

CITY OF BOSTON

CLIMATE ACTION PLAN

2019 UPDATE

MAYOR MARTIN J. WALSH

October 2019



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Dear neighbors,

Addressing climate change has been a top priority for my administration ever since I took office in 2014. We've worked hard to cut the emissions that cause climate change, prepare our neighborhoods for its inevitable effects, and make sure Boston is a thriving and healthy community for generations to come. I'm proud of the progress we've made so far, from committing to become carbon neutral, to creating the first vision for a resilient Boston Harbor and coastline. We've made Boston a national and international leader in this work.

Now, we're taking our next big step. The 2019 Climate Action Plan Update details the specific actions we will take over the next five years to significantly cut emissions across all sectors of city life, in order to reach our ultimate goal of carbon neutrality.

Our work is informed by the most up-to-date science and projections from climate experts. The recent report from the United Nations Intergovernmental Panel on Climate Change (IPCC), as well as the United States' Fourth National Climate Assessment, show that the global community must act with urgency to confront this crisis before it's too late. In Boston, we're heeding this warning, and setting a strong example by acting to become carbon neutral by 2050.

The Climate Action Plan is by the people and for the people of Boston. Over five years, we talked with thousands of Bostonians at dozens of Greenovate events and public forums. We worked closely with businesses, non-profits, colleges and universities, and faith communities. We heard over and over that climate change is already affecting people's lives. They have seen stronger storms and more flooding along our waterfront. This past summer was the hottest ever on record, with heat waves putting our most vulnerable communities at risk. Climate change is here. It's happening now, and our city is united in our commitment to address it.

This carbon reduction plan works hand-in-hand with Climate Ready Boston, our initiative to prepare neighborhoods for the impacts we know we will face as a result of climate change, as well as Resilient Boston Harbor, our plan to strengthen Boston's entire 47-mile coastline with a system of parks, beaches, and trails that block floods and improve quality of life all year round.

We know communities that contribute the least to climate pollution bear the greatest impacts of climate change. As we reduce emissions and prepare our communities for the impacts of climate change, we must place people first. This means designing and implementing policies for and with communities of color, low-income neighborhoods, youth, older adults, women, people with impairments, persons facing homelessness, and people with limited English proficiency. This also means asking those who have contributed disproportionately to climate change to take action first. By placing equity at the heart of climate action, we can achieve fair outcomes for every Bostonian.

Implementing this plan is a major undertaking, and it's one of the most important challenges we'll face as a city. It will require courageous solutions and creative teamwork. We must make our buildings and our transportation systems much more energy efficient. We must invest in clean energy and job training.

We must rise to the occasion, because our city's future depends on it. We will be successful, because Bostonians are known for pursuing what is right and just, even in the face of adversity. We know what's at stake if we do not act with urgency. I look forward to working with you as we build a carbon-free and climate-ready future.

Sincerely,



Martin J. Walsh, Mayor



INTRODUCTION

The City of Boston has long recognized the importance of climate action to safeguard the future of our community. In 2007, the City began releasing and updating a Climate Action Plan that sets ambitious goals to reduce emissions and prepare for the impacts of climate change, and lays out strategies to reach them. In 2017, Mayor Martin J. Walsh strengthened our emissions reduction goal to achieving carbon neutrality. The 2019 Climate Action Plan Update sets the stage for Boston's transition to carbon neutrality and describes our work plan for the next five years. By laying out detailed steps, this Plan sets the City and all of its partners up for success.



The City of Boston has installed solar panels on the roof of the Tobin Community Center.

Individuals and organizations across the city have already taken many significant steps to reduce their climate impact. Boston has added more than 24 MW in local solar power capacity since 2015.[1] More than 56,000 homes, or 22 percent of all households in Boston, have received no-cost energy assessments from Mass Save.[2] The number of households that use fuel oil for heating has dropped from more than 45,000 to under 22,000.[3] Energy-positive (E+) homes are being built in Dorchester, Roxbury, Jamaica Plain and Mission Hill. Large commercial buildings (50,000 square feet or larger) reduced their total energy use by more than 7 percent between 2013 and 2017, and large new developments are identifying pathways to carbon neutrality and exploring district energy systems. Boston residents and workers drove 14 percent fewer miles per person in 2017 than they did in 2005.

The 2019 Climate Action Plan Update will accelerate Boston's progress, charting a clear course for reaching Boston's 2030 and 2050 carbon reduction goals.[4] These actions will require the collaboration of all sectors, especially to ensure that benefits are shared equitably among Boston residents.

WHAT IS CARBON NEUTRALITY?

Carbon neutrality means releasing no net carbon emissions on an annual basis. For Boston, this means reducing carbon emissions from buildings, transportation, waste, and our energy supply as much as possible, and supporting activities that remove carbon from the atmosphere (carbon offsets) to compensate for any remaining emissions. According to the Carbon Free Boston analysis, we can eliminate up to 90 percent of carbon emissions using existing technologies.

1 *Massachusetts Clean Energy Center, Renewable Energy Production Tracking System, accessed online July 2019.*

2 *Data from Mass Save (2009- Q2 2019), and U.S. Census Bureau, American Community Survey (ACS), 5-Year Estimates.*

3 *U.S. Census Bureau, American Community Survey (ACS), 1-Year Estimates.*

4 *In this document, "carbon" or "carbon emissions" refers to greenhouse gas emissions measured in tons of carbon dioxide equivalent. For more information, please refer to the City of Boston Greenhouse Gas Inventory Methodology.*

BOSTON IS...

#1 MOST ENERGY-EFFICIENT CITY

in the country, 2013 through 2019

- American Council for an Energy Efficient Economy



2019

National Planning Achievement Award for Resilience

- American Planning Association

DEADLINE 2020

1 OF FIRST SIX CITIES

to commit to Deadline 2020 *- C40 Cities*



10-MINUTE WALKS

Every Bostonian lives within a 10-minute walk from a high-quality public park

- The Trust for Public Land

5 YRS AHEAD OF SCHEDULE

Boston reached its 2020 carbon target for municipal operations

- City of Boston 2017 GHG Inventory Report

#3



most walkable city in the U.S.

- 2019 Walk Score

STATE OF THE CLIMATE

Since Boston released its first Climate Action Plan in 2007, our climate has changed considerably:

- July 2019 was Boston's hottest month on record since record-keeping began in 1872.[5]
- In the winter of 2015, Boston broke its all-time seasonal snow record since we began keeping records in 1872.[6]
- On 22 April 2019, Boston received 2.3 inches of rain, which broke an 82-year old record. The previous single-day record was 1.89 inches in April 1937.[7]
- In January 2018, Boston experienced a "bomb cyclone" that caused tidal surge and icy flooding. The National Weather Service recorded its highest water level since it began keeping records for Boston Habor in 1921.[8]



The Charles River froze over during the winter of 2015, when Boston received a record amount of snow.

As a coastal city, Boston is particularly vulnerable to sea level rise, as well as other effects of climate change such as extreme temperatures and precipitation. These effects will disproportionately affect communities of color, women, youth, disabled people, elderly people and people with limited English proficiency. Projected impacts include:[9]

- By 2050, Boston's summers may be as hot as Washington, DC's summers are today; by the end of the century, they may be hotter than Birmingham, AL summers are today.
- Heat-related mortality was 2.9 per 100,000 people per year in Boston from 1985 to 2016. This rate is expected to more than double in the 2020s. By the 2080s, this rate may more than triple to 10.5 per 100,000 under a moderate emissions scenario, and could reach 19.3 per 100,000 in a "business-as-usual" emissions scenario.
- As soon as the 2050s, 7 percent of the total land area in the city could be exposed to stormwater flooding from more frequent, more intense rain storms.
- At the end of the century, between 10 and 20 percent of Charlestown, East Boston, Downtown, and South Boston will face flooding at high tide, even when there is no storm.
- In the latter part of this century (2070s or later), if we don't act, the buildings most exposed to coastal and river flooding will predominantly be residential and mixed-use buildings that house over 88,000 people (nearly 15 percent of Boston's population).



Bostonians take a break from the summer heat in the Frog Pond at the Commons.

5 *Monthly Mean Average Temperature for Boston Area, MA from Northeast Regional Climate Center, NOWData, accessed online 4 September 2019.*

6 *National Weather Service, "Boston Breaks Record Seasonal Snowfall," 15 March 2015, accessed online 26 September 2019.*

7 *National Weather Service, Record Event Report, April 22nd, 2019, accessed online 4 September 2019.*

8 *Historic crest from National Weather Service, Boston Harbor Hydrograph, accessed online 26 September 2019.*

9 *City of Boston, "Climate Ready Boston: Final Report," December 2016, pp. xviii-xxxi.*

BOSTON'S CLIMATE GOALS

In 2011, the City of Boston set carbon reduction goals of 25 percent by 2020 and 80 percent by 2050 below 2005 levels. To avoid more extreme climate change impacts, Boston, and indeed the entire global community, needs to take bolder action sooner. Future sea level rise and temperature change depend on how much we, around the world, are able to cut carbon emissions. With a sharp reduction in global emissions, end of century sea level rise could stay under two feet in Boston; a continuation of business as usual may result in over seven feet of sea level rise.[10]

In his 2017 State of the City address, Mayor Martin J. Walsh announced Boston's goal of carbon neutrality by 2050—an ambitious yet necessary commitment to meet the urgency of the climate challenge. Becoming carbon neutral means that in 2050 Boston will release no net carbon emissions into the atmosphere. In *Imagine Boston* 2030, our city's long-term strategic plan, we also set an interim carbon reduction goal of 50 percent by 2030. Our carbon neutrality goal means that Boston is fulfilling our commitment to the Paris Climate Agreement and leading efforts to keep global warming under 1.5 degrees Celsius.

By 2017, the City of Boston reduced emissions from municipal buildings and fleets by more than 40 percent below 2005 levels. Based on the progress the City expects to make in energy efficiency and renewable energy, this Plan increases our reduction goal for municipal operations from 50 percent to 60 percent by 2030.



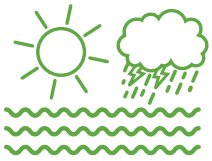
MITIGATION

Reduce community-wide carbon emissions by

50% *in* **2030** & 100% *in* **2050**

Reduce municipal emissions by

60% *in* **2030** & 100% *in* **2050**



ADAPTATION

Prepare for sea level rise, hotter summers, and more rainfall during storms



MOBILITY

Empower Bostonians to access all parts of the city safely and reliably by transit, on foot or on a bike



WASTE REDUCTION

Become a zero waste community and increase the recycling rate from 25% to

80%



CONNECTED COMMUNITIES

Enhance community connectivity so that all families may thrive in a carbon-neutral, climate-ready Boston

10 *City of Boston, "Climate Ready Boston: Final Report," December 2016, p. xviii.*



CARBON REDUCTION AND CLIMATE ADAPTATION

Why we need to do both

Climate action has been divided into two primary strategies: carbon reduction and climate adaptation. Carbon reduction (sometimes called "mitigation") addresses the cause of climate change by stopping the release of greenhouse gases, and even drawing carbon out of the atmosphere. If we reduce emissions sufficiently, we can limit changes to the Earth's climate and avoid the worst climate change projections.

Adaptation addresses the impacts of climate change by preparing communities and the natural and built environment to withstand local climate change impacts. Even if we achieve our carbon reduction goals, the unprecedented amount of carbon we have released into the atmosphere is already changing our climate. Adaptation to these locked-in changes is necessary. However, if Boston and other communities do not eliminate carbon emissions, climate change could overwhelm our adaptation efforts. Climate Ready Boston, described later in this report, is our initiative to prepare Boston for the effects of climate change.

Effective climate action requires both adaptation and carbon reduction strategies.

Reaching carbon neutrality aligns with our goals to enhance our community's resilience to the impacts of climate change. The ambitious plans to protect the city from the impacts of climate change (Climate Ready Boston) will not be effective for long unless we address the cause. Actions to reduce carbon emissions also remove harmful air pollutants from our homes, places of work and streets. Making our buildings more energy efficient and fossil fuel free will make homes healthier and more comfortable and workplaces more productive. Investing in local clean power, energy storage and energy infrastructure will make our city more resilient to extreme weather. Investing in our building stock will create jobs and new business and research opportunities.

The City of Boston is committed to simultaneously addressing racial and social equity and environmental challenges. Vulnerable groups such as communities of color and low-income neighborhoods are often disproportionately impacted by environmental shocks and stresses and are less likely to have access to the resources necessary for recovery. Climate action in Boston has two guiding principles for equity.

First, people of color and low-income communities must not be disproportionately impacted by climate hazards. Second, benefits from climate mitigation and preparedness efforts should be shared equitably among all people.

DEADLINE 2020

The City of Boston is a member of C40 Cities, a global network of about 100 cities working together to limit climate change. Their 2017 report, Deadline 2020, found that the world's megacities needed to take significant action by 2020 to be on a path to meet their targets under the Paris Agreement for keeping global temperature rise below 1.5 degrees Celsius. By taking the actions identified in Deadline 2020, C40 cities could deliver around 40 percent of the global savings needed to achieve the goals of the Paris Agreement. This Climate Action Plan Update is part of Boston's commitment as a C40 member.



Mayor Martin Walsh attends the grand opening for Walker Park Apartments and Delphine's Courtyard Pocket Park in September 2019. The Walker Park Apartments are designed to a LEED Silver standard, equipped with high-efficiency heating systems and Energy Star-rated appliances. Future City-funded affordable housing projects will be designed to a Zero Net Carbon (ZNC) standard for healthier and greener affordable homes.



Image by k_notgeil from Pixabay



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CLIMATE ACTION ACROSS THE CITY

Climate action is not an isolated endeavor. Rather, it is inextricably tied to many of the City's wider social, environmental and economic goals. For this reason, climate action is embedded in many other citywide plans.

Imagine Boston 2030

The City's first comprehensive plan in 50 years, *Imagine Boston 2030*, sets a long-term vision for the City and outlines goals towards economic growth, increased affordability and equity, and climate change preparedness for 2030. This plan highlights some cross-cutting challenges and opportunities related to climate change, as the City assesses future policy, zoning, and other requirements in response to Boston's changing needs. Strategies detailed in the report include steps towards improving environmental quality and resiliency of waterfront areas, enhancing energy efficiency and security, as well as preparing Boston's built infrastructure and its residents for more frequent and intense heat waves, extreme storms, and flooding.

Resilient Boston

Urban resilience is the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, thrive, adapt and grow no matter what kinds of chronic stresses and acute shocks they experience.[11] *Resilient Boston*, the City's strategy for advancing resilience and racial equity, began a community dialogue that resulted in four long-term visions for Boston. One of the long-term visions is a connected, adaptive city that will:

- Develop a redundant and reliable public transportation network to provide equitable accessibility for all Bostonians;
- Prepare for the impacts of climate change and other threats while accelerating sustainable infrastructure, environment, and communities; and
- Improve the collaboration of partners working in Boston communities to address climate change and other emergencies.

Go Boston 2030

The *Go Boston 2030 Vision and Action Plan* establishes goals and actions related to the transportation networks and assets in the City that include:

- Expanding access of all modes of travel in Boston's neighborhoods;
- Improving safety related to transportation; and
- Ensuring reliability of Boston's transit and roadway networks.

The plan highlights the importance of increasing the use of public transit in order to reduce greenhouse gas emissions, and incorporates measures to ensure the resilience of our transportation networks in light of projected climate change impacts. The *Action Plan* details 58 projects and policies including transit and active transportation projects that would contribute to reductions in emissions.

Open Space and Recreation Plan 2015-2021

The *Open Space and Recreation Plan* presents an inventory of existing open space throughout the City. The Plan identified three central challenges, one of which is climate change and resilience, complementing the 2014 Climate Action Plan. Objectives and actions related to this challenge include:

- Evaluating opportunities for open space to serve as protective infrastructure in coastal areas and flood zones;
- Evaluating heat, energy use, and waste generation related to City parks; and
- Developing best practices and performance measures for green infrastructure in the City's open space sites.

11 *100 Resilient Cities, "What is Urban Resilience?," accessed online 3 September 2019.*



Every summer for the past few years, Newbury Street becomes car-free open space on select weekends, as part of the Open Newbury Street series.

Boston Housing 2030

In 2014, Boston released an updated housing plan that supports neighborhood health, the environment, community development, and economic growth. This plan starts with the need to build approximately 53,000 new housing units to accommodate the projected population growth by 2030, a task that would also create 51,000 construction jobs. A 2018 update increased the housing construction goal to align with updated population projections, and made a stronger commitment to affordability, prevention of displacement, and equitable housing access. The plan now calls for 69,000 new units of housing at a variety of income levels by 2030. That includes nearly 16,000 new units of income-restricted housing, which will bring Boston's total number of income-restricted units to 70,000. As the building sector represents the single greatest contribution to the city's energy consumption and carbon emissions, it is critical to ensure these new housing units are built to a standard consistent with our carbon neutrality goal. The City is promoting Transit-Oriented Development (TOD) to reduce the climate impact of new growth. Under the *Boston Housing* 2030 plan, 64 percent of all new housing production to date has been in highly transit-accessible areas (5 minute-walk to major transit), compared to just 37 percent in the existing housing stock.

BuildBPS

In September 2015, the city launched the BuildBPS master plan process. The report, released in March 2017, outlines strategies to address much-needed upgrades to the City's educational facilities with a long-range capital investment strategy. The BuildBPS initiative focuses on reducing the number of times students change schools from pre-K to grade 12, increasing access to quality learning centers, and siting new facilities in areas with low access to educational resources. The Plan adopted energy efficiency as a guiding principle for new construction, and, as BPS improves its existing facilities, identified climate control and electrical upgrades, green roofs, and solar and energy efficiency projects as opportunities to create environments that are conducive to learning, reduce operating costs, and demonstrate leadership on climate.



Mayor Martin Walsh attends the opening of Martin's Park, a climate-resilient and inclusive park and play space is the first of its kind in the City.

OUR PROGRESS SINCE 2014

The Greenovate Boston 2014 Climate Action Plan Update – the second update to the original 2007 plan – laid out 35 strategies and 98 actions, and set ambitious goals for 2020 and beyond. This section describes some of the major initiatives taken to implement the plan. A more detailed progress report is available on the City of Boston website.

CLIMATE READY BOSTON

Preparing for the impacts of climate change



In accordance with the 2014 Update , the City launched the **Climate Ready Boston** program and released the *Climate Ready Boston* plan in December 2016. Developed with support from the Boston Green Ribbon Commission and other local partners, the *Climate Ready Boston* plan included updated local climate projections, a detailed vulnerability analysis, and strategies to enhance our community's preparedness for climate change. The report identified three major risks: sea level rise, extreme heat, and extreme precipitation. The social vulnerability analysis identified communities and assets especially at risk from the impacts of climate change, including people of color, low-income people, women, youth, disabled people, people with limited English proficiency and older residents. The Climate Ready Boston plan included 11 strategies, with 39 actions. The Climate Ready Boston progress tracker is updated twice a year.[12]



The City launched the Climate Ready Dorchester process to develop coastal resilience solutions for the neighborhood at an open house in September 2019.

> *"We are working every day to be a Climate Ready Boston. [...] We're not just planning for the next storm we will face – we're planning for storms the next generation will face."*
>
> *– Mayor Martin J. Walsh, 2018 remarks to the Greater Boston Chamber of Commerce*

12 *City of Boston Climate Ready Boston Progress Tracker, accessible online.*



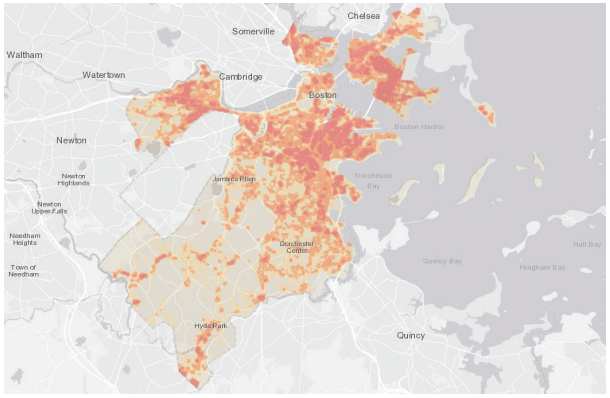
Resilient Boston Harbor (above) is Mayor Walsh's climate-ready vision to enhance Boston's waterfront. Announced in the fall of 2018, *Resilient Boston Harbor* shows how a network of accessible open spaces and climate-ready buildings and infrastructure will increase resilience to major flooding events, while also increasing access and open space area along the waterfront. Like all the City's current planning, it prepares the City for 40 inches of sea-level rise, expected around the 2070s. Furthering Mayor Walsh's vision are a series of detailed **neighborhood plans** for coastal resilience. Coastal resilience plans are complete for parts of East Boston and Charlestown, for South Boston, and are underway for Downtown, the North End, and Dorchester.

The Boston Planning & Development Agency (BPDA) has released coastal flood resilience design guidelines that serve as a reference for residents, business owners and developers to translate flood resilience strategies into best practices. The guidelines will also be used to administer a future **Coastal Flood Resilience Zoning Overlay District**. Recommendations for the Zoning Overlay District have been developed and are under internal review as of October 2019. The BPDA has also enacted the Smart Utilities Policy to prepare Boston's utility infrastructure for the impacts of climate change, and to increase the uptake of green infrastructure, district energy, and other smart technologies in large new developments.



CITIZEN SCIENCE IN BOSTON

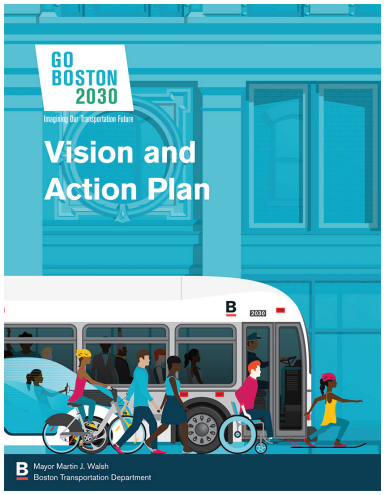
In the summer of 2019, the Museum of Science led a citizen science project to map the air temperatures experienced by residents in the summer. Dark, dense materials like asphalt in cities absorb heat during the day and release it back into the air at night, a phenomenon known as the Urban Heat Island effect. Hot summer nights can exacerbate the health effects of daytime exposure to high temperatures by disrupting sleep and increasing stress and dehydration. With the help of the Museum of Science, volunteers attached temperature sensors to their cars and bikes to collect data in Boston, Cambridge and Brookline. Partner scientists are using the data to create a map of temperatures that residents experience in their neighborhoods.



Source: Climate Ready Boston Map Explorer

GO BOSTON 2030

Reducing transportation emissions



Go Boston 2030 is the City's long-term plan to transform Boston's transportation system. In accordance with the 2014 Climate Action Plan Update, Go Boston 2030 adopted climate responsiveness as a guiding principle and set goals to make Boston a city where all residents have better and more equitable travel choices, where efficient transportation networks foster economic opportunity, and where the City has taken steps to prepare for climate change.

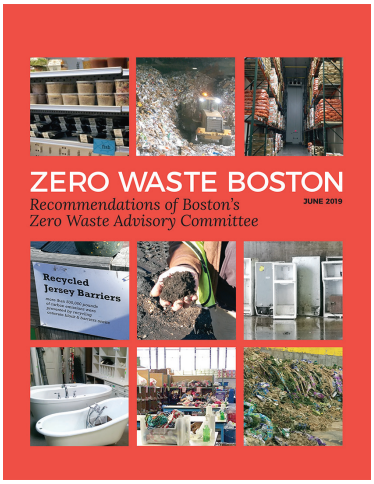
By emphasizing accessibility, safety and reliability, Go Boston 2030 will make it easier and more attractive for Bostonians to go car-free. Actions to shift travelers from driving alone to choosing shared and active transportation modes will make travel more efficient, reduce total vehicle miles traveled in Boston, and help decrease our transportation carbon emissions.

Since the plan's adoption, the City has invested in 30 new staff positions and started implementing many of the projects it laid out, including new bus lanes along priority corridors, mobility hubs, and key bike infrastructure connections.

The City of Boston has begun implementing Zero Waste Boston strategies, including expanding education and outreach campaigns around recycling in partnership with institutions like the New England Aquarium. The City is now developing curbside composting and textile recycling programs for residents.

ZERO WASTE BOSTON

Making Boston a waste- and litter-free city



In June 2019, Mayor Walsh released the Zero Waste Boston plan, completing another action from the 2014 plan. The Zero Waste Boston initiative aims to divert at least 80 percent of the City's waste from landfills and municipal solid waste combustors by 2035. The Zero Waste Boston strategies could reduce carbon emissions from waste disposal by 60 percent.

Short- and long-term measures to become a zero-waste city include:

- New services to handle capacity for increased diversion (waste collection services, drop off centers, transfer facilities);
- New rules to incentivize source reduction and waste diversion activities (requirements, fees, bans); and
- Education and outreach initiatives for residents and businesses to adopt new activities (technical assistance, behavior change marketing campaigns, grants).





Boston residents can drop off residential food scraps for composting in the Project Oscar bin outside City Hall and four other locations. The City is developing a curbside composting program for residents.

GREENOVATE BOSTON

Engaging Boston residents in climate action

Greenovate is Mayor Walsh's initiative to empower Boston residents to carry out community-level action in support of Boston's climate resilience, carbon neutrality, and zero waste goals. Greenovate's mission is to expand the community of people in Boston who are aware of, talking about, and taking action on climate change.

Launched in 2017, the Greenovate Boston Community Leaders program is increasing awareness and understanding about the climate impacts that Boston is facing, and involving Bostonians in developing and advancing climate actions to address it. To date, nearly 300 Bostonians have participated in the program. Through their engagement and community actions, the Leaders have reached more than 2,000 community members. Recently the program added a new track for highly engaged residents to participate as co-facilitators of the program and serve as community ambassadors to the City's climate and energy planning.

Greenovate Boston maintains a climate action guide for Boston residents to reduce their carbon footprint at home, at work, in school and around town. Newly developed behavior change campaigns combine behavioral science and marketing strategies will inform and motivate actions by Boston residents that collectively could produce significant carbon reductions.

BUILDING ENERGY REPORTING

Informing and supporting buildings to reduce energy use

In April 2013, the City enacted the Building Energy Reporting and Disclosure Ordinance (BERDO). The ordinance requires that all commercial and residential buildings that are 35,000 square feet or have 35 units or more report their energy and water use to the city each year. The City of Boston then discloses this information on Analyze Boston, the City's open data platform. The City provides outreach and support to help property owners and the compliance rate reached 90 percent of square feet in 2018. The BERDO data indicate that the first cohort of buildings to start reporting reduced their average energy use by 7 percent between 2014 and 2017.[13]

In addition to the reporting requirement, every five years, buildings must show they have taken action to reduce their energy use or emissions by 15 percent or conducted a detailed assessment of options to reduce their energy use. In 2019, the first cohort of buildings that began reporting to BERDO are now completing the energy action and assessment requirement.

Over 2,200 buildings are covered by BERDO. These buildings account for over 258 million square feet, or 34 percent of Boston's total floor space, as well as a significant proportion of Boston's carbon emissions.

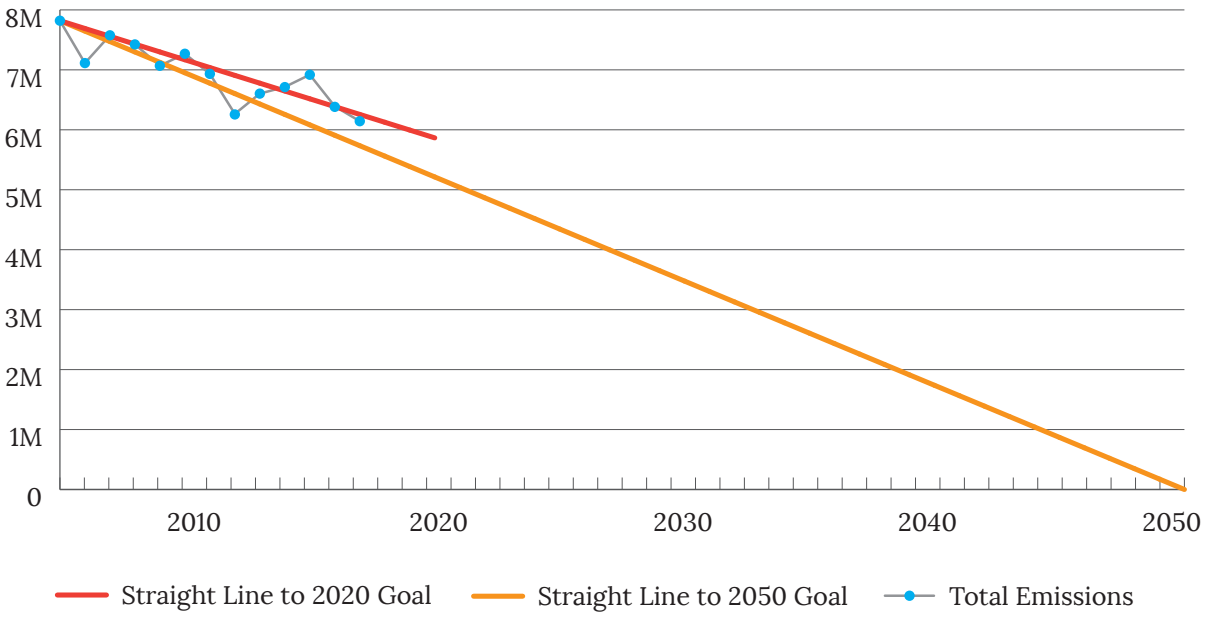
13 *Based on self-reported data from 750 buildings.*



BOSTON'S CARBON FOOTPRINT

The City of Boston has released an annual inventory of carbon emissions attributable to the City's residents and economic activity since 2005. The inventory allows the City to understand where our emissions come from, quantify the potential impacts of programs and policies to reduce emissions, and track progress towards our goals. The inventory accounts for emissions from energy use by residents, businesses and other activities, on- and off-road transportation (excluding airplanes), and waste management. To compile the inventory, we incorporate data from Boston utilities, data on fuel oil and vehicle fuel consumption, and a combination of measured and modeled transportation data.

Boston Community Carbon Emissions, 2005-2017, and Progress Towards Goals (in metric tons)



Since 2005, Boston's emissions have decreased by approximately 21 percent, from 7.9 to 6.1 million metric tons of carbon. The reduction in Boston's emissions has occurred at the same time that the population and the number of jobs in Boston have increased. Per capita emissions have decreased from 15 metric tons of carbon in 2005, to 9 metric tons in 2017. Emissions per million dollars of Gross City Product (GCP) have fallen from 86 to 48 metric tons of carbon per million dollars over the same period.

Almost all of the Boston community's carbon emissions stem from the building and transportation sectors: buildings account for 71 percent of total emissions; transportation accounts for nearly 29 percent of remaining emissions. Boston is currently on track to meet our 2020 carbon target.

Boston Carbon Emissions by Source, 2017



52%

COMMERCIAL, INDUSTRIAL/ LARGE RESIDENTIAL



29%

TRANSPORTATION



19%

SMALL RESIDENTIAL



<1%

FUGITIVE EMISSIONS



<1%

WASTEWATER TREATMENT

FACTORS DRIVING THE CHANGE

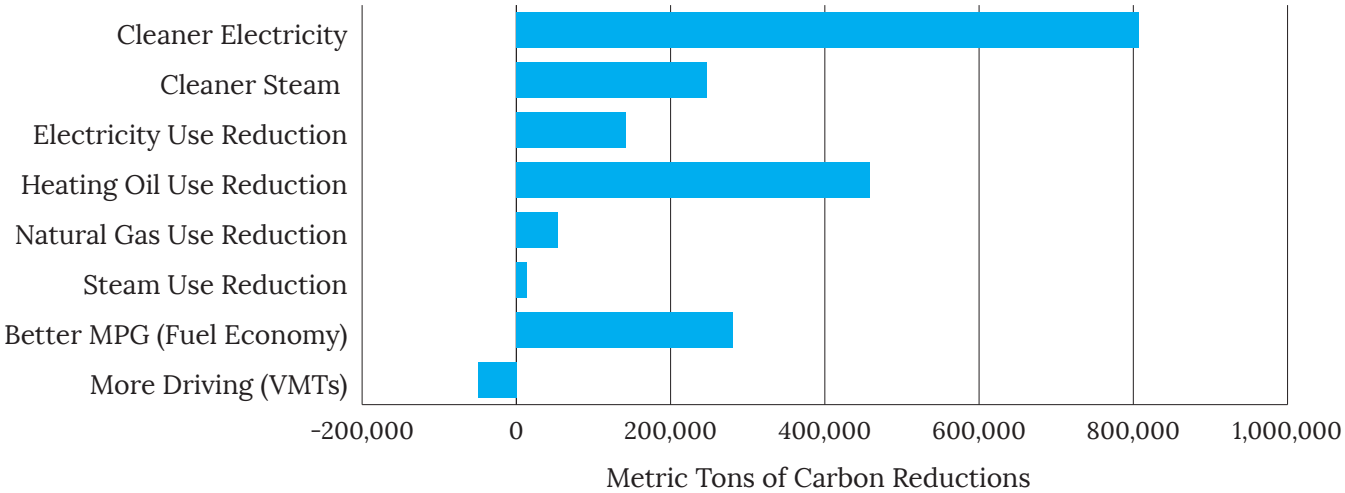
Approximately 45 percent of Boston's emissions reduction comes from the generation of cleaner electricity. This is the result of state and regional action to clean the New England electric grid, as well as falling natural gas prices. The Regional Greenhouse Gas Initiative (RGGI), a cap-and-trade program for power plants in the Northeast, has also helped make New England's electricity cleaner. Mandates to increase the amount of renewable supply on the grid, like the Commonwealth's Clean Energy Standard, will continue to support this trend. By replacing coal and oil with natural gas and, increasingly, renewables, New England power generators are producing more electricity with less carbon.

Fuel oil used for heating has also fallen by half since 2005. More than 20,000 Boston households have replaced fuel oil with cheaper, lower-carbon natural gas or electric heating systems. As heating systems are replaced, they can be upgraded with more efficient systems, or switched to systems that do not require the use of fossil fuels, like electric air-source and air-to-water heat pumps.

Steam generation for the Kendall power station, which supplies much of Downtown, has become cleaner due to fuel-switching from oil to natural gas and the addition of the Kendall cogeneration plant in 2014. The Kendall plant previously discharged hot process water directly into the Charles River, but now recovers the energy for steam distribution. The project not only cut the carbon intensity of steam, but also reduced sulfur dioxide and nitrogen oxide pollution.

Transportation emissions in Boston have held steady, despite a growing number of jobs attracting commuters to Boston. While the total miles driven in Boston has increased, individual travelers are driving fewer miles on average. Vehicles are also getting better mileage. Thanks to federal standards, the average fuel economy of Massachusetts vehicles increased 17 percent between 2005 and 2017.[14]

Source of Carbon Reductions, 2005-2017



Over 45 percent of past emissions reductions were due to a cleaner electricity grid, as power plants have switched from coal and oil to gas.

14 *Based on total vehicle miles traveled and State reported combined gasoline and gasohol data from Federal Highway Administration, Highway Statistics 2005 and Highway Statistics 2017.*



The Kendall cogeneration plant (pictured to the left) delivers green steam to hundreds of buildings in downtown Boston.

PROGRESS TOWARDS OUR 2020 GOALS

The City of Boston has made progress towards the goals set in the 2014 Climate Action Plan Update. The Boston community is on track towards our initial goal of reducing carbon emissions 25 percent by 2020.

In 2017, our emissions had decreased 21 percent from 2005 levels. We have also made progress towards the other 2020 targets set in the 2014 Climate Action Plan Update:

2020 TARGETS	ACHIEVED TO DATE
72,000 completed home energy audits	56,714 audits (79 percent of target) completed through Mass Save between 2009 and Q2 of 2019
36,000 weatherizations, heating system replacements or other significant upgrades	27,631 projects (77 percent of target) completed through Mass Save between 2009 and Q2 of 2019
7 percent energy use reduction across all BERDO buildings	7 percent average energy use reduction across the first cohort of BERDO buildings from 2013 to 2017
15 percent of energy use from cogeneration	125 megawatts of co-generation installed through 2018
10 megawatts of commercial solar	15 megawatts (150 percent of target) installed since 2015
Improved fuel economy	17 percent improvement between 2005 and 2017
5.5 percent below 2005 vehicle miles traveled (VMT)	Total VMT increased 14 percent while VMT per capita decreased 14 percent between 2005 and 2017



RISING TO THE CARBON NEUTRALITY CHALLENGE

While Boston is on track to meet our 2020 carbon target, we are not yet on a path to meet our 2050 carbon neutrality goal. That's why this Climate Action Plan Update is advancing priority actions for the next five years to put us on track for carbon neutrality. We will continue to work with our residents and local businesses and institutions, as well as international, national and regional partners, to implement our vision of a carbon-neutral Boston.

> *"We are America's climate champion, with a target date of 2050 for going 100 percent carbon-neutral."*
>
> *- Mayor Martin J. Walsh, State of the City 2017*



Mayor Walsh participates in a panel discussion with Mayor Turner of Houston, Mayor Garcetti of Los Angeles, and Mayor Rogero of Knoxville, during the 2018 International Mayors Climate Summit in Boston.

GLOBAL LEADERSHIP AND REGIONAL COLLABORATION

The City of Boston is on the forefront of climate action. In 2017, Mayor Walsh, joined a bipartisan coalition of 3,500 leaders in government, business, faith, and cultural institutions, to sign the "We Are Still In" declaration, pledging Boston's continued support for the Paris Climate Agreement, even as the U. S. President announced his intention to withdraw the United States from the agreement. Boston is also committed to meeting the Paris goals as a member of the Global Covenant of Mayors (GCoM) for Climate and Energy, an international alliance of cities and local governments that facilitates local partnerships, fosters a network of information sharing and publicly reports progress on carbon reduction and climate preparedness efforts.

Boston also participates in national and international networks dedicated to sharing lessons learned and collaborating with cities across the globe. In 2014, Boston joined the C40 Cities Climate Leadership Group, an international network of cities that are committed to action to address climate change through sustainable and quantifiable approaches. Mayor Walsh is a member of C40's steering committee. The City of Boston is also one of the founders the Urban Sustainability Directors Network (USDN), which enables peer-to-peer learning and joint projects among more than 180 North American cities.

The City of Boston works with partners in state government to further our common climate goals. The Global Warming Solutions Act is the Commonwealth of Massachusetts' framework legislation to reduce carbon emissions across the state by 80 percent from 2005 levels by 2050. Recent reports indicate that statewide carbon emissions in 2016 were 21 percent below the 1990 level.[15] In 2019, the Commonwealth launched the "80x50 Study" to assess a suite of mid- and long-term policies for the Commonwealth to best meet its 2050 goal.

15 *Commonwealth of Massachusetts, "Global Warming Solutions Act 10-Year Progress Report," April 2019.*



A street team engaged more than 1,400 residents and commuters in the 2019 Climate Action Plan Update.



More than 70 organizations participated in the working group that helped to develop this Plan.

The City of Boston and the 14 other neighboring cities and towns in the Metropolitan Mayors Coalition (MMC) collaborate on climate change issues that are affecting, and will continue to impact, communities in the region. In 2017, all MMC municipalities committed to achieving net-zero carbon emissions by 2050. Their actions range from expanding electric vehicle charging infrastructure to implementing community-wide zero-waste plans to adopting green building zoning requirements. The MMC cities and towns have also committed to coordinating climate preparedness efforts.

ENGAGING RESIDENTS AND LOCAL STAKEHOLDERS IN CLIMATE ACTION

For the 2019 Update, we broadly engaged the community to make sure our climate strategies reflect our values and work for everyone. Making our city carbon neutral and climate ready needs the help of all Boston residents, community groups, businesses, cultural institutions, and other local and metro area stakeholders. The City of Boston needs partners to collaborate on new programs and policies, and to innovate and take action within their own communities and industries.

A Street Team of Boston youth and residents engaged residents and commuters throughout Boston and learned about their climate action priorities, challenges, and needs. More than 10 community-based organizations supported the Street Team by recruiting participants and distributing information and surveys to their membership. By taking climate action engagement into Boston's neighborhoods, the Street Team engaged communities whose voices are often underrepresented in climate action planning, including:

- Black, Latinx, and other communities of color;
- Low-income communities;
- Community college and vocational school students;
- Renters;
- Small business owners (especially minority- and women-owned businesses); and
- Youth.

The City of Boston assembled a community Working Group to help identify key strategies and develop roadmaps for them. The Working Group included representatives of community groups, environmental justice and environmental advocacy groups, labor unions, student associations, developers, real estate and architecture associations, green construction companies, transportation service providers, regional agencies, neighboring municipalities, faith-based organizations, academic and cultural institutions, and more.

2019 CAP UPDATE COMMUNITY PARTICIPATION BY THE NUMBERS

- *More than 70 organizations participated in the Working Group, which met four times.*
- *20 Boston youth and other residents, including fluent Spanish, Haitian Creole and Mandarin Chinese speakers, received training and participated in the Street Team.*
- *The Street Team attended 19 community events and engaged more than 1,400 residents and commuters, collecting more than 700 survey responses and conducting 16 interviews with small businesses, 14 of which were minority- and/or women-owned.*

Moving forward, the Greenovate Boston program will continue to raise awareness and provide resources for residents to live sustainably, train residents to lead climate action in their communities, and connect Bostonians to engagement and volunteer opportunities with the City.

The City will also continue to engage civic, business and institutional leaders in climate action, building on existing partnerships with organizations such as the Boston Green Ribbon Commission.

Continuing our tradition of partnership and education around climate in Boston ensures that we can transform our community to become a carbon-neutral Boston that is healthy, thriving and resilient.



2020-2024 CARBON REDUCTION PLAN

Mayor Walsh has set a goal of making Boston carbon neutral by 2050. This plan focuses on strategies to accelerate emissions reductions from Boston's buildings, transportation systems, and energy supply.

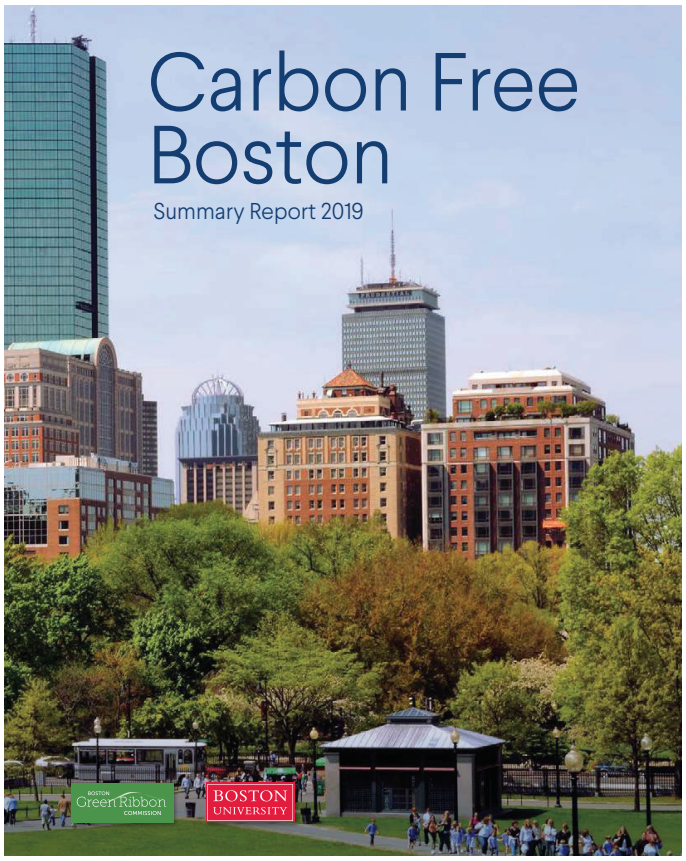
ABOUT THE CARBON FREE BOSTON REPORT

Mayor Walsh commissioned the Carbon Free Boston report from the Boston Green Ribbon Commission (GRC) in 2017. The analysis, led by the Boston University Institute for Sustainable Energy (ISE), assessed policy and existing technology options to decarbonize Boston's buildings, transportation, waste and energy sectors by 2050. The report, released early in 2019, presented pathways to carbon neutrality for the four sectors, as well as a framework to approach carbon offsets. The report was followed up with a social equity report and sector-specific technical reports.

The Carbon Free Boston analysis concluded that to reach carbon neutrality, Boston must:

- *Reduce demand for energy by increasing efficiency;*
- *Convert nearly everything that runs on fossil fuels to run on electricity; and*
- *Buy 100 percent carbon-free electricity.*

For buildings, the analysis indicated that adopting a Zero Net Carbon standard for new construction by 2030, and retrofitting and electrifying at least 80 percent of existing buildings are essential steps. In transportation, measures from the Go Boston 2030 plan to shift travelers from driving alone to shared and active modes are key to reduce vehicle miles traveled (VMT) and energy needs; Carbon Free Boston then found that all remaining drivers will need to switch to electric or other zero-emissions vehicles. The strategies laid out in Zero Waste Boston, our zero-waste plan, can decrease 78 percent of annual direct emissions from waste disposal.



The Carbon Free Boston analysis is the technical backbone of the 2019 Climate Action Plan Update.

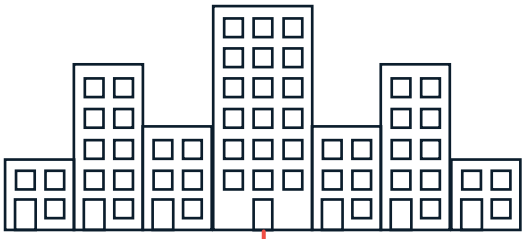
Based on findings from the Carbon Free Boston analysis and input from the community working group and other stakeholders, the 2019 Update details the most impactful strategies to help Boston meet its 2030 and 2050 carbon reduction goals. In particular, it focuses on key steps for the building, transportation and energy sectors over the next five years.

In order to ensure that climate action results in positive outcomes for all Bostonians, the 2019 Update process involved both an inclusive public engagement approach and a community-based working group. As we implement these strategies, the City of Boston will work with people of color, low-income communities, and other socially vulnerable communities, to achieve fair outcomes for all Bostonians.



BUILDINGS

Boston's buildings account for approximately 71 percent of our community carbon emissions, and represent the greatest opportunity for emissions reductions. Decarbonizing Boston's building sector depends on shifting to zero net carbon (ZNC) new construction by 2030, and retrofitting and electrifying at least 80 percent of our existing buildings over the next 30 years.

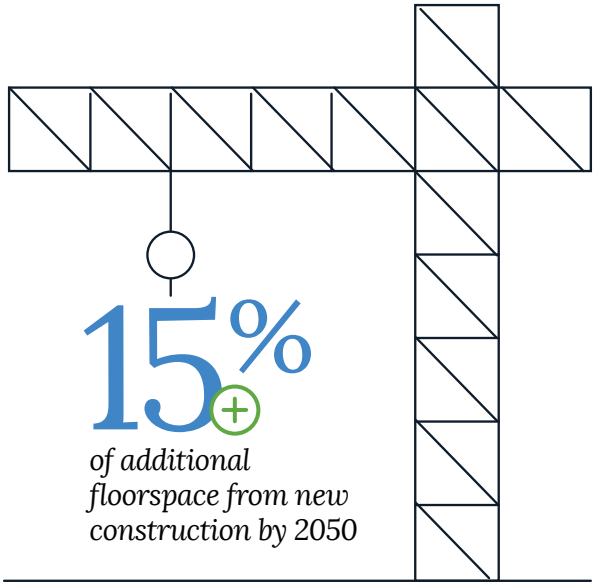


Boston has more than

86,000 *buildings*

4.3 MMT CO_2e

estimated amount of emissions from Boston buildings in 2017



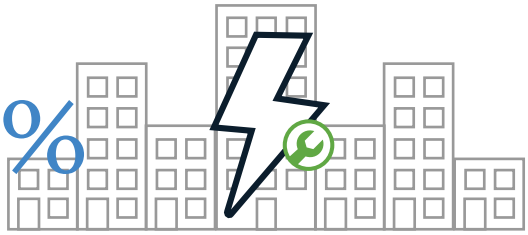
15%

of additional floorspace from new construction by 2050



New buildings need to be built to a zero net carbon standard by 2030

80%



Estimated number of buildings that need to undergo deep energy retrofits and be electrified by 2050

The 2,200 largest buildings represent about 34 percent of Boston's total floor area and account for close to half of our total emissions. The remaining building emissions come from 84,000 buildings. In many cases, smaller buildings may be easier to make carbon neutral now, but the largest buildings typically have more management and financial resources. Therefore, large and small buildings require different strategies and tools.

In a carbon-neutral building sector, all new development needs to be ZNC or energy positive. Since 2014, the City of Boston has seen 4 to 6 million square feet per year of new building space.

By 2050, Boston is expected to add 122 million square feet of new development. By shifting to ZNC new construction, building developers prevent the need for high-cost retrofits in the future. Timing matters. Adopting a ZNC standard by 2030 would cut 17 percent of cumulative emissions from new construction to 2050; adoption by 2023 would cut another 17 percent. The shift to ZNC building standards will also need to ensure that all ZNC development is resilient, and that ZNC residential development is inclusionary and affordable. The City of Boston can build on existing green building zoning requirements, including Article 37 of the Zoning Code.

WHAT ARE ZERO NET ENERGY (ZNE) AND ZERO NET CARBON (ZNC) BUILDINGS?

A ZNE building is a low-energy building that meets all of its annual energy needs with on-site renewable energy. ZNE buildings are typically connected to the electric grid. Some buildings are even energy-positive (E+) and deliver surplus energy to the grid.

A ZNC building is a low-energy fossil fuel-free building that meets its annual energy needs from a mix of on- and off-site renewable energy assets. Even with on-site renewable energy generation, larger and more energy-intensive buildings, like medical or laboratory facilities, may require off-site renewable energy delivered by the grid to be ZNC.

ZNE and ZNC buildings employ better insulated roofs and walls, better windows, and smaller, more efficient, fossil fuel-free heating, cooling, and ventilating systems to reduce energy loads. In new construction, cost savings from smaller systems offset other additional costs, enabling ZNE and ZNC buildings to be delivered for little or no added cost. Low energy buildings with renewable energy and energy storage are more resilient and reduce stress on the electric grid.

A ZNC building code would establish better standards for low-energy buildings and on-site renewable energy systems.



For existing buildings, widespread deep energy retrofits and fossil fuel-free heating and hot water systems are the most effective carbon reduction strategies. 85 percent of floorspace that will exist in 2050 has already been built. To reach carbon neutrality, four out of five buildings in Boston will need to implement deep energy retrofits and electrification by 2050. Deep energy retrofits can reduce citywide emissions by up to 40 percent using commercially available technologies. The City of Boston will lead by example by retrofitting municipal buildings, and will require private building owners to reduce their building emissions by introducing carbon performance standards. Both steps leverage existing incentives in state programs such as Mass Save. The work necessary to retrofit Boston's buildings has the potential to support the local economy and expand local career opportunities in energy efficiency and construction. It will also be important to develop anti-displacement strategies, specific strategies for affordable housing and historic buildings, and flexible compliance mechanisms.

WHAT DOES IT MEAN TO CARRY OUT A DEEP ENERGY RETROFIT AND ELECTRIFY A BUILDING?

Deep energy retrofits achieve at least a 50 percent energy use reduction by:

- *Upgrading mechanical systems, lighting systems, and appliances;*
- *Insulating walls, roofs, crawlspaces, and foundations;*
- *Upgrading HVAC and plumbing;*
- *Replacing windows;*
- *Air sealing; and*
- *Installing renewable energy systems where possible.*

Electrification means converting fossil fuel systems to electric equivalents. For example, a building owner could replace a fuel oil boiler with a heat pump. By combining deep energy retrofits with electrification and clean energy procurement, existing buildings can become carbon neutral.

Decarbonizing Boston's buildings requires a favorable regulatory context. The City of Boston will work with state, regional and local partners to support a building sector-wide shift toward energy-efficient practices and fossil fuel-free building systems and programs that connect Boston residents, women, people of color and youth to careers in green building and operations. The City will also advocate for state-level policy and program changes, including a ZNC building code and improvements to utility incentive programs, to better support our carbon neutrality goal.

The City of Boston will pursue the following strategies to reduce building emissions over the next five years:

1. Construct new municipal buildings to a zero net carbon standard
2. Adopt a zero net carbon standard for City-funded affordable housing in Boston
3. Strengthen green building zoning requirements to a zero net carbon standard
4. Invest in energy efficiency and renewable energy generation in municipal buildings
5. Develop a carbon emissions performance standard to decarbonize existing large buildings
6. Expand workforce development programs for building decarbonization
7. Advocate for state building policies that align with carbon neutrality by 2050

1 CONSTRUCT NEW MUNICIPAL BUILDINGS TO A ZERO NET CARBON STANDARD

The City of Boston will strengthen its new municipal building requirements to a multi-tiered Zero Net Carbon (ZNC) standard. This standard will significantly reduce or completely eliminate the use of fossil fuels in future City buildings.

By implementing this multi-tiered ZNC standard, along with high-efficiency climate and lighting systems, and efficient building enclosures, consumption of energy generated by fossil fuels will be significantly reduced, if not totally eliminated.

Because municipal buildings account for three-quarters of carbon emissions from local municipal operations, higher standards for building energy performance are essential to reach the Mayor's goal, and prepare Boston and its residents for future challenges. In the next few years, the City will look to apply a similar standard to large-scale building renovations.

EXPECTED BENEFITS



Up to 17,000 tons of annual carbon emissions avoided from municipal activities



Improved air quality in and around the buildings leading to better and healthier environments



Provides ZNC examples for other sectors and neighboring municipalities

BOSTON'S ZNC STANDARD

There are four tiers that comprise the City's established ZNC standard. The City will, upon individual project evaluation, target the most stringent tier possible. Each of these tiers is reliant on a carefully engineered, high-efficiency mechanical system and building enclosure.

- ZNC-onsite: a ZNC-onsite building is one that is optimally efficient, has no onsite fossil fuel combustion, and over the course of a year, generates renewable energy onsite in a quantity equal to or greater than the total amount of energy consumed onsite.
- ZNC-offsite: in contrast to ZNC onsite, this option allows for energy from offsite renewable sources to be included. Such fuel sources could include the purchase of renewable energy credits (RECs), or participation in a clean power purchase agreement (PPA).
- ZNC-ready: a building that is ZNC-ready would become ZNC (either onsite or offsite) when its electricity is supplied by 100 percent renewable sources.
- ZNC-convertible: a building that uses electricity supplemented with some onsite fossil fuel use (e.g., combined heat and power), but that can be readily changed over to 100 percent renewable energy sources upon availability.

2 ADOPT A ZERO NET CARBON STANDARD FOR CITY-FUNDED AFFORDABLE HOUSING IN BOSTON

The City of Boston will create and implement zero net carbon (ZNC) emissions guidelines for the construction of new affordable housing in Boston. These guidelines will increase the baseline requirements for new construction to a net-zero emissions standard in 2020, and extend it over the next few years to the retrofit of existing buildings.

Housing a Changing City, a comprehensive plan that addresses the housing needs of Boston's growing population, sets a goal of creating 69,000 new units of housing at a variety of income levels across the city. This includes nearly 16,000 new units of income-restricted housing, bringing Boston's total number of income-restricted units to 70,000 by 2030. The plan also points out the benefits of lowered utility costs and increased environmental health that can be provided by zero net carbon and energy-positive homes. This is particularly important since utility costs in Boston are among the highest nationally, and disproportionately impact households that are cost-burdened.

DESIGNING FOR EQUITY

- Prioritize resources to ensure those living in affordable housing are among the first to receive the benefits of clean and energy efficient homes

METRICS FOR SUCCESS

- 100 percent of new publicly funded affordable housing built after 2020 is ZNC or ZNC-ready

EXPECTED BENEFITS

- Avoided carbon emissions from new construction
- Reduced maintenance costs
- Increased access to renewable energy through on-site generation
- Health benefits from improved indoor air quality and level of comfort
- Reduction in energy costs for households



Energy-positive townhomes in Roxbury produce more energy than they need, thanks to energy-efficient design and on-site solar generation.

	STEPS	TIMELINE
New construction	1. Release Department of Neighorhood Development (DND) *Guidelines for Zero Emissions Buildings*	2019
	2. Identify high-carbon intensive building materials to avoid and suggest greener, alternative materials	2019-2020
	3. Give special consideration in 2019 funding round to Zero Emission Buildings	2019
	4. Update DND Request for Proposals (RFP) language to reflect new Zero Emission Building standards	2020
	5. Connect facilities managers to Building Operator Training programs	Ongoing
Existing buildings	1. Assess existing affordable housing stock and strategies for deep energy retrofits with combined electrification	2020
	2. Partner with affordable housing providers and residents to demonstrate and develop deep energy retrofit technologies (panelization systems, compact highly efficient mechanical systems, etc.) and processes by performing deep energy retrofits on properties across the city	Starting 2020
	3. Develop design guidelines for deep energy retrofits with electrification • Assess incremental cost and evaluate financial resource needs • Integrate resilience strategies into these guidelines for areas at risk to flooding, increased heat, other extreme weather events	By 2022
	4. Update RFP language to reflect deep energy retrofit and electrification strategies	By 2022

EXISTING TOOLS AND EFFORTS

› In 2011, the City launched the E+ Green Building Program. This program has demonstrated the feasibility of energy positive multi-family homes in Boston's neighborhoods with over 14 units completed and more than 100 in the pipeline including affordable housing in Dorchester, Jamaica Plain, Mission Hill and Roxbury.

COMMUNICATION AND EDUCATION

› Produce design workshops for affordable housing architects and developers to present and discuss the City's proposed pathways for achieving zero net carbon buildings

› Partner to develop workforce training program to educate contractors, project managers, and developers on air-sealing, framing, and other best practices for Zero Emissions building

3 STRENGTHEN GREEN BUILDING ZONING REQUIREMENTS TO A ZERO NET CARBON STANDARD

Building on existing resources and tools, the City will expand and strengthen its green building requirements to a zero net carbon (ZNC) standard in order to accelerate towards our 2050 carbon neutrality goal.

A ZNC standard requires that buildings emit no net carbon emissions. A ZNC building has an airtight, well-insulated exterior envelope and smaller, more efficient all-electric or carbon-free heating, cooling, and hot water systems. There are no on-site fossil fuel systems. Combined with on-site renewable generation and off-site renewable energy purchases, ZNC buildings with efficient envelopes and no fossil fuel systems can run entirely on clean, renewable energy, thus bringing their annual carbon emissions down to zero.

To strengthen its green building requirements, the Boston Planning & Development Agency (BPDA) will lead a public process to develop new zoning. As part of that work, the BPDA will work with other key City departments and engage the building sector and community.

DESIGNING FOR EQUITY

- Prioritize energy-positive (E+) ZNC projects in low-income and environmental justice communities
- Develop mechanisms to mitigate issues related to affordability, gentrification and displacement of low-income renters

METRICS FOR SUCCESS

- 100 percent of developments covered by the policy are built to a ZNC standard

EXPECTED BENEFITS



Up to a 19 percent reduction in total annual building emissions from business as usual



Increased thermal comfort and indoor air quality improvements for building occupants



Avoided costs of deep energy retrofits to comply with future performance standards



Lower operating costs for building owners and lower energy bills for tenants and occupants

COMMUNICATION AND EDUCATION

- Public awareness campaigns and recognition programs explaining the benefits of ZNC buildings and celebrating practice leaders including partnering with local professional organizations and advocacy groups
- Workshops and training on ZNC design, engineering, and construction practices and their benefits and opportunities for building owners, developers, contractors, inspectors and end-users
- Public outreach to residents, businesses, property owners, and design and real estate stakeholders in the development - and later, the implementation - of zoning recommendations and design guidelines

STEPS	TIMELINE	IMPLEMENTERS & PARTNERS
1. Require that building developers submit a *Carbon-Neutral Building Assessment* as part of Article 37 zoning review requirements	2019	BPDA, City
2. Promote new ZNC buildings in the Boston area to improve knowledge of ZNC costs and best practices	Ongoing	BPDA, in partnership with developers, architects and engineers, academic institutions, energy-focused community organizations
3. Launch technical analysis and public process to: • Assess the feasibility of ZNC standards for building types and develop timeline for implementation • Assess on-site renewable energy practices and standards and procurement of off-site renewable energy • Explore extending green building requirements to small project review (developments between 20,000 and 50,000 square feet) • Develop zoning recommendations for a ZNC standard	2019-2020	BPDA, City, technical experts, industry stakeholders, utilities, community groups
4. Enact new zoning requirements and timeline for implementation	2020	BPDA
5. Evaluate the creation of a carbon linkage fee	Starting 2020	City, BPDA
6. Communicate, educate, and oversee compliance of ZNC building requirements	Starting 2021	BPDA, City, industry associations, community groups

EXISTING TOOLS AND EFFORTS

› **Article 37 of the Boston Zoning Code** currently requires that all new construction subject to Article 80 Large Project Review (generally 50,000 square feet and over) meet minimum sustainability standards, using the LEED rating system. This system awards a range of points for energy performance, connectivity to transit, indoor air quality, construction waste management, and in other environmental impact realms. The Article 37 review process also includes a sustainability narrative, a climate change resiliency checklist and coordination with the Smart Utilities Policy.

› In 2011, the City adopted the Massachusetts **Stretch Energy Code**, which sets higher building energy efficiency and performance standards above the state's Base Building Energy Code. In June 2019, the Board of Building Regulations and Standards instructed their Energy Advisory Committee to recommend ways in which to incorporate net-zero energy provisions into the energy code.

4 INVEST IN ENERGY EFFICIENCY AND RENEWABLE ENERGY GENERATION IN MUNICIPAL BUILDINGS

The Renew Boston Trust is the City's initiative to finance energy efficiency in municipal buildings. The City of Boston invests in energy conservation measures in its buildings, then pays itself back using the money saved on our energy bills, which is guaranteed by the City's contractor. This creative financing allows the City to move more quickly to make municipal buildings more efficient. The first phase of the Renew Boston Trust included energy conservation measures at 14 municipal buildings and solar-generated electricity at three sites. The City will also work to coordinate self-funding energy conservation measures with planned capital improvements to maximize the impact of our investments. In particular, this financing approach will support BuildBPS, the Mayor's comprehensive initiative to modernize schools and build new school buildings. The Renew Boston Trust invested $10 million in Phase 1, and will invest an additional $10 million in Phase 2 and $25 million in Phase 3.

DESIGNING FOR EQUITY

- The City will work with its contractor to expand outreach to minority contractors and increase compliance with the Boston Resident Jobs Policy.
- By investing in energy efficiency, we will make indoor air temperatures more comfortable for students and teachers in Boston's public schools, as well as for City employees across municipal buildings.

EXPECTED BENEFITS



Phase 1: 1 percent reduction in annual municipal carbon emissions, $600,000 in energy savings per year



Phase 2+: additional emissions reductions and energy savings (size to be determined)



Health and comfort benefits of heating, ventilation and air conditioning upgrades in municipal buildings, including fire stations and schools

EXISTING TOOLS AND EFFORTS

- In 2018, the City piloted Building Operator Certification (BOC) training to ensure facility operators from Boston and surrounding municipalities are equipped to make City-owned buildings perform at their highest level. Additional municipal BOC trainings are planned. In partnership with the Massachusetts Clean Energy Center, the Renew Boston Trust will install battery energy storage at the Boston Fire Training Academy on Moon Island. This new equipment will increase the resilience of the facility, as well as provide recruits with the opportunity to train with energy storage systems. The Trust will also install solar thermal water heating systems at Boston Fire Department stations elsewhere in the city.

STEPS	TIMELINE
1. Complete Phase 1 projects	2019-2020
2. Select building portfolio and carry out energy assessments for Phase 2	2019
3. Explore developing a separate energy service contract for streetlights	2020
4. Complete design and begin installation of Phase 2 energy conservation measures	By mid-2020
5. Select building portfolio, including schools, and carry out energy assessments for Phase 3	By late 2020
6. Secure funding and begin early scoping for Phase 4	By 2021
7. Complete design and begin installation of Phase 3 energy conservation measures	By early 2021



The City of Boston has installed solar panels on the roof of the Roslindale Community Center through the Renew Boston Trust program.

5 DEVELOP A CARBON EMISSIONS PERFORMANCE STANDARD TO DECARBONIZE EXISTING LARGE BUILDINGS

The City of Boston will develop and introduce a performance standard to reduce carbon emissions from Boston's existing large buildings. Just 2,200 of Boston's largest buildings represent about 34 percent of Boston's total floorspace and approximately half of our total emissions.

The standard will require that all buildings larger than a certain threshold meet fixed carbon targets that decrease over time. Performance standards specific to different building typologies will ensure that buildings make steady progress on emissions reductions, while allowing building owners to develop solutions that are cost-effective and appropriate for the building's use. The new standard will build on the reporting requirement of the Building Energy Reporting and Disclosure Ordinance (BERDO), and replace the current energy action and assessment requirement.

The City will work with partners to develop case studies and foster best practices throughout the Boston region. This includes sharing lessons from demonstrations of deep energy retrofits and thermal electrification in different building types. The City will also collaborate with neighboring municipalities and other partners to improve technical and financial assistance for building owners.

DESIGNING FOR EQUITY

- Explore ways to enable affordable housing to reduce emissions, while avoiding passing on retrofit costs to tenants. Include affordable housing, small business, environmental justice organizations, and community groups in the policy advisory group
- Develop mechanisms to support affordable housing and small business upgrades

EXPECTED BENEFITS



Avoided carbon emissions



Energy savings due to enhanced building efficiency



Increased thermal comfort and indoor air quality for building occupants

RETROFITTING HISTORIC BUILDINGS

- More than half of Boston's buildings were built before 1950. These older and historic structures are located throughout the city, and many are integral to Boston's character and vibrancy.
- Retrofitting historic buildings reduces material consumption and emits less carbon than demolishing buildings and constructing new ones, even if the new structure is Zero Net Carbon (ZNC). Historic buildings have embodied carbon in them that is lost if a building or its components are demolished. They are often relatively energy efficient, with passive heating, cooling and lighting systems.
- The City will develop pathways and guidelines for property owners to decarbonize and prepare their older buildings for the effects of climate change, while preserving the historic character of the structures.

STEPS	TIMELINE	IMPLEMENTERS & PARTNERS
1. Introduce a building performance scorecard for BERDO buildings	End of 2019	City
2. Launch the technical analysis and public process to develop a building emissions performance standard • Develop framework to set mandatory carbon emissions targets by building type that decrease over time • Evaluate alternative compliance fund that can be used to support affordable housing retrofits or community energy projects • Develop pathways for affordable housing, historic properties, and other building types as needed to achieve performance targets • Evaluate lowering the size threshold for buildings covered by the standard (currently 35,000 square feet under BERDO)	By 2020	City, in consultation with building sector, techincal experts, community development corporations (CDCs), community-based organizations, and other stakeholders
3. Expand financing mechanisms for retrofits, including exploring the creation of a local climate bank	Starting 2020	City
4. Engage with utility companies to improve the process for building owners to obtain and report their energy data	Ongoing	City
5. Develop guidance for combined deep energy retrofits and electrification, including for historic buildings	By 2021	City, community groups, industry associations
6. Propose amendment to BERDO to replace energy action and assessment requirement with the building emissions performance standard	By 2021	City
7. Pilot deep energy retrofits with thermal electrification in the 15 Carbon Free Boston building typologies to provide sector-specific case studies • Collaborate with local industry and professional associations to share lessons learned	2020-2024	City, building owners, philanthropy, community groups, industry and professional associations
8. Study mechanisms to improve the energy efficiency of existing buildings not covered by the standard, including rental and time of sale scorecards, rental energy efficiency requirements, and other measures.	2020-2024	City, policy experts, building owners, industry associations, community groups

METRICS FOR SUCCESS

- 100 percent reduction in annual carbon emissions from large buildings in 2050
- 100 percent of covered buildings reach their carbon targets or complete alternative compliance payment

EXISTING EFFORTS AND TOOLS

- Since 2013, the **Building Energy Reporting and Disclosure Ordinance (BERDO)** requires all mid- and large-size buildings to track their energy and water usage. These buildings must also complete an energy assessment or an energy action every five years.
- The City of Boston's **Renew Boston Trust** uses energy performance contracts to finance energy efficiency measures in municipal buildings. The City is receiving support from the **Bloomberg American Cities Climate Challenge** to support similar models for Boston's nonprofit institutions.
- The Environment Department released the **Resilient, Historic Buildings Design Guide** in August 2018 to illustrate resilience strategies that can be incorporated into the preservation of historic properties. Similar guidance will be developed for carbon-neutral retrofits of landmarks and historic buildings.
- **Mass Save**, an initiative sponsored by Massachusetts' utilities to enable residents, businesses and institutions to make energy efficiency upgrades, offers a wide range of energy efficiency services, rebates, incentives, trainings, and information. The City implements outreach programs to connect residents and businesses in Boston to Mass Save and help them take full advantage of these incentives. The Mass Save program is funded by a charge on customers' gas and electricity bills.

COMMUNICATION AND EDUCATION

- To support building owners as they undertake deep energy retrofits and switch to clean energy sources, Boston will work with neighboring municipalities and state partners to develop a building decarbonization support program to connect buildings to technical and financial resources, as well as provide building performance scorecards. The City of Boston will collaborate with Mass Save to communicate energy saving and financing opportunities to building owners and operators.



Boston Properties implemented extensive energy conservation measures at 200 Clarendon Street, previously the John Hancock Tower. The Energy Star score improved from 38 to 83 over five years, saving the property millions of dollars in utility costs each year.

6 EXPAND WORKFORCE DEVELOPMENT PROGRAMS FOR BUILDING DECARBONIZATION

The City of Boston will work to support and enhance existing training programs and programs to increase the diversity in the building trades through upskilling and incumbent worker training. Many Boston-based high schools and higher education institutions offer certifications and degrees in facilities management and green building technologies, and connect students to careers in Boston. Local programs connect youth, women, and people of color with career opportunities in the building trades. Trade unions also offer programs to train incumbent workers and increase diversity in the trades. Since it is important to balance training programs with job matching, the City will explore ways to expand job fairs and boards for building construction and operation, and to connect contractors with building projects.

Today, more than 62,000 people work in energy efficiency jobs in the Boston metro area.[16] Approximately 80 percent buildings in Boston will need to undergo deep energy retrofits and prepare for the impacts of climate change. To carry out that work, Boston needs to grow the pipeline of Boston's future green builders and hone the skills of our active labor force. This includes:

- **Facilities management.** Building operators, maintenance workers and building automation controls experts all play a vital part in ensuring that buildings run at peak performance.
- **Construction trades.** Every tradesperson involved in building renovations - electricians, carpenters, roofers, plumbers, HVAC technicians, estimators, pipefitters and more - will need to understand what a deep energy retrofit entails and become familiar with electric building systems, to allow buildings to reduce their emissions.

To support and enhance the work of local and regional institutions, trade unions and non-profit partners, the City will also convene key players to develop a citywide strategy, coordinate the efforts of current workforce development programs, and ensure the building sector is ready to retrofit and operate carbon-neutral buildings.

EXPECTED BENEFITS


Creation of local, well-paying, high-quality jobs


Local economic investment


Enhanced employment security (through new trade skills development)


Increasingly diverse workforce in the building professions


Improved building performance and sharing of best practices as industry knowledge and workforce for net zero carbon buildings advances

16 *E2 (Environmental Entrepreneurs), "Clean Jobs Cities 2018," September 2018.*

DESIGNING FOR EQUITY

- The City of Boston will continue to build a diverse, inclusive workforce of people of color, women, recent immigrants, veterans, and young professionals.
- Job training programs should be designed to accommodate different skill sets and educational levels and should be financially accessible to all Boston residents.
- High-quality job opportunities in this field need to be accessible and fairly distributed. Living wages and appropriate benefits should be provided, as well as opportunities for career advancement. Wherever possible, employers should give workers a voice in formulating policies, enforcing wage and hour rules, and protecting against wage theft.

METRICS FOR SUCCESS

- Construction work hours on public and large private projects performed by:
  - Boston residents: 51 percent
  - Women: 12 percent
  - People of color: 40 percent
- 50 percent of individuals who begin training go on to graduate from or complete training
- 75 percent placement rate into jobs or additional training for individuals who complete training

STEPS	TIMELINE	IMPLEMENTERS AND PARTNERS
1. Regularly convene an internal City working group on workforce development for energy efficiency and green buildings to: • Coordinate citywide programming • Develop an equitable workforce development strategy that builds on the Regional Infrastructure Jobs Plan, including marketing and outreach • Convene stakeholder and community roundtables around specific topics as needed • Collaborate with industry partners and stakeholders to advertise and scale training programs • Coordinate with local municipalities, regional agencies and Mass Save	Starting 2019	City and stakeholders, including trade unions, construction companies, community colleges, regional partners, universities, non-profit and community-based organizations.
2. Estimate baseline and future construction labor needs to meet carbon neutrality goals • Inventory career ladder and training programs for union and open shop workers, including for those without a high school diploma • Identify labor and training gaps	2019-2020	City, technical experts
3. Pilot and coordinate training programs and support partner-led programs, including: • A training course to develop the capacity of MWDBE contractors to bid on municipal and large-scale projects • Building Operator Certification training programs	Starting 2019	City, in partnership with local and regional non-profits and industry associations

STEPS	TIMELINE	IMPLEMENTERS AND PARTNERS
4. Develop facilities management training and job opportunities for municipal building staff • Explore adding a facilities management track to City Academy • Increase the number of municipal building operators with Building Operator Certification • Develop training and advancement opportunities for incumbent maintenance staff	2020-2021	City
5. Expand technical offerings and career pathways in Boston Public Schools • Support and enhance existing programs at career and technical education (CTE) high schools • Apply for state grant to offer a new pre-college green building innovation pathway at non-technical schools • Expand access to technical courses (e.g., after-school carpentry program accessible to all students) • Expand summer internship opportunities through the Building Boston's Future program	Starting in 2020	City, in partnership with local non-profits, training programs and industry associations

EXISTING TOOLS AND EFFORTS

Boston's schools and academic institutions are preparing students and mid-career professionals for careers in the green building sector:

› Several Boston public schools have career and technical education (CTE) programs that support green buildings. **Madison Park High School** serves approximately 10,000 students, with certification programs for carpentry, electrical, facilities management, plumbing and sheet metal. The **John D. O'Bryant School of Mathematics and Science** offers computer science and engineering pathways. The **Boston Green Academy** has an environmental science and technology program. Boston Public Schools is also developing an **after-school carpentry program** that will be open to students across the district.

› Many higher education institutions in Boston offer certificates and degrees that prepare their students for careers in facilities management or in the trades. These institutions include Benjamin Franklin Institute of Technology, Bunker Hill Community College, Mass Maritime, Northeastern University, Roxbury Community College, and Wentworth Institute of Technology, among many others.



Mayor Martin J. Walsh joins members of YouthBuild Boston, the Dudley Street Neighborhood Initiative and Madison Park High School students, and lends a hand in installing siding onto one of the City of Boston's Neighborhood Home Initiative homes being built at 31-33 Woodville Street in Dudley Square.

The City of Boston is investing in workforce development:

- **The Neighborhood Jobs Trust** collects fees from developers of large commercial projects to fund jobs, job training and other related services. The Trust funds programs like the Tuition-Free Community College Plan, Roxbury Community College Center for Smart Building Technology, and Youth Options Unlimited (YOU) Boston, a workforce development organization that works with young people who are court-involved or gang-affiliated, re-entering the community from incarceration, or seeking refuge from poverty or violence.

The City and its partners operate training programs for youth and incumbent professionals to access training:

- The **Tuition-Free Community College Plan** covers tuition and other expenses for eligible Boston residents who have completed high school. Participating colleges include Bunker Hill Community College, Roxbury Community College, MassBay Community College, and the Benjamin Franklin Institute of Technology. Students can also transfer to tuition-free four-year colleges through the Boston Bridge from the state's Commonwealth Commitment program.
- In 2018, the City hosted **Building Operator Certification (BOC) training** to ensure municipal operators can make City-owned buildings perform at the highest level. Building off of that success, A Better City and Local Initiatives Support Corporation (LISC) Boston have hosted additional training sessions in 2019. The City of Boston will partner to carry out at least four more rounds of training before the end of 2020.
- **Trade unions** also offer training programs to their incumbent workers. Many City- and partner-led programs recruit Boston residents to train and place them in careers in the building industry.
- The Mayor's Office of Workforce Development's **City Academy** is a training pipeline for Boston residents to access entry-level City positions. There are currently free training tracks for Commercial Driver's License (CDL) and Hoisting and Emergency Medical Training. The CDL and Hoisting training partners with the Public Works Department, Parks and Recreation Department, and Boston Water and Sewer Commission, as well as Suffolk Construction, a private construction industry partner.

- **YouthBuild Boston** is a job training organization that works to prepare under-served community members in the Boston area for jobs in the building trades. As part of the Office of Workforce Development's Greater Boston American Apprenticeship Initiative, WinnResidential and Wentworth Institute of Technology have partnered with YouthBuild Boston to offer a paid **Facilities Maintenance Technician apprenticeship**. Participants are paid a living wage and receive a certificate upon completion.
- The **Economic Mobility Lab** tests ideas to economically empower low- and moderate-income Bostonians. Its programs include **Building Boston's Future**, a Boston Center for Youth and Families (BCYF) program to place high school students in workplaces for paid 7-week internships.
- **Operation Exit** is a re-entry program that provides participants with the career readiness and occupational skills training needed to apply for state-registered Building Trades apprenticeship programs.
- **Building Pathways** is a Boston-based non-profit organization that operates the Building Trades Pre-Apprenticeship Program, which prepares under-represented, disadvantaged or low-skilled Boston metro area residents to enter a union apprenticeship program.

The programs listed above are just a few of the many programs connecting Boston's youth, people of color, women, and other residents to careers in construction and facilities management. The Mayor's Office of Workforce Development works to connect residents and companies to appropriate programs and opportunities.

WHAT IS THE BOSTON RESIDENT JOBS POLICY?

The Boston Resident Jobs Policy (BRJP) is an ordinance passed in 1983 and updated most recently in 2017. Private development projects over 50,000 square feet and any public development project must meet the following employment standards for the total work hours of journey people and apprentices in each trade:

- *at least 51 percent must go to Boston residents;*
- *at least 40 percent must go to people of color; and*
- *at least 12 percent must go to women.*

The BRJP office and the Boston Planning & Development Agency (BPDA) monitor projects for BRJP compliance. The Boston Employment Commission also reviews projects and makes recommendations to the BRJP office and the BPDA to strengthen compliance.

7 ADVOCATE FOR STATE BUILDING POLICIES THAT ALIGN WITH CARBON NEUTRALITY BY 2050

While the City of Boston is taking steps to mitigate emissions from large buildings, we also need higher energy efficiency and renewable energy standards across the entire building sector. Continued advocacy by the City and its partners for statewide building codes and utility incentive programs that align with carbon neutrality will allow municipalities across Massachusetts to construct buildings that not only support our climate goals, but also ensure that Bostonians and other Baystaters can live and work in better buildings.

In parallel with updating zoning requirements, the City of Boston is advocating for updating the Massachusetts Stretch Energy Code to a Zero Net Carbon (ZNC) standard. In Massachusetts, the state-level Board of Building Regulations and Standards (BBRS) sets energy performance standards for building construction and renovation. In 2009, the BBRS developed a Stretch Energy Code for the first time, allowing municipalities to adopt a higher performance standard than that of the Base Energy Code. At the time, the Stretch Code represented a roughly 20 percent improvement in energy performance over the Base Code. But as of March 2019, the Base Code has effectively caught up to the Stretch Code. Updating the Stretch Code to a ZNC standard is key to reaching Boston's carbon neutrality goals.

In order to carry out deep energy retrofits and electrification at scale, building owners need access to a more robust suite of incentives and financing mechanisms. The City of Boston will work with state and regional partners to advocate for changes to Mass Save and other state programs that better support whole building approaches and encourage fuel-switching from fossil fuels to electric or other carbon-free technologies. The Energy Efficiency Advisory Council (EEAC) guides Mass Save, the ratepayer-funded utility energy efficiency incentive program. With utility incentive programs structured to encourage deep decarbonization of buildings, building owners will be better equipped to develop capital plans that significantly improve the carbon performance of their buildings over time.

The City of Boston will continue to advocate, as part of the Mayor's legislative agenda, for state legislation and regulatory changes that align with our goals for a carbon-neutral and climate-ready Boston.

METRICS FOR SUCCESS

- The BBRS approves a ZNC Stretch Code, or comparable policies or programs, that allows municipalities in Massachusetts to adopt ZNC requirements for all new construction.

DESIGNING FOR EQUITY

- Creating consistent net-zero building standards ensures that all housing is built to the same, higher level of energy efficiency and comfort, reducing the energy cost burden of owners or tenants.

EXPECTED BENEFITS



Up to 300,000 tons of annual avoided carbon emissions from business as usual



Lower energy bills for Boston homes, businesses and institutions



Removing harmful air pollution and improving indoor air quality



Creating green jobs and boosting real estate values

EXISTING TOOLS AND EFFORTS

- **Mayor Martin J. Walsh** sent a joint letter with the City Manager of Cambridge and the Mayor of Somerville to the BBRS requesting a discussion of a ZNC Stretch Code at their June 2019 meeting. The Board discussed the proposal and sent it to the Energy Advisory Committee for review.
- The City of Boston is enrolled as a member of the **International Code Council**. We will strengthen our advocacy for changes to the International Energy Conservation Code (IECC). The IECC provides the basis for updates to the Base Energy Code every three years, per the directive of the 2008 Green Communities Act

STEPS	TIMELINE	IMPLEMENTERS & PARTNERS
1. Provide public comment and support as part of the BBRS process to study a ZNC update to the Stretch Code A. Share the City's efforts with residents and local organizations to increase awareness and support for a ZNC Stretch Code	Ongoing	City of Boston, neighboring cities, regional partners, industry associations, academic institutions, energy utilities, energy-focused community groups
2. Advocate for energy efficiency programming that supports whole-building deep energy retrofits at the Massachusetts Energy Efficiency Advisory Council (EEAC) • Provide comment on draft three-year plans, and advocate to add measures on an ongoing basis (e.g., air-to-water heat pumps) • Support equity-based frameworks for incentive structures • Advocate to change the Green Communities Act to allow ratepayer-funded incentive programs to include societal benefits in the cost-effectiveness assessment, or remove the requirement entirely	Ongoing	City, regional partners, EEAC, utilities
3. Advocate for state policy changes that support residential energy efficiency including scorecards and energy disclosure requirements at points of turnover (e.g., time of sale, time of lease)	Ongoing	City, regional partners, state representatives, local and statewide environment- and energy-focused organizations
4. Participate in ECC to cast votes in favor of energy efficiency proposals	Ongoing	City



TRANSPORTATION

In a carbon-neutral Boston, many more people will travel to and around the city by using public transit, biking, or walking, all of which release little to no carbon per trip compared with cars. Go Boston 2030, Mayor Walsh's long-term transportation vision, lays out 58 transportation projects and policies that expand access to connected transportation options, improve traffic-related safety on Boston's streets, and ensure reliability of service for the City's residents, commuters and visitors. The City's targets include cutting drive-alone trips by more than half, increasing public transit ridership by more than a third, increasing biking rates fourfold, and doubling walking rates.

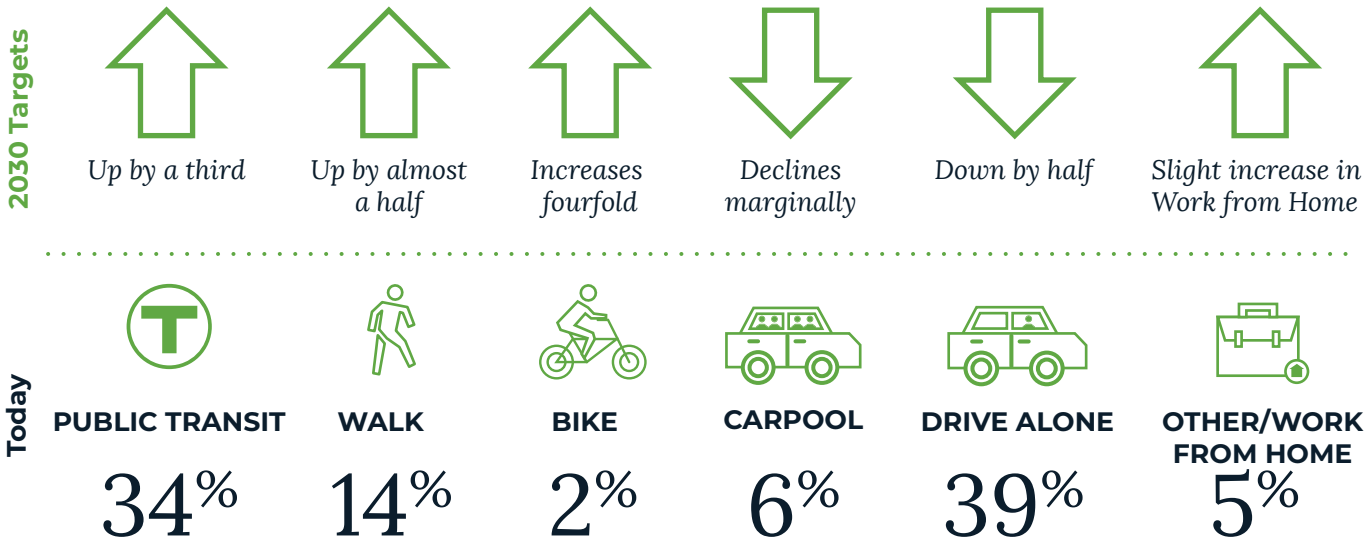
The Go Boston 2030 projects and policies will reduce vehicle miles traveled and carbon emissions from transportation. Transportation accounts for nearly a third of Boston's total carbon emissions, most of that from private vehicles that run on gasoline. As a regional hub, Boston draws hundreds of thousands of commuters daily. Because of this dynamic, three-quarters of transportation emissions come from travel between Boston and its suburbs. As we shift as many travelers as possible out of personal vehicles, we also have to ensure that any vehicles left on the road become zero-emissions vehicles (ZEVs), such as electric vehicles.

Replacing gas and diesel vehicles with electric or other zero-emissions alternatives will reduce Boston's remaining transportation emissions, as well as remove harmful air pollution. As prices continue to decline, EVs will become increasingly affordable. Most current car owners in Boston are "garage orphans" - renters and street parkers who do not control their parking space and cannot install EV chargers at home. To expand access to charging and ZEV technologies, the City will develop a roadmap for public EV charging and carshare, install EV charging stations in municipal lots and at select curb locations, and develop vehicle replacement strategies for municipal fleets. This is in addition to the City's EV policy requires charging infrastructure in many new developments.

To achieve the mode shift and carbon reduction goals of Go Boston 2030, this Plan details five key strategies to accelerate emissions reductions from Boston's transportation system.

8. Advocate for Boston's priority transit projects within regional plans
9. Improve and expand active transportation infrastructure
10. Encourage mode shift through transportation demand management and sustainable parking policies
11. Accelerate citywide zero-emission vehicle deployment
12. Accelerate municipal fleet transition to zero- and low-emission vehicles

Go Boston 2030 Mode Shift Targets



1.8 MMT CO_2e

Estimated total emmissions from Boston's transportation system in 2017

65%

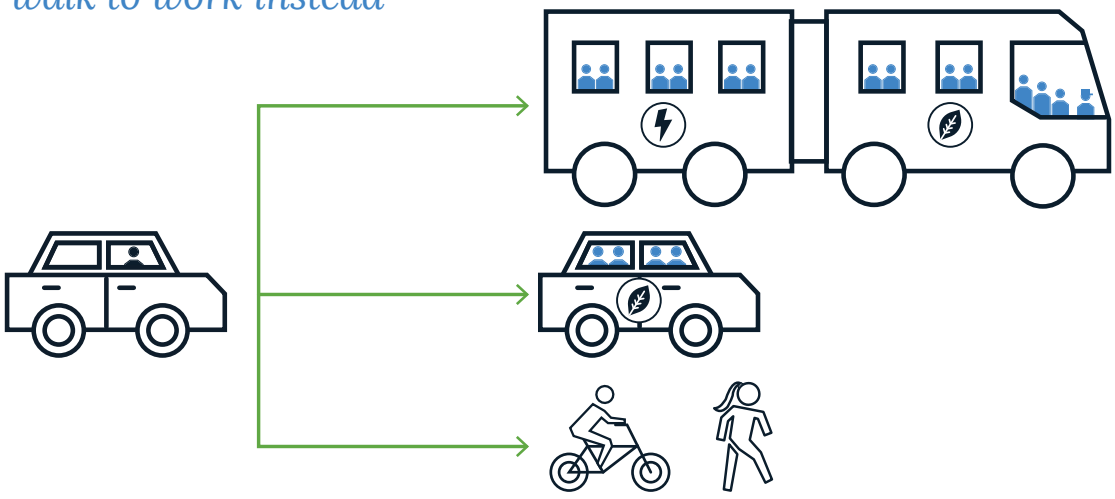
of total transportation emissions came from passenger vehicles

75%

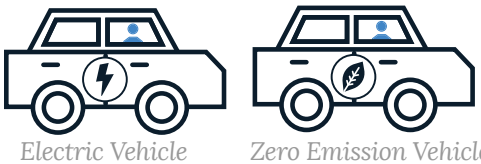
of total transportation emissions from travel to and from the Boston metro area



We need people who drive alone to take transit, carpool, bike or walk to work instead



Any remaining vehicles must be electric or zero-emission vehicles



Electric Vehicle *Zero Emission Vehicle*

8 ADVOCATE FOR BOSTON'S PRIORITY TRANSIT PROJECTS WITHIN REGIONAL PLANS

The residents of Boston deserve high-quality, subway-like service across our rail and transit network. As part of the implementation strategy for Go Boston 2030, our long-term transportation plan, the City of Boston will continue to advocate for and advance the urban rail and rapid bus projects prioritized by the community. This includes increasing service on the Fairmount commuter rail line, advancing bus priority infrastructure installation, and working with Massachusetts Bay Transportation Authority (MBTA) officials to create a vision and timeline for a Red-Blue Line connector.

The City of Boston will also contribute to regional planning efforts, such as the ongoing Rail Vision process to improve the existing commuter rail system led by the Massachusetts Department of Transportation (MassDOT). The Boston Transportation Department (BTD) now has a dedicated team to advocate and design for public transportation expansion and improvements in underserved neighborhoods in the city. These new resources will contribute to achieving the Go Boston 2030 goals of improving mobility and economic outcomes for Bostonians, as well as residents of the Greater Boston region, while encouraging mode shift away from single occupancy vehicles toward healthier, more sustainable modes.

METRICS FOR SUCCESS

- 25 miles of new bus priority lanes by 2030
- Increase public transit commuter rates by a third by 2030

EXPECTED BENEFITS



55,000 ton reduction in annual carbon emissions from business as usual



Reduce vehicle-miles traveled (VMT) by 7 percent



Improved air quality and quality of life



Improved mobility and economic competitiveness in the Greater Boston region

DESIGNING FOR EQUITY

- Participate in ongoing MBTA feasibility assessment in support of low-income fares
- Hire organizers from within the community to build support for new transit projects in underserved neighborhoods
- Use social vulnerability metrics to guide the formation of the City's new Bus Priority Network
- Build on the successful model of the Roslindale bus project, using partnerships with local organizations and advocacy groups, including student groups to build community support for bus priority projects
- Coordinate with the Regional Housing Partnership to increase affordable housing supply along regional transit lines across the Boston metro area

STEPS	TIMELINE	IMPLEMENTERS & PARTNERS
1. Advance a service enhancement proposal for the Fairmount Line	2019	City, MBTA, Transit Matters, Fairmount Indigo Transit Coalition
2. Create Boston's first Bus Priority Network map • Implement three or more bus priority projects per year	Starting 2019	City, MBTA, local merchants, community organizations, student groups, and advocacy groups
3. Expand Inner Harbor ferry service from Lovejoy Wharf, Fan Pier, Lewis Mall, and other new local ferry routes	Ongoing	City, MassDOT, MBTA, Massport, transportation management associations (TMAs), community groups
4. Support upgrading the Silver Line to provide better rapid bus service and terminal from downtown to Dudley	2019 - 2020	City, MBTA
5. Support technology improvements to increase Green Line speed and reliability, including safety systems, signal priority technologies, station improvements and stop consolidation	2019 - 2020	City, MBTA
6. Support flood protection and carbon reduction measures for at-risk MBTA stations	Ongoing	MBTA, City
7. Create new transit hubs or carry out improvements at existing hubs in the Longwood Medical Area, at West Station, and in Sullivan Square	Ongoing	City, TMAs, MBTA, BPDA
8. Increase sense of transit reliability through real-time information integration initiative, with 20 pilot locations across the Boston area	Starting 2020	MBTA, City
9. Advocate for measures that reduce the cost and improve the quality of public transit in Boston • Support changes to gas taxes, vehicle subsidies and commuter tax incentives to deter driving and support transit • Support equitable transit investments in the Boston metro area as part of the Transportation and Climate Initiative	Ongoing	City

DEDICATED RESOURCES

› Financial agreement with the MBTA in which the MBTA funds the initial implementation of bus priority infrastructure within Boston along certain high priority corridors and the City funds maintenance

› New transit-dedicated staff in the City's Transportation Department

EXISTING TOOLS AND EFFORTS

› Based on extensive public input, **Go Boston 2030** identifies regional-scale transit projects to be implemented near- and long-term that will improve mobility in and out of the City and connectivity across communities in the Boston area. The City is implementing the better bike corridors and rapid bus projects laid out in the plan.



Travel lanes that prioritize buses, like the bus lanes on Washington Street in Roslindale, help ensure faster and more reliable service for riders.



Charlies Cards are available at City Hall, select MBTA stations, and 15 Boston Public Library locations.

- Mayor Walsh's **2019 legislative package** includes An Act to Allow Regional Ballot Initiatives, An Act to Allow Parking Assessments for Infrastructure Investment, and An Act to Update Transportation Network Company Assessments. The **Act Relative to Regional Transportation Ballot Initiatives** would enable a municipality to raise local money through a ballot initiative to fund Boston's priority transportation projects. The **Act to Update Transportation Network Assessments** would increase the price of solo rides booked through ride-hailing companies.
- **The MBTA Rail Vision Study** is identifying cost-effective strategies to improve mobility and economic competitiveness of the greater Boston region by transforming the existing commuter rail system.
- **The CharlieCard Access Initiative** seeks to make transit use cheaper and more convenient for riders. CharlieCards—previously only available through one's employer, via online order, or at Downtown Crossing—are now free and available at City Hall and at 15 branches of the Boston Public Library.
- In addition to the rapid bus projects birthed from Go Boston 2030, the City has identified additional corridors where upgrades with bus priority treatments would have sizable, positive impacts on the city's transit network. This network and the Go Boston 2030 rapid bus projects have been combined to form the **Boston Bus Priority Network**.
- The **Transportation and Climate Initiative** (TCI) is a regional collaboration of 13 Northeast and Mid-Atlantic jurisdictions that seeks to develop the clean energy economy, improve transportation, and reduce carbon emissions in the transportation sector. TCI is currently exploring a regional cap-and-trade policy to reduce carbon emissions from the transportation sector.

COMMUNICATION AND EDUCATION

- The City's Transit Team will share project-specific information and engagement opportunities on its website.
- The City will host "learn-a-thon" events across Boston's neighborhoods to disseminate information about the many tools that comprise bus priority.
- The City's Transit Team will participate in community events on an ongoing basis, as well those hosted by partner organizations such as the MBTA, MassDOT, BPDA, and community groups.

9 IMPROVE AND EXPAND ACTIVE TRANSPORTATION INFRASTRUCTURE

An essential element of a carbon-neutral transportation strategy is the shift away from single-occupancy automobile trips. Public transit, walking, and biking release far smaller quantities of carbon than automobiles. A transportation system that emphasizes walking and bicycling burns less fuel, reduces air pollution, and makes streets less crowded, less stressful, and much safer.

The City is implementing street design projects that prioritize walking and help create a connected, safe network of bike facilities, with the goal of increasing biking rates fourfold. The City is also prioritizing sidewalk repair and traffic-calming projects in areas most in need.

Land use and development patterns have a major impact on residents' ability to walk or bike for their everyday needs. The City will continue to integrate and expand active transportation infrastructure into neighborhood planning efforts and individual development projects, to advocate for improved walking and bicycling and to discourage new automobile trips.

NEXT 5 YEARS

The City will take the following steps to continue to improve and expand active transportation infrastructure:

- *Create a program to hire Boston non-profits and residents to implement outreach processes for walking and bicycling projects and to co-create neighborhood priorities for walking and bicycling improvements;*
- *Deepen partnerships between City agencies, such as the Boston Public Health Department and the Department of Neighborhood Development, to ensure equitable outcomes from transportation investments;*
- *Develop relevant materials in commonly-used languages to be shared at community events, by direct mail and online, to ensure that all residents are informed about projects and are able to participate;*
- *Continue to expand incentives and accessibility initiatives around bike riding, particularly for young people, including bike-riding classes for youth and additional infrastructure near schools.*

EXPECTED BENEFITS



Reduced carbon emissions from avoided automobile trips



Public health benefits



Increased connectivity to jobs and educational opportunities



Safer residential streets that encourage community gathering and play

DESIGNED FOR EQUITY

- The Neighborhood Slow Streets program ensures that traffic-calming requests are prioritized for the areas with the greatest need: where we have more children, older adults, and people with disabilities; where more crashes are happening per mile; and near public places and spaces including parks, schools, and libraries.
- The publicly-owned bike share program is designed to complement bus and rail transit, providing a low-cost option for first- and last-mile trips. A discounted fare is available to households who qualify for a variety of public assistance programs or who have incomes below 40 percent Area Median Income (AMI).
- The Public Works Department and Mayor's Office of New Urban Mechanics have partnered to develop the StreetCaster program, and create new networks of sidewalks in areas that need them most, while simultaneously improving the way that resident requests for repairs through the City's 311 system are addressed.

METRICS FOR SUCCESS

- A fourfold increase in biking rates by 2030
- 50 percent increase in walking rates by 2030
- 100 percent of homes located within a 10-minute walk of a bike share station
- 3-5 neighborhoods receive traffic-calming measures annually through the Neighborhood Slow Streets program

EXISTING TOOLS AND EFFORTS

- The City's **Neighborhood Slow Streets program** partners with communities to develop appropriate and responsive traffic-calming plans for small, residential streets that suffer from high crash rates and are home to youth, elders, and those with disabilities.
- **Bluebikes** is the City's public bike share program. The regional network offers 3,500 bikes at more than 325 stations throughout Boston, Brookline, Cambridge, Everett, and Somerville. In 2018, the City of Boston added 51 new stations. As a result, 85 percent of Boston households are now within a 5-7 minute walk of a Bluebikes station, up from 67 percent in 2017. Mayor Walsh's FY20 capital budget and financial support from Blue Cross and Blue Shield of Massachusetts mean another 50 stations will be installed in 2019. The expansion has included 25 stations in new neighborhoods and additional capacity in the existing service area.
- The City's **Women Bike** program offers free learn-to-ride classes led by women for Boston residents who identify as female or gender-nonconforming. Classes are offered monthly between May and October each year.
- The City's **Youth Cycling Program** helps students from grades 2 to 12 learn bicycle safety. The Boston Bikes team brings bikes, helmets, instructors, and an active 2-week curriculum. Boston Public Schools can apply for the program in the fall and spring of each year. More than 38,000 young Bostonians have participated in the program since 2009.

10 ENCOURAGE MODE SHIFT THROUGH TRANSPORTATION DEMAND MANAGEMENT AND SUSTAINABLE PARKING POLICIES

The City of Boston will adopt transportation demand management (TDM) and parking programs and policies that support the mode shift goals of Go Boston 2030 and our carbon neutrality goals. Policies will incentivize the use of shared vehicles and public transit over single-occupancy vehicles, reducing congestion, air pollution, and carbon emissions in Boston's busiest neighborhoods and promoting healthier communities and lifestyles.

In fulfillment of its Go Boston 2030 commitment, the City is updating its TDM policies. The initiative is working with developers, employers, and state and City agencies to forge policy and programming that promote dramatic mode shift away from driving alone, reduce emissions, and improve multimodal connectivity. The updated TDM policies will include a points-based system that will allow developers to choose from a menu of TDM options as part of their Transportation Access Plan Agreement (TAPA), a zoning requirement for large projects in Boston. These TDM options aim to reduce the vehicle miles traveled generated by new projects. The TAPA process will also be brought online to make the agreements more publicly accessible and to further promote solutions like carshare fleets, bikeshare, transit access passes, teleworking, unbundled parking, daily rather than monthly parking passes, parking cash out programs and other transit benefits.

The City will also update and expand parking programs and policies, in particular the parking freezes, to further reduce drive-alone rates. The parking freezes implement the federal Clean Air Act and are intended to reduce air pollution by restricting the availability of parking and thereby discouraging driving, especially by commuters. This is accomplished by establishing a cap on the number of certain types of off-street parking that is allowed.

EXPECTED BENEFITS



Up to a 62,000 ton reduction in annual carbon emissions from business as usual



Reduce VMT by approximately 7 percent, particularly in new development



Improved air quality, safety and wellbeing in new developments



Commuter mode shift from drive alone to shared and active transportation modes



Increased access to bikeshare, carshare, transit and EV charging

DESIGNING FOR EQUITY

- Weight TDM measures by neighborhood need
- Focus guidelines for traffic impact analysis for new developments on pedestrians, cyclists and bus riders to prioritize moving people over moving vehicles

› Support equitable mode shift and air pollution reduction measures that prioritize benefits to EJ communities

› Develop a program to allow implementation of community-based parking alternatives for use of the public right-of-way

STEPS	TIMELINE	IMPLEMENTERS & PARTNERS
1. Complete inventory of the Downtown Parking Freeze and develop priorities and timeline for other parking and curb use inventories	2019	City, BPDA
2. Release citywide TDM framework and new TAPA guidelines • Introduce points-based system • Redefine parking maximum ratios	2020	City, BPDA, transportation management associations (TMAs), developers, regional planning organizations
3. Update Downtown, South Boston and East Boston parking freeze regulations	2020	City, BPDA
4. Launch an online platform to streamline the TAPA process, including a points-based system for developers to select TDM measures	2021	City
5. Carry out parking inventories of priority areas and identify neighborhoods for tactical interventions (e.g., pick-up and drop-off areas, performance-based parking extension…) • Pilot flexible curbs with shifting functions based on time of day and demand (e.g., Bus Rapid Transit, passenger vehicles, bike and scooter parking) • Expand pick-up and drop-off areas to additional neighborhoods • Continue to expand performance-based parking	2020	City, MassDOT, Massport, TMAs, private developers, advocacy groups
6. Study transportation impact fee (a one-time fee paid by developers) that would be used to improve transportation networks outside of development projects	2022	City
7. Evaluate the impact of expanding the parking freeze to additional neighborhoods	2021-2024	City, BPDA
8. Assess additional programs and policies to deter single occupancy vehicles, including residential parking permits, parking cash-out and other commuter incentives	Ongoing	City

METRICS FOR SUCCESS

› Cut the drive alone rate in half by 2030

› Increase public transit commuter rates by a third by 2030

DEDICATED RESOURCES

› As part of the implementation of Go Boston 2030, the Boston Transportation Department has hired a full-time staff member to oversee its TDM program.



The City uses smart parking meters to calibrate parking prices according to the time of day and driver demand. This performance-based parking system has managed parking demand, improved safety, and decreased congestion.

EXISTING TOOLS AND EFFORTS

- The current process to integrate transportation demand management strategies occurs largely through the Transportation Access Plan Agreement (TAPA) as part of the large project review process for large developments over 50,000 square feet.
- The **Downtown and South Boston parking freezes** set caps on the number of off-street parking spaces to reduce air pollution. New developments seeking to build off-street parking must apply for parking freeze permits through the **Air Pollution Control Commission**.
- The City set parking **maximum parking requirements** for new development in Access Boston 2000-2010, Boston's transportation plan before Go Boston 2030. These requirements decrease the closer development is located to transit hubs.
- **Performance-based parking** in Back Bay and the Seaport set dynamic metering rates (e.g., charging more for parking at peak times) that reduced idling and cruising.
- Mayor Walsh's **2019 legislative package** includes An Act to Allow Regional Ballot Initiatives, An Act to Allow Parking Assessments for Infrastructure Investment, and An Act to Update Transportation Network Company Assessments, including by increasing the price of solo rides.

COMMUNICATION AND EDUCATION

- Bring TAPAs online.
- Work with employers and TMAs to host workshops and events that promote biking, walking and carpooling.
- Distribute multilingual information for landlords and tenants citywide on TDM programs.
- Public campaigns to demonstrate both benefits of limited parking and concerns associated with free private vehicle parking (e.g., use of public space for private purposes, percent of road use time allocated to private vehicles versus public).
- Coordination with TMAs to generate awareness and excitement for tactical, localized pilot infrastructure.

11 SUPPORT CITYWIDE ZERO-EMISSION VEHICLE (ZEV) DEPLOYMENT

The City of Boston will develop a ZEV Roadmap, which will lay out strategies to increase access to electric vehicle charging infrastructure and transition shared mobility and fleets to electric vehicles or other ZEVs. These strategies will address the lack of infrastructure and education around electric vehicles (EVs) and other ZEV technologies over the next five years, as well as issues around equity and accessibility.

To reach carbon neutrality, Boston must transition all remaining vehicles on the roads to electric or other zero-emission vehicles over the next 30 years, inaddition to maximizing mode shift from single occupancy vehicles to shared and active modes.

A ZEV is a vehicle that emits no tailpipe emissions from the onboard source of power, such as battery electric vehicles and hydrogen fuel cell vehicles. ZEVs generate fewer emissions than gas- and diesel-powered vehicles and do not produce tailpipe pollution. ZEV sales have grown rapidly in Massachusetts, nearly doubling between 2017 and 2018 alone.

DESIGNING FOR EQUITY

- Prioritize deployment of EV charging infrastructure in municipal lots and other publicly-owned locations in environmental justice communities
- Explore mechanisms to offer EV carshare and reduced price or free electric vehicle charging at City-owned stations for residents participating in a qualifying benefit program (e.g., Supplemental Nutrition Assistance Program (SNAP) beneficiaries
- Evaluate and, when appropriate, promote financial mechanisms to make transitioning to ZEVs affordable, particularly for low-income residents, including lease-purchase models, zero-interest loans and vehicle trade-in programs
- Create economic opportunity for low-income residents by partnering with transportation network companies and mobility on demand providers to electrify their fleets and provide low-cost leases on ZEVs for drivers
- Carry out targeted education initiatives in low uptake neighborhoods to increase driver exposure and encourage drivers to choose EVs over internal combustion engines

METRICS FOR SUCCESS

- Public charging infrastructure available in every Boston neighborhood by 2023
- 100 percent of residents within a 10-minute walk of a public EV charger or EV carshare facility

EXPECTED BENEFITS



Up to a 400,000 ton reduction in annual carbon emissions from business as usual



Air pollution reductions of 3,400 kg PM2.5, 39,000 kg NOx from business as usual



$300 savings in maintenance costs per vehicle per year



Local employment from electric vehicle supply equipment installation

STEPS	TIMELINE	IMPLEMENTERS & PARTNERS
1. Convene an internal City working group to help develop and implement a citywide ZEV strategy, and to support transitioning municipal fleets to ZEVs	Starting in 2019, ongoing	City
2. Develop a ZEV Roadmap to accelerate Boston's transition to EVs and other ZEV • Set targets for deployment, • Install chargers in City-owned lots and public right of way, • Develop how-to guides, and • Employ strategies to increase public and private fleet adoption	Starting 2020	City
3. Pilot electric vehicle car share as an expansion of DriveBoston and in partnership with community organizations • Prioritize locations near transportation hubs and environmental justice communities • Explore sustainable business models for community-owned or -managed EV carshare	Starting 2020	City, carshare providers, community groups, community development corporations (CDCs), technical and design consultants
4. Install electric vehicle charging on 6 municipally-owned parking lots through the Eversource Make Ready program • Develop principles and timeline for roll-out in additional lots	By 2020	City, Eversource, technical consultants
5. Release how-to guides for installing EV chargers targeted at landlords, employers and residents	By 2020	City, technical consultants
6. Incorporate ZEV strategies into Boston's travel demand management (TDM) programs, including: • Integrate EV requirements into the Transportation Access Plan Agreement (TAPA) process • Collaborate with Transportation Management Associations (TMAs) and TAPA holders to expand charging in existing developments, and adopt other EV strategies like reduced price charging for ZEV workplace or rideshare vehicles	2020	City, BPDA, private developers, regional partners, TMAs
7. Work with dealerships and other partners to highlight availability of ZEVs through ride and drive events and educational campaigns	Ongoing	City, Eversource, auto dealers, MassDEP, regional partners, RMV, Auto Original Equipment Manufacturers (OEMs)

STEPS	TIMELINE	IMPLEMENTERS & PARTNERS
8. Encourage uptake of electric vehicles in private fleets and third-party carshare systems, including through the updated TAPA process	Ongoing	City, BHA, CDCs and other community partners, carshare service providers, TMAs, large employers
9. Consider additional transportation options through the permitting of shared micromobility such as e-scooters and e-bikes	Starting 2020	City
10. Study equipment replacement strategies for older or highly-polluting vehicles, including developing a used EV market	Ongoing	City

EXISTING TOOLS AND EFFORTS

- The City of Boston has an **electric vehicle policy**, which currently requires that 25 percent of off-street parking in development undergoing Article 80 review be serviced by EV charging and the remaining 75 percent be EV.
- **DriveBoston** is the City's program to provide public parking spaces in municipal lots and on City streets for carshare vehicles, increasing accessibility and public awareness of car sharing as an alternative to private vehicle ownership.
- The **Small Vehicle Sharing Business Advisory Committee** is an internal City working group considering policies associated with permitting small vehicle sharing-businesses, including the potential of a shared e-scooter pilot program.
- Mayor Walsh's **2019 legislative agenda** includes an **Act Relative to Transportation Network Company Rider Assessments**. The bill would provide a financial incentive for zero-emission vehicles, such as electric vehicles, with a reduced per-mile fee or an exemption in some cases.
- The **Eversource Make Ready program** is helping increase access to electric vehicles by supporting 100 percent of the infrastructure costs for new charging stations.
- **The Massachusetts Offers Rebates for Electric Vehicles (MOR-EV)** program has issued rebates of up to $1,500 for the purchase or lease of battery EVs and fuel-cell electric vehicles and up to $450 for zero-emission motorcycles.
- As of 2019, individuals can receive up to $7,500 in **federal tax credits** for buying an EV.
- The Massachusetts Department of Environmental Protection manages the **Massachusetts Electric Vehicle Incentive Program (MassEVIP)**, as well as Volkswagen Settlement funds. MassEVIP offers incentives for workplace, multi-unit dwelling and public access charging, and for fleet operators to acquire EVs and charging stations.

COMMUNICATION AND EDUCATION

- The City of Boston will maintain online resources for current and prospective electric vehicle drivers in the Boston area. This includes how-to guides for property owners, residents, and employers, for EV infrastructure installation, as well as information about financial incentives and charging networks. The City will also partner with Eversource, auto dealerships, and other partners, to host ride and drives and engagement initiatives.

12 ACCELERATE MUNICIPAL FLEET TRANSITION TO ZERO- AND LOW-EMISSION VEHICLES

Fuel used to power the City of Boston's vehicle fleet accounts for 0.5 percent of Boston's total emissions, and 25 percent of the local government emissions. The City will work to accelerate the deployment of zero- and low-emissions vehicles in municipal fleets. Zero-emission vehicles (ZEVs)—such as some plug-in hybrid vehicles, battery electric vehicles, hydrogen fuel cell vehicles—generate fewer emissions than gas- and diesel-powered vehicles and don't produce tailpipe pollution. The 2007 Executive Order on Climate Action ordered that City departments purchase alternative fuel, flexible fuel or hybrid vehicles, or the most fuel-efficient vehicles within their class. Although costs have gone down, the City remains constrained by the high price of some electric and hybrid vehicles. Currently, 30 percent of municipal vehicles in the Central Fleet are electric vehicles or hybrids.

EXPECTED BENEFITS

- Eliminate up to 25 percent of carbon emissions from municipal operations
- Improved air quality and reduced noise
- $300 savings in maintenance per vehicle per year

METRICS FOR SUCCESS

- All vehicles purchased for Central Fleet are electric or zero-emissions vehicles, or best in class if an appropriate ZEV is not available
- 100 percent of passenger vehicles are emissions free by 2035
- 100 percent of medium-duty vehicles are emissions free by 2050
- 100 percent of heavy-duty vehicles are emissions free or low emissions by 2060



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The City has been adding electric vehicles to Fleet Hub, the vehicle-sharing program for municipal employees.

STEPS	TIMELINE	IMPLEMENTERS AND PARTNERS
1. Convene a quarterly internal City Working Group to coordinate municipal fleet management and citywide ZEV strategy	Starting in 2019	City
2. Develop a vehicle replacement plan to convert the Central Fleet to 100 percent zero- and low-emission vehicles • Analyze telematics data from five Central Fleet vehicles to determine optimal EV replacements and charging sites as an initial test • Evaluate carrying out a full fleet assessment using telematics data	2020	City, data experts
3. Develop a plan and timeline to deploy electric vehicle charging infrastructure across municipal facilities and lots	2020	City, Eversource
4. Pilot electric, renewable diesel, and other carbon-neutral technologies for heavy fleet vehicle replacement	Starting 2021	City
5. Develop vehicle replacement plans for non-Central Fleet vehicles	2020-2023	City

EXISTING TOOLS AND EFFORTS

› Four out of five vehicles in the City of Boston's Central Fleet are equipped with **telematics** systems that provide information on vehicle and fuel usage, including idling.

› **Boston Public Schools** is transitioning its bus fleet from diesel to propane. Propane buses are more efficient and can save nearly 50 percent per mile in fuel and maintenance costs relative to diesel. They are also cleaner, particularly when replacing older diesel buses, emitting fewer air pollutants and up to 15 percent fewer greenhouse gases.[17]

› The City of Boston is receiving support on zero-emissions vehicle deployment as part of the **Bloomberg American Cities Climate Challenge**. This includes developing guidance for installing charging infrastructure in municipal parking lots, how-to guides, and EV incentive programs for residents, employers and auto-dealerships.

COMMUNICATION AND EDUCATION

› To support electric vehicle uptake and appropriate use, City staff will have access to training for electric vehicle operation and maintenance. The City will also offer test rides for City employees to familiarize themselves with electric vehicles.

17 *U.S. Department of Energy, "Case Study – Propane School Bus Fleets," August 2014.*



ENERGY SUPPLY

Boston buildings, transportation and waste management systems must be powered by clean, renewable energy to achieve our carbon neutral goal. This means switching away from fossil fuels to clean and renewable electricity or other carbon-neutral energy sources. The sooner we make the shift, the sooner we will reduce carbon emissions from our buildings and transportation, and decrease Boston's cumulative contribution to global climate change.

Currently, Massachusetts has a statewide Clean Energy Standard that requires 80 percent clean energy sources by 2050 for the electricity sector. This means that Boston will need to go further than the State's efforts in order to achieve 100 percent clean energy. Strategies to decarbonize Boston's energy supply include:

- Procuring renewable electricity for residents and businesses in Boston through municipal aggregation (Community Choice Energy);
- Buying renewable energy generated by local solar, wind, and non-petroleum fuel sources (e.g., biofuel);
- Buying Renewable Energy Certificates (RECs); and
- Buying renewable energy from resources outside New England.

Over the next five years, the City of Boston will implement three primary strategies to transition to a carbon-free and resilient energy supply:

13. Implement and expand Community Choice Energy
14. Plan for the deployment of carbon-neutral district energy microgrid systems
15. Support state policies and programs that further decarbonize the region's and Boston's energy supply

13 IMPLEMENT AND EXPAND COMMUNITY CHOICE ENERGY

Community Choice Energy (CCE), also known as municipal aggregation, is a way for cities and towns to purchase electricity on behalf of their residents. The CCE program will allow the City to harness the buying power of its residents and businesses to purchase electricity for Bostonians in bulk. The CCE program can increase the stability of electricity prices and deliver higher percentages of electricity produced by renewable resources. Eversource, the City's electric utility, will continue to manage the distribution of electricity to residents and businesses, but the City will choose the companies that supply the electricity to CCE customers. For every kilowatt-hour of electricity used by CCE customers, the City will retain a fraction of a penny to cover the cost of the program's development and administration. Boston's CCE program will allow the City to purchase more renewable energy than the state requires utility companies to buy, and will give residents a trusted option to power their homes and businesses.

METRICS FOR SUCCESS

- New sources of renewable electricity added to the grid
- Number of residents who become and remain CCE customers
- Number of residents who opt to purchase 100 percent renewable electricity
- Number of low- and fixed-income residents whose energy bill becomes more predictable and affordable as a result of their participation in the program

EXPECTED BENEFITS



Reduced carbon emissions from electricity consumption by residents and businesses



Electricity that has a higher percentage of renewable electricity than is required by state law



Electricity prices that are more stable and vary less season by season



Protection from the predatory practices of some retail electricity suppliers

DESIGNED FOR EQUITY

- Buy power based on principles and vision developed by the CCE community working group
- Make participation in the CCE program optional for all residents at all times
- Increase supply of renewable energy to low-income residents, potentially by using the aggregation to invest directly in new, local renewable projects; Include a reduced cost, alternative for CCE customers with low or fixed incomes that provides them with electricity that meets the state-required percentage of renewable electricity
- Educate residents about the predatory practices of some retail electricity suppliers, who often prey on the City's elderly and low-income populations by offering low introductory rates that include hidden fees and price increases

PROGRAM VALUES

A community-based working group set the following principles and values to govern the CCE program:

- Reduce carbon emissions;
- Increase the amount of renewable energy generation on the grid;
- Support local renewable energy;
- Ensure affordability and price stability;
- Strengthen consumer protection; and
- Commitment to environmental justice.

COMMUNICATION AND EDUCATION

- The plan that the City submitted to the Department of Public Utilities for our CCE program includes a comprehensive communication campaign that relies on printed materials, online resources, community meetings, a customer service center, translation services,and other communication tools. The campaign has been designed to reach all of Boston's residents and small businesses by taking demographics, language diversity, and other factors into account.

STEPS	TIMELINE	IMPLEMENTERS & PARTNERS
1. Launch CCE program, pending approval of Boston's plan by the Department of Public Utilities	2020 (pending DPU approval)	City, Colonial Power Group, Community Paradigm Associates
2. Implement an opt-up engagement program in partnership with community organizations	Starting 2020	City, community-based organizations and environmental groups
3. Evaluate development of a municipal ratepayer-funded energy efficiency incentive program	Starting 2020	City, local funders, technical consultants
4. Develop a plan to carry out direct investment in renewables through CCE	2020-2022	City, Colonial Power Group, Community Paradigm Associates, community advisory group
5. Use data collected through the CCE program to find opportunities to support energy efficiency programs	Starting 2021	City, utility partners, Mass Save

The City is working with Colonial Power Group and Community Paradigm Associates to design and implement CCE in Boston. Colonial Power Group has helped more than 60 Massachusetts cities and towns launch and manage CCE programs. Community Paradigm Associates specializes in municipal law and process. They will also help us with collaborative decision-making and community engagement. The City launched a community working group made up of residents, experts, advocates, and community leaders in December 2018 to inform the design and implementation of the CCE program. As of September 2019, the CCE program is pending review and approval by the Department of Public Utilities.

14 PLAN FOR THE DEPLOYMENT OF CARBON-NEUTRAL DISTRICT ENERGY MICROGRID SYSTEMS

Adopted by the Boston Planning & Development Agency (BPDA) in 2018, the Smart Utilities Policy for Article 80 Large Project Development Review aims to integrate the resilience and efficiency benefits of district energy and microgrids into the planning and design process for large new developments.

The Smart Utilities Policy calls for the incorporation of five Smart Utility Technologies (SUTs) into new Article 80 developments based on different size thresholds and criteria. Two SUTs apply only to projects over 1.5 million square feet:

- District energy microgrid; and
- Telecom utilidor (an accessible underground duct bank that consolidates assets for telecom services, reducing the need for street openings to install telecom services)

District energy systems can produce steam, hot water and chilled water ("thermal services") at a central plant and provide these thermal services to multiple buildings, usually via underground pipes. District energy systems can produce these thermal services from both renewable energy sources and fossil fuels. Depending on the energy sources used, these systems can also provide electricity ("electrical services"). A system that provides both thermal and electrical services can be referred to as a district energy microgrid.

Due to better energy efficiency and economies of scale, district energy provides opportunities to reduce energy use, energy cost, and carbon emissions when compared to individual building systems. District energy may also improve community resilience by providing energy services even when the regional grid cannot deliver electricity due to an emergency.

Current district energy microgrid systems in Boston provide secure heating and electricity to approximately 10 percent of total floorspace in the city; however, many of these systems rely on natural gas.[18] While compared to the electric grid of today these district energy systems result in higher efficiency and fewer carbon emissions, as the regional electric grid gets cleaner, the emission reduction benefits of fossil fuel-based district energy microgrids will no longer be outweighed. While district energy systems that use natural gas can reduce emissions until 2032, by 2050 the *Carbon Free Boston* analysis found that equipping large new buildings with natural gas cogeneration-based district energy systems may add 4,000 tons of carbon per year.

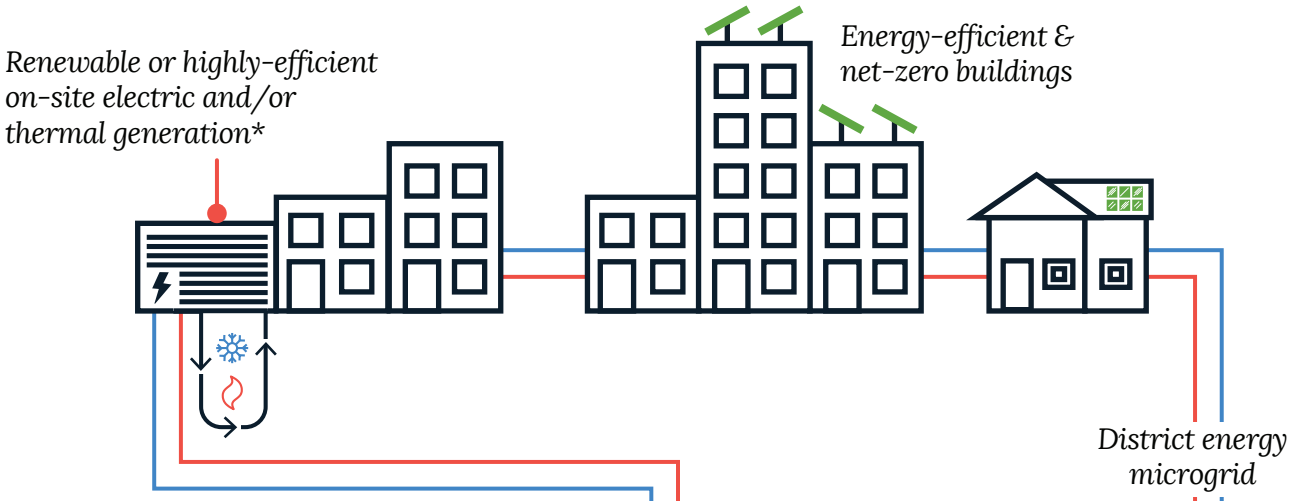
18 *Boston University Institute of Sustainable Energy, "Carbon Free Boston: Summary Report," January 2019, pp. 88-91.*

While many existing systems rely on natural gas, some new projects are deploying district energy microgrid systems that are compatible with a carbon-neutral energy future:

- As a result of the Smart Utilities Policy, some developers are adopting district energy microgrid-ready design when their energy models indicate that a natural gas-based district energy microgrid has no clean emissions reduction benefit over the current grid. A district energy microgrid-ready design allows developers and property owners to integrate carbon-neutral and resilient energy options as they emerge.
- The new Harvard District Energy Facility (DEF) in Allston uses an efficient low temperature hot water distribution system that can be converted to emerging carbon-neutral technologies in the future. The facility also includes the largest thermal storage tank in Massachusetts, which can supply the campus with chilled water during the daytime to lower the burden on the power grid during peak times, potentially reducing carbon emissions and saving money. Harvard University has set goals to be fossil fuel-neutral by 2026 and fossil fuel-free by 2050.
- HEET, a local non-profit, commissioned BuroHappold Engineering to assess the feasibility of replacing leakprone gas infrastructure with interconnected street-segment geothermal to deliver renewable thermal to all. HEET expects to develop pilot projects with local gas companies over the next few years.

In the next five years, the City of Boston and the BPDA will take the following actions:

- Continue to align the Smart Utilities Policy with carbon neutrality goals by emphasizing carbon-neutral district energy systems using renewable and all-electric sources; and
- Develop a strategy to prioritize where, if at all, natural gas-based systems would still be needed in the future, including hospitals.



*Includes:

- Thermal energy storage systems to reduce peak energy demand;
- Ground source heat pumps and geothermal district energy
- Co-generation systems for life-preserving facilities such as hospitals and emergency shelters.

15 SUPPORT STATE POLICIES AND PROGRAMS THAT FURTHER DECARBONIZE THE REGION'S AND BOSTON'S ENERGY SUPPLY

The City of Boston can take steps to decarbonize the energy supply for local government operations, but in order to become carbon-neutral, every sector needs access to clean, renewable energy and smart energy systems. The City will build on its record of leadership on energy through the Mayor's legislative agenda and public advocacy on key issues at the state level.

SUPPORT FOR A 100 PERCENT CLEAN GRID

The Massachusetts Clean Energy Standard (CES) set a target of 80 percent of electricity sales that energy suppliers must procure from clean sources by 2050. However, a 100 percent clean, renewable energy supply is a baseline condition for reaching carbon neutrality. As a member of the Implementation Advisory Committee for the Global Warming Solutions Act, the City of Boston will support inclusion of scenarios that examine a 100 percent clean grid in the state's 80x50 study and plans. The City will also continue to support policies and incentive programs for expanded energy storage, solar and wind generation, and other distributed energy resources.

FUEL-SWITCHING IN ENERGY EFFICIENCY INCENTIVE PROGRAMS

The Massachusetts Energy Efficiency Advisory Council (EEAC) oversees utility-operated energy efficiency programs. These programs, under the umbrella brand of Mass Save, operate in accordance with three-year plans developed with the EEAC and approved by the Department of Public Utilities. The 2019-2021 three-year plan is the first that does not prohibit the use of energy efficiency incentives to switch heating system fuels. The City of Boston will work with the Metropolitan Area Planning Council and other partners on the EEAC to ensure that Mass Save incentives are structured to encourage systematic fuel-switching away from fuel oil and natural gas to electricity or other clean energy sources.

NATURAL GAS INFRASTRUCTURE AND DEMAND RESPONSE

Natural gas use and leaks from natural gas pipes accounted for 29 percent of Boston's community-wide emissions in 2017. As part of his 2019 legislative agenda, Mayor Walsh has introduced an Act to Modernize Our Natural Gas Infrastructure/ Reduce Gas Leaks. This legislation would give the Massachusetts Department of Public Utilities the authority to fine natural gas distribution companies for the total volume of all gas leaks. This policy change would incentivize the utility companies to update their infrastructure, provide revenue to reduce communities' exposure to gas leaks, and fund projects to replace trees and other resources harmed by gas leaks.

In order to encourage efficiency in natural gas use, the City will support the development of a framework to encourage demand response among commercial natural gas users, for instance by drawing from on-site energy storage systems. In the electricity sector, ISO New England, the agency that operates our regional electric transmission grid, compensates large electricity users for reducing consumption when demand or market prices are high. By encouraging customers to



Chris Cook, Chief of Environment, Energy, and Open Space, inspects the geothermal test well site for the Boston University Center for Computing & Data Sciences.

reduce consumption, ISO-NE avoids putting the grid under too much stress. The natural gas sector can similarly optimize investments in grid capacity by using demand response. National Grid has piloted a demand response program for commercial customers in New York; a similar framework could be tested in the Boston area.



Street trees provide shade and cooling, but methane leaks from natural gas pipes can suffocate them by depriving their roots of oxygen. Mayor Walsh introduced legislation in 2019 to give cities more resources to replace trees and generally reduce communities' exposure to gas leaks.

CONNECTING RESILIENCE AND ENERGY EFFICIENCY

The state is currently developing the Clean Peak Energy Standard, which will provide incentives to clean energy providers that can supply electricity or reduce demand during seasonal peak demand periods. Currently, when electricity demand peaks, energy suppliers have to power up fossil fuel generators to meet the need and prevent grid outages. The Clean Peak Energy Standard will encourage suppliers to meet peak electricity demand with cleaner power and reduce the need for back-up fossil fuel generators.

One of the features under consideration is a general resilience multiplier that would reward facilities that can continue to provide power during grid outages. The Clean Peak Standard should also consider an added social equity multiplier that rewards facilities that serve low-income communities during grid outages.



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A CARBON-FREE COMMUNITY

While the strategies laid out in this Update will achieve significant progress toward carbon neutrality as we currently measure our emissions, in the long run we will need to take a larger view of what it means to become a carbon-neutral Boston. Beyond the energy that powers our buildings and transportation, our economic decisions as consumers, businesses and institutions can also result in significant carbon emissions and support industries that contribute to global climate change.

16 DECARBONIZE THE CONSUMPTION OF BOSTON RESIDENTS AND BUSINESSES

The Zero Waste Boston plan lays out strategies to divert 90 percent of Boston's waste, and includes a strong focus on source reduction, which can reduce waste emissions by 40 percent in 2050.

The Carbon Free Boston analysis found that the incineration of Boston's waste in waste-to-energy facilities, as well as waste collection and composting, generated about 393,000 tons of CO_2e in 2017. Zero Waste Boston strategies may reduce direct emissions from waste by 60 percent.

In addition to the emissions generated by waste disposal, consumption by the Boston community gives rise to the generation of carbon emissions outside city borders to produce goods and services for Boston residents. According to the C40 Cities report *Consumption-based GHG emissions of C40 cities*, upstream emissions may represent more than double the emissions from local energy use in buildings, transportation and waste management.[19]

In the next five years, the City will take steps to reduce consumption-based emissions:

- Conduct a consumption-based emissions inventory;
- Promote sustainable consumption and help the public shift to goods and services with lower emissions;
- Explore embodied carbon and actions to increase material reuse and use of carbon-sequestering materials; and
- Encourage land use and economic development policies that support neighborhood retail and Boston-based startups, to build a local, circular economy that allows residents to meet all of their basic needs close to home and to live car-free.



Buying used is one of many ways to reduce our personal carbon impact. A consumption-based inventory can improve our understanding of how to best reduce emissions from the items we use in our everyday lives.

19 *C40 Cities, "Consumption-based GHG emissions of C40 cities," March 2018.*

17 GREEN MUNICIPAL INVESTMENTS

The City of Boston has prioritized making responsible investments that reflect our values and benefit our neighborhoods. In February 2019, Mayor Walsh launched the Environmental, Social, Governance (ESG) Investment Initiative to invest up to $150 million of City operating funds in the short-term fixed income securities of companies that maintain strong corporate ESG practices. The City of Boston also joined the Ceres Investor Network as a means to facilitate corporate engagement around environmental practices.

In the next five years, the City will also take the following steps to continue to decarbonize municipal operations:

- Monitor the performance of the ESG Investment Initiative;
- Update our guidelines for environmentally preferable procurement (EPP), also sometimes called "green purchasing"; and
- Explore incorporating ESG principles into management of the City of Boston pension and trust funds.

18 DEVELOP A VALUES-BASED FRAMEWORK FOR CARBON OFFSETS

The Carbon Free Boston analysis estimated that Boston is able to reduce emissions by more than 90 percent by 2050. But 10 percent of emissions may remain from fuel use or processes that are too costly or difficult to decarbonize with current-day technology. Our ability to address this remainder will probably improve in the next 30 years, but we still need to think about offsets.

Carbon offsets are certificates that represent a metric ton of carbon that is permanently reduced, avoided, or removed from the atmosphere. An independent third party verifies the offset, which may then be sold or retired. By retiring an offset, an emitter can claim to have negated a ton of carbon.

In the next five years, the City of Boston will take steps to:

- Develop guidelines for carbon offsets for future City policies and programs;
- Explore a local carbon offsets market in partnership with neighboring municipalities and regional partners; and
- Evaluate the role of urban forestry and resilience benefits of local carbon offsets.


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WORKING GROUP PARTICIPANTS

Alexandra Smith
128 Business Council

Kathryn Carlson
A Better City

Yve Torrie
A Better City

Amelia Youngstrom
Action for Boston Community Development

James Collins
Action for Boston Community Development

Lisa Frantzis
Advanced Energy Economy

Gabe Shapiro
All In Energy

Anna Leslie
Allston-Brighton Health Collaborative

Ashley Tibett
Alternatives for Community & Environment

Hajar Logan
Alternatives for Community & Environment

Mela Miles
Alternatives for Community & Environment

Richard Juang
Alternatives for Community & Environment

Lisa Jacobson
Barr Foundation

Shanna Cleveland
Barr Foundation

Rickie Harvey
Boston Clean Energy Coalition and West Roxbury Saves Energy

Andrew Wells-Bean
Boston Climate Action Network

George Henderson
Boston Climate Action Network

Linda Hirsch
Boston Climate Action Network

Michael Prokosch
Boston Climate Action Network

Christopher Donnelly
Boston Green Academy

Jacqueline Novicki
Boston Green Academy

Kayla Arreaga
Boston Green Academy

Litsch Prinston
Boston Green Academy

Simon Chernow
Boston Green Academy

Alice Brown
Boston Harbor Now

Alice Brown
Boston Harbor Now

Magdalena Ayed
Boston Harborkeepers

Andrea Love
Boston Society of Architects

Ahria Ilyas
Boston Student Advisory Council

Ebun Osinubi
Boston Student Advisory Council

Henry Swiman
Boston Student Advisory Council

Henry Swiman
Boston Student Advisory Council

Malik Bullock
Boston Student Advisory Council

Stanley Aneke
Boston Student Advisory Council

Wellington Matos
Boston Student Advisory Council

Scott Palmer
Builders and Remodelers Association of Greater Boston

Mary Vogel
Building Pathways

Lisa Owens
City Life/Vida Urbana

Oliver Sellers Garcia
City of Somerville

Michael Green
Climate Xchange

Bronwyn Cooke
City of Cambridge

Stephanie Groll
City of Cambridge

Seth Federspiel
City of Cambridge

Hannah Payne
City of Somerville

Danilo Morales
Codman Square Neighborhood Development Council

Collique Williams
Community Labor United

Staci Rubin
Conservation Law Foundation

Gokce Akin-Olcum
Environmental Defense Fund

Liz Delaney
Environmental Defense Fund

Eric Wilkinson
Environmental League of Massachusetts

William Stack
Eversource

Jon Coleman
Ford

Matthew Raifman
Ford

Meredith Outterson
Greater Boston Interfaith Organization

Patricia Baumer
Greater Boston Real Estate Board

Loie Hayes
Green Energy Consumers Alliance

Amy Longsworth
Green Ribbon Commission

Magdalena Ayed
Harborkeepers

Caroleen Verly
Harvard University Office of Sustainability

Heather Henriksen
Harvard University Office of Sustainability

Jaclyn Olsen
Harvard University Office of Sustainability

Hubert Murray
Health Care Without Harm

Scott Mullen
Lime

Stacy Thompson
LiveableStreets Alliance

Emily Jones
Local Initiatives Support Corporation (LISC) Boston

Ben Sisko
Lyft

Jan Henderson
MASCO

Betsy Harper
Massachusetts Department of Housing and Community Development

Simone Early
Massachusetts Department of Housing and Community Development

Daniel Sullivan
Massachusetts Department of Transportation

Katherine Fichter
Massachusetts Department of Transportation

Hong-Hanh Chu
Massachusetts Executive Office of Energy and Environmental Affairs

Nerali Patel
Massport

Brian Doherty
Metro Boston Trades Council

Cameron Peterson
Metropolitan Area Planning Council

Kasia Hart
Metropolitan Area Planning Council

Megan Aki
Metropolitan Area Planning Council

Jeff Rosenblum
MIT Urban Mobility Lab

Andee Krasner
Mothers Out Front

Edith Buhs
Mothers Out Front

Anastasia Nicolaou
NAIOP Massachusetts

Stephanie Kruel
NAIOP Massachusetts

Tamara Small
NAIOP Massachusetts

Philip Giffee
Neighborhood of Affordable Housing

Lauren Baumann
New Ecology

Mariama White-Hammond
New Roots AME

John Balfe
Northeast Energy Efficiency Partnerships

Maria Meijburg
nuTonomy

Julie Klump
Preservation of Affordable Housing

Frank Mruk
Roxbury Community College

Kevin Hepner
Roxbury Community College

Patricia Puszko
Seaport TMA

Jacob Walther
Sierra Club

Michele Brooks
Sierra Club

Veena Dharmaraj
Sierra Club

Emily Lewis
Sociedad Latina

Harvey Michaels
Temple Israel

Norm Lamonde
Turner Construction Company

Meredith Elbaum
USGBC - MA Chapter

Justin Hank
Veolia

Ned Bartlett
Veolia

Adi Nochur
Walk Boston

Lisa Cunningham
Warner Cunningham

Aajia Hall
Youth On Board

Jen Wishnie
Youth On Board

Jenny Sazama
Youth On Board

Carlota Melo
Zipcar

STEERING COMMITTEE

Christopher Cook
Office of Environment, Energy and Open Space

Kristopher Carter
Office of New Urban Mechanics

Adam Cederbaum
Law Department

Katie Choe
Public Works Department

John Feuerbach
Department of Neighborhood Development

Jonathan Greeley
Boston Planning & Development Agency

Vineet Gupta
Boston Transportation Department

Dion Irish
Inspectional Services Department

Tricia Lyons
Public Facilities Department

Richard McGuiness
Boston Planning and Development Agency

Midori Morikawa
Office of Economic Development

Gregory Rooney
Boston Transportation Department

David Urkevich
Budget Office

CITY OF BOSTON DEPARTMENTS

Age Strong Commission

Boston Planning & Development Agency

Boston Public Schools

Boston Transportation Department

Department of Neighborhood Development

Environment Department

Public Facilities Department

Public Works Department

Office of Budget and Management

Office of Environment, Energy and Open Space

Office of Equity and Inclusion

Office of New Urban Mechanics

Office of Policy

Office of Resilience and Racial Equity

Office of Workforce Development

Operations

CITY OF BOSTON STAFF

ENVIRONMENT DEPARTMENT

Katherine Eshel (Lead)
Alison Brizius
Nicholas Armata
Susan Cascino
David Corbie
Joseph Cornish
Rory Cuddyer
Rosanne Foley
Christopher Kramer
Joseph Larusso
Lourdes Lopez
Alex Mireku
Nicholas Moreno
David Musselman
Brenda Pike
Peyton Siler Jones
Benjamin Silverman
Carl Spector
Bradford Swing
Lauren Zingarelli
Maura Zlody

CITY OF BOSTON STAFF (CONT.)

PUBLIC FACILITIES DEPARTMENT

Evan Brinkman
Paul Donnelly
Michael Soucy

TRANSPORTATION DEPARTMENT

Samantha Devine
Tyler Lew
Matthew Moran
Alaa Mukahhal
Lindiwe Rennert
Stefanie Seskin
Matthew Warfield

BOSTON PLANNING & DEVELOPMENT AGENCY

Michael Christopher
John Dalzell
Manuel Esquivel
Richard McGuinness
Kathleen Pedersen

DEPARTMENT OF NEIGHBORHOOD DEVELOPMENT

Joseph Backer
Jessica Boatwright
John Feuerbach
Jay Lee

OTHER DEPARTMENTS

Matthew Bradley
Sean Chen
William Coughlin
Sabrina Dorsainvil
Naida Faria
Nicholas O'Neill
Stacia Sheputa
Lexi Smith
Kim Thai-Durrigan
Natasha White

CONSULTANT SUPPORT

Vanasse Hangen Brustlin
Kim Lundgren Associates
Archipelago Strategies Group

APPENDIX

The following reports are referenced in this Plan and may be found on the City of Boston website:

› 2014 Climate Action Plan Update Progress Report

› 2017 Community Greenhouse Gas Inventory Report

ABBREVIATIONS

APCC Air Pollution Control Commission

BCYF Boston Center for Youth and Families

BERDO Building Energy Reporting and Disclosure Ordinance

BOC Building Operator Certification

BPDA Boston Planning & Development Agency

BPS Boston Public Schools

BTD Boston Transportation Department

BHA Boston Housing Authority

CDC Community Development Corporation

DoIT Department of Innovation and Technology

E+ Energy positive

EV Electric vehicle

GWSA Global Warming Solutions Act

MAPC Metropolitan Area Planning Council

MassDEP Massachusetts Department of Environmental Protection

MassDOT Massachusetts Department of Transportation

MWDBE Minority, Women, and Disadvantaged Business Enterprise

RFP Request for Proposals

RMV Registry of Motor Vehicles

TDM Travel Demand Management

TMA Transportation Management Association

ZEV Zero-Emission Vehicle

ZNC Zero Net Carbon

ZNE Zero Net Energy

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City of Boston



MAYOR MARTIN J. WALSH