeting for enforcement and technical and financial assistance for local governments and community education; (2) Expand Extended Producer Responsibility (EPR) policies and other fee structures for disposables (i.e., mattresses, paint, electronics, bottling, and consumer packaging).
- **Municipal:** (1) Adopt local policies that reduce waste (i.e., limit single-use plastics, regulate disposal of building and construction waste).

# Section Endnotes



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67. For more information on emissions calculations please see the Appendix: GHG Methodology Description and Summary by Sector. Disposal locations of waste by town are not tracked. Therefore, waste crossing in or out of the MSA boundary was unable to be determined. Consequently, it was assumed that waste categorized as net exports were Scope 3, and in-state disposal were Scope 1. An updated methodology to calculate emissions resulting from the disposal of waste will be considered in the CCAP.
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# 5. Implementation and Next Steps

The next six years will be a vital time for communities and the region to reduce GHG emissions rapidly and equitably to prevent the worst and disproportionate impacts of climate change. By 2030, the work on the eleven priority measures outlined in this plan, as well as priority measures in the Massachusetts and New Hampshire state plans, must be well underway. Fortunately, local, regional, and state government and community partners have shown leadership over nearly two decades on sustainability and climate issues. While much of the local authority to plan, adopt policies, and implement programs in this PCAP lies within municipal government, the role of regional planning agencies and commissions, state policy and funding, and federal policy and funding will all be essential to meeting local and state GHG emission reduction goals. Collaboration across sectors and levels of government will be needed to make substantial progress on the priority measures. The following section outlines the relevant authorities to implement and key considerations in carrying out the plan.

## 5.1. Municipal Authority to Implement

Within the Greater Boston MSA, Massachusetts and New Hampshire delegate different levels of authority to municipal government. Massachusetts is a home rule state, with strong local authority to pass policies and govern themselves. New Hampshire is a Dillons Rule state, which means municipal governments are limited in their authority by what the state has explicitly defined. The following is an overview of some of the relevant roles that local governments have.

| Role   | Massachusetts Municipal Authority   | New Hampshire Municipal Authority   |
|--|---|---|
| Fiscal: Budget, taxation, and capital planning                     | Yes   | Yes   |
| Land use planning and policy (master plans, zoning and permitting) | Yes, although state law sets some requirements  | Yes, although state law sets some requirements  |
| Code adoption and enforcement (Building, fire, and energy Codes)   | Codes are adopted at the state level and enforced locally; Municipal opt-in Stretch Energy Code and Specialized Code available. | Codes adopted at the state level, but counties and municipalities may adopt stricter codes. |
| Control of municipal and school facilities                         | Yes   | Yes, municipal facilities; School Districts are considered separate entities.               |

| Role   | Massachusetts Municipal Authority  | New Hampshire Municipal Authority  |
|--|--|--|
| Municipal-owned roads and rights-of-way            | Yes  | Yes  |
| Electricity generation                             | Municipal Light Plant-yes; option for municipal aggregation through DPU approvals. | Municipal Light Plant-yes; option for municipal aggregation through DUC approvals. |
| Education, outreach, and communication on programs | Yes  | Yes  |

In addition to local authority, municipalities can establish shared services and facilities that pool resources, expertise, and functions. Some relevant examples of this include shared school districts, regional public health services, shared staff roles like sustainability planners or energy managers, waste and water, regional climate resilience planning and projects, and regional transportation.

## 5.2. Regional Planning

Both Massachusetts and New Hampshire rely on regional government agencies. In Massachusetts there are 13 Regional Planning Agencies (RPA), four of which are in the Greater Boston MSA. In New Hampshire there are nine Regional Planning Commissions (RPC), three of which are in the MSA. While RPAs/RPCs do not have the authority to adopt policies or regulations, they play a critical role in developing regional plans and strategies, informing state policy, and providing technical assistance on a wide variety of topics to local governments and partner organizations, including on land use, climate, sustainability, and clean energy issues. RPAs/RPCs can also establish regional programs that provide education, outreach procurement, and technical support across multiple communities. RPAs/RPCs can help local governments regionalize and establish shared services, including joint procurement. Regional government can support all priority measures identified in this PCAP, and several can be led or co-led by RPAs/RPCs.

## 5.3. Building Partnerships

In addition to local and regional government, many of the measures outlined in this plan require trusted, impactful relationships with community partners, including local community-based organizations and non-profits led by LIDAC community members. Municipalities should also build government-to-government relationships with Tribal Councils, which serve as tribes' legislative bodies. Approaches should draw on collaborative governance, described by the National Policy Consensus Center as "community and public policy decision making processes and structures that enable participants [across the boundaries of public, private, and civic sectors] to work together [and leverage the unique attributes and resources of each] to enhance their communities and shape sustainable public policy decisions."<sup>1</sup>



Figure 40: Malcolm X Park in Boston, Massachusetts. Photo by Weston & Sampson

#### Some examples of collaborative governance in the climate space include:

- **The Mass Save program's Community First Partnership** funds municipalities to collaborate with community-based organizations and hire part-time staff to conduct outreach about energy efficiency and decarbonization incentive focused on reaching households underserved by Mass Save Programs.<sup>2</sup>
- **Boston's Building Emissions Reduction Ordinance** is a new municipal policy that was shaped by community members' concerns and multiple stakeholder discussions. Community-based organizations including Alternatives for Community and Environment, advocated for an equitable policy design process that included a policy implementation review board comprised of two-thirds community members.<sup>3</sup>

Implementation of the Greater Boston Climate Action Plan offers an exciting opportunity for municipalities to build relationships and shape policies, practices, and programs to decarbonize and improve housing, transportation, electricity generation, public health, and climate resilience in LIDAC communities.

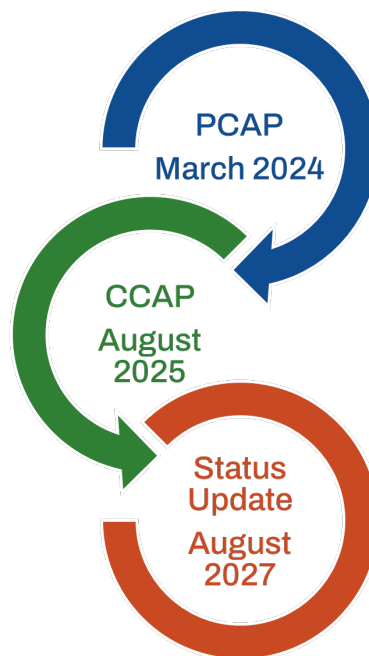
## 5.4. Centering Equity in Planning and Implementation

Local and regional governments also have opportunities to counter economic and racial inequities through the implementation of the PCAP. Existing inequitable conditions have resulted from a long history of discriminatory housing, transportation, economic, and environmental policies and practices whose legacy continues to impact today's communities.<sup>4</sup> For example, low-income households and households of color continue to be concentrated in formerly red-lined neighborhoods with inadequate, older homes which results in higher energy bills.<sup>5</sup> Another example includes historic placement of highways that cut through LIDAC communities in Massachusetts, increasing air pollution, physically dividing communities and economics, and removing community members and businesses by eminent domain.<sup>6</sup> These realities are essential to consider when implementing programs such as building decarbonization and public transit expansion. Future efforts to reduce climate impacts should focus on repairing past harms and ensuring frontline communities are the primary beneficiaries.

Building and re-building trust between government and communities requires time, internal reflection and institutionalization of equity, and accountability measures and feedback loops.<sup>7</sup> Initiatives, such as the Racial Equity Advancement and Collaborative Hub, a training and peer learning initiative for municipal staff led and supported by the Government Alliance on Equity, Federal Reserve Bank of Boston, and MAPC, help to encourage municipal staff to explicitly consider racial equity in policies, funding, hiring, practices, programs, and more.<sup>8</sup> While the results of these policies won't be solved solely within the context of the Greater Boston Climate Action Plan, the implementation of the measures offer a clear opportunity to begin implementing these best practices and centering equity in all climate work throughout the region.

## 5.5. Next Steps

The PCAP is the first deliverable of the EPA's Climate Pollution Reduction Grant planning program, which continues through August 2027. The next planning phase is the development of the Comprehensive Climate Action Plan (CCAP), which will be completed by August 2025 and followed by implementation and status updates in 2027.



The CCAP will include identifying measures in additional sectors and both near-term and long-term emissions reduction priorities. It will also include an updated GHG inventory and establish long-term GHG emissions projections and reduction targets. The CCAP will expand on the measures in the PCAP to include co-pollutant and workforce planning analyses. The project team and advisory groups will expand community engagement efforts during the CCAP, particularly within LIDAC communities in the region. Engagement will likely include additional public listening sessions, sector- and stakeholder-specific focus groups, and surveys.

Information about the CPRG process and opportunities to engage will be regularly updated on the [Greater Boston Climate Action Plan](#) webpage.



# Section Endnotes



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information!

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# Glossary

**Air Pollution:** small particulates, dust, gases, and aerosols that are released into the atmosphere that reduce air quality and have negative effects on human health and the environment. Air pollution can get inside our lungs and sometimes even our bloodstream. This is linked to many health issues, including asthma, heart attacks, and lung disease.

**Air Source Heat Pump (ASHP):** an efficient technology that provides space heating and cooling by pulling heat from the air and does not require on-site combustion of fossil fuels. ASHPs are often categorized as a ducted system or mini-splits.

**Carbon Emissions:** carbon dioxide (CO<sub>2</sub>) is a greenhouse gas that's emitted when fossil fuels, such as coal, natural gas, methane, oil, and gasoline, are burned in vehicles, during the generation of electricity and heating, and for industrial processes (such as in factories).

**Carbon Neutral Policy:** a policy goal to reduce greenhouse gas (GHG) emissions through energy efficiency and clean energy, and the remaining emissions are balanced by carbon “offsets”, strategies that remove carbon from the atmosphere or keep carbon in the ground.

**Clean Energy:** sources of electricity, heating, and cooling derived from renewable technologies including solar photovoltaics (PV), solar hot water, wind, geothermal, air source heat pumps, as well as other emerging technologies such as waste energy recovery. These sources are also known as renewable energy because they are not from limited fossil fuel-based sources like coal, methane gas, and oil.



*Figure 41: Solar panels. Photo by Weston & Sampson*





*Figure 42: Flooding in Weymouth, Massachusetts. Photo by Weston & Sampson*

**Clean Heating/Cooling:** sources of energy that provide heating in the winter and/or cooling in the summer from renewable energy sources and not the burning of fossil fuels. Some examples include air source heat pumps, geothermal, and waste heat recovery.

**Climate Adaptation:** making changes to the built infrastructure (such as buildings and homes) or the natural environment (such as parks and open space) to best prepare them for the impacts of climate change, including flooding, drought, extreme heat, and extreme storms.

**Climate Change:** describes the long-term changes in average weather patterns, temperatures, and precipitation across the world due to the warming of the earth's atmosphere. Scientific consensus shows that current climate change is caused by human activity, specifically the burning of fossil fuels that release greenhouse gases into the atmosphere causing global temperatures to increase. While global average temperatures are rising, the local impact to weather may include both increases and decreases in temperature, changes in precipitation (rain and snow), increased risk of severe weather events, sea level rise, and other changes. Climate change impacts the world around us including shifts in agricultural and growing seasons, pollen and air quality, insect borne diseases, pests, and other impacts to the environment.

**Climate Mitigation:** strategies to slow down and reduce the severity of climate change impacts by reducing the amount of greenhouse gases emitted into the air.

**Climate Preparedness:** preparing for the impacts of climate change, including emergency planning and community services.

**Community Choice Aggregation (CCA) or Green Municipal Aggregation:** also known as municipal electricity aggregation, allows town and city governments to use bulk purchasing power (where they pay a lower price for the service in exchange for purchasing a larger quantity of the service) to negotiate contracts for electricity supply on behalf of the residents and small businesses in the community that are on the basic electricity service. The contracts often include a higher percentage of renewable energy than standard electricity mix.



**Community Shared Solar (CSS):** a program that allows multiple electric energy customers to subscribe, participate, or purchase a portion of a solar energy project located somewhere else in their community (for example, a field with solar panels). Participants receive a credit on their utility bill for their portion of clean energy produced. This is an option for those who cannot install solar panels on their own property for any reason and renters.

**Decarbonization:** reducing and ultimately eliminating fossil fuel-based energy sources in the energy, buildings, and transportation sectors.

**District Energy:** type of heating and cooling system (thermal energy) that is done at a neighborhood or district scale across multiple properties. District energy can either use fossil fuels, such as natural gas or renewable sources like geothermal to power the system.

**Electric Vehicle (EV):** a vehicle, such as a car or truck, that is powered fully or mostly by electricity instead of gasoline.

**Electric Vehicle Supply Equipment (EVSE):** also called charging stations or charging docks, the equipment that provides electric power to recharge the vehicle's battery. EVSE systems include conductors, software, communications protocols, and other related equipment.

**Electricity Grid:** the full electricity system including power plants that generate electricity, and the transmission and distribution lines that transmit electricity to power the homes, businesses, and facilities that use it.



Figure 43: Electric vehicles in Belmont, Massachusetts. Photo by Weston & Sampson



**Electrification:** converting a machine or system to use electricity instead of burning natural gas, oil, or other fuels. The benefit of electrification is that the energy source can come from renewable sources such as solar PV or wind.

**Energy Burden:** the percentage of a household's income spent on home energy bills. A high energy burden is a household that spends more than an average share of their income.

**Energy Efficiency (EE):** process to make a building or site utilize less electricity, natural gas, delivery fuel, or other energy sources. This includes things like installing LED lightbulbs, weatherization, using smart sensors/automatic light switches, tankless water heaters, energy smart appliances, and behavioral changes of the building occupants.

**Energy Insecurity:** people who are unable to pay for basic energy needs such as heating, cooling, and lighting in their homes live in a state of energy insecurity. This is often the case when a household has a very high energy burden and may be at risk of having utilities shut off due to non-payment.

**Energy Storage (ES):** also known as "battery storage" allows for the storage of electricity to be used later. There are now commercially available batteries at a wide range of capacity- including residential, commercial, and utility scale storage. Storage can be paired with solar energy for additional benefits and incentives. ES can be used to manage demand and peak shaving or increase resilience of the grid on specific sites.

**Environmental Justice (EJ):** the principle that all people have a right to be protected from environmental hazards and experience healthy environments regardless of race, ethnicity, income, immigration status, or English language proficiency.

**Environmental Justice Community:** in Massachusetts, communities designated as Environmental Justice meet one or more of the criteria- low-income, minority, or language isolation. EJ communities often historically and presently have a higher exposure and sensitivity to environmental harms.

**Equity:** the condition of fair and just inclusion into a society. Equity will exist when those who have been most marginalized have equal access to opportunities, power, participation, and resources and all have avenues to safe, healthy, productive, and fulfilling lives. It requires restructuring deeply entrenched systems of privilege and oppression that have led to the uneven distribution of benefits and burdens over multiple generations."

**Extended-Range Electric Vehicles:** a type of plug-in hybrid vehicle that can go further distances than a traditional EV, due to an axillary engine that can be used to charge the vehicle's battery when it is depleted. Only electricity is used to power and drive the wheels.

**Fossil Fuels:** carbon-based fuels mined or drilled from the earth such as coal, oil, natural gas/methane gas, and gasoline. When processed and burned, fossil fuels emit greenhouse gases and other harmful pollutants.

**Geothermal:** a renewable energy source that extracts heat from the earth and can be used for heating and cooling, or to generate electricity. Geothermal may be used at a single building scale like Ground Source Heat Pumps or a district scale such as networked geothermal which connects multiple buildings.

**Greenhouse Gases (GHG):** when fossil fuels like gasoline, diesel, and natural gas are burned they emit gases such as carbon dioxide (CO<sub>2</sub>) and methane into the atmosphere. These gases trap heat around the earth which changes our worldwide climate. This is referred to as the greenhouse gas effect.

**Greenhouse Gas Inventory:** a greenhouse gas (GHG) inventory accounts for the emissions within a geographic boundary (municipality, state) in a specific year. GHG emissions can be accounted for through different methods, the most common of which is to look at emissions that result from activities occurring within the geographic boundary. GHG emissions are expressed in Metric Tons Equivalent of Carbon, even though there are many types of GHGs.

**Ground Sources Heat Pump:** also known as a Geothermal Heat Pump, an efficient technology that provides space heating and cooling, and potentially hot water by pulling heat from the ground and does not require on-site combustion of fossil fuels.

**Microgrids:** electrical system that utilize battery storage and sometimes solar to be able to island or separate from the electricity grid in case of an outage. Microgrids can improve resilience and reliability, particularly for critical community facilities. Microgrids typically connect adjacent or co-located properties.

**Micro-mobility:** small scale and slow speed transportation devices that are human or electric powered, including bicycles, electric bikes (e-bikes), bike share, and electric scooters, hoverboards, and skateboards.

**Mild Hybrid Electric Vehicles:** vehicles that use a battery and electric motor to power the vehicle and allow the engine to shut off when the vehicle stops but cannot power the vehicle alone.

**Net Zero:** process by which a single building or community reduces energy consumption first through energy efficiency, and then produces the same amount of energy it uses through renewable sources like solar. Some net zero definitions require on-site or in-region generation.

**Plug-in-Hybrid Electric Vehicles (PHEV):** a vehicle that uses batteries to power an electric motor and another fuel, such as gasoline, to power and internal combustion engine. The batteries can be charged via charging equipment or through regenerative braking.

**Solar Photovoltaics (PV):** form of renewable energy that uses solar panels or array to capture the energy from the sun and produce electricity. Solar PV can be used on different scales, including small residential rooftops, solar parking canopies, medium scale rooftop solar on commercial or institutional buildings, or large-scale ground mounted solar.

**Sustainability:** means meeting the needs of today without compromising the needs of future generations. Including social, economic, and environmental needs. In addition to issues around climate and energy, sustainability often includes things like waste, recycling, composting, and addressing environmental pollution.

**Weatherization:** the process of sealing up air leaks and adding insulation to homes and buildings to better save energy, money, and improve quality of the building.



# **Appendix A.**

## Greenhouse Gas Emissions Inventory Methodology

## A.1. Summary Overview

The greenhouse gas (GHG) emissions inventory was conducted using a baseline year of 2017. Emissions were categorized into five key sectors: stationary energy & electricity, transportation, waste, agriculture, and natural & working lands. Descriptions of the type of data included for each of these sectors is included in Appendix Table 1.

**Appendix Table 1: Community-wide Emissions Sectors and Subsectors**

| Sector                          | Subsector   | Source   |
|---------------------------------|---|--|
| Stationary Energy & Electricity | Residential Buildings   | Electricity  |
|                                 |   | Electricity Transmission & Distribution (T&D) Losses |
|                                 |   | Fuel Oil   |
|                                 |   | Natural Gas  |
|                                 |   | Natural Gas Distribution Losses                      |
|                                 | Commercial & Institutional Buildings & Manufacturing Industries | Electricity  |
|                                 |   | Electricity T&D Losses                               |
|                                 |   | Fuel Oil   |
|                                 |   | Natural Gas  |
|                                 |   | Natural Gas Distribution Losses                      |
|                                 | Construction  | Off-Road (Various Fuels)                             |
|                                 |   | Off-Road (Various Fuels)                             |



| Sector                  | Subsector                          | Source                       |
|-------------------------|------------------------------------|------------------------------|
| Transportation          | On-road (and MBTA Ferries)         | Compressed Natural Gas (CNG) |
|                         |                                    | Diesel                       |
|                         |                                    | Electricity                  |
|                         |                                    | Electricity T&D Losses       |
|                         |                                    | Gasoline                     |
|                         | Rail                               | Diesel                       |
|                         |                                    | Electricity                  |
|                         |                                    | Electricity T&D Losses       |
| Waste                   | Solid Waste Disposal               | Methane Commitment           |
|                         | Biological Treatment of Waste      | Direct Emissions             |
|                         | Incineration and Open Burning      | Incineration                 |
|                         | Wastewater Treatment and Discharge | Effluent                     |
|                         | Solid Waste Disposal               | Methane Commitment           |
|                         | Incineration and Open Burning      | Incineration                 |
| Agriculture             | Fertilizer                         | Fertilizer Application       |
| Natural & Working Lands | Carbon Sequestration               | Urban Forestry               |

The MAPC GHG Emissions Inventory Tool's methodology was used as the basis for calculating CO<sub>2</sub>e emissions (MMT) for all sectors. Please refer to the Tool's detailed methodology document for further details. Variations made to the methodology from the MAPC Tool, in order to most accurately represent the MSA, are described in the detailed sector summaries below.

## A.2. Data Summaries by Sector

### Electricity & Stationary Energy

#### Electricity

Data for the electricity subsector sources were collected from publicly available state and federal datasets, as identified in Appendix Table 2.

**Appendix Table 2: Electricity Subsector Sources**

| Sector      | Subsector  | Source                              | Dataset                                   | Description   |
|-------------|--|-------------------------------------|---|---|
| Electricity | Residential, Commercial, Institutional Buildings | Electricity Usage by Community (MA) | MassSave Data <sup>1</sup>                | MassSave electricity data by community for 2017. Usage data is calendarized to represent actual usage (not billing) in a given month or year and is available for all communities served by investor-owned electric utilities.  |
|             |  | Electricity Usage by County (NH)    | EIA <sup>2</sup>                          | EIA statewide electricity data by sector for 2017. Coupled with Economic & Social Indicators for New Hampshire, 2017-2021 report which includes a pie chart of the percentage breakdown of electricity consumption by county. This report also sourced electricity data from EIA. |
|             |  | Municipal Light Departments (MA)    | MA DPU <sup>3</sup> & MA DEP <sup>4</sup> | Municipal Light Plant annual returns from the MA Department of Public Utilities (DPU). This data source fills the gaps from Mass Save where it says "municipal."  |
|             |  | Community Choice Aggregation (MA)   | MA DPU <sup>5</sup>                       | Municipal aggregation annual reports from MA DPU, containing usage and program.   |
|             |  | Electricity T&D Losses (MA & NH)    | EIA <sup>6</sup>                          | T&D losses.   |

There were a few variations made to the methodology from the MAPC Tool, in order to most accurately represent the MSA. They included the following:

- New England eGRID emissions factors were used for NH electricity calculations.
- In 2017, NH did not have any community choice aggregation or municipal utilities.
- NH Transmission & Distribution Grid Loss Factor (%) was determined based the 2017 EIA NH electricity profile and calculated separately from the MA Transmission & Distribution Grid Loss Factor. The calculation results are shown in Appendix Table 3.

**Appendix Table 3: Electricity Transmission & Distribution Grid Loss Factor for New Hampshire**

| Total Disposition (MWh) | Direct Use (MWh) | Total Disposition Excluding Direct Use (MWh) | Estimated Losses (MWh) | Grid Loss Factor (%) |
|-------------------------|------------------|--|------------------------|----------------------|
| 17,585,222              | 105,111          | 17,480,111                                   | 586,810                | 3.36%                |

The results of the electricity emissions calculations are shown in Appendix Table 4.

**Appendix Table 4: Community-wide Electricity CO<sub>2</sub>e Emissions**

| Sector      | Subsector   | Source                 | Carbon Dioxide Equivalent Emissions (MMT CO <sub>2</sub> e) | Percent of Total Community-wide Emissions |
|-------------|---|------------------------|---|---|
| Electricity | Residential Buildings   | Electricity            | 2.80  | 6.3%                                      |
|             |   | Electricity T&D Losses | 0.14  | 0.3%                                      |
|             | Commercial & Institutional Buildings & Manufacturing Industries | Electricity            | 5.29  | 11.9%                                     |
|             |   | Electricity T&D Losses | 0.26  | 0.6%                                      |

## Stationary Energy

Data for the stationary energy subsector sources were collected from publicly available state and federal datasets, as identified in Appendix Table 5.

**Appendix Table 5: Stationary Energy Sources and Datasets**

| Sector            | State   | Source   | Dataset   | Description  |
|-------------------|---------|--|-----------|--|
| Stationary Energy | MA & NH | Off-Road County Total and Manufacturing Employment               | US Census | US Census Data from Table CB1700CBP All Sectors: County Business Patterns by Legal Form of Organization and Employment Size Class for U.S., States, and Selected Geographics: 2017. This is county level employment data for all sectors and the manufacturing sector. |
| Stationary Energy | MA & NH | Off-Road County and City/Town Total and Manufacturing Employment | US Census | US Census Data from Table S2405 Industry by Occupation for the Civilian Employed Population 16 Years and Over, 2017 5 year estimate. This source has county and city/town level data for total employment and manufacturing employment.                                |
| Stationary Energy | NH      | Natural Gas by sector for the state                              | EIA       | EIA statewide natural gas usage for 2017 by sector (residential, commercial, industrial, vehicle, electric power) in units of million cubic feet. Have natural gas losses by state for 2017 also.  |
| Stationary Energy | MA      | Natural Gas usage by community by month                          | MassSave  | MassSave statewide Natural Gas data by community or county for 2017. Usage data is calendarized to represent actual usage (not billing) in a given month or year.  |
| Stationary Energy | NH      | EPA MOVES off-road transportation emissions                      | EPA MOVES | This data source will fill the gaps from Mass DataCommon where there was no NH data for off-road transportation emissions by county  |



| Sector            | State | Source   | Dataset    | Description   |
|-------------------|-------|--|------------|---|
| Stationary Energy | NH    | FHWA gas consumption for transportation emissions  | FHWA       | FHWA Highway Statistics Series 2017 Table MF-24 data on gasoline consumption for non-highway construction vehicles and industrial/commercial vehicles (CO2 only)  |
| Stationary Energy | MA    | County Off-Road Transportation Emissions CO2 & CH4 | DataCommon | County off road transportation emissions  |
| Stationary Energy | MA    | Square Feet of Developed Open Space                | DataCommon | Open space off road county and municipality landscaped area emissions   |
| Stationary Energy | MA    | Commercial and Industrial Heating Oil              | EOLWD      | Massachusetts Executive Office of Labor and Workforce Development (EOLWD) Employment and Wages (ES-202) annual report data, all ownership types, with "Total, All Industries", "Category and all sub-categories". County level data was used and communities that are not in the MSA were subtracted from county totals.  |
| Stationary Energy | NH    | Square Feet of Developed Open Space                | NLCD       | Square feet of developed open space from the National Land Cover Database for 2016. Developed open Space defined as "Developed, Open Space-areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes." |

| Sector            | State   | Source                                | Dataset | Description  |
|-------------------|---------|---------------------------------------|---------|--|
| Stationary Energy | NH      | Commercial and Industrial Heating Oil | NHES    | Annual Census of Employment & Wages for Labor Market Areas from the New Hampshire Employment Security (NHES) for 2017. Data includes three digit NAICS codes, number of establishments (units) and average annual employment. The Labor Market Areas used included the NH portions of Nashua, Lowell-Billerica-Chelmsford, Lawrence-Methuen-Salem, and Haverhill-Newburyport-Amesbury. The Nashua LMA included 3 communities that are not within the MSA and these were excluded using the 2 digit codes by community.   |
| Stationary Energy | MA & NH | Municipal Heating Oil                 | EIA     | Fuel oil consumption and conditional energy intensity by census region from the Energy Information Administration (EIA) 2018 Commercial Buildings Energy Consumption Survey (CBECS) Data. 156 million gallons of fuel oil consumed by local government owned buildings in the Northeast which includes the 6 New England states, NY, NJ, and PA. This data was used with 2017 Census data for Number of Municipalities in each state. The number of municipalities in the MSA represents 2.6% of all municipalities in the 9 states and this percentage was multiplied by the total gallons of fuel oil. |

There were a few variations made to the methodology from the MAPC Tool, in order to most accurately represent the MSA. They included the following:

- The same percentages as electricity consumption by county were applied to identify natural gas consumption that should be allocated to the NH portion of the MSA.<sup>7</sup>
- To determine NH Fuel Oil consumption, the Massachusetts values were scaled based on details in Appendix Table 6.

**Appendix Table 6: Scaling for the Fuel Oil Adjustment Ratio for NH<sup>8</sup>**

| Scale                   | Fuel oil consumption per household using fuel oil (gallons) |
|-------------------------|---|
| US                      | 507   |
| MA                      | 619   |
| NH                      | 591   |
| <b>Adjustment Ratio</b> | <b>1.45</b>   |

### ***Electricity & Stationary Energy Summary***

Results of the electricity and stationary energy consumption for the MSA are describe in Appendix Tables 7 & 8.

**Appendix Table 7: SUMMARY Community-wide Electricity & Stationary Energy Usage and Emissions**

| Type                         | kWh            | Percent |
|------------------------------|----------------|---------|
| Investor Owned Utilities     | 30,852,994,515 | 82.4%   |
| Community Choice Aggregation | 602,824,815    | 1.6%    |
| Municipal Utilities          | 4,179,481,554  | 11.2%   |
| T&D Losses (all)             | 1,805,800,273  | 4.8%    |

**Appendix Table 8: SUMMARY Community-wide Summary of Building Energy Use by Subsector & Source**

| Subsector  | Source                   | Emissions (MTCO <sub>2</sub> e) | % of Total Energy Emissions |
|--|--------------------------|---------------------------------|-----------------------------|
| <b>Residential Buildings</b>   | Res. Electricity         | 2,798,270                       | 12.6%                       |
|  | Res. Fuel Oil            | 3,087,157                       | 13.9%                       |
|  | Res. Natural Gas         | 4,686,913                       | 21.1%                       |
| <b>Commercial &amp; Institutional Buildings and Facilities &amp; Manufacturing Industries*</b> | Comm. & Man. Electricity | 5,288,009                       | 23.8%                       |
|  | Comm. & Man. Fuel Oil    | 530,477                         | 2.4%                        |
|  |                          | 5,795,272                       | 26.1%                       |
| <b>All Buildings</b>   | Electricity              | 8,086,279                       | 36.4%                       |
|  | Fuel Oil                 | 3,617,634                       | 16.3%                       |
|  | Natural Gas              | 10,482,185                      | 47.2%                       |

\*The above energy consumption and emissions data excludes electricity transmission and distribution losses associated with electricity and natural gas.

## Transportation

There were a few variations made to the methodology from the MAPC Tool, in order to most accurately represent the MSA. They included the following:

- The MAPC Tool recommends using 2014 MA Vehicle Census Data for on-road vehicles, however, more recent data has since been released and was used to interpolate values for 2017.
- NH on-road vehicle data was sourced from national Department of Transportation (DOT) and Department of Energy (DOE) resources, as described in Appendix Table 9. The data was not available by the same fuel types as MA data.
- Data pertaining to public buses were likely already included in both the MA and NH datasets and the quantities of fuel obtained directly from regional transit authorities (RTAs) were subtracted from commercial fuel usage and bus fuel usage for MA and NH, respectively, to avoid double counting emissions associated with public transportation.



**Appendix Table 9: Transportation Sources and Datasets**

| Sector         | State   | Source  | Dataset   | Description   |
|----------------|---------|---|---|---|
| Transportation | MA      | On-road vehicles  | MA Vehicle census (interpolated by MAPC to obtain 2017 data)  | Residential, commercial, state, and municipal vehicle fuel usage by fuel type (gasoline, diesel, flexfuel, hybrid, electric)                      |
| Transportation | NH      | On-road vehicles  | DOT State Statistical Abstracts, <sup>9</sup><br>DOT Highway Statistics<br>Motor Fuel Use <sup>10</sup> | Registered vehicles, vehicle miles traveled, and fuel usage (gasoline and special fuels) by vehicle type (automobile, buses, trucks, motorcycles) |
| Transportation | NH      | Electric vehicles   | DOE Vehicle Registrations by State <sup>11</sup>  | Electric vehicles registered in NH in 2017  |
| Transportation | MA      | MBTA Buses, trackless trolley, The Ride, ferries, heavy & light rail, commuter rail | MBTA Data APTA Metrics  | Quantities of gasoline, diesel, CNG, and electricity by source  |
| Transportation | MA & NH | Other regional transit authorities  | Contacted RTAs directly   | Quantities of gasoline, diesel, CNG, and electricity associated with fixed route and on-demand services   |

Refer to Appendix Tables 12 & 13 for emissions by transportation subsector.

## Waste

Waste emissions were calculated based on the following four subsectors: Solid Waste Disposal, Biological Treatment of Waste, Incineration and Open Burning, and Wastewater Treatment and Discharge.

There were a few variations made to the methodology from the MAPC Tool, in order to most accurately represent the MSA. They included the following:

- Disposal locations of waste by town are not tracked. Therefore, waste crossing in or out of the MSA boundary was unable to be determined. Consequently, it was assumed that waste categorized as net exports were Scope 3, and in-state disposal were Scope 1.
- Mass of solid waste disposed by composting and anaerobic digestion for the MSA was estimated using the EPA dataset described in Appendix Table 10. Using MA as the basis for the MSA estimation, tons per person of composting waste were calculated, and then that rate was applied to the total population of the MSA.

**Appendix Table 10: Waste Sources and Datasets**

| Sector | State   | Source                             | Dataset                              | Description  |
|--------|---------|------------------------------------|--------------------------------------|--|
| Waste  | MA & NH | Solid Waste Disposal               | MassDEP <sup>12</sup>                | Tons landfilled waste  |
| Waste  | MA & NH | Biological Treatment of Waste      | EPA <sup>13</sup>                    | Composting & anaerobic digestion   |
| Waste  | MA & NH | Incineration and Open Burning      | MassDEP <sup>16</sup>                | Tons incinerated waste   |
| Waste  | MA & NH | Wastewater Treatment and Discharge | US Census, MWRA (contacted directly) | Percent of MSA population served by WWTPs with anaerobic digestion and co-generation systems and other WWTPs |

Refer to Appendix Tables 12 & 13 for emissions by waste subsector.

## ***Agriculture***

The MAPC GHG Emissions Inventory Tool does not include natural and working lands and it was therefore added to this regional GHG inventory to account for emissions associated with agricultural fertilizers. For this sector, the EPA Local Greenhouse Gas Inventory Tool was used to determine methodology.

Fertilizer application to lands within the MSA contribute to GHG emissions from the volatilization into the air in the form of nitrous oxide (N<sub>2</sub>O). The portion of the quantities of commercial fertilizer purchased in MA and NH were allocated to the MSA by using the percent of farms or acres of farms by county. In counties that are not fully within the MSA, a portion was allocated based on land area.

**Appendix Table 11: Agriculture Sources and Datasets**

| Sector      | State   | Source                      | Dataset   | Description                             |
|-------------|---------|-----------------------------|---|---|
| Agriculture | MA & NH | Commercial fertilizer usage | EPA <sup>14</sup>   | Commercial fertilizer purchased in 2017 |
|             |         |                             | State Census of Agriculture (UMass <sup>15</sup> , USDA <sup>16</sup> ) | Land in farms in 2017                   |

### ***Natural and Working Lands***

The MAPC GHG Emissions Inventory Tool does not include natural and working lands and it was therefore added to this regional GHG inventory to account for carbon sequestration from trees. The OurTrees tool from i-Tree<sup>17</sup> was used to obtain the annual carbon sequestered and CO<sub>2</sub> equivalent in units of tons for each community in the MSA. The value for all communities was summed to get the total annual carbon sequestration for the region. This tool also provides air pollution removal for carbon monoxide, ozone, nitrogen dioxide, sulfur dioxide, and PM<sub>2.5</sub>.

## **A.3. Further GHG Inventory Detailed Results**

**Appendix Table 12: Community-wide Emissions Summary by Sector**

| Sector                  | MTCO <sub>2</sub> e | MMTCO <sub>2</sub> e | Percent     |
|-------------------------|---------------------|----------------------|-------------|
| Stationary Energy       | 18,309,819          | 18.3                 | 41%         |
| Electricity             | 8,487,727           | 8.5                  | 19%         |
| Transportation          | 15,290,327          | 15.3                 | 34%         |
| Waste                   | 2,300,097           | 2.3                  | 5%          |
| Agriculture             | 29,597              | 0.03                 | 0.1%        |
| Natural & Working Lands | (2,484,411)         | (2.5)                |             |
| <b>Gross Emissions</b>  | <b>44,417,568</b>   | <b>44.4</b>          | <b>100%</b> |
| <b>Net Emissions</b>    | <b>41,933,156</b>   | <b>41.9</b>          |             |

**Appendix Table 13: Community-wide Emissions Summary by Sector and Subsector**

| Sector                          | Subsector                                | Total Emissions (MT CO <sub>2</sub> e) | % of Total Emissions | % of Emissions in Respective Sector |
|---------------------------------|--|--|----------------------|-------------------------------------|
| Stationary Energy & Electricity | Residential Buildings                    | 11,981,189                             | 27.0%                | 44.7%                               |
|                                 | C&I Buildings & Manufacturing Industries | 14,367,269                             | 32.3%                | 53.6%                               |
|                                 | Construction                             | 449,089                                | 1.0%                 | 1.7%                                |
| Transportation                  | MA Passenger Vehicles                    | 11,218,951                             | 25.3%                | 73.4%                               |
|                                 | MA Commercial Vehicles                   | 1,426,488                              | 3.2%                 | 9.3%                                |
|                                 | MA State & Municipal Vehicles            | 149,417                                | 0.3%                 | 1.0%                                |
|                                 | MA On-road Buses and Trolleys            | 126,007                                | 0.3%                 | 0.8%                                |
|                                 | MA Railways                              | 215,249                                | 0.5%                 | 1.4%                                |
|                                 | NH Vehicles                              | 2,153,116                              | 4.8%                 | 14.1%                               |
|                                 | NH Buses                                 | 1,099                                  | 0.0%                 | 0.0%                                |
| Waste                           | Solid Waste Disposal                     | 1,947,928                              | 4.4%                 | 84.7%                               |
|                                 | Biological Treatment of Waste            | 3,112                                  | 0.0%                 | 0.1%                                |
|                                 | Incineration and Open Burning            | 72,007                                 | 0.2%                 | 3.1%                                |
|                                 | Wastewater Treatment and Discharge       | 277,051                                | 0.6%                 | 12.0%                               |



| Sector  | Subsector             | Total Emissions (MT CO <sub>2</sub> e) | % of Total Emissions | % of Emissions in Respective Sector |
|---|-----------------------|--|----------------------|-------------------------------------|
| Agriculture   | Commercial Fertilizer | 29,597                                 | 0.1%                 | 100%                                |
| Natural & Working Lands                               | Carbon Sequestration  | (2,484,411.40)                         |                      |                                     |
| <b>All Sectors &amp; Subsectors (Gross Emissions)</b> |                       | <b>44,417,568</b>                      | <b>100%</b>          | <b>100%</b>                         |

# Section Endnotes



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1. <https://www.masssavedata.com/public/home>
2. <https://www.eia.gov/electricity/data.php>
3. <https://www.mass.gov/info-details/find-an-mlp-annual-return>
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7. <https://www.nhes.nh.gov/elmi/products/documents/vs23-all-chap-full-pub.pdf> (pg. 51 of 103)
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15. <https://ag.umass.edu/resources/massachusetts-agricultural-data/acres-land-in-farms>
16. [https://www.nass.usda.gov/Publications/AgCensus/2017/Online\\_Resources/County\\_Profiles/New\\_Hampshire/cp99033.pdf](https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/New_Hampshire/cp99033.pdf)
17. <https://ourtrees.itreetools.org/#/>



# Appendix B.

## Greenhouse Gas Emissions Reductions Calculations

## B.1. Greenhouse Gas Reduction Measure Quantification Approach

The estimated greenhouse gas emissions (GHG) reductions were calculated for each of the eleven priority measures using a variety of publicly available data. All emissions reduction values are provided in units of metric tons of carbon dioxide equivalent per year (MTCO<sub>2</sub>e/year), for the year that the measure is completed. Data sources include:

- **Reports published by MA and NH state departments**
  - *Examples: MA Clean Energy and Climate Plan for 2025 and 2030, MA Decarbonization Roadmap, Solid Waste Master Plan, etc.*
- **Local examples of successful projects that have tracked metrics**
  - *Examples: Fare-free transit, bike share, etc.*
- **Quantification tools developed by governments and utilities**
  - *Examples: EPA Avoided Emissions and Generation Tool (AVERT), Mass Save Heating Comparison Calculator, etc.*

The GHG inventory inputs and outputs were modified in order to calculate the GHG emissions reduction for each priority measure. For calculations that were not directly related to inventory data, consistent 2017 emissions factors were used to estimate the impact of activity data (e.g., kWh, gallons, etc.). Emissions associated with electricity are expected to decrease over time as more renewable energy is included in the ISO New England grid mix. For measures related to electrification of buildings and vehicles, the increased electricity associated with the switch from fossil fuels to electric was included in most calculations. However, emissions from increased electricity consumption are expected to decrease over time and/or may not capture increased renewable electricity usage at the local level, which may result in an under-estimate the potential reductions. During the Comprehensive Climate Action Plan, additional emissions modeling will better estimate the changing electricity emissions factors. A brief description of the key assumptions accompanies the values for each measure. Many of the calculations include a low and high range based on these assumptions. Emissions reduction calculations are calculated per measure and should not be viewed as an aggregated amount due to potential for double counting emissions reductions and/or interactivity between measures.

### TRANSPORTATION

#### ***T1. Strategy: Make Public Transit More Affordable & Accessible***

**T1. Action:** Implement fare-free or reduced fare routes and/or passes on key routes in underserved areas served by the RTAs within the MSA. Implement accessibility and resiliency measures at and near stops and stations (i.e. benches, ramps, shade structures, sidewalk improvements, lighting, signage in multiple languages) and improve frequency and reliability of buses and other transit modes.

**T1. GHG Emissions Reduction = 134,298 MTCO<sub>2</sub>e/year to 268,596 MTCO<sub>2</sub>e/year**

**T1. Approach:** Reductions were calculated based on information from the Worcester Regional Transit Authority (WRTA) fare-free program, which is projecting an increase in ridership by 16%

from FY23 to FY24 (for system-wide free fares).<sup>1</sup> Using National Transit Database Transit Agency Profile ridership information for 2017, the range of emissions reductions was calculated based on assuming an increased ridership between 8% and 16% on the MBTA and all RTAs in the MSA.<sup>2</sup> Gasoline savings were calculated assuming the avoided trips would have been an average of 10.7 miles with a gasoline vehicle<sup>3</sup> with a fuel efficiency of 22.1 miles per gallon.<sup>4</sup>

## ***T2. Strategy: Expand Multi-Modal Transportation & Micro-Mobility***

**T2. Action:** Create and expand multimodal transportation networks and infrastructure that are safe and accessible to pedestrians, cyclists, and other micro-mobility technology users (i.e., bike share and e-bike or e-scooter users). Prioritize connecting commercial centers, schools, and parks, especially where access to public transit is limited. Develop maps and guides that illustrate these networks.

### **T2. GHG Emissions Reduction = 2,166 MTCO<sub>2</sub>e/year to 4,332 MTCO<sub>2</sub>e/year**

**T2. Approach:** This measure would lead to an increase in the number of people that bike to work via Blue Bikes (bike share). The GHG reductions calculations are based on a 15 percent increase in number of people who bike to work and assume they travel an average Blue Bike trip distance (1.85 miles) for one additional trip per week (52 weeks/year).<sup>5</sup> This resulted in a savings of 245,789 gallons of gasoline, or if it is assumed the same number of people are taking two trips per week,<sup>6</sup> this would yield a savings of 491,577 gallons of gasoline.

## ***T3. Strategy: Make EVs More Affordable & Accessible***

**T3. Action:** Create EV car share programs; prioritize access and affordability for low-income households. Expand financial assistance programs (i.e., subsidies, rebates, low-cost financing) for purchase of EVs.

### **T3. GHG Emissions Reduction = 269,427 MTCO<sub>2</sub>e/year to 538,854 MTCO<sub>2</sub>e/year**

**T3. Approach:** Massachusetts needs 970,000 EVs on the road by 2030 to meet emissions reduction goals,<sup>7</sup> of which about 610,302 vehicles are within the MA portion of the MSA. Assuming the same ratio for NH, an additional 58,799 vehicles are included in the analysis. For an average fuel efficiency of 22.1 miles per gallon<sup>4</sup> and an average of 12,371 miles traveled per year, switching from gasoline vehicles to EVs (0.31 kWh/mile)<sup>8</sup> yields a GHG reduction of 4.027 MTCO<sub>2</sub>e/vehicle (accounting for the increase in electricity). If all vehicles were electrified by 2030, the MSA would see a reduction of about 2,694,269 MTCO<sub>2</sub>e (based on 2017 emissions factors).<sup>9</sup> This measure alone is unlikely to accomplish the goal and therefore a range of 10% to 20% is used to allocate possible reductions.

## ***T4. Strategy: Expand Access To & Affordability of EV Charging***

**T4. Action:** Develop and implement a regional EV charging network strategy, with a focus on public, curbside, overnight charging, especially near multifamily housing and commercial centers. Explore EV charging incentives and cost reduction programs to make charging equitable and accessible to LMI drivers.

### **T4. GHG Emissions Reduction = 65,936 MTCO<sub>2</sub>e/year to 131,873 MTCO<sub>2</sub>e/year**



**T4. Approach:** The MSA has an estimated 1,161,901 vehicles<sup>10</sup> that are owned by people that live in multifamily buildings with three or more units. Assuming that one Level 2 charging port can support 16 electric vehicles (based on the MA Electric Vehicle Infrastructure Coordinating Council Initial Assessment),<sup>11</sup> 13,203 charging ports would be needed to support the electrification of 211,255 vehicles (out of the total of 1,161,901 vehicles) owned by residents of multifamily buildings, to meet the State's 2030 vehicle electrification and emissions reduction goals.<sup>12 13</sup> If this were achieved in 2030, the annual emissions reduction would equate to 659,364 MTCO<sub>2</sub>e (based on 2017 emissions factors). This measure alone is unlikely to accomplish the goal and therefore a range of 10% to 20% is used to allocate possible reductions.

## BUILDINGS

### ***B1. Strategy: Develop & Expand Technical Assistance Programs***

**B1. Action:** Develop and build on existing building decarbonization technical assistance programs (e.g. energy coaches, CAP agencies, community liaisons/ambassadors, on-call technical experts) to support residents and businesses with decarbonization planning, provide outreach and education support on climate and other issues (e.g. health impacts), and connect residents and businesses to funding and incentive opportunities.

**B1. GHG Emissions Reduction = 270,875 MTCO<sub>2</sub>e/year to 320,125 MTCO<sub>2</sub>e/year**

**B1. Approach:** Reductions were calculated based on 2017 Mass Save electric and gas incentive data as a proxy for the energy savings from a technical assistance program.<sup>14</sup> For communities with data unavailable, including NH communities, an average value was assumed based on the data for the rest of the MSA. The range shows the expected emissions reductions assuming a 10-30% increase in adoption rate relative to planned estimates and historical measure installation.

### ***B2. Strategy: Develop & Expand Funding/Finance Programs***

**B2. Action:** Establish financial assistance programs (i.e., on-bill financing, additional subsidies, pre-weatherization funds, carbon offset fund) to support building decarbonization, energy efficiency, on-site renewable energy, weatherization, and pre-weatherization barriers, with a focus on multifamily and affordable housing.

**B2. GHG Emissions Reduction = 320,125 MTCO<sub>2</sub>e/year to 369,375 MTCO<sub>2</sub>e/year**

**B2. Approach:** Reductions were calculated based on 2017 Mass Save electric and gas incentive data. For communities with data unavailable, including NH communities, an average value was assumed based on the data for the rest of the MSA.<sup>15</sup> The range shows the expected emissions reductions assuming a 30-50% increase in adoption rate relative to planned estimates and historical measure installation.

### ***B3. Strategy: Decarbonize Municipal Buildings***

**B3. Action:** Develop and implement a plan to transition new and existing municipal buildings to net-zero buildings through building electrification and renewable energy deployment. Establish a municipal technical assistance program to support decarbonization transition planning and implementation, including legal support to maximize availability of tax credits.

### **B3. GHG Emissions Reduction = 39,933 MTCO<sub>2</sub>e/year to 59,900 MTCO<sub>2</sub>e/year**

**B3. Approach:** Reductions were calculated by assuming municipal natural gas and heating oil usage (data from Mass Energy Insight for 2017) would decrease by a range of 10% to 15% by 2030.<sup>16</sup> Any increase in electricity usage is assumed to be from renewable sources and therefore no emissions associated with the increase in electricity are included in this calculation.

### ***B4. Strategy: Explore Renewable Thermal Energy Pilots/Projects***

**B3. Action:** Collaborate with utilities to accelerate and facilitate (and/or explore municipal ownership and development of) networked geothermal or water-based district heating and cooling projects in key neighborhoods.

### **B4. GHG Emissions Reduction = 1,468 MTCO<sub>2</sub>e/year - 2,935 MTCO<sub>2</sub>e/year**

**B4. Approach:** Given the lengthy process to design, permit, and construct this infrastructure, it was assumed that between 5 and 10 projects would come online between 2025 and 2030 that each serve 100 buildings.<sup>17</sup> Using the Mass Save Heating Comparison Calculator, it was determined that for every building, assumed to be 1,814 ft<sup>2</sup>, transitioning from a natural gas boiler (with portable AC units for a cooling system) to a geothermal heat pump with an annual usage of 586 therms would yield a carbon reduction of 2.1 MTCO<sub>2</sub>e per building.<sup>18</sup> It was assumed that for each project 90 buildings would be residential and 10 would be commercial. Commercial buildings were assumed to be 16,200 square feet and have a baseline energy use of 2.1 kWh per square foot and 38.4 cubic feet natural gas per square foot, based on the 2018 Commercial Buildings Energy Consumption Survey from EIA<sup>19</sup>. Assuming the same total MMBTU per building and that it was now all was electricity usage, this would result in an emissions savings of 10.5 MTCO<sub>2</sub>e per building, based on 2017 emissions factors and no increased efficiency.

## **ENERGY GENERATION**

### ***E1. Strategy: Develop Renewable Energy Projects***

**E1. Action:** Expand deployment of renewable energy projects such as community shared solar and microgrids through expanded municipal ownership and public-private partnerships.

### **E1. GHG Emissions Reduction = 206,160 MTCO<sub>2</sub>e/year to 269,049 MTCO<sub>2</sub>e/year**

**E1. Approach:** The total community solar in the MA portion of the MSA was 140.7 MW, as of 2022 according to the DOE Community Solar Market Trends.<sup>20</sup> The cumulative MW of community solar in the MA portion of the MSA have increased an average of 18% per year between 2018 and 2022. The emissions reductions reflect the avoided emissions in 2030 if capacity increases continued at a rate of 18% (low end) or increased to 22% (high end). The total MW capacity equates to 528.7 MW (low end) and 690.3 MW (high end) in 2030.

## ***E2. Strategy: Adopt Municipal Aggregation***

**E2. Action:** Increase usage of renewable electricity through expanding adoption of Municipal Aggregation with 100% renewable energy as the default option and achieving 100% renewables in municipal utility electric supply; include a subsidy for low-to-moderate income customers to ensure affordability.

### **E2. GHG Emissions Reduction =**

**Residential: 910,169 MTCO<sub>2</sub>e/year to 1,441,100 MTCO<sub>2</sub>e/year**

**Commercial: 1,006,074 MTCO<sub>2</sub>e/year to 1,341,431 MTCO<sub>2</sub>e/year**

**E2. Approach:** As of February 2024, there are 63 communities in the Massachusetts portion of the MSA that have been approved for municipal aggregation.<sup>21</sup> The emissions reduction associated with municipal aggregation demonstrates a range of 60% to 100% participation in a 100% renewable option for residential electricity usage and 30% to 40% participation in a 100% renewable option for commercial electricity, based on 2017 electricity consumption in these 63 communities. This approach was determined in collaboration by project team members.

## **WASTE**

### ***W1. Strategy: Reduce Solid Waste Going to Landfills & Incinerators***

**W1. GHG Emissions Reduction = 36,967 MTCO<sub>2</sub>e/year to 55,450 MTCO<sub>2</sub>e/year**

**W1. Approach:** The MA 2030 Solid Waste Master Plan has a 30% waste reduction goal.<sup>22</sup> This is equivalent to a reduction of 1,185,258 tons of waste (when applied to both MA and NH portions of MSA), half of which is assumed to be diverted to composting or anaerobic digestion (592,629 tons). This yields an emissions saving of 554,503 MTCO<sub>2</sub>e. If only a 20% reduction was achieved, and a 10% diversion to composting or anaerobic digestion, 369,669 MTCO<sub>2</sub>e would be reduced. It was assumed that 10% of these reductions can be attributed to this measure and that additional efforts would be needed to the state level to meet the goal identified in the Solid Waste Master Plan.

# Section Endnotes



Click for more  
information!

1. Central MA Regional Planning Commission
2. [https://www.transit.dot.gov/ntd/transit-agency-profiles?field\\_geography\\_target\\_id=All&field\\_address\\_administrative\\_area=MA&combine=](https://www.transit.dot.gov/ntd/transit-agency-profiles?field_geography_target_id=All&field_address_administrative_area=MA&combine=)
3. [https://nhts.ornl.gov/assets/2017\\_nhts\\_summary\\_travel\\_trends.pdf](https://nhts.ornl.gov/assets/2017_nhts_summary_travel_trends.pdf)
4. Based on 2017 vehicle census data provided by MAPC for passenger gasoline vehicles
5. <https://bluebikes.com/system-data>
6. [Data from Census.gov](#)
7. <https://www.mass.gov/doc/ma-2050-decarbonization-roadmap/download>
8. Average fuel economy used in GHG Inventory based on values from <https://www.fueleconomy.gov/>
9. <https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle#:~:text=typical%20passenger%20vehicle%3F-,A%20typical%20passenger%20vehicle%20emits%20about%204.6%20metric%20tons%20of,8%2C887%20grams%20of%20CO2>
10. Number of households is consistent with the number used in the GHG inventory and data for MA is from MAPC Data Common which is sourced from the American Community Survey. NH data obtained from original ACS source. <https://datacommon.mapc.org/browser/datasets/211>
11. <https://www.mass.gov/files/documents/2023/08/11/EVICC%20Initial%20Assessment%20Final%2008.11.2023.pdf>
12. [https://explore.dot.gov/views/StateStatisticalAbstracts\\_16699101653250/DashboardALT?%3Aembed=y&%3Aiid=1&%3AisGuestRedirectFromVizportal=y](https://explore.dot.gov/views/StateStatisticalAbstracts_16699101653250/DashboardALT?%3Aembed=y&%3Aiid=1&%3AisGuestRedirectFromVizportal=y)
13. <https://www.transportation.gov/rural/ev/toolkit/ev-basics/charging-speeds>
14. <https://www.masssavedata.com/Public/TimeSeries>
15. <https://www.masssavedata.com/Public/TimeSeries>
16. <https://www.massenergyinsight.net/>

17. [https://www.mass.gov/info-details/massachusetts-household-heating-costs?\\_gl=1\\*63pihx\\*\\_ga\\*Njk0MDk5MTMxLjE2NDQ4NDM3ODc.\\*\\_ga\\_MCLPEGW7WM\\*MTcwODUzMTQxOC45LjAuMTcwODUzMTQxOC4wLjAuMA](https://www.mass.gov/info-details/massachusetts-household-heating-costs?_gl=1*63pihx*_ga*Njk0MDk5MTMxLjE2NDQ4NDM3ODc.*_ga_MCLPEGW7WM*MTcwODUzMTQxOC45LjAuMTcwODUzMTQxOC4wLjAuMA)
18. <https://www.masssave.com/residential/heating-comparison-calculator>
19. [2018 Commercial Buildings Energy Consumption Survey, Preliminary Consumption and Expenditures Highlights \(eia.gov\)](#)
20. <https://www.energy.gov/communitysolar/community-solar-market-trends>
21. <https://www.mass.gov/info-details/municipal-aggregation>
22. <https://www.mass.gov/doc/2030-solid-waste-master-plan-working-together-toward-zero-waste/download>





# Appendix C.

Full List of LIDAC  
Communities

NOTE: LIDAC designations were sourced from the EPA IRA Disadvantaged Communities dataset provided by the EPA.

This dataset is a combination of the Climate and Economic Justice Screening Tool (CEJST) and the Environmental Justice Screening tool (EJScreen).

| State        | Total Number of Towns in MSA | Towns with LIDAC Census Tracts | Percentage of Towns with LIDACs | Total Census Tracts within MSA | Number of LIDAC Census Tracts | Percentage of LIDAC Census Tracts |
|--------------|------------------------------|--------------------------------|---------------------------------|--------------------------------|-------------------------------|-----------------------------------|
| MA           | 136                          | 49                             | 36%                             | 1013                           | 406                           | 40%                               |
| NH           | 31                           | 10                             | 32%                             | 110                            | 68                            | 62%                               |
| <b>TOTAL</b> | <b>167</b>                   | <b>59</b>                      | <b>35%</b>                      | <b>1123</b>                    | <b>474</b>                    | <b>42%</b>                        |

| Towns with LIDAC Census Tracts |            |               |
|--------------------------------|------------|---------------|
| Massachusetts                  |            | New Hampshire |
| Abington                       | Milford    | Derry         |
| Acton                          | Milton     | Hudson        |
| Ashland                        | Natick     | Kingston      |
| Beverly                        | Newton     | Londonderry   |
| Billerica                      | Norwood    | Merrimack     |
| Boston                         | Peabody    | Milford       |
| Braintree                      | Plymouth   | Nashua        |
| Bridgewater                    | Quincy     | Pelham        |
| Brockton                       | Randolph   | Salem         |
| Brookline                      | Revere     | Seabrook      |
| Cambridge                      | Salem      |               |
| Chelsea                        | Somerville |               |

| Towns with LIDAC Census Tracts |            |               |
|--------------------------------|------------|---------------|
| Massachusetts                  |            | New Hampshire |
| Danvers                        | Stoneham   |               |
| Dedham                         | Stoughton  |               |
| Everett                        | Swampscott |               |
| Framingham                     | Tewksbury  |               |
| Gloucester                     | Walpole    |               |
| Haverhill                      | Waltham    |               |
| Holbrook                       | Watertown  |               |
| Lawrence                       | Weymouth   |               |
| Lowell                         | Winchester |               |
| Lynn                           | Winthrop   |               |
| Malden                         | Woburn     |               |
| Marlborough                    |            |               |
| Medford                        |            |               |
| Methuen                        |            |               |



# Appendix D.

Other Funding Available



## Buildings

### Technical Assistance for Building Decarbonization

- (Federal Rebate) [High-Efficiency Electric Home Rebate Program](#): Covers 100 percent of electrification project costs for low-income households (who earn less than 80 percent of their Area Median Income) and 50 percent of costs for moderate-income households (who earn between 80 and 150 percent of their Area Median Income). A State energy office may use up to 20% of awarded funds for planning, administration, or technical assistance.
- (Federal) [Building Codes Implementation for Efficiency and Resilience Program](#): Designed to create or enable state or regional partnerships to provide training and materials to—(i) builders, contractors and subcontractors, architects, and other design and construction professionals, relating to meeting updated building energy codes in a cost-effective manner; and (ii) building code officials, relating to improving implementation of and compliance with building energy codes; (B) to collect and disseminate quantitative data on construction and codes implementation, including code pathways, performance metrics, and technologies used; (C) to develop and implement a plan for highly effective codes implementation, including measuring compliance; (D) to address various implementation needs in rural, suburban, and urban areas; and (E) to implement updates in energy codes for— (i) new residential and commercial buildings (including multifamily buildings); and (ii) additions and alterations to existing residential and commercial buildings (including multifamily buildings).
- (MA) [MassCEC Building Electrification and Transformation Accelerator \(BETA\)](#): Pilot program to develop a decarbonization assessment process for commercial buildings larger than 20,000 square feet and multifamily buildings with 15 units or more. The program will provide in-depth building audits to help plan electrification and decarbonization retrofits.
- (MA) [MassCEC EmPower Massachusetts](#): Provides funding to communities and community-based organization to explore, develop, and implement program models or projects that provide access to the benefits of clean energy for previously underserved populations.
- (MA) [Mass Save Programs](#): Provides services, rebates, incentives, training, and information to improve energy efficiency.
- (NH) [New Hampshire Saves Program](#): Provides electric and natural gas customers with information, incentives, and support designed to save energy and reduce costs.

### Financial Assistance for Building Decarbonization

- (Federal) [Energy Efficiency and Conservation Block Grant Program](#): Allows for grants to nonprofit organizations and governmental agencies for the purpose of performing energy efficiency retrofits.
- (Federal) [Solar for All](#): EPA will award up to 60 grants to states, territories, Tribal governments, municipalities, and eligible nonprofits to expand the number of low-income and disadvantaged communities primed for residential solar investment—enabling millions of low-income households to access affordable, resilient, and clean solar energy.
- (Federal) [Inflation Reduction Act Tax Credits for Energy Efficiency](#): Provides tax credits and deductions for clean energy and energy efficiency equipment.



- (Federal) [Green and Resilient Retrofit Program \(GRRP\)](#): Provides funding for direct loans and grants to fund projects that improve energy or water efficiency, enhance indoor air quality or sustainability, implement the use of zero-emissions electricity generation, low-emission building materials or processes, energy storage, or building electrification strategies, or address climate resilience, of eligible HUD-assisted multifamily properties.
- (Federal) [Greenhouse Gas Reduction Fund](#): Provides funding to deliver lower energy costs and economic revitalization to communities through the [National Clean Investment Fund](#), [Clean Communities Investment Accelerator](#), and the [Solar for All](#) competition.
- (Federal) [US Department of Treasury Capital Management Fund](#): Awards grants to Community development financial institutions (CDFIs) and non-profit affordable housing organizations to finance affordable housing solutions and community revitalization efforts that benefit individuals and families with low-incomes and low-income communities.
- (MA) [Income-Eligible LEAN Deep Energy Retrofit](#): Provides incentives for retrofits of income-eligible multifamily buildings to reduce site EUI by at least 40%.
- (MA) [Low- and Moderate-Income Decarbonization Program](#): Funds decarbonization retrofits of existing low- or moderate-income residential buildings.
- (MA) [Mass Save Programs](#): Provides services, rebates, incentives, training, and information to improve energy efficiency.
- (MA) [Weatherization Assistance Program](#): Provides LIHEAP-eligible households with energy efficiency services. Typical work includes air sealing, attic and/or sidewall insulation, weatherstripping and minor repairs associated with the weatherization installed measures.
- (MA) [MassCEC Equity Workforce Planning and Capacity Grants](#): Provides grants of up to \$30,000 to develop a program plan ready for implementation and grants of up to \$150,000 for capacity building to start or expand a clean energy equity workforce program.
- (MA) [Commonwealth Corporation Workforce Training Funding Program](#): Provides resources to Massachusetts businesses to fund training for current and newly hired employees.
- (MA) [HousingWorks Sustainable and Green Housing Initiatives](#): Consolidates the Transit Oriented Housing Program and the Climate Resilient Housing Program to accelerate and unlock new housing through, for example, office conversions and development of modular homes.
- (MA) [Affordable Housing Trust Fund](#): Provides resources to governmental subdivisions, community development corporations, local housing authorities, community action agencies, community-based or neighborhood-based non-profit housing organizations, non-profit organizations, for-profit entities, and private employers to create or preserve affordable housing.
- (MA) [MassHousing Climate Ready Housing Program](#): Funds projects to dramatically reduce carbon emissions and improve health of residents of affordable housing buildings.
- (MA) [MassHousing Neighborhood Stabilization Program](#): Provides capital grant funds for redevelopment, reconstruction, renovation, or repair of substandard properties.
- (NH) [New Hampshire Saves Program](#): Provides electric and natural gas customers with information, incentives, and support designed to save energy and reduce costs.

## Net-Zero Municipal Buildings

- (Federal) [Community Facilities Direct Loan & Grant Program](#): Provides affordable funding to develop essential community facilities **in rural areas**. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings.
- (Federal) [Energy Efficiency and Conservation Block Grant Program](#): Funding for development, implementation, and installation on or in any government building of the eligible entity of onsite renewable energy technology that generates electricity from renewable resources, including— (A) solar energy; (B) wind energy; (C) fuel cells; and (D) biomass.
- (Federal) [Grant Funding to Address Indoor Air Pollution at Schools](#): Provides funding to monitor and reduce GHG emissions and other air pollutants at K-12 schools in low-income and disadvantaged communities.
- (Federal) [Elective Pay](#): Allows tax-exempt and governmental entities to receive the full value of clean energy investment and production tax credits.
- (MA) [Community Compact Program](#): A community will agree to implement at least one best practice that they select from across a variety of areas. The community's chosen best practice(s) will be reviewed between the Commonwealth and the municipality to ensure that the best practice(s) chosen are unique to the municipality and reflect needed areas of improvement. The Greenhouse gas reduction and renewable energy best practice area requires that a community participate in programs offered by DOER's Green Communities Division to reduce energy use, cut GHG emissions attributed to buildings and vehicles, increase renewable energy, and adopt building codes that support energy efficiency and electrification in new construction and major renovations.
- (MA) [Mass Save Programs](#): Provides services, rebates, incentives, training, and information to improve energy efficiency.
- (MA) [Green Communities Climate Leader Communities Programs](#): Helps municipalities reduce emissions by electrifying non-electric energy uses and maximizing the efficiency of buildings and transportation.
- (MA) [Massachusetts School Building Authority](#): Provides funding to municipalities to support the design and construction of educationally-appropriate, flexible, sustainable, and cost-effective public school facilities.
- (MA/NH) [Energy Performance or Energy Service Contracts](#): Offered by energy service companies, which are commercial business or nonprofits that provide a range of energy solutions, including design and implementation of energy-saving project, to guarantee energy savings for the customer (often government and nonprofit entities).
- (NH) [Community Development Finance Authority's Clean Energy Fund](#): Provides technical and financial resources for municipalities, businesses, and non-profits to invest in energy efficiency improvements and renewable energy projects.
- (NH) [Community Facilities Energy Assessment Program](#): Provides grant funding to reduce the cost of energy-related studies for New Hampshire municipalities and non-profit organizations.

## District Scale Renewable Thermal Energy Projects

- (Federal Tax Credit) [Residential Clean Energy Tax Credit](#): Qualified expenses include the costs of new clean energy property including geothermal heat pumps.
- (Federal Rebate) [High-Efficiency Electric Home Rebate Program](#): Covers 100 percent of electrification project costs for low-income households (who earn less than 80 percent of their Area Median Income) and 50 percent of costs for moderate-income households (who earn between 80 and 150 percent of their Area Median Income).
- (MA) [Community Compact](#): A community will receive funding when they agree to implement at least one best practice that they select from across a variety of areas. The community's chosen best practice(s) will be reviewed between the Commonwealth and the municipality to ensure that the best practice(s) chosen are unique to the municipality and reflect needed areas of improvement. The Greenhouse gas reduction and renewable energy best practice requires that a municipality participate in programs offered by DOER's Green Communities Division to reduce energy use, cut GHG emissions attributed to buildings and vehicles, increase renewable energy, and adopt building codes that support energy efficiency and electrification in new construction and major renovations.
- (MA) [MassCEC Kickstart Massachusetts](#): Provides grants of up to \$50k to communities to assess potential sites for networked geothermal projects.



## Transportation

### Public Transit Affordability and Accessibility

- (Federal) [All Stations Accessibility Program](#): Eligible activities are capital projects to upgrade the accessibility of legacy rail fixed guideway public transportation systems for people with disabilities, including those who use wheelchairs, by increasing the number of existing stations or facilities for passenger use that meet or exceed the new construction standards of title II of the Americans with Disabilities Act.
- (Federal) [Better Utilizing Investments to Leverage Development \(BUILD\) Transportation Grants Program](#): Funds investments in transportation infrastructure, including transit.
- (Federal) [Capital Investment Grant Program](#): Funds transit capital investments, including heavy rail, commuter rail, light rail, streetcars, and bus rapid transit. Includes the New Starts, Small Starts, and Core Capacity Improvement Programs.
- (Federal) [Enhanced Mobility of Seniors & Individuals with Disabilities](#): Provides formula funding to meet the transportation needs of older adults and people with disabilities when transportation service is unavailable or insufficient.
- (Federal) [Low or No Emissions Grant Program](#): Provides funds for state and local authorities to purchase or lease zero-emission and low-emissions transit buses and acquire, construct, or lease required supporting facilities.
- (Federal) [Mobility, Access & Transportation Insecurity \(MATI\): Creating Links to Opportunity Research and Demonstration Program](#): Provides funding and support to explore strategies to improve people's mobility and access to daily needs and evaluate outcomes and impacts upon individuals and communities.

- (Federal) **Public Transportation Innovation Grant Program**: Provides funding to develop innovative products and services assisting transit agencies in better meeting the needs of their customers. Eligible recipients may include universities, public transportation systems, state DOTs, non-profit and for-profit entities.
- (MA) **Community Transit Grant Program**: All projects must center the needs of older adults and people with disabilities, and all projects must respond to a need identified in your region's Coordinated Human Service Transportation Plan. Eligible applicants can apply for funding to operate transportation services, support mobility management initiatives, or receive wheelchair-accessible vehicles.
- (MA) **Complete Streets Program**: provides technical assistance and construction funding to eligible municipalities. Eligible municipalities must pass a Complete Streets Policy and develop a Prioritization Plan. Currently, 290 of 351 municipalities have registered and 243 have approved plans. Project types include transit station/stop access Improvements like curb ramps, bus shelters, bike parking, Park & Ride, etc.
- (MA administered) **Community Development Block Grant (CDBG)**: Municipalities can apply for public social services funding to offer free or reduced-fare rides to low-income individuals. Wareham used funds to offer discounted dial-a-ride fares, bus passes, and out-of-town medical transportation to low-income seniors.
- (MA) **Regional Transit Innovation Grant**: Can be used to enhance and expand existing transit services; implement new and innovative transit services; expand service hours or weekend service; improve rural connectivity; improve connectivity across regional transit service areas; transit electrification; and/or operating and capital expenses.
- (MA) **Shared Streets and Spaces Grant Program**: Provides funding to municipalities and public transit authorities to quickly implement improvements to plazas, sidewalks, curbs, streets, bus stops, parking areas, and other public spaces in support of public health, safe mobility, and strengthened commerce.
- (MA) **State Transportation Improvement Program**: All federally-funded roadway and transit projects in Massachusetts. Includes projects such as bicycle paths, bridges, roadways, sidewalks, and transit improvements.
- (NH) **Statewide Transportation Improvement Program**: Four-year plan that provides details about federally-funded transportation projects that are being implemented in New Hampshire.

## Multi-Modal Transportation

- (Federal) **Advanced Transportation Technologies and Innovative Mobility Deployment**: Provides funding to deploy, install, and operate advanced transportation technologies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment including for advanced traveler information systems.
- (Federal) **Congestion Mitigation and Air Quality Improvement (CMAQ) Program**: Provides a funding source for State and local governments to fund transportation projects and programs to help meet the requirements of the Clean Air Act. Uses include bicycle and pedestrian facilities, shared micromobility projects including shared scooter systems, and more.
- (Federal) **Neighborhood Access and Equity Grant Program**: provides opportunities to redress the legacy of harm from transportation infrastructure including: construction-related displacement, environmental degradation, limited access to goods and services, degraded public health due to

air and noise pollution, limited opportunities for physical activity, and hampered economic vitality of the surrounding community. The Community Planning Grants portion of this program are for eligible feasibility studies of removing, retrofitting, or mitigating an existing facility to restore community connectivity or and other transportation planning activities. The Capital Construction Grants fund the replacement of an eligible facility with a new facility that restores community connectivity.

- (Federal) **Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Program**: Provides funds to plan and construct surface transportation infrastructure projects that will improve safety, environmental sustainability, quality of life, mobility and community connectivity, economic competitiveness and opportunity including tourism, state of good repair, partnership and collaboration, and innovation.
- (Federal) **Safe Streets and Roads for All (SS4A) Grant Program**: Implementation grants provide Federal funds to implement projects and strategies to address a roadway safety problem. Projects and strategies can be infrastructure, behavioral, and/or operational activities.
- (Federal) **The Transportation Alternatives (TA) Set-Aside**: Provides funding for a variety of generally smaller-scale transportation projects such as pedestrian and bicycle facilities development.
- (MA) **Complete Streets Program**: Provides technical assistance and construction funding to eligible municipalities. Eligible municipalities must pass a Complete Streets Policy and develop a Prioritization Plan. Currently, 290 of 351 municipalities have registered and 243 have approved plans. Project types include pedestrian and bike network connections, among others.
- (MA) **Shared Streets and Spaces Grant Program**: Provides funding to municipalities and public transit authorities to quickly implement improvements to plazas, sidewalks, curbs, streets, bus stops, parking areas, and other public spaces in support of public health, safe mobility, and strengthened commerce.
- (NH) **Complete Streets Program**: Provides technical assistance and construction funding to ensure safe access, convenience, and comfortable travel for pedestrians, bicyclists, motorists, and transit riders of all ages and abilities.

## EV Affordability

An additional EV Funding Resource can be found [here](#)

- (Federal Tax Credit) **Credits for new clean vehicles**: Buyers may qualify for a credit up to \$7,500 if you buy a new, qualified plug-in EV or fuel cell electric vehicle (FCV)
- (Federal Tax Credit) **Alternative Fuel Infrastructure Tax Credit (IRS) EV**: For charging infrastructure installed through December 31, 2032, is eligible for a tax credit of 30 percent of the cost, not to exceed \$100,000. Eligible fueling equipment must be installed in census tracts where the poverty rate is at least 20 percent, or the median family income is less than 80 percent of the State median family income level.
- (MA tax credit) **MOR-EV Rebate Program**: This program aims to reduce air pollution and greenhouse gas emissions and support greater adoption of electric vehicles across the Commonwealth by offering rebates to consumers (residents, corporations, and other entities) who register their on-road zero emission vehicles in Massachusetts. MOR-EV provides rebates for the purchase or lease of eligible battery electric vehicles and fuel-cell electric vehicles, including passenger cars and medium- and heavy-duty trucks and other vehicle types. The program also offers rebates for used EVs and a rebate adder for income-qualifying residents.



## EV Charging

Additional potential federal charging grants can be found [here](#)

- (Federal) [Charging and Fueling Infrastructure Grant Program](#): provides funding to strategically deploy publicly accessible electric vehicle charging infrastructure and other alternative fueling infrastructure. This grant program has two tracks: Corridor Charging (deploy electric vehicle charging in designated corridors) and Community Charging (develop infrastructure for public roads, schools, parks, and in publicly accessible parking facilities).
- (Federal) [Energy Storage Demonstration and Pilot Grant Program](#) DOE is directed to fund three energy storage demonstration projects by September 30, 2023 and establish a separate pilot grant program. Eligible uses include integrating fast charging of electric vehicles.
- (Federal) [Advanced Transportation Technologies and Innovative Mobility Deployment](#): Provides funding to deploy, install, and operate advanced transportation technologies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment including Integration of intelligent transportation systems with the smart grid and other energy distribution and charging systems.
- (Federal Formula Funds) [National Electric Vehicle Infrastructure Formula Program](#): Provides funding to States to strategically deploy electric vehicle (EV) charging infrastructure and to establish an interconnected network to facilitate data collection, access, and reliability. The acquisition and installation of electric vehicle charging infrastructure to serve as a catalyst for the deployment of such infrastructure and to connect it to a network to facilitate data collection, access, and reliability.
- (Federal) [Congestion Mitigation and Air Quality Improvement \(CMAQ\) Program](#): Provides a funding source for State and local governments to fund transportation projects and programs to help meet the requirements of the Clean Air Act. Uses include procuring electric vehicles and charging stations.
- (Federal Financing) [Transportation Infrastructure Financing and Innovation Act \(TIFIA\)](#): Provides credit assistance for qualified projects of regional and national significance. Any type of project that is eligible for Federal assistance through existing surface transportation programs (highway projects and transit capital projects) is eligible for the TIFIA credit program. An eligible project must be included in the applicable State Transportation Improvement Program.
- (MA) [Community Compact Program](#): is a voluntary, mutual agreement entered into between the Healey-Driscoll Administration and individual cities and towns of the Commonwealth, which will result in the implementation of at least one best practice that they select from across a variety of areas. The Resilient & Reliable Transportation best practice requires that a municipality facilitate increased use of electric vehicles and related infrastructure. Plans could include upgrades to the electric grid, analyses of charging station needs, installation of charging infrastructure, and replacement of gas or diesel municipal vehicles with electric vehicles when feasible.
- (MA) [MassEVIP Public Access Charging Incentives](#): Is one of several MassDEP rolling grant programs aimed at making electric vehicles (EVs) and EV charging stations more widely available across Massachusetts. provides incentives for property owners or managers with publicly accessible parking to acquire and install Level 1 and Level 2 EV charging stations. Funds up to 100% of government owned locations and up to 80% at all other locations.



## Electricity Generation

### Renewable Energy Projects

- (Federal) **Energy Storage Demonstration and Pilot Grant Program** DOE is directed to fund three energy storage demonstration projects by September 30, 2023 and establish a separate pilot grant program. Eligible uses include integrating renewable energy resource production.
- (Federal) **Solar for All:** EPA will award up to 60 grants to states, territories, Tribal governments, municipalities, and eligible nonprofits to expand the number of low-income and disadvantaged communities primed for residential solar investment—enabling millions of low-income households to access affordable, resilient, and clean solar energy.
- (MA) **Community Compact:** A community will receive funding when they agree to implement at least one best practice that they select from across a variety of areas. The community's chosen best practice(s) will be reviewed between the Commonwealth and the municipality to ensure that the best practice(s) chosen are unique to the municipality and reflect needed areas of improvement. The Greenhouse gas reduction and renewable energy best practice requires that a municipality participate in programs offered by DOER's Green Communities Division to reduce energy use, cut GHG emissions attributed to buildings and vehicles, increase renewable energy, and adopt building codes that support energy efficiency and electrification in new construction and major renovations.
- (NH) **Renewable Energy Fund:** Provides funds through renewable energy rebate programs or competitive grant solicitations, including residential and commercial and industrial solar and renewable energy rebates and low/moderate-income community solar programs.
- (NH) **Residential Renewable Electrical Generation Rebate Program:** Provides rebates to NH residents who install PV or wind turbine electrical generation systems.
- (NH) **Commercial & Industrial Solar Incentive Program:** Provides incentives to commercial and industrial businesses that install new solar electric or thermal facilities.

### Municipal Aggregation

- (Federal Tax Credit) **Elective Pay:** The IRA includes a provision that, in lieu of tax credits, makes a direct payment option available to non-taxable entities investing in and producing clean energy. Municipalities, along with entities such as water and school districts, will have access to a direct payment option applicable to tax years 2023 through 2032. Direct pay will be available through the following Production Tax Credit and Investment Tax Credit programs:
  - Renewable Electricity Production Tax Credit • Energy Investment Tax Credit
  - Carbon Capture and Sequestration Tax Credit
  - Advanced Energy Project Credit
  - Nuclear Power Production Tax Credit
  - Clean Electricity Investment Tax Credit
  - Clean Hydrogen Production Tax Credit
  - Commercial Clean Vehicle Credit

- Advanced Manufacturing Production Tax Credit
- Alternative Fuel Refueling Property Credit
- Clean Electricity Production Tax Credit
- Clean Fuel Production Credit



## Waste

- (Federal) **Solid Waste Infrastructure Recycling Grant Program**: Provides grants to improve post-consumer materials management and infrastructure; support improvements to local post-consumer materials management and recycling programs; and assist local waste management authorities in making improvements to local waste management systems.
- (Federal) **Consumer Recycling Education and Outreach Grant Program**: Provides funding for projects that will inform the public about residential or community recycling or composting programs, provide information about the materials that are accepted as part of residential or community recycling or composting programs, and increase collection rates and decrease contamination across the nation.
- (MA) **Efficiency and Regionalization Grant Program**: Provides financial support for governmental entities interested in implementing regionalization and other efficiency initiatives that allow for long-term sustainability.
- (MA) **Sustainable Materials Recovery Program (SMRP) Municipal Grants**: Supports local recycling, composting/organics, reuse, source reduction, policy development and enforcement activities that increase diversion and reduce disposal.
- (MA) **SMRP Recycling Dividends Program (RDP)**: Provides payments to municipalities that have implemented specific programs and policies proven to maximize reuse, recycling, and waste reduction.
- (MA) **Reduce, Reuse, Repair Micro-Grants**: Provides grants of up to \$5,000 to municipalities, regional authorities, and eligible organizations for short-term waste reduction projects.
- (MA) **Recycling & Reuse Business Development Grants**: Helps Massachusetts recycling processors and manufacturers create sustainable markets for eligible materials.
- (NH) **Unlined Municipal Landfill & Incinerator Closure Grant Program**: Provides reimbursement to municipalities for 20% of the eligible costs associated with the closure of an unlined landfill and/or incinerator.
- (NH) **Municipal Recycling and Storage Equipment Grants**: Provides funds to assist with the purchase of recycling equipment.



# **Appendix E.**

## Stakeholder and Community Engagement Summary

## Justice40 Advisory Group Survey | January 2024

Ahead of the first meeting, MAPC asked advisory group members to share their priorities for GHG reduction measures in the Buildings, Power Generation, and Transportation sectors.



### Electricity Generation

The advisory group members mentioned several priorities related to solar, including incorporating rooftop solar into existing low-income energy efficiency and weatherization programs, exploring programs to increase rooftop solar in low-income communities (potentially through shared solar), and partnering with institutions like hospitals to host community solar. Members also highlighted the need to potentially subsidize the cost of renewable power generation for low-income households and implement “one bill” community solar arrangements. Members highlighted measures like increasing grid redundancy, mitigating air pollution, developing easily accessible funding opportunities to support energy democracy projects in environmental justice communities, and creating high-quality job opportunities for BIPOC, low-income, and previously incarcerated community members.



### Buildings

The advisory group members suggested potential measures involving financial and technical assistance for building decarbonization and resilience upgrades for low-income households with a focus on subsidizing installation and operating costs of electrification measures to avoid increasing energy burden while keeping housing affordable. Members cited examples like BERDO and Portland’s PCEF as potential funding measures, and recommended expansion of Mass Save funding for retrofits. Members also recommended expedited permitting for affordable passive house construction and potential transit-oriented zoning changes.



### Transportation

Advisory group members suggested measures to encourage mode shift away from cars and reduce Vehicle Miles Traveled, including transit-oriented zoning and complete streets infrastructure investments. Related to EV adoption, members recommended expanding on-street and multifamily EV charging, subsidizing the cost of charger installations for low-income households, developing car sharing models, and improving communication about available EV resources and funding to BIPOC communities and indigenous tribes. Members highlighted the need to expand public transportation service and reliability, including in gateway cities and throughout Cape Cod, reduce public transportation costs, electrify the MBTA, and fund pilots to electrify ambulances traveling through environmental justice communities.



## Justice40 Advisory Group Meeting 1 | January 8, 2024

The Justice40 Advisory Group shared their feedback on the draft list of 20 measures.



### Electricity Generation

On the renewable energy measure, advisory group members highlighted the importance of on-bill financing for community solar projects. Members also identified a need for programs that increase rooftop solar in low-income communities, more effectively share information about solar opportunities, and pair upgrades with electrification to offset costs of switching from gas to heat pumps. Municipalities might consider partnerships with large institutions like hospitals, which could host microgrids or community solar. For the municipal aggregation measure, advisory group members suggested incentivizing municipalities to increase the percentage of low-income households enrolled and providing additional support to municipalities navigating the DPU filing process. For district energy projects, advisory group members recommended establishing clear pathways for community-based organizations to partner with municipalities on projects, exploring zoning changes necessary to pursue district energy projects, and focusing on wind and solar.



### Buildings

For financial assistance for building decarbonization, advisory group members built on previous comments that electrification should be fully subsidized for low- and medium-income owners and tenants, adding that funding must be easy to access, this measure must explicitly involve landlords, and this measure should incorporate barrier mitigation and resiliency measures. For the technical assistance measure, members recommended offering free heat pump coaching and providing more detailed estimates to households of the costs of electrification and potential solar savings. In discussions about rental energy disclosure and home energy ratings, advisory group members commented that this must be coupled with green leases or other measures to ensure housing stays affordable. For measures related to specialized energy code adoption, advisory group members said there needs to also be local funding and zoning relief. For measures related to municipal net-zero carbon standards, members encouraged municipalities to incorporate parking and transit access into standards.



### Transportation

In terms of multimodal transportation, advisory group members recommended that micromobility options be well integrated into public transit. In terms of public transportation reliability and service, advisory group members recommended that municipalities collaborate with transportation entities and also improve municipal-owned facilities like bus stops. For municipal fleet electrification, advisory group members recommended exploring electrifying ambulances and focusing municipal electrification in municipalities with environmental justice communities. For EV expansion (vehicles and charging), members emphasized the need for better engagement strategies and partnerships with CBOs and for consideration of subsidies for EVs and hybrids for low-income and rural households.

## Justice40 Advisory Group Meeting 2 | January 30, 2024

For each of the 10 selected measures, the Municipal Advisory Group members recommended who they think should be involved, anticipated barriers, and how they think this measure can be designed for equitable implementation.



### Electricity Generation

For the renewable energy measure, advisory group members recommended involving construction unions, safety net health systems and hospitals, contractors, vocational schools, mobile home communities, and public housing authorities, and identified potential barriers, including the logistics of community solar in dense neighborhoods and lack of education and awareness about community solar. For the municipal aggregation measure, advisory group members recommended involving housing authorities, police departments, and schools, and identified barriers including opt-in defaults and third-party suppliers. For thermal energy projects, advisory group members recommended focusing on dense urban communities with multifamily housing, particularly where decarbonization costs are a barrier, and income-eligible residents. Advisory group members highlighted a range of barriers, including a lack of skilled labor, the need for cultural monitoring to protect ancient sites, and laws including the National Environmental Policy Act, National Historic Preservation Act, the American Indian Religious Freedom Act, the Indian Development Act, and Executive Order 13007 on Indian Sacred Sites.



### Buildings

For the technical assistance for building decarbonization measure, advisory group members recommended collaboration with grassroots community-based organizations, unions with climate initiatives, first-time homebuyer assistance programs, and Community First Partnership communities. Advisory group members also encouraged a neighborhood-scale approach to decarbonization and the need to simultaneously improve health and safety and identified barriers including Mass Save's focus on energy efficiency rather than decarbonization, lack of funding for moderate-income households, and deferred maintenance. They highlighted the need to pair decarbonization efforts with solar to reduce energy burdens. For the financial assistance for building decarbonization measure, advisory group members recommended collaboration with vocational schools, landlords, labor groups, and cultural and interest groups and identified barriers and highlighted the need to learn from past efforts, such as the Green Justice Coalition. For the net-zero municipal buildings measure, advisory group members recommended collaboration with the MA School Building Authority, unions, and MassCEC.



### Transportation

For the public transit and affordability and accessibility measure, advisory group members said systematically excluded populations should be prioritized and highlighted that an MBTA low-income fare is in the works. Members cited barriers such as needing to build authentic trust-based relationships with community members and accountability in existing structures. For the multimodal transportation measure, advisory group members recommended collaboration with existing bike share programs, bike give outs in New Hampshire, and organizations who work with community members living with disabilities and said that time of use restrictions on bike paths and lack of bike lock infrastructure are barriers. For the EV affordability measure, advisory group members suggested rebates for hybrids and not just electric vehicles for low-income or rural households. For the EV charging measure, advisory group members said measures should focus on public housing and multifamily housing and engage private parking owners and landlords. Aging infrastructure, misconceptions around EVs, language barriers in outreach, and tension around parking space were cited as concerns.

## Justice40 Advisory Group Meeting 3 | February 15, 2024

### Electricity Generation, Waste, Transportation, Buildings

During the third meeting, advisory group members reviewed the draft PCAP measures and provided specific track changes and comments.

## Municipal Advisory Group Meeting 1 | November 20, 2023

The Municipal Advisory Group shared their current work and priorities for the near future and identified key co-benefits (e.g. public health benefits) that they would like to see reflected in the measures.



### Buildings

Advisory group members highlighted the need for regional technical assistance and matching funding for municipal and non-municipal decarbonization, dedicated Decarbonization staff at housing authorities, funding to address renter-landlord split incentives, and funding for pre-weatherization barriers.



### Transportation

Advisory group members highlighted the need for improved shared transportation options, increased awareness about public transportation, subsidies for public transportation, and coordinated, strategic network of Electric Vehicle Charging Stations.



### Electricity Generation

Advisory group members highlighted the need for regional technical assistance for battery storage, support for Municipal Light Plants' efforts, improved infrastructure planning for grid capacity, and additional resources to increase solar adoption in low-income households and reduce energy burden.

## Municipal Advisory Group Meeting 2 | January 9, 2024

The Municipal Advisory Group shared their feedback on the draft list of 20 measures.



### Buildings

For measures related to financial and technical assistance for building decarbonization, advisory group members encouraged the measure coordinate with existing Mass Save and DOER Climate Leaders programs, include funding for pre-weatherization barriers, create one place or “hub” to store all relevant information, prioritize small businesses and mixed-use buildings, and compel landlords to participate and provide funding specific to rental properties. For measures related to municipal decarbonization and net zero carbon standards, advisory group members highlighted the need for additional assistance related to direct pay and tax credits, guidance on messaging, coordination with the Climate Leaders Community Program, and collaboration with the Massachusetts School Building Authority. Advisory group members raised concerns about a measure to require rental energy disclosure, expressing that this would need to be coupled with requirements to not raise rents and heavily involve landlords



### Transportation

For measures related to multimodal transportation, advisory group members highlighted the need to fill gaps in the existing Blue Bike program and address zoning barriers. Advisory group members supported the fare free transportation measure and encouraged free fares for high school students and others. For municipal fleet electrification measures, advisory group members highlighted the need for additional state and federal funding for electric school buses and pilots for electrifying heavy duty vehicles. Advisory group members said that EV charging measures must include efforts to strengthen engagement with multifamily housing owners to increase direct charging capacity for renters, centralize and standardize ongoing costs of operating the network, and create alternative, non-municipal ownership models. Advisory group members also highlighted the need to reduce parking requirements, conduct air quality monitoring, and advocate for more MBTA funding.



### Electricity Generation

For measures related to renewable energy, advisory group members recommended incorporating battery storage, providing more technical assistance for low-income community solar programs, and providing support to municipalities to ensure use of available tax credits. For measures related to municipal aggregation, advisory group members emphasized the need to build out transmission infrastructure simultaneously, involve Municipal Light Plants in discussions, and consider the impacts of 100% renewable energy by default policies on costs to residents. For measures related to utility collaboration and district energy, advisory group members flagged that this measure may take too long to implement on the CPRG timeline and recommended seeking alternative funding sources and establishing longer term collaborations with utilities.



### Misc.

Across measures, advisory group members highlighted the importance of workforce development. Members recommended coordination with CAP agencies, development of vocational programs in Environmental Justice communities, and increased regional shared services and information sharing between small municipalities with less capacity.

## Municipal Advisory Group Meeting 3 | February 6, 2024

For each of the 11 selected measures, the Municipal Advisory Group members recommended who they think should be involved and how they think this measure can be designed for equitable implementation. In mid-February, Advisory Group members also provided specific track changes and comments on the draft measures.



### Buildings

For the draft technical assistance for building decarbonization measure, advisory group members recommended collaboration with landlords, contractors, and CAPs, and cited community-based energy coach programs, Electrify Cambridge, and other local programs as ongoing successful approaches. Advisory group members highlighted barriers to implementation including: split incentive challenges, lack of education and capacity around Mass Save programs, limited financing, the need for rent increase safeguards, and lack of contractor training. For the draft financial assistance for building decarbonization measure, advisory group members recommended collaboration with Mass Save, LEAN, housing authorities and other major developers of housing and identified barriers to implementation including the slow timeline of some Mass Save funding, the lack of capacity to take advantage of incentives, and the limits of ratepayer funding. For the draft net-zero municipal buildings measure, advisory group members recommended collaboration with MassCEC, DOER, and utilities. Members cited barriers including the need for more financial planning and instruments for municipalities, lack of workforce development, insufficient funding for retrofits, constantly changing funding context, varying local support, and others.



### Transportation

For the public transit affordability and accessibility measure, advisory group members encouraged collaboration with RTAs, TMAs, employers, and startups working on wayfinding products but saw barriers with the unreliable nature of underlying infrastructure and differences between suburban and urban contexts. For the multi-modal transportation measure, advisory group members encouraged regional coordination on regional assets (e.g. bike trail). For the EV affordability measure, advisory group members cited supply chain issues as a barrier. For the EV charging measure, advisory group members cited barriers including reliability concerns, municipal bottlenecks, and mismatches in the number of cars vs. chargers.



### Electricity Generation

For the draft municipal aggregation measure, advisory group members recommended collaboration with the Department of Public Utilities and investor-owned utilities, and cited delays in DPU rulings as a barrier.



### Waste

Within the waste sector, advisory group members cited several successful existing projects including a regional composting facility in Essex, municipal transfer stations, tool libraries and swap sheds, and more. The group cited the costs and availability of glass recycling and plastic bags contaminating recycling as barriers.



## Listening Session 2 and 3 | January 24 and 25, 2024

Attendees provided input on the 10 selected measures, including their ideas for implementation partners, equitable implementation, barriers, and necessary enabling actions.

**Note: Input from the first listening session is summarized in the Public Listening Sessions section.**



### Electricity Generation

For the renewable energy measure, attendees identified lack of capacity in small communities, confusing program requirements, and limited land availability as barriers. They recommended this measure include outreach programs about community solar, consider siting solar on the land in highway medians, incorporate community benefits agreements, include MLPs, and more. Key partners would include consultants, MLPs, solar co-ops, utilities, solar developer companies, financiers and bankers, and universities. DPU would also need to address its policies around transmission lines to make this measure successful. For the municipal aggregation proposal, attendees identified the long time required for approval and price spikes as barriers. Participants emphasized the need to incorporate technical assistance and financial assistance for CBOs with relationships in EJ communities and to integrate education about benefits of municipal aggregation and energy scams. They also recommended incorporating solar installations into this measure and providing specific support for low-income communities to “opt-up.” For the measure related to district thermal energy, participants said lack of understanding, technology immaturity, and the need to make large infrastructure upgrades (including digging up roads) are barriers. They emphasized the need to incorporate workforce development into this measure and specifically incorporate labor unions.



### Buildings

For the measure related to technical assistance for building decarbonization, attendees recommended that the measure design reflect key learnings from Mass Save’s Community First Partnership (CFP) program, incorporate remediation of health factors like lead, and center procedural justice. For the measure related to financial assistance for building decarbonization, attendees identified a range of potential implementation barriers, including renter-landlord split incentives and lack of education, the high cost of retrofits, language access, and differences in incentives in communities with Municipal Light Plants. Attendees again recommended this measure reflect CFP learnings, integrate closely with the technical assistance measure, reduce burdensome paperwork, and provide a wide array of financial options for payment (direct pay, tax incentives for landlords). Simultaneously, participants noted, the state must expand grid capacity and ensure Mass Save programs better serve renters. For the measure related to municipal decarbonization, attendees highlighted a need for innovative solar solutions in light of zoning and shade limitations on installations.



## Transportation

For the multimodal transportation measure, attendees identified barriers including lack of data on multimodal transportation use and competition between bike paths and parking spots. For measures related to expanded EV use and charging, participants cited lack of outreach to municipalities and landlords, lack of general education about EVs, costs to charge, and a limited maintenance budget as barriers to implementation. They highlighted the need to incorporate charging for heavy duty vehicles and to encourage coordination between internal municipal departments who might all touch pieces of updating EV infrastructure (e.g. opportunities to make EV infrastructure upgrades while a department is conducting sewer upgrades or other infrastructure upgrades). Housing authorities and regional entities should be involved, they said. For the measure related to expansion and improvement of public transportation, participants identified barriers including insufficient infrastructure in rural communities, lack of accessibility to T stations and bus stops, and insufficient language access efforts. Participants recommended a range of additions to strengthen the measure, including incorporating education measures like “transportation buddy” programs that raise awareness of existing transit options, establishing transit advisory groups, and expanding public transportation timing and reliability to meet the needs of service workers and others working outside of “standard” commuter hours. They said the T Riders Union and employers should be involved and that the region would need to see further investments in the MBTA to make this measure successful.