

# GREENOVATE BOSTON

2014 CLIMATE ACTION PLAN UPDATE



MAYOR MARTIN J. WALSH

## 2014 CLIMATE ACTION PLAN STEERING COMMITTEE MEMBERS

### **Vivien Li, Co-Chair**

The Boston Harbor Association, President

### **Brian Swett, Co-Chair**

City of Boston, Chief of Environment,  
Energy and Open Space

### **Andrew Kendall**

Henry P. Kendall Foundation, Executive Director

### **Anthony Janetos**

The Frederick S. Pardee Center for the Study of  
the Longer-Range Future, Director

### **Brian Doherty**

Building and Construction Trades Council

### **Bud Ris**

New England Aquarium, Former President and CEO

### **Christine Poff**

Boston Parks Advocates, Lead Organizer;  
Franklin Park Coalition, Executive Director

### **Crystal Johnson**

Integrative Sustainability and Environmental  
Solutions, Energy & Sustainability Strategist

### **Cynthia Loesch**

Codman Square Neighborhood Council,  
Vice President

### **Edward Glaeser**

Harvard University, Professor of Economics;  
Taubman Center for State and Local Government,  
Director; Rappaport Institute of Greater Boston,  
Director

### **Jacqueline Douglas**

Livable Streets Alliance, Executive Director

### **Jhana Senxian**

Sustainability Guild International, CEO

### **Kelly Saito**

Gerding Edlen, President

### **Magdalena Ayer**

Maverick Association of Residents

### **Marilyn Swartz-Lloyd**

MASCO, President and CEO

### **Mark Liu**

Chinese Progressive Association, Deputy Director

### **Nancy Kilburn**

Greater Boston Interfaith Organization; Roxbury  
Presbyterian Church Social Impact Center, Director

### **Penn Loh**

Tufts University Masters of Public Policy Program  
and Community Practice, Director

### **Rick Dimino**

A Better City, President and CEO

### **Robbin Peach**

MassPort, Program Manager for Resilience

### **Rosanne Foley**

Fields Corner Main Street, Director

### **Stephanie Pollack**

Northeastern University, Dukakis Center for  
Urban and Regional Policy, Associate Director

### **David Brewster**

EnerNOC, Inc, President

### **Tom McShane**

Dewey Square Group, Principal; Boston Harbor Island  
Alliance, Director City of Boston Representatives

### **Councilor Matt O'Malley**

Boston City Council, Environment and  
Parks Committee Chair

### **John Barros**

City of Boston, Chief of Economic Development

### **Sheila Dillon**

City of Boston, Chief of Housing

### **Felix Arroyo**

City of Boston, Chief of Health and Human Services

### **James Gillooly**

Boston Transportation Department,  
Interim Commissioner

### **Barbara Ferrer**

Boston Public Health Commission, Director

### **Michael Dennehy**

Public Works Department, Interim Commissioner



*Mayor Walsh announcing the 2014 Climate Action Plan Steering Committee in March 2014. He also announced that Boston joined the C40 Cities, an invitation-only global network of cities on the front line of preparing for and helping prevent climate change.*



## LETTER FROM MAYOR MARTIN J. WALSH

### DEAR NEIGHBORS,

When I took office in January 2014, it was clear that climate and sustainability were top priorities for Boston. Hundreds of people showed up to the public forums on the environment and open space in January. Throughout the past year, I've been impressed by and grateful for your participation and engagement—from the Steering Committee, to the Greenovate Boston Community Summit, to the hundreds of ideas and comments submitted along the way. I am proud to launch the Greenovate Boston 2014 Climate Action Plan Update under my administration.

Boston has long been a leader on climate action, starting with the 2007 Executive Order on Climate Action. We knew then, and it has only become more clear, that Boston must both dramatically reduce its greenhouse gas emissions and prepare for the unavoidable impacts of climate change. Between 2007 and 2012, we made great progress, from green buildings to single-stream recycling. Then in the fall of 2012, Hurricane Sandy struck New York and New Jersey, causing unimaginable damage and heartache—73 Americans lost their lives and the storm caused \$68 billion dollars in damage.

Had the storm hit just five hours earlier, Boston could have experienced similar losses. We were not better prepared than New Jersey or New York—we were lucky, and luck is not a policy we can count on. The climate continues to change, resulting in rising sea levels and more extreme weather. Boston must focus its collective will on making sure we do everything possible to be ready, and we need to take the lead on reducing the well-documented human contribution to climate change.

Addressing climate change is challenging, but if we work together, the steps we take can do more than protect us; they can create good jobs while improving our health, our public space, and our civic life. And, with your input and support, plus consistent data to track our progress, that is exactly what this plan is designed to achieve.

Sincerely,

A handwritten signature in black ink, appearing to read "Martin J. Walsh". The signature is fluid and cursive, written over a white background.

Martin J. Walsh, Mayor of Boston

# CONTENTS



Soliciting community ideas at the 2014 Greenovate Boston Community Summit.



Boston Shines Savin Hill clean up.

- 03 Letter From Mayor Martin J. Walsh**
- 06 Executive Summary**
- 09 Acronyms and Definitions**
- 10 Introduction**
  - 11 State of the Climate
  - 11 Impacts to Boston
  - 11 National and International Progress
- 13 About the Plan**
- 16 Cross-Cutting Themes**
  - 16 Social Equity
  - 16 Economic Development
  - 17 Public Health and Safety
  - 18 Community Engagement
- 19 Boston's Carbon Footprint**
  - 21 Understanding the Trends
  - 22 Tracking Progress
    - 22 GHG Targets
    - 24 Participation
    - 24 Strategies and Actions
- 25 Implementation and Next Steps**
- 26 Neighborhoods**
  - 30 2020 Goals and Targets
  - 30 Strategies and Actions
    - 30 Community Engagement
    - 32 Buildings and Energy
    - 33 Waste and Consumption
    - 36 Trees and Open Space
- 38 Large Buildings and Institutions**
  - 42 2020 Goals and Targets
  - 42 Strategies and Actions
    - 42 Buildings and Energy
    - 47 Waste and Consumption
- 50 Transportation**
  - 54 2020 Goals and Targets
  - 55 Strategies
    - 55 Fuel Economy
    - 55 Reduce Vehicle Miles Traveled
    - 57 Development, Zoning, and Land Use
    - 57 Data and tracking systems
- 58 Climate Preparedness**
  - 60 2020 Goals and Targets
  - 60 Strategies and Actions
    - 60 Planning and Infrastructure
    - 62 Community Engagement
    - 66 Trees and Open Space
    - 67 Buildings and Energy
- 70 80x50**
  - 72 Core Objectives and Long-term Strategies
    - 72 Carbon-neutral and resilient visioning
    - 75 Interim carbon target
    - 76 Ongoing research and learning
    - 77 A transformation of the environmental awareness of all Bostonians
- 78 Credits and Endnotes**

## CONTENTS *continued*

### FIGURES

- 06 **Figure 1:** GHG Progress and Goals by Sector, 2005–2013
- 08 **Figure 2:** Boston’s GHG Goals and Targets by Sector (infographic)
- 12 **Figure 3:** The Greenhouse Gas Effect (infographic)
- 13 **Figure 4:** GHG Emissions by Sector, 2013
- 14 **Figure 5:** Boston’s Climate Action Timeline 2011–2014 (infographic)
- 16 **Figure 6:** Climate Preparedness Timeline (infographic)
- 19 **Figure 7:** GHG Emissions by Fuel Type, 2013
- 20 **Figure 8:** GHG Progress and Goals by Fuel Type, 2005–2013
- 20 **Figure 9:** Per Capita vs. Total GHG Emissions, 2005–2013
- 21 **Figure 10:** Sources of GHG Reductions, 2005–2013
- 22 **Figure 11:** Performance Measurement, An Example: Residential Sector (infographic)
- 23 **Figure 12:** GHG Intensity of Energy Fuels
- 23 **Figure 13:** Vehicle Miles Traveled vs. Fuel Economy, 2005–2013
- 24 **Figure 14:** Households Heating with Oil vs. Natural Gas, 2005–2013
- 24 **Figure 15:** Percent of Residents Living and Working in Boston, 2005–2013
- 24 **Figure 16:** Driving Mileage: Massachusetts vs. Boston, 2013
- 35 **Figure 17:** Boston’s Residential Waste Stream (infographic)
- 55 **Figure 18:** Per Capita Vehicles Miles Traveled (VMTs) vs. Total VMTs
- 69 **Figure 19:** Coordinating Climate Preparedness Efforts (infographic)

### ILLUSTRATIONS

- 28 Neighborhoods
- 40 Large Buildings and Institutions
- 52 Transportation
- 68 Climate Preparedness



*Boston Bikes Program visits Boston schools and other youth-serving organizations with a fleet of bikes and helmets, a team of instructors, and an active curriculum that gets kids and teens riding bikes.*



*Students participating in The Food Project, a non-profit organization that teaches Boston youth about sustainable agriculture.*

# EXECUTIVE SUMMARY

The Greenovate Boston 2014 Climate Action Plan Update builds upon seven years of work in reducing citywide greenhouse gas (GHG) emissions and preparing for the unavoidable impacts of climate change. Beginning with the 2007 Executive Order, the City of Boston set GHG reduction goals of 25 percent below 2005 levels by 2020 and 80 percent by 2050 for municipal operations, and requires the City to plan and prepare for the impacts of climate change. In 2011, the City released *A Climate of Progress*, Boston’s first community-wide plan, which set the same GHG reduction goals for all of Boston, while continuing to prepare for the impacts of climate change.

Boston has made significant progress toward these goals. Citywide, GHG emissions are 17 percent lower than they were in 2005. Emissions from City government operations have been reduced by almost 25 percent since 2005. Meanwhile, it has become increasingly clear that Boston must also prepare for the unavoidable impacts of climate change. The 2014 Update builds upon the 2011 Plan in six key areas:

1. More comprehensive climate preparedness strategies;
2. Cross-cutting themes including social equity, economic development, and public health and safety;
3. More extensive and inclusive community engagement;
4. An updated, more rigorous greenhouse gas inventory and emission projections;
5. A look at Boston’s 80 percent by 2050 GHG reduction goal (80x50);

6. A website that tracks implementation, performance measures, and lessons learned.

The 2014 Plan outlines specific strategies and actions across five sections, which comprises the body of the Plan:

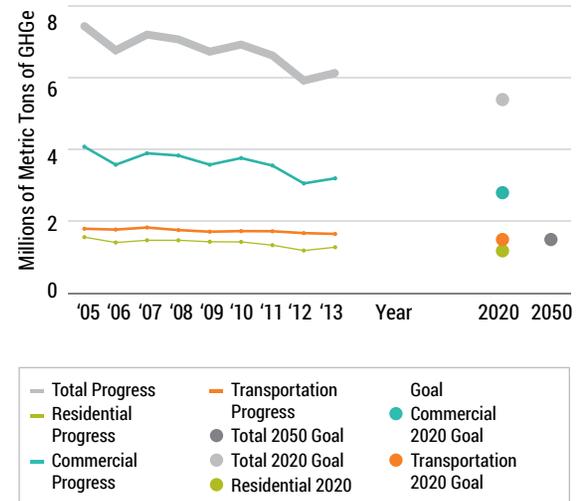
- Neighborhoods
- Large Buildings and Institutions
- Transportation
- Climate Preparedness
- 80x50

The strategies and actions in each of these sections work toward achieving the sector and the Plan’s overarching goals. These goals, strategies, and actions were developed by a Steering Committee, five strategy subcommittees, active engagement of thousands of people through neighborhood meetings and events, and with support from City staff.

In early 2015, implementation plans for the action items will be developed with continued community input and regular progress updates will be included in the online version. The online version also includes a system of rigorous metrics and targets that connect the strategies to Boston’s carbon footprint.

Equally important to reducing Boston’s GHG emissions are the cross-cutting themes that are critical to creating a more sustainable city. As the City conducts education and outreach on climate change, Bostonians must understand how climate action addresses their near-term needs. The strategies and actions in the Plan address the importance of community engagement, social equity, public health and safety, and economic development.

**FIGURE 1: GHG Progress and Goals by Sector, 2005–2013**



Boston reduced GHG emissions by approximately 17% from 2005 through 2013. Most of these reductions were due to a cleaner electric grid. The next 8% of reductions needed to get to Boston’s 2020 goal will be harder to achieve. Reaching the 2050 goal will require a transformation of our energy and transportation infrastructure.

The 2014 Climate Action Plan will ensure Boston’s continued global leadership in reducing GHG emissions and preparing for climate change. With this Plan, Boston will continue to develop as a vibrant and sustainable city for current and future generations and champion the actions needed to meet the global challenges of climate change.

## PRIORITIES

### REDUCE GREENHOUSE GAS EMISSIONS BELOW 2005 LEVELS

- 25 percent by 2020 and 80 percent by 2050
- Expand energy efficiency programs through targeted outreach and new financing mechanisms.
- Increase local and low-carbon energy sources, including expanding district energy and co-generation.
- Re-envision Boston's transportation system to dramatically reduce emissions from this sector.

### PROMOTE HEALTHY AND EQUITABLE COMMUNITIES

- Encourage sustainable development that creates opportunities for current and future residents.
- Ensure equitable access to green jobs and facilitate job training.
- Implement Housing a Changing City, the 2015–2021 Open Space plans
- Promote equity in all policies and programs.

### MEASURE PROGRESS

- Track and publicly report on the Climate Action Plan's progress year-over-year.
- Use performance measurement, targets and goals to motivate climate action and behavior change.

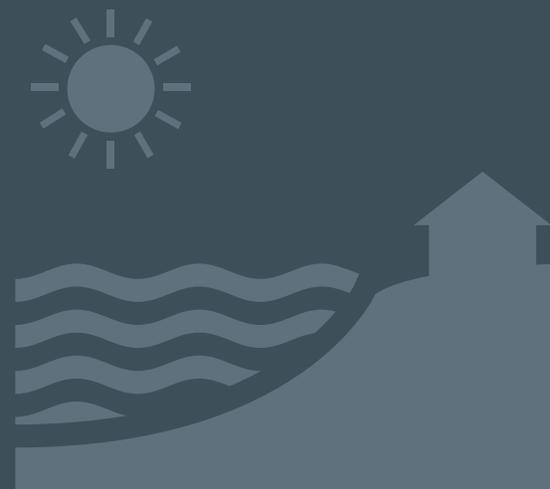


### PREPARE BOSTON FOR THE IMPACTS OF CLIMATE CHANGE

- Work with regional and state agencies, and surrounding communities to align and accelerate regional preparedness planning.
- Incorporate climate preparedness into existing local planning and community engagement efforts.
- Ensure public- and private-sector developments and major capital projects are prepared for expected climate change over their projected life.

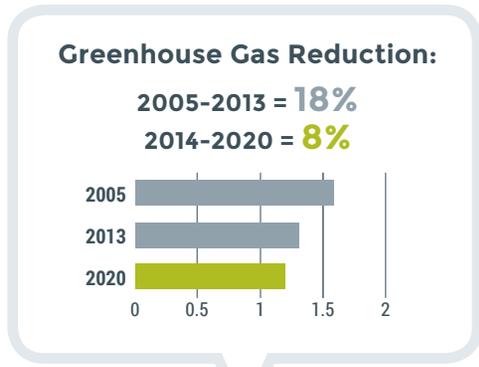
### INCREASE COMMUNITY ENGAGEMENT

- Support grassroots, community-driven climate action efforts.
- Incorporate sustainability into all aspects of education.

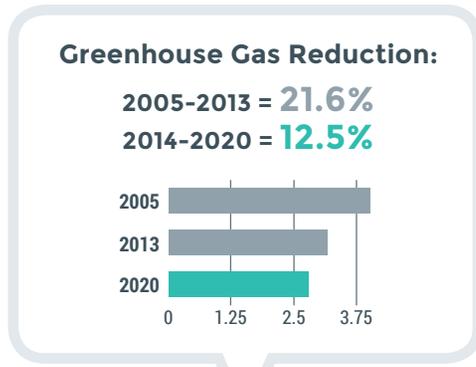


**EXECUTIVE SUMMARY** *continued*

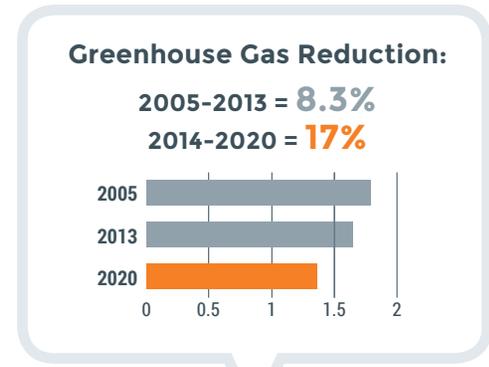
FIGURE 2: Boston's GHG Goals and Targets by Sector



**NEIGHBORHOODS**



**LARGE BUILDINGS AND INSTITUTIONS (LBI)**



**TRANSPORTATION**

**PROGRESS TO DATE**

- 1 Completed 35,858 audits (2009 to 2013)
- 2 Completed ~18,000 significant actions (2009 to 2013)

**2020 TARGETS**

**72,000** Completed Home Energy Audits



**36,000** Weatherizations, Heating System Replacements, or Other Significant Upgrades



**PROGRESS TO DATE**

- 1 LBI and institutions have decreased energy use by 4.1%
- 2 Steam provides roughly 10% of LBI use
- 3 Installed 14.3 MW of solar citywide

**2020 TARGETS**

Reduce energy consumption across all BERDO buildings:

- 60 million sq. ft. buildings **5%**
- 40 million sq. ft. buildings **12.5%**
- 20 million sq. ft. buildings **25%**



**15%** energy use from co-generation  
**10MW** of commercial solar



**PROGRESS TO DATE**

- 1 Reduced VMTs 0.5% per capita 2005 to 2012
- 2 Residency rate increased from 35.2% to 37.8% between 2005 and 2012

**2020 TARGETS**



**Improved Fuel Economy**  
 Target TBD



**5.5% below 2005 VMT**  
 (Vehicle miles traveled)

# ACRONYMS AND DEFINITIONS

**80x50** City of Boston's goal to reduce GHG emissions by 80 percent of 2005 levels by 2050

**100RC** The Rockefeller Foundation's 100 Resilient Cities network

**BHA** Boston Housing Authority

**BPHC** Boston Public Health Commission

**BRA** Boston Redevelopment Authority

**BTB** Boston Transportation Department

**BERDO** Building Energy Reporting and Disclosure Ordinance

**BPS** Boston Public Schools

**C40** C40 Cities Climate Leadership Group

**CAP** Climate Action Plan

**Carbon Footprint** The total set of GHG emissions caused directly and indirectly by an individual, organization, event or product

**Carbon Neutrality** Achievement of net-zero carbon emissions by balancing the amount of carbon released with an equivalent amount through sequestration or offset

**CHP Systems** Combined heat and power systems, also known as cogeneration, generate electricity and useful thermal energy (heat) in a single generated system. Heat that is normally wasted in conventional power generation is recovered as useful energy, which avoids the losses that would otherwise be incurred from separate generation of heat and power.

**Climate Mitigation** The collective reduction of greenhouse gases to slow down and eventually stop disastrous climate change

**Climate Preparedness** Preparing for the near- and long-term vulnerabilities to the natural and systemic impacts of climate change. This term is used synonymously with climate adaptation.

**CO<sub>2</sub>** Carbon dioxide is naturally present in the atmosphere as part of the Earth's carbon cycle—the natural circulation of carbon among the atmosphere, oceans, soil, plants, and animals). CO<sub>2</sub> is one of the primary greenhouse gases, accounting for the majority of all U.S. GHG emissions from human activities. The main source of CO<sub>2</sub> emissions related to human activities is the combustion of fossil fuels (coal, natural gas, and oil) for energy and transportation.

**CO<sub>2</sub>e/GHG<sub>e</sub>** Carbon dioxide equivalent, which is a term for describing different greenhouse gases in a common unit.

**District Energy** Local generation and distribution of thermal and electric energy

**EEOS** Office of Environment, Energy, and Open Space

**Emissions Factor** A number that determines the amount of greenhouse gas emissions generated for every unit of fuel consumed. Renewable electricity, for example, effectively has an emissions factor of 0. Natural gas for heating has a factor of 0.053 metric tons of GHGe/MMBTU, while electricity in New England has an average factor of 0.123 GHGe/MMBTU.

**Greenhouse Gas (GHG)** Greenhouse gases are heat-trapping gases that lead to global climate change. GHGs include carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and fluorinated gases (hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride).

**Greenovate Boston** The City of Boston's community-wide movement to engage all Bostonians in helping the city reach its climate goals to build a greener, healthier, and more prosperous city.

**GRC** Green Ribbon Commission

**USGBC LEED** U.S. Green Building Council's Leadership in Energy and Environmental Design system for rating and certifying green buildings.

**LBI** Large Buildings and Institutions

**MAPC** Metropolitan Area Planning Council

**MBTA** Massachusetts Bay Transportation Authority

**MMBTU** Millions of British Thermal Units. MMBTU is a generic unit of energy that allows apples-to-apples comparisons among different kinds of fuels—for example, the amount of electricity versus fuel oil needed to heat water, all other things being equal.

**Net-zero Building** A residential or commercial building with greatly reduced energy needs through efficiency gains such that the balance of energy needs can be supplied with renewable technologies—also known as net-zero—energy building.

**OEM** City of Boston's Office of Emergency Management

**PV** Photovoltaic solar, a technology that generates electricity from sunlight

**Resilience** The capacity of an individual, community, or institution to dynamically and effectively respond to change, including unanticipated disruption, while continuing to function at an acceptable level.

**RGGI** The Regional Greenhouse Gas Initiative is a cooperative effort among the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont to cap and reduce CO<sub>2</sub> emissions from the power sector.

**USDN** Urban Sustainability Directors Network

**VMTs** Vehicle miles traveled or vehicle miles of travel is a measurement of miles traveled by vehicles in a specified region for a specified time period. The United States Federal Highway Administration (FHWA) compiles monthly and yearly VMT statistics nationally and by state.

# INTRODUCTION

Climate change presents one of the greatest challenges of our time, for both Boston and the world. The Greenovate Boston 2014 Climate Action Plan Update lays out concrete steps and a vision for Boston to play its part in reducing global greenhouse gases (GHG), while preparing for the impacts of climate change that are already occurring, as well as those that will occur in the next 100 years.

This Plan does not represent the beginning or the end of Boston's climate action efforts. Across the entire city, from the neighborhoods, to the private sector, to City government, significant progress has been made. Plummeting solar prices are accelerating residential and commercial installations across the city. In addition, more than 32,000 homes in Boston, the equivalent of 12 percent of all homes in the city, have received their no-cost energy assessments. Large buildings have made substantial headway in cutting energy use, and district energy planning efforts are underway. The City has accelerated its climate preparedness efforts with, for example, a municipal vulnerability assessment, the launch of an international design competition, and the incorporation of climate preparedness in development design review.



*More than 500 residents, businesses, and community leaders from all over Boston participated in the first Greenovate Boston Community Summit held on May 31, 2014.*

The Greenovate Boston 2014 Climate Action Plan Update builds upon this progress, setting a clear path for reaching Boston's 2020 GHG goals, creating a vision for a carbon-neutral city, and preparing Boston for the impacts of climate change.

## What is Climate Preparedness?

Climate preparedness ensures that our community is ready to live with the changes that have already occurred and those that are coming in the next hundred years. Also known as climate adaptation or climate resilience, climate preparedness involves modifications that can be made to the built environment—our buildings, roads, water pipes, and electrical cables—as well as to our “green infrastructure”—the types of trees planted, the space given to brooks and rivers, and the shape of the landscape. Furthermore, preparedness applies to the social and economic environment, how and when businesses operate, how well neighbors know each other, and what resources are available to help those in need.

## City of Boston: Leading by Example

- #1 city for energy efficiency programs and policies in the country, 2013 (American Council for an Energy Efficient Economy)
- #3 walkable city in the U.S., 2014 (WalkScore)
- Invited to join C40 Cities Climate Leadership Group, 2014
- Recognized by the Obama Administration as a Climate Action Champion, 2014
- Selected by the Rockefeller Foundation to join 100 Resilient Cities, 2014

## INTRODUCTION *continued*

### STATE OF THE CLIMATE

The Earth's climate is changing, and evidence of man-made climate change has increased in the past few years.<sup>1</sup>

- 2012 was the second costliest year in U.S. history for natural disasters, amounting to \$110 billion in damages.<sup>2</sup>
- Global annual average temperature has increased more than 1.5 degrees Fahrenheit since 1880 (through 2012).<sup>3</sup>
- Globally, 2014 was the hottest year on record.<sup>4</sup>
- Minimum Arctic sea ice extent, which occurs in early to mid-September, has decreased by more than 40 percent since satellite records began in 1978.<sup>5</sup>
- Global average sea level was 1.5 inches above the 1993-2010 average in 2013. The rise has accelerated to the rate of one-eighth of an inch per year.<sup>6</sup>

### Impacts to Boston

Many projections indicate that the average annual temperature in the Northeast will rise between three and ten degrees Fahrenheit by the 2080s. Climate change may also result in more intense and concentrated bursts of precipitation (e.g., rain and snowfall), though they may be less frequent. Boston, as a coastal city, is particularly vulnerable and at high risk to climate impacts.

- Boston has been ranked the eighth most-at-risk coastal city in the world in terms of annual economic impact from projected flooding.<sup>7</sup>
- Sea-level rise in Boston is likely to be greater than the global average because Boston's land is subsiding, or sinking, at about six inches per century, and changing ocean currents and other features are affecting the distribution of ocean water.<sup>8</sup>
- By 2047, Boston's coldest years will likely be warmer than the warmest years Boston has experienced since 2005.<sup>9</sup>
- In the past 24 months, Boston experienced four near-miss 100-year floods: Superstorm Sandy, Winter Storm Nemo, and two other Nor'easters.
- Boston's coastal neighborhoods and the majority of the Harbor Islands would flood if sea level rises five feet—equivalent to Superstorm Sandy hitting Boston at high tide.<sup>10</sup>
- By the end of the century, Boston may experience up to 62 days above 90 degrees Fahrenheit, up from the current average of 10 days.<sup>11</sup>

### National and International Progress

Although these facts show the challenges presented by climate change, this Plan exemplifies the many ways in which cities are leading by example. Recent developments at the international and national levels, such as new regulations for power plants, and international agreements, hold promise for protecting the planet for present and future generations.



*An artist's depiction of future sea-level rise in Boston.*

## INTRODUCTION *continued*

### Sharing Best Practices

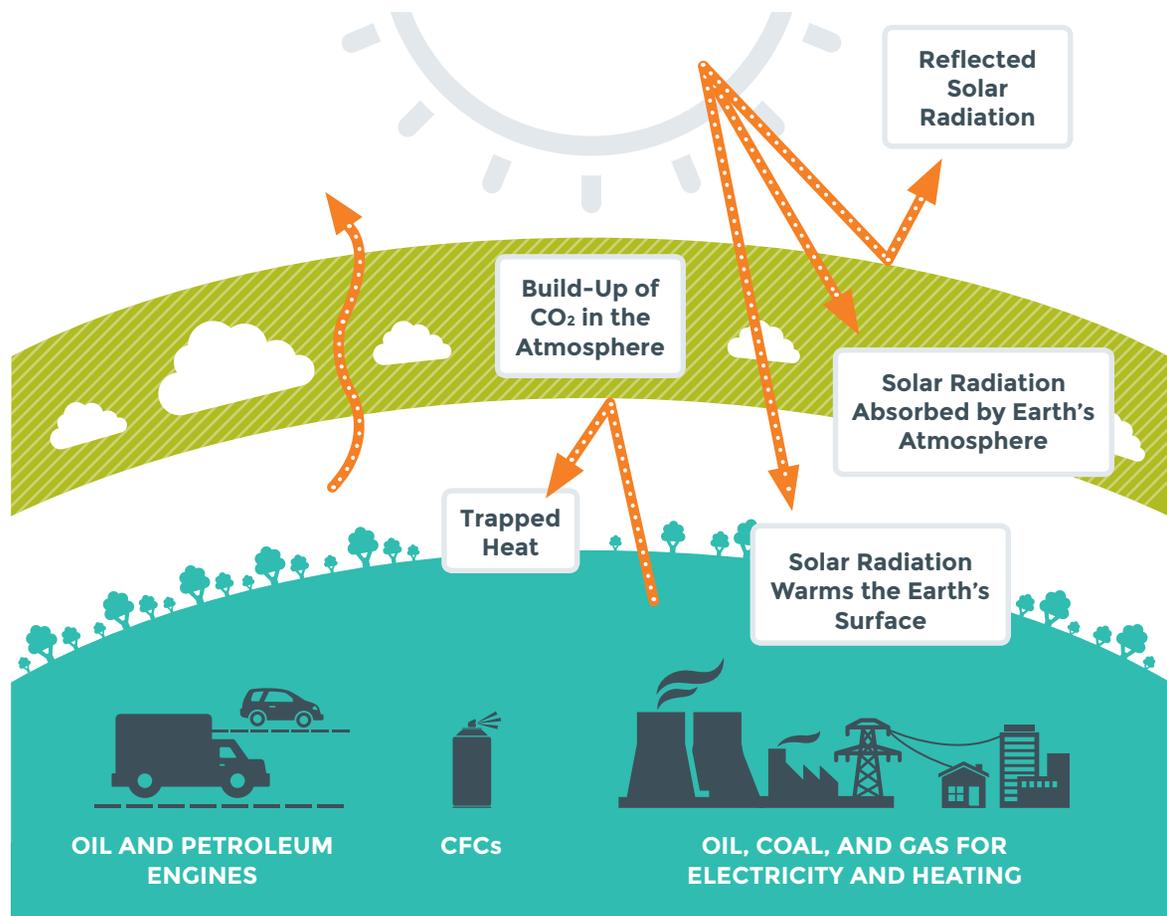
Boston is sharing lessons learned through a variety of national and international networks. Boston has long been a part of the Urban Sustainability Directors Network (USDN), a member group of more than 120 North American cities dedicated to promoting peer-to-peer learning, funding scalable projects, and expanding access through regional networks.

More recently, Boston joined the C40 Cities Climate Leadership Group, an invitation-only global network of cities on the front line of preparing for and helping to prevent climate change. Cities are invited to join the C40 based on population size, economic output, and commitment to and leadership in taking action on climate change. Boston's participation in the C40 will open up greater opportunities for sharing what the City has done and benefiting from insights and partnerships with cities in the C40's global network.

**USDN** urban sustainability directors network

**C40CITIES**  
CLIMATE LEADERSHIP GROUP

FIGURE 3: The Greenhouse Gas Effect

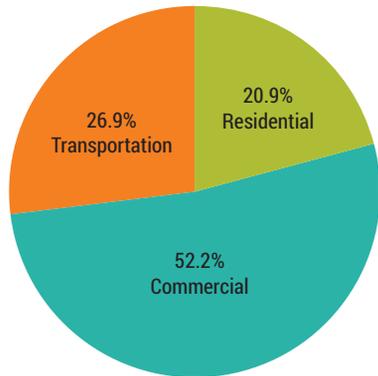


*A build-up of CO<sub>2</sub> in the atmosphere causes heat to be trapped in the Earth's atmosphere, instead of escaping.*

# ABOUT THE PLAN

Boston’s GHG reduction goals of 25 percent by 2020 and 80 percent by 2050 below 2005 levels were recommended by the community and adopted by the City of Boston in the *2011 Climate Action Plan, A Climate of Progress*. This plan set forth that Boston would incorporate climate projections into all formal planning and project review processes, engage all segments of the community in climate action, and develop innovative businesses and workforce skills to take advantage of climate action opportunities. The 2014 Plan will also continue its progress on these principles.

FIGURE 4: GHG Emissions by Sector, 2013



Commercial emissions account for over 50% of our GHG emissions, though because of the way data is reported, the commercial wedge usually includes emissions for large residential buildings. Transportation and residential emissions accounted for 7% and 1% of emissions, respectively.

As new priorities, the 2014 Plan also incorporates:

1. More comprehensive climate preparedness strategies;
2. Cross-cutting themes including social equity, economic development, and public health and safety;
3. More extensive and inclusive community engagement;
4. An updated, more rigorous greenhouse gas inventory and projections;
5. A look at Boston’s 80 percent by 2050 GHG reduction goal (80x50);
6. A website that tracks implementation, performance measures, and lessons learned.

After detailing these new features, the rest of the plan will be outlining key strategies and actions for five sections:

- Neighborhoods
- Large Buildings and Institutions
- Transportation
- Climate Preparedness
- 80x50



Flooding in Christopher Columbus Park on the Boston waterfront during Nor'easter Hercules, January 3, 2014.

## Go Boston 2030

Go Boston 2030 is a City of Boston initiative to envision a bold transportation future for Boston for the next 5, 10, and 15 years. The plan will develop a far-reaching vision that proposes transformative policies and projects to improve transportation for the City’s residents, businesses, and visitors. The two-year process will be driven by data and steered through an unprecedented and inclusive public engagement process. Much of the details of the transportation strategy will be developed under Go Boston 2030.



## FIGURE 5: BOSTON'S CLIMATE ACTION TIMELINE 2011-2014

Boston has made significant progress on many of the actions from the 2011 Climate Action Plan. Below is summary of these actions and their status. The timeline highlights the work that has been done in each of these areas.

### BUILDINGS AND ENERGY SOURCES

- ☑ Renew Boston and Electric Utility Efficiency Programs
- ☑ Renewable Portfolio Standard
- ☑ Renew Boston and Gas Utility Efficiency Programs
- ✓ Appliance Standards
- ✓ Building Codes
- ☑ Energy Efficiency Retrofit Ordinances
- ☑ Behavior Change—Buildings
- ☑ Oil Heat Efficiency Program
- ✓ Benchmarking and Labeling
- ☑ Low-Carbon Standard for Heating Fuels
- ☑ Stretch Code or equivalent
- ☑ Cool Roofs

### TRANSPORTATION

- ✓ Federal/State Mileage and GHG Standards
- ☑ Vehicle Miles Traveled Reduction Strategies
- ☑ Mass Transit/Parking
- ☑ Car Sharing
- ☑ Bike Programs
- ☑ Behavior Change—Transportation
- ☑ Low-Carbon/Renewable Fuel Standards for Gasoline and Diesel
- ☑ Anti-Idling

### SOLID WASTE

- ☑ Commercial Solid Waste Reduction
- ☑ Residential Solid Waste Reduction

### ADAPTATION

- ✓ Give adaptation the same priority as mitigation
- ☑ Assess vulnerability
- ☑ Remain flexible
- ☑ Include climate change in all planning and review
- ✓ Review impacts on existing programs and infrastructure

### ECONOMY

- ☑ Promote good green jobs
- ☑ Promote economic equity

### COMMUNITY ENGAGEMENT

- ☑ Promote climate action at the neighborhood level
- ☑ Collaborate with community in program development and implementation

- ☑ Support a citywide awareness campaign
- ☑ Equip individuals to take action
- ☑ Continue to lead by example

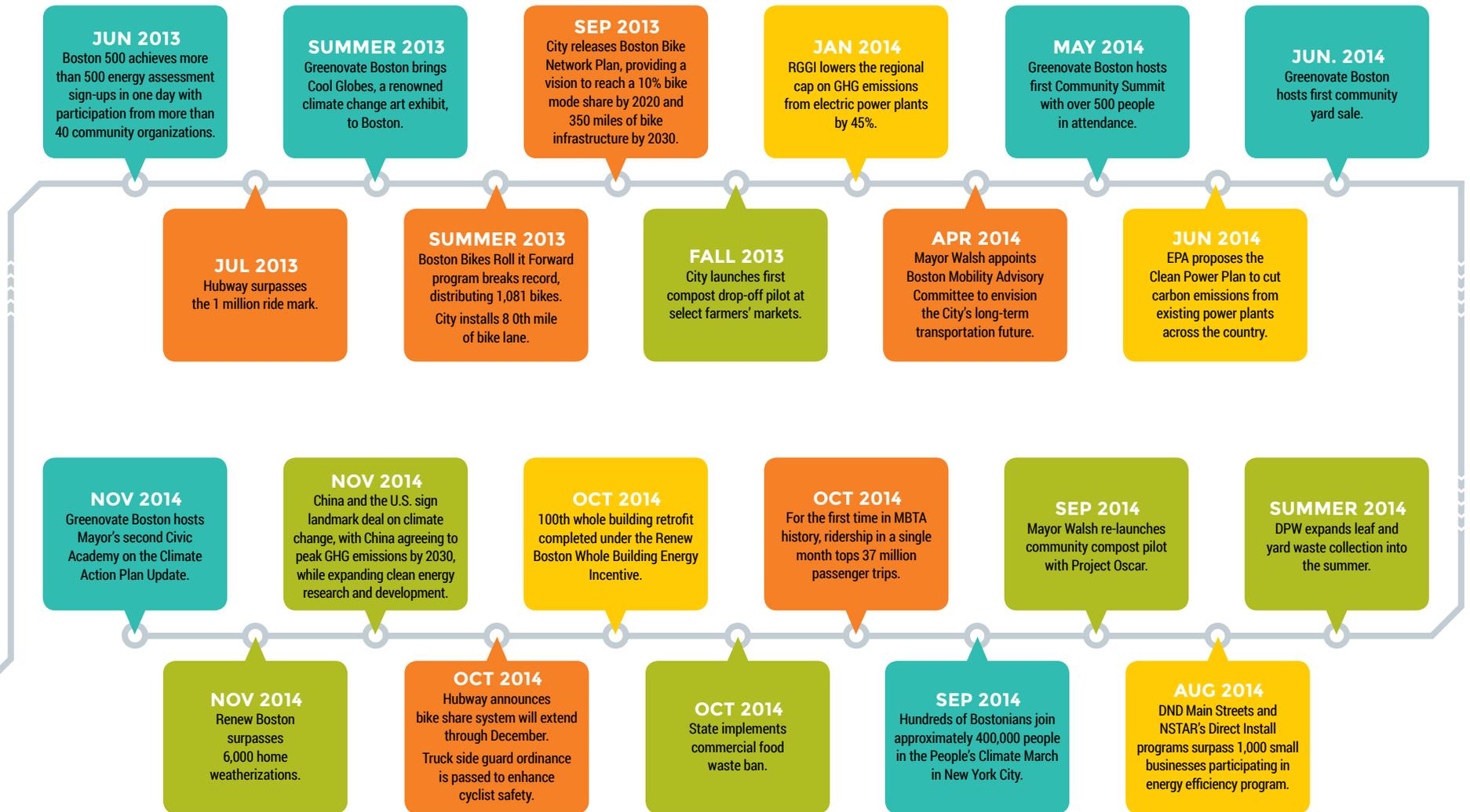
### IMPLEMENTATION

- ☑ Secure sufficient human and financial resources
- ☑ Develop a detailed plan and monitor implementation

- ✓ Implemented or Completed
  - ☑ In progress
  - ☑ Not implemented

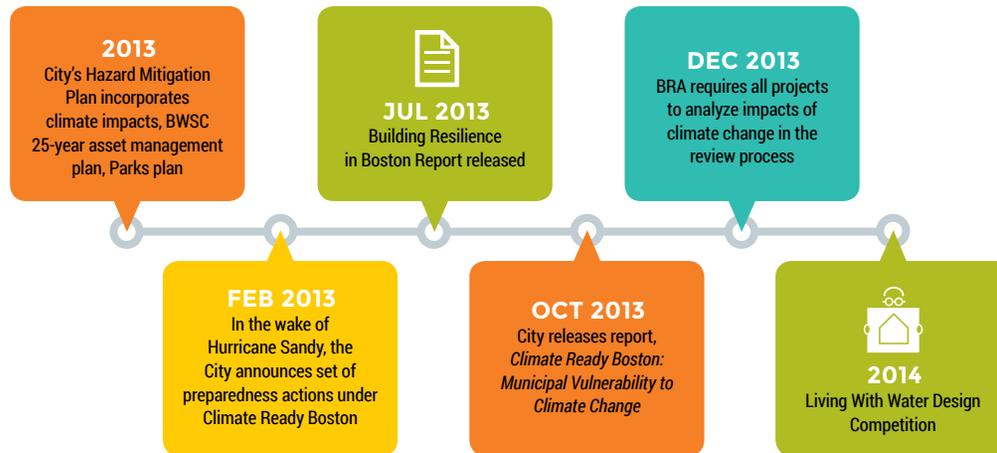


ABOUT THE PLAN *continued*



■ Building and Energy Sources
 ■ Transportation
 ■ Waste Reduction
 ■ Community Engagements

FIGURE 6: Climate Preparedness Timeline



**CROSS-CUTTING THEMES**

Each section of the plan recognizes the cross-cutting themes of economic development, social equity, public health and safety, and community engagement. Whereas each action details what the City intends to do, these themes answer the question of how these actions should be implemented and how they contribute to the City's broader goals.

**Social Equity**

The 2014 Update will be implemented with two guiding principles around social equity. Inspired by the environmental justice movement, the first principle holds that minority and low-income communities must not be

disproportionately impacted by climate hazards. The second principle holds that benefits from climate mitigation and preparedness efforts should be shared equally among all groups of people.

As sea level rise and heat waves increase the threat to human health, the wellness and resilience of vulnerable populations must be prioritized. Boston Public Health Commission (BPHC), Office of Emergency Management (OEM), and other City departments are working together and with the community to increase community resilience related to both environmental and social stresses. The BPHC, for example, provides a number of community preparedness resources through its Get

Ready, Be Safe, Stay Healthy campaign. Going forward, the recent designation of Boston as a Rockefeller 100 Resilient Cities (100RC) initiative will allow for a broader social resilience effort.

The second principle holds that the benefits of GHG reduction must be shared equally. Efforts to reduce GHG emissions can also improve social equity by bringing additional services and programs to those who need them most. For example, Action for Boston Community Development (ABCD), funded in part by federal fuel assistance programs, has completed more than 5,500 audits and nearly 11,000 weatherizations or heating system upgrades in low-income households. Another example is the expansion of Hubway bike sharing stations and adequate bike facilities in all neighborhoods.

On a global level, climate action and social equity are strongly linked. Developed nations are responsible for a majority of the world's carbon emissions, yet developing countries and their populations are often the most vulnerable. On the local level, climate change, if unaddressed, will disproportionately affect Boston's most vulnerable populations. With equity as a guiding principle, Boston will demonstrate that cities can thrive while transitioning away from a carbon-based economy.

**Economic Development**

Climate action is inherently local, and through efforts such as energy efficiency, local, renewable energy installations, waste recovery, and local agriculture, climate action can create safe jobs with living wages that cannot be exported overseas. From 2010 to 2014,

## ABOUT THE PLAN *continued*

jobs in the clean energy sector in Massachusetts grew by 47 percent, approximately 28,000 jobs.<sup>12</sup> In addition to jobs traditionally associated with the green economy, a diverse array of sustainability-related goods and services, from construction to consumer goods and food, have seen increasing demand and higher margins. Climate action could be a major driver of growth in the Massachusetts economy, and Boston has a key role to play in shaping this growth to be equitable and sustainable.

Economic development in Boston is also an important strategy to reduce overall GHG emissions. Bostonians, when compared with suburban residents, have a much lower carbon footprints. They are more likely to take public transportation, bike, or walk to work. Homes and offices in the city also tend to be smaller, resulting in less energy use for heating and cooling.

Cities make it easy for people to connect to one another, providing not only social and cultural benefits, but also enabling shared resources. In a city, not everyone needs their own car, bike, or even backyard. These resources are shared among neighbors through, for example, the Hubway bike-sharing program and Boston's parks. Technology also makes sharing easier, expanding the possibilities for exchanging everything from tools to recreational equipment and small kitchen appliances.

### **Public Health and Safety**

Meeting people's basic needs, such as clean air and water, access to healthy food, safe and healthy homes, and safe places to play and exercise, all require that we take care of our environment and our communities. Making this connection between climate change and public health is crucial, given that many Bostonians face basic health and safety challenges on a daily basis. Community trauma in any form—from the Boston Marathon bombing to violence in our neighborhoods—has profound impacts on individuals. The strategies and actions in the Climate Action Plan will help all Bostonians satisfy these basic needs, while creating a greener, more sustainable city.

Boston has been praised for the clean-up of the Charles River and the Boston Harbor, but the city still faces many other environmental health issues such as asthma triggered by poor air quality. Efforts to green Boston's buildings goes beyond energy efficiency to include improving indoor air quality, which can help address asthma incidence. Urban farming provides healthy, local food, as well as connecting people to their community and environment. From the built environment to the outdoors, climate action can lead to healthier environments for us all.



*By participating in the Food Project, Boston youth learn about sustainable agriculture and gain a personal connection to the issues of food justice.*

## ABOUT THE PLAN *continued*



*In 2011, a 365-foot wind turbine was installed in Charlestown. It generates 3 million kilowatt hours per year and provides a \$300,000 annual savings in electricity costs. The project was funded through the American Recovery and Reinvestment Act (ARRA).*

How we prepare for climate change, or don't, will also impact the health and safety of our communities. Heat waves, for example, are the deadliest disasters in the U.S. Warmer weather will also mean increased exposure to potentially harmful diseases that are spread through insects, such as West Nile virus.

Health policymakers at the Boston Public Health Commission are working on health in holistic, systemic ways. BPHC's Health in All Policies, for example, abides by two principles. First, it incorporates health considerations into decision-making across all the agencies and organizations that influence community design, including transportation and development. Second, it engages residents, who best understand the community context, into these processes.

The Plan incorporates BPHC's approach and aims to proactively address public health and safety issues we face today, as well as those we'll face in the future.

### **Community Engagement**

In 2010, Boston's Climate Action Leadership Committee and Community Advisory Committee made clear that community engagement must be a critical component of Boston's Climate Action Plan. The community's summary report, *Sparking Boston's Climate Revolution*, stated that, "Because the costs of inaction are high, because Boston has ambitious goals, effective climate action requires the help of every Bostonian." With this in mind, the City of Boston involved the community from the onset of the 2014 Update process so

that all Bostonians will have ownership of the plan and be empowered to implement it.

The 2014 Update process included a Steering Committee, appointed by Mayor Martin J. Walsh to advise the City. The Steering Committee consisted of representatives from all sectors of the community, including businesses, advocacy groups, research institutions, and City officials. The Steering Committee was supported by strategy subcommittees for each section of the Plan—Neighborhoods, Large Buildings and Institutions (LBI), Climate Preparedness, and 80x50. The Large Buildings and Institutions subcommittee largely consisted of the Green Ribbon Commission's Commercial and Industrial working group. The Go Boston 2030 Steering Committee constituted the transportation subcommittee.

Community engagement will remain a priority throughout implementation. The Green Ribbon Commission will continue to lead stakeholder engagement in the LBI sector for both climate mitigation and preparedness. The Neighborhoods subcommittee will continue to meet regularly to work on implementing climate action in the neighborhoods.

# BOSTON'S CARBON FOOTPRINT

Since 2005, the City of Boston has been measuring its GHG emissions with data from Boston utilities, fuel oil data, and modeled transportation data. Data collection methods and availability have steadily improved, and the City has revised its inventory process over the past year.<sup>13</sup>

Since 2005, Boston's emissions have declined by approximately 17 percent, from 7.44 to 6.13 million metric tons of CO<sub>2</sub>e (carbon dioxide equivalent—a standard unit for measuring GHG emissions.). This reduction is equivalent to taking 120,000 homes off the grid for one year.

Additionally, per capita emissions has decreased from 12.7 CO<sub>2</sub>e per person in 2005 to 9.5 in 2013. This decrease has occurred despite the increase in population and jobs in Boston.

For the first time, each sector has been assigned a specific GHG reduction goal, as well as targets for program participation in order to achieve the goal.



Members of the Boston the Green Ribbon Commission meet to address climate change issues.

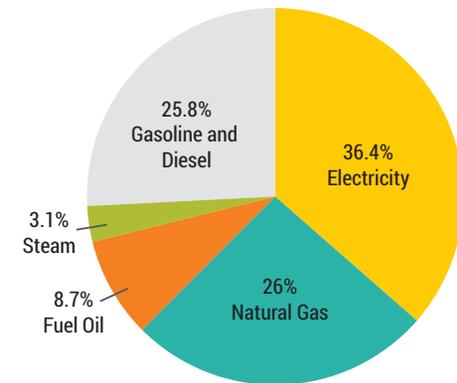
## The Green Ribbon Commission

The Boston Green Ribbon Commission, formed in 2011 and now co-chaired by Mayor Walsh, is a group of business, institutional and civic leaders in Boston working to develop shared strategies for fighting climate change in coordination with the City's Climate Action Plan. Many cities have produced similar plans. But few have also enlisted the support and leadership of the local business community as effectively as Boston. With five working groups—Commercial Real Estate, Health Care, Higher Education, Climate Preparedness, and Transportation—the Green Ribbon Commission is a platform for Boston's institutional and business leaders to prepare the city for climate change while reducing our greenhouse gases.

## 2014 Update Community Participation by the Numbers

- More than 700 people participated online through Engage.GreenovateBoston.org.
- Approximately 300 people attended meet-ups hosted by community groups.
- More than 500 people attended Greenovate Boston's first community summit, held in May 2014.

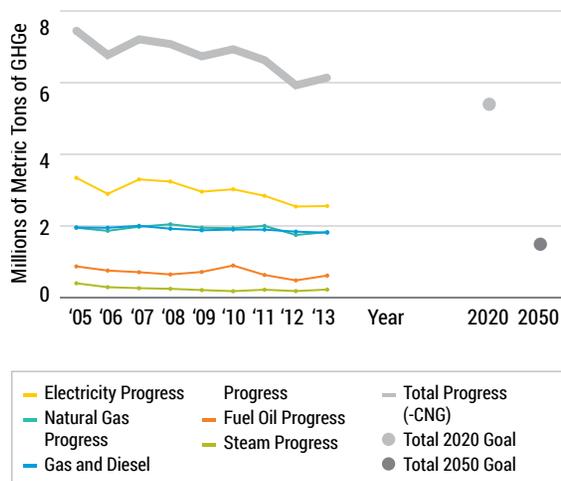
FIGURE 7: GHG Emissions by Fuel Type, 2013



Electricity makes up the largest share of Boston's GHG emissions, but its percentage of the pie has steadily declined since 2005. By 2020, steam from co-generation should make up a much larger percentage.

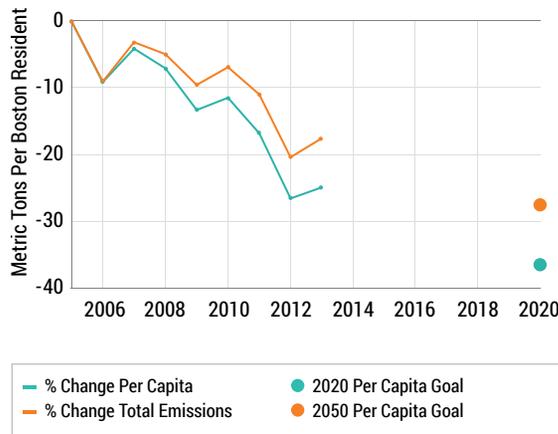
## BOSTON'S CARBON FOOTPRINT *continued*

**FIGURE 8: GHG Progress and Goals by Fuel Type, 2005–2013**



A cleaner electric grid and a steady shift away from oil have driven GHG reductions. Though emissions increased slightly in 2013, in part due to a colder winter, GHG emissions from heating fuels still remain substantially lower than in past years (in terms of weather, 2013 was comparable to 2007).

**FIGURE 9: Per Capita vs. Total GHG Emissions, 2005–2013**



Per capita emission reductions have outpaced absolute emissions reduction. If there had been no growth, emissions would have decreased 24.9%. Growth added roughly 7% to GHG emissions between 2005 and 2013.

### Per Capita Emissions

Boston's carbon reduction has outpaced the city's growing population and economy. However efforts to reduce our energy use and carbon footprint have more than accommodated this growth. As a result, emissions per person in Boston have decreased from 12.7 CO<sub>2</sub>e per person in 2005 to 9.5 in 2013. Without this growth, total GHG emissions would have decreased by nearly 25 percent.

Among U.S. cities, Boston has one of the lowest emissions per capita. New York City has lower per capita emissions at 6.4, largely due to its denser population and high public transportation use. However, European cities such as Copenhagen and Stockholm have achieved much lower emissions per capita—4.7 and 3.3, respectively, due to both high energy efficiency, clean electricity generation, and low rates of driving. This proves that low-carbon cities with an exceptionally high standard of living are possible.

## BOSTON'S CARBON FOOTPRINT *continued*

### UNDERSTANDING THE TRENDS

Approximately 40 percent of the reduction in Boston's GHG emissions comes from the generation of cleaner electricity. By replacing coal and oil with natural gas, New England power plants are now producing fewer GHGs.

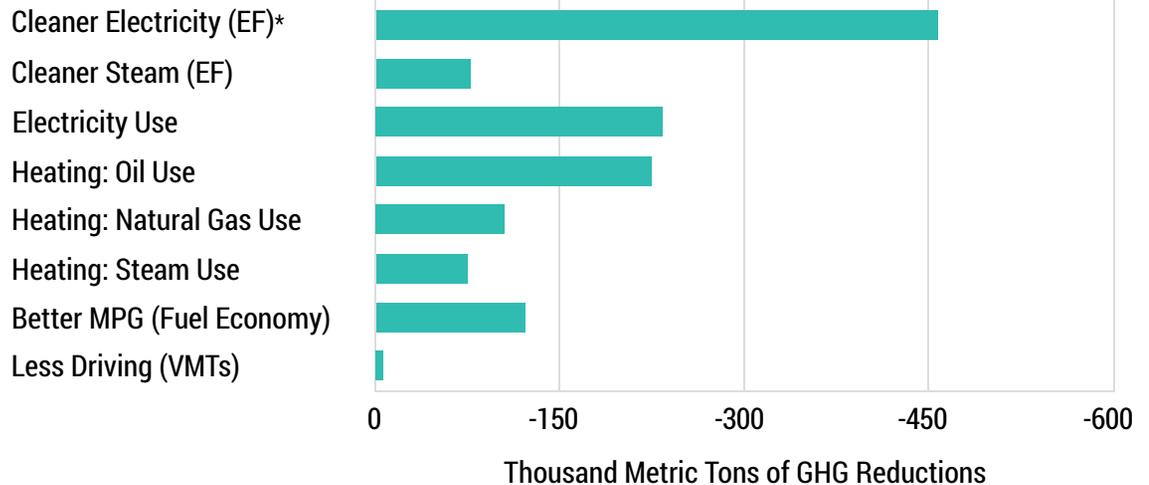
Cap and trade initiatives under the Regional Greenhouse Gas Initiative (RGGI), are expected to continue making Boston's power supply cleaner and less carbon intensive. Going forward, however, these reductions are expected to be at a much slower rate than seen from 2005 to 2013.

A significant amount of heating fuel oil has also been replaced with lower-carbon natural gas. As heating systems are upgraded or replaced, they become much more energy efficient. As a result, overall energy use for heating is decreasing.

Weather also impacts the amount of energy needed to heat buildings. A warmer than usual winter in 2012 resulted in a decrease of GHG emissions specifically from heating fuel sources. Not only does colder weather require more energy for heating, but it also drives up natural gas prices, which often lead power plants to switch to oil, as seen in 2013.

Transportation emissions are declining despite the increase in jobs and commuters in Boston. Miles driven in Boston has remained relatively constant because the average number of miles driven per person has declined. New fuel standards have improved the fuel economy of cars and trucks in Boston. It is expected that these federal standards alone will continue to reduce GHG emissions from transportation by approximately 1.8 percent per year.

FIGURE 10: Sources of GHG Reductions, 2005-2013



Over 40% of past reductions were due to cleaner, less carbon-intensive sources of electricity and steam, as power plants have switched from coal and oil to gas.

Emissions Factor (EF) denotes the amount of GHGs generated for each unit of energy.

While most energy and GHG trends are heading in the right direction, continued progress will require further action. Clean, local generation and energy efficiency must play a much larger role in reducing emissions, if Boston is to reach its 2020 GHG reduction goal. A fuller discussion of trends can be found online at [GreenovateBoston.org](http://GreenovateBoston.org).

**TRACKING PROGRESS**

The City will implement an online performance measurement system with data updated annually and quarterly at GreenovateBoston.org. The performance measurement system will track Boston's GHG emissions, strategies, actions, and program participation. Going forward, the website will expand to include additional measures and targets around tree planting, equity, and climate preparedness.

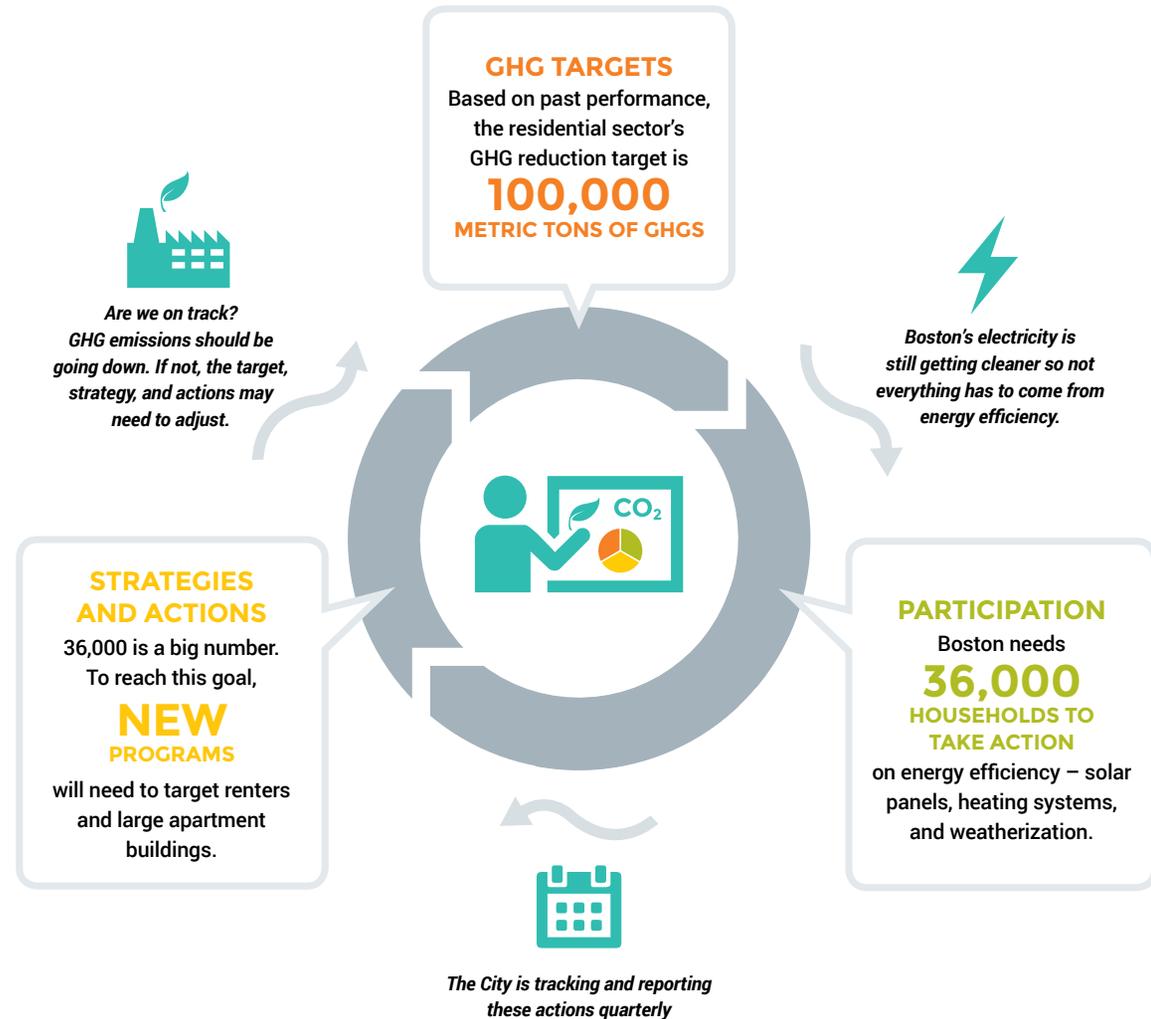
**GHG Targets**

In order to create targets for reaching Boston's 25 percent by 2020 goal, the City incorporated:

1. Remaining GHG emissions reduction needed between 2014 and 2020;
2. Macro trends (such as changes in the electric grid and population growth);
3. Past program participation trends.

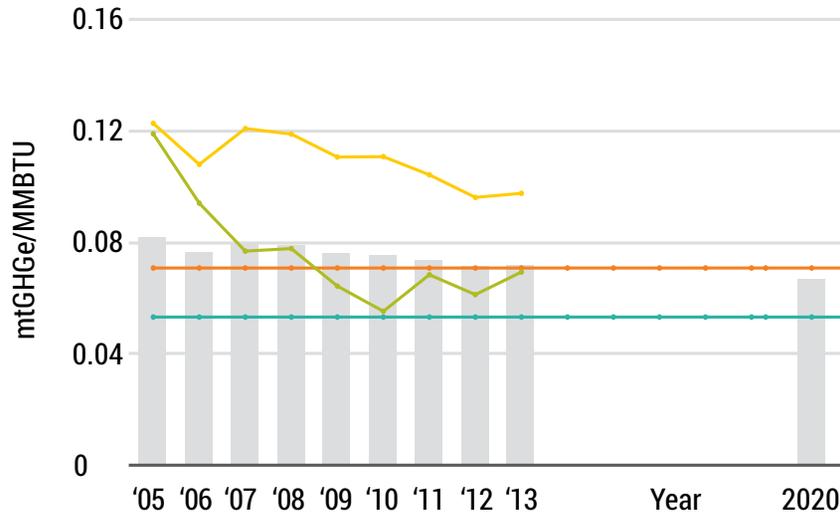
Transportation has the highest percentage reduction target of 17 percent because of the reductions that are expected to occur due to new federal fuel economy standards. Nearly every new car in 2025 will be a electric hybrid of some sort. The LBI proportion is also higher because of the sectors, demonstrated ability to make significant reductions over the past eight years. Lastly, Neighborhoods has a goal of 8 percent. This lower allocation is due to existing challenges in the residential sector. For example, in some cases, landlords are responsible for making energy improvements to a triple-decker or apartment building, but only tenants reap the benefits through energy savings on their utility bills. This means landlords are unlikely to make energy improvements.

**FIGURE 11: Performance Measurement, An Example: Residential Sector**



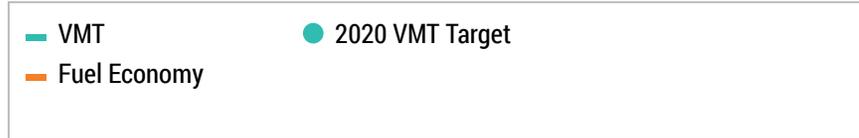
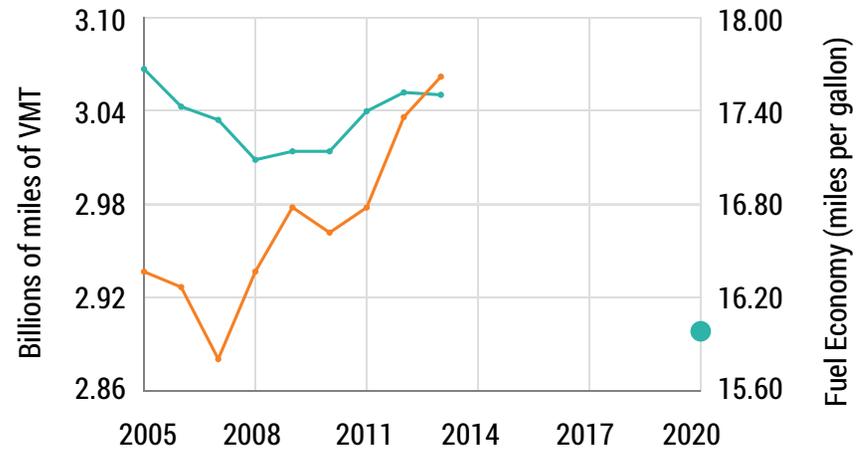
## BOSTON'S CARBON FOOTPRINT *continued*

FIGURE 12: GHG Intensity of Energy Fuels



The chart above measures how “clean” each fuel is—how many GHGs are released for each unit of energy. Steam has the potential to become much cleaner because of the increasing use of co-generation, where steam by-product from producing electricity is captured to generate heat. A key goal target is to expand, and a key goal of the Plan is to expand co-generation in Boston to cover 15% of LBI energy use reported to the City by 2020.

FIGURE 13: Vehicle Miles Traveled vs. Fuel Economy, 2005–2013



The total number of miles driven (VMTs) in Boston has remained relatively flat, yet fuel economy has increased. The number of jobs and commuters may increase in Boston, but increases in fuel economy is projected to accelerate because of new standards from the federal government. This fuel economy increase will be one of the most powerful drivers of emissions reductions moving forward.

## BOSTON'S CARBON FOOTPRINT *continued*

### Participation

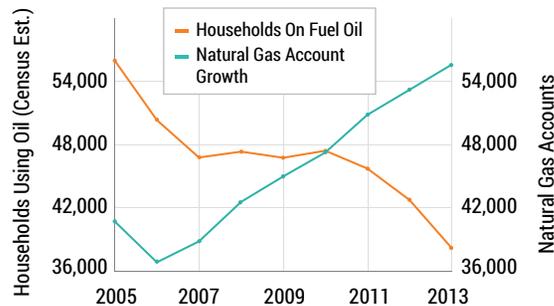
Given many of the Plan's strategies are voluntary, reaching Boston's goals will require substantial participation from residents and businesses in all relevant programs, City-administered or otherwise. As such, each sector will have specific participation targets. These participation targets directly affect Boston's GHG footprint. Program participation by ZIP code will be shared wherever possible.

One example of how participation affects GHGs is Renew Boston. Each home weatherization is estimated to reduce GHGs by roughly 1.3 metric tons, while heating system upgrades can reduce GHGs by as much as two metric tons. Each audit is estimated to reduce GHGs by about 0.3 metric tons of GHGs because of energy efficient light bulbs and programmable thermostats that are given during the audit. When combined with a cleaner electricity grid, roughly 72,000 audits and 36,000 weatherizations and heating system replacements will reduce GHGs by 100,000 metric tons.

### Strategies and Actions

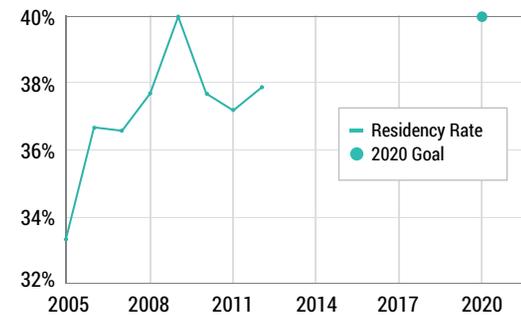
The remainder of the Plan details the strategies and actions that will help Boston achieve its 2020 goal. The online Plan and performance measurement system will include all actions and implementation details, which will be updated as the City and other entities make progress. The online version will also contain background information on the actions and will serve as a resource for both the City and its residents.

**FIGURE 14: Households Heating with Oil vs. Natural Gas, 2005–2013**



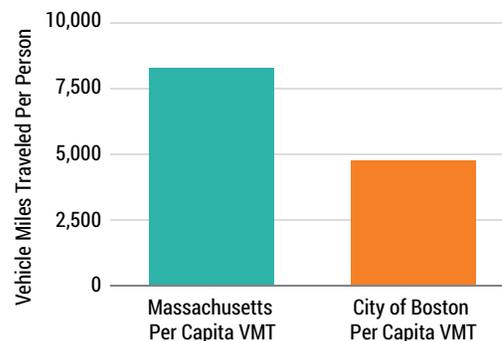
The number of Boston households on oil heat has been declining since 2010, while the number of residential natural gas accounts has soared. These boiler conversions have driven emissions reductions, as heating oil releases 1.33 times the GHG emissions as natural gas.

**FIGURE 15: Percentage of Residents Living and Working in Boston, 2005–2013**



The percentage of Boston workers who also live in Boston (residency rate) is an important measure of the City's greenhouse gas emissions. By providing current residents with jobs in Boston, while also providing housing in Boston for people work in the city, people will drive less and live in homes that use less energy. Ideally, the residency rate will surpass 40% by 2020.

**FIGURE 16: Driving Mileage: Massachusetts vs. Boston, 2013**



Living in dense, urban areas enables people to drive less. Vehicle miles traveled (VMTs) per person in Boston is much less than the state average.

# IMPLEMENTATION AND NEXT STEPS

The Greenovate Boston 2014 Climate Action Plan Update was a shared effort between the City of Boston and all those who contributed, including the Steering Committee, community partners, local businesses, and institutions. With 35 strategies and 98 actions, the Plan sets forth an ambitious agenda for the next three years and beyond.

The 2014 Update is a “living document.” It will continue to evolve online with input from the community and City departments to create implementation strategies for the actions identified in the Neighborhoods, Large Buildings and Institutions, and Climate Preparedness chapters. The online version will include details such as who is responsible for leading the implementation of the action, next steps, available resources, and what is needed to move forward. The Transportation section will continue to evolve through the Go Boston 2030 process over the next three years. The City will add implementation details, resources, and milestones, while updating metrics and progress.

Implementation of the Plan will be led by the City, but its success requires the willingness to act and support from the entire community. Reaching these goals requires partners from all sectors and people from every neighborhood in Boston participate.

To get involved in implementation or to see how we are doing, visit [GreenovateBoston.org](http://GreenovateBoston.org).



*Assembling compost bins on the Boston City Hall green roof.*

# NEIGHBORHOODS





## NEIGHBORHOODS

30 2020 Goals and Targets

30 Strategies and Actions

30 Community Engagement

32 Buildings and Energy

33 Waste and Consumption

36 Trees and Open Space

# NEIGHBORHOODS

- 1 NEIGHBORHOOD NETWORK:** A low-carbon, climate-prepared future hinges upon grassroots support. Neighborhood-level planning and a neighborhood network are two strategies that will increase local climate action.
- 2 SOLUTIONS TO THE LANDLORD-TENANT SPLIT INCENTIVE:** Renters are often reluctant to make investments in energy efficiency. Similarly, when a landlord is not responsible for paying energy bills, there is little incentive to invest in energy efficiency. The City aims to ease the split so that multi-family housing, such as Boston's iconic triple decker, can become more efficient.
- 3 NEW TECHNOLOGIES:** Smart grid and low-carbon innovation driven by Boston companies is accelerating. The City will work with the utilities to both vet and incentivize adoption of these technologies.
- 4 LOW-CARBON/RENEWABLE/RESILIENT HEATING:** Heating accounts for about 60% of residential energy bills and emissions, making low-carbon heating a priority.
- 5 ZERO WASTE:** The City will explore a zero waste plan for residential waste, which could include more robust recycling policies, composting programs, and garbage disposal installation. Waste put down garbage disposals, along with all sewage, route to anaerobic digesters on Deer Island.
- 6 MULTI-CULTURAL ENGAGEMENT:** Boston is a majority-minority city. Making sustainability and climate change relevant to each of Boston's diverse populations is critical.

- 7 TREES AND GREEN SPACE:** The City has a goal to reach 35% tree canopy coverage by 2030. Achieving this goal will likely require public-private partnerships and citizen volunteers for tree planting and maintenance.
- 8 PUBLIC RECYCLING:** All new public trash bins will come with recycling bins. The City will explore designs that can minimize contamination in public recycling. Recycling in parks will also be expanded.
- 9 YOUTH ENGAGEMENT:** Boston's youth represent the future of climate action. Engagement at a young age is crucial for cultivating leadership and green behaviors. Boston Public Schools aims to establish green teams and champions at every school. BPS will also make sustainability a part of the curriculum.
- 10 URBAN AGRICULTURE:** With Article 89, urban agriculture is blooming in Boston. Vacant lots are being repurposed. The City has also begun a food resilience study. Access to local, healthy food remains a priority for the Office of Food Initiatives.
- 11 PARKS:** Boston's parks not only provide recreation for residents, they also protect against flooding, stormwater pollution and help cool the City. The Open Space Plan envisions an equitable parks system that continues to provide multiple benefits.





6

GREEN BUILDING SUPPLIES

COMMITTEES DE CONSTRUCCION VERDES

GREEN BUILDING SUPPLIES

COMMITTEES DE CONSTRUCCION VERDES

MERCADO DE ORGANICOS

ORGANIC

有机市场

BANK GREENS FARM

7

FARM FRESH PRODUCE

BPS

9

10

8

11

# NEIGHBORHOODS

## 2020 Goals and Targets

### PROGRESS TO DATE

- 1 Completed 35,858 audits (2009 to 2013)
- 2 Completed ~18,000 significant actions (2009 to 2013)



Boston’s strength, diversity, and vitality are rooted in its neighborhoods. They are home to Boston’s residents and small businesses, triple-deckers and brownstones, schools and parks, community gardens and bodegas. While Boston’s neighborhoods account for approximately 20 percent of the city’s greenhouse gas emissions, they are where climate action and sustainability come to life. The championing of climate action at the neighborhood level will enable the City to adopt smart policies and programs that prepare the City for climate change and drive further GHG reductions over the long term.

Between 2014 and 2020, the residential sector has a target of reducing greenhouse gas emissions by 7.8

percent, or approximately 100,000 metric tons. Between 2005 and 2013, the residential sector reduced emissions by 104,000 metric tons. This reduction will require an acceleration of existing energy efficiency. While these programs have the most direct bearing on greenhouse gas emissions, all residents must become engaged with climate action and sustainability.

This chapter outlines strategies to bring climate action to the neighborhoods through green space, trees, recycling, composting, and urban food systems. Any strategy relating to both climate preparedness and the neighborhoods appear in the Climate Preparedness Section for the sake of clarity. As Boston implements the Plan, mitigation and preparedness strategies relating to the neighborhoods will be coordinated.

## Strategies and Actions

### COMMUNITY ENGAGEMENT

#### 1.1 EMPOWER RESIDENTS AND BUSINESSES TO TAKE CLIMATE ACTION IN THEIR NEIGHBORHOODS

In order to reach Boston’s climate goals, every resident and business must help implement the Climate Action Plan. That is why, in 2013, the City launched Greenovate Boston, the City’s overarching sustainability initiative to help drive and support climate action throughout Boston’s neighborhoods. Many residents and businesses are already taking action. Greenovate Boston serves as a resource to support them, as well as a platform to encourage further action and help connect grassroots action to Boston’s citywide goals and strategies.

### 1.1 ACTIONS

#### 1.11 Create a neighborhood climate action network

Greenovate Boston will work with the community to determine the best structure to help facilitate communication between community members, as well as between the City and the community.



#### 1.12 Pilot neighborhood-level sustainability planning

Greenovate Boston will provide a framework for individuals and communities to set goals, complete projects and gain support for taking climate action in their neighborhoods.



#### 1.13 Create a one-stop shop for sustainability resources

Greenovate Boston will work across City departments to develop guides and resources that connect Bostonians with information on relevant City processes and tips for local sustainability.



#### 1.14 Expand messaging and communications

Work collaboratively with community groups to deliver multilingual messaging using a diverse set of channels and existing networks including: all City touch points with the public, local weekly and foreign language newspapers, special events, and communities of faith and houses of worship.



#### 1.15 Create a performance measurement system

Create a comprehensive and communicable performance measurement system to track overall progress toward climate goals, increase transparency and accountability, and provide neighborhood-level data.



## NEIGHBORHOODS *continued*

### 1.2 EMPOWER AND EDUCATE YOUTH AND YOUTH-SERVING ADULTS TO TAKE ACTION ON CLIMATE CHANGE IN THEIR SCHOOLS AND NEIGHBORHOODS

Bostonians must be engaged in climate action at a young age in order to establish the necessary habits and behaviors, as well as cultivate the leadership that we need to reach citywide carbon reduction goals. Boston's K-12 and higher education schools are taking actions every day to green their campuses and, in many cases, are engaging young people in the process. The leading green schools have active Green Teams led by a Sustainability Champion. These Green Teams provide opportunities for young people to take action to green their buildings, promote sustainable behaviors among staff and students, and develop leadership skills that prepare them for their careers.

#### 1.2 ACTIONS

##### 1.21 Establish Green Teams and Sustainability Champions at every school

Designated Sustainability Coordinators will lead student Green Teams at all schools in Boston.



##### 1.22 Integrate sustainability and climate change concepts throughout curriculum and youth programming

Sustainability must be a connected theme throughout the curriculum and programming of Boston Public Schools and other youth organizations and programs.



*Curley School students in Jamaica Plain clean up their outdoor classroom in celebration of the 2013 Green Apple Day of Service.*

## NEIGHBORHOODS *continued*

### BUILDINGS AND ENERGY

#### 2.1 EXPAND AND ACCELERATE ENERGY EFFICIENCY AND RENEWABLE ENERGY PROGRAMS AND PARTICIPATION

More so than any other strategy, energy efficiency promoted through Renew Boston, the City's energy efficiency program, and incentives and services offered by Boston's utility partners, will be critical to meeting Boston's near-term greenhouse gas reduction goals. To reach these goals, participation in existing programs such as audits and weatherizations for 1-4 unit homes, small business direct install, and bulk solar purchasing, must be accelerated. In addition, new programs and marketing must be developed to reach new audiences. Such programs may include additional technologies and incentives that start with enhancing renter participation, targeting low-income and foreign-language populations, ensuring compatibility with historic preservation, encourage a shift away from oil and electric-resistance heating systems, and marketing programs for five-unit and above buildings.

#### 2.1 ACTIONS

##### 2.11 Expand energy efficiency programs for new participants

Create energy efficiency programs that enhance renter, low-income, and multi-family experiences and increase participation in energy efficiency programs.



##### 2.12 Accelerate residential solar

Continue to accelerate solar deployment by continuing Solarize program and tackling existing barriers in the multi-family and renter market.



##### 2.13 Support small businesses going green

Introduce a matchmaking service for small businesses that allows them to be paired with sustainability services.



##### 2.14 Accelerate participation and expand the scope of energy audits

Explore introducing an energy audit at the home point-of-sale or through the building permitting process, while making the audit an entry-point into all available efficiency products and services.



##### 2.15 Introduce new technology

Deploy residential technologies that start with enabling renters to participate in energy efficiency, such as Wi-Fi-enabled "smart" thermostats, while piloting new business models that tackle tenant-landlord split issues.



*Mass Saves signs up Boston residents for their no-cost home energy assessment.*

##### 2.16 Expand the Whole Building Incentive

Scale up and build on the Whole Building Incentive to encourage higher incentives for weatherizations that occur over the entire building, as well as better coordination among the landlord and building tenants.



##### 2.17 Promote programs in multiple languages

Enhance translation abilities of home performance contractors so that energy efficiency is accessible by all populations in Boston.



##### 2.18 Transition to low-carbon heating sources

Work with the Commonwealth to shift residential units and small businesses away from inefficient and carbon-intensive heating systems, including electrical resistance heat, oil heat, and inefficient natural gas heat.



## NEIGHBORHOODS *continued*

### WASTE AND CONSUMPTION

#### 3.1 MAKE PROGRESS TOWARD A WASTE- AND LITTER-FREE CITY

Boston's residential waste currently goes to a waste-to-energy facility, which provides energy to power Boston's electricity grid. The carbon emissions from that facility are included in the emissions factor and no longer included separately in the inventory. However, the City of Boston and the community are still committed to reducing waste by increasing recycling and reuse, and diverting organics. By keeping these valuables out of Boston's waste stream, we can collectively save money, create local jobs, and improve the environment.

#### 3.1 ACTIONS

##### 3.11 Launch a zero waste planning process

A comprehensive planning process will identify strategies to move the city toward zero-waste.



##### 3.12 Increase recycling in public places

The City's Department of Public Works, Parks and Recreation Department and Property management will work to expand recycling in public places.



*Compost drop-off at Egleston Farmer's Market.*

#### CROSS-CUTTING THEME

### Economic Development: From Green Jobs to A Green Economy

According to the Massachusetts Clean Energy Center (MassCEC), clean energy jobs grew by 24 percent in 2012 and 2013 to almost 80,000 jobs in Massachusetts. Next Step Living, one of Boston's primary efficiency services vendors, grew from just 19 employees in 2009 to almost 900 by the end of 2014.

Boston Housing Authority's (BHA) energy efficiency contract will save over \$100 million in energy costs, and its Project Labor Agreement created 600 jobs, of which 103 were BHA residents. Going forward, green principles must be embedded into the entire economy, creating demand for green services by raising City standards and public interest in how efficient our homes can be, what happens to our waste, and where our food comes from, while training workers with the skills necessary to meet the needs of a green economy.

**CROSS-CUTTING THEME:**

**Equitable Food Access in Dudley Square**

A decade ago, a third of the land near Dudley Square lay vacant. Today, community gardens and greenhouses, staffed by more than 100 youth volunteers, grow local, healthy food for the neighborhood. This work, pioneered by The Food Project, City Fresh Foods, City Growers, Dudley Street Neighborhood Initiative, and others, provides healthy, affordable, and local food for Roxbury and Dorchester, traditionally underserved neighborhoods that have a minority population of greater than 70 percent. Food production is only the start—existing or future plans for local processing, retail sales, and waste processing related to these gardens close the loop, creating jobs, making communities healthier, and strengthening community bonds. To further this vision, the City of Boston has begun a food resilience study to understand the opportunities and challenges in the regional food system. In the long term, creating strong, resilient neighborhoods throughout Boston will better prepare Boston for climate change.

**3.2 EXPAND ACCESS TO HEALTHY AND LOCAL FOOD**

Access to healthy, local food emerged through the 2014 Transition report, the Greenovate Boston Community Summit, and other Greenovate Boston Meet-ups as a clear community priority. By participating in urban farming, whether by growing food to sell; purchasing fresh products from a local farmer; or, growing your own food in a community plot or backyard, people can contribute to positive environmental, economic and social impacts. Climate change is predicted to have a profound impact on the global food system. Therefore a robust, local food system is a critical component of climate preparedness planning.



*Fresh produce at Back Bay Station.*

**3.2 ACTIONS**

**3.21 Transform vacant lots into urban farms or community garden plots**

The Department of Neighborhood Development will continue to explore the transformation of vacant lots into urban agriculture or community garden plots.



**3.22 Increase healthy food education**

The Office of Food Initiatives will expand programs to educate residents about healthy food options, in particular simple and easy ways to prepare and serve healthy foods.



**3.23 Expand the healthy corner store initiative**

Expand BPHC's Healthy Corner Store Initiative to additional neighborhoods and increase citywide participation.



**3.24 Complete a citywide food resilience study**

With funding from the Kendall Foundation, the City has recently commissioned a team to complete a citywide food resilience study.



**3.25 Increase education around and access to local healthy food in Boston Public Schools**

Expand Boston Public School's Farm to School and Fresh Fruit and Vegetable programs and increase on-site production of food to supplement food served at breakfast and lunch.



**FIGURE 17: BOSTON'S RESIDENTIAL WASTE STREAM**



\* Percentages based on July-Nov. 2014

## NEIGHBORHOODS *continued*

### TREES AND OPEN SPACE

#### 4.1 PROTECT AND EXPAND GREEN SPACES AND THE URBAN FOREST IN ALL NEIGHBORHOODS

Trees and open space are an important part of any climate action plan—not only do they help clean Boston’s air, but they reduce the urban heat island effect and absorb flood waters. Trees and open space are also exceedingly recognized for their public health benefits, from improved air quality to creating peaceful places for Bostonians to recharge. Boston has long been recognized for its historic park system; however maintaining Boston’s parks and growing the urban forest will take the support and collaboration of the public and private sector.

#### 4.1 ACTIONS

##### 4.11 Create a tree canopy plan

Create a clear, actionable tree canopy plan to increase tree canopy coverage 35 percent by 2030.



##### 4.12 Create an open space plan

Create and implement the 2015–2021 open space plan for maintaining and enhancing Boston’s green spaces.



*Airport Park offers green space in East Boston.*



# LARGE BUILDINGS AND INSTITUTIONS





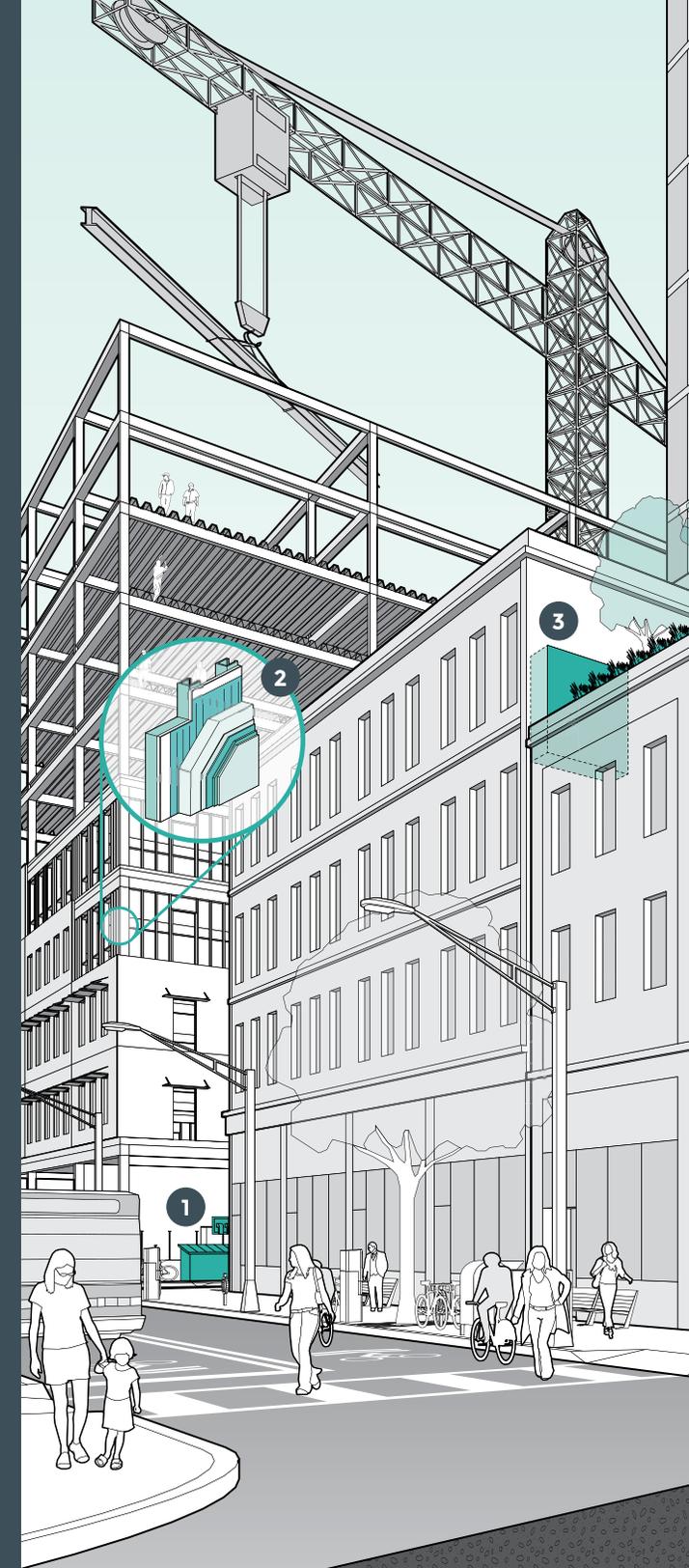
## LARGE BUILDINGS AND INSTITUTIONS

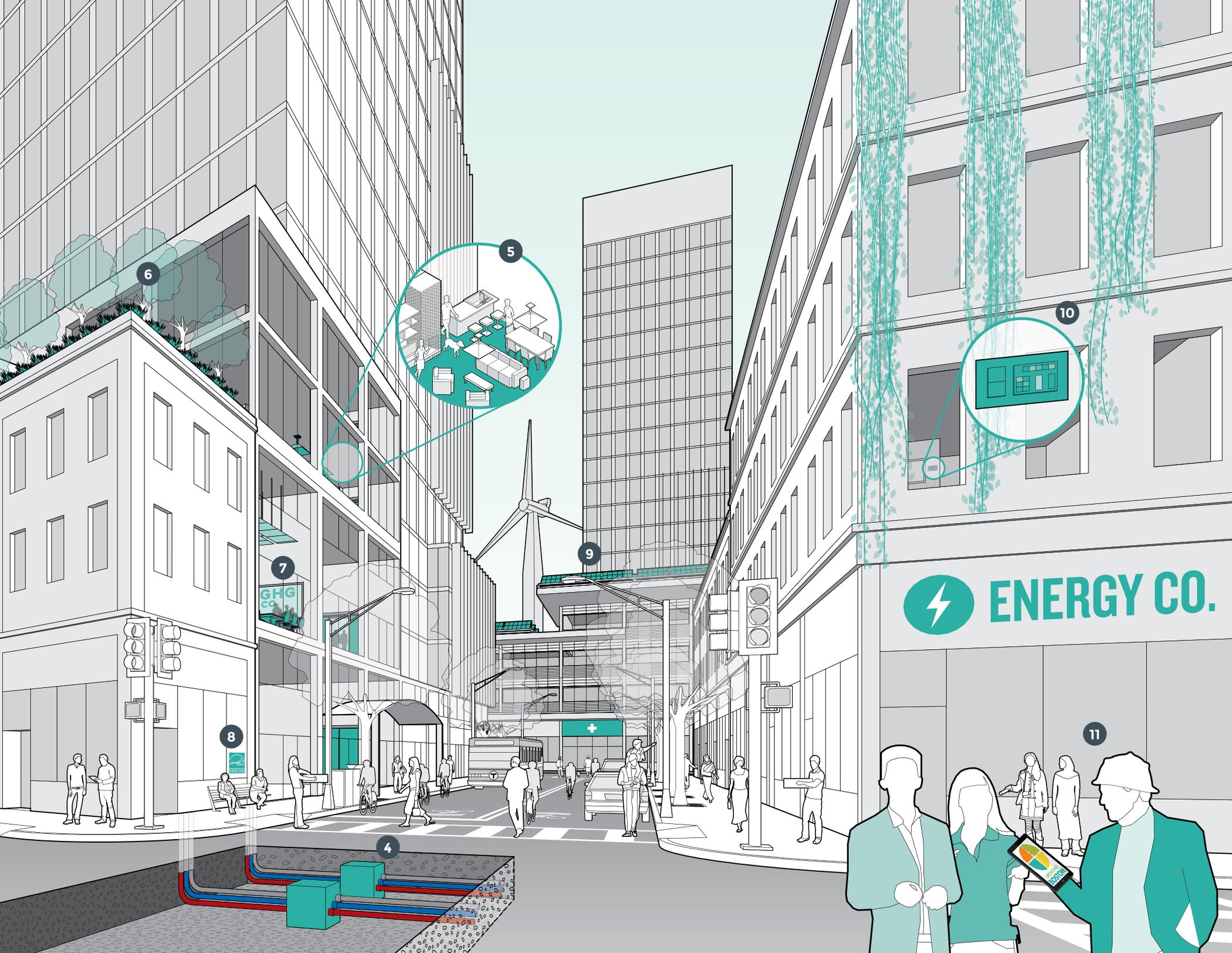
- 42 2020 Goals and Targets
- 42 Strategies and Actions
  - 42 Buildings and Energy
  - 47 Waste and Consumption

# LARGE BUILDINGS AND INSTITUTIONS

- 1 LOCAL ANAEROBIC DIGESTION AND COMMERCIAL RECYCLING:** Boston will increase waste diversion through innovative recycling and organic diversion technologies like anaerobic digesters. For example, all sewage and food scraps from waste disposals is sustainably processed today at the Deer Island anaerobic digester.
- 2 HIGH-PERFORMING NEW BUILDINGS:** Through Article 80, Boston requires all large new construction to be LEED-certifiable today. The City will continue examining ways in which zoning and energy codes can raise the green bar for all buildings.
- 3 ELEVATION OF CRITICAL INFRASTRUCTURE:** Large buildings should integrate climate preparedness into renovation and construction plans (see Climate Preparedness chapter). One example is the elevation of critical infrastructure, like electrical control boxes, to the roof instead of the basement.
- 4 DISTRICT ENERGY:** Boston's steam pipes provide efficient steam heat from co-generation to downtown and Longwood area buildings. Expanding this district heating and cooling and local energy is critical for our long-term energy future.
- 5 MIXED-USE PLANNING:** Boston's 2030 housing plan incorporates sustainable development principles, such as dense, mixed-use development with access to public transportation. These developments will cut greenhouse gas emissions while improving public health.
- 6 COOL ROOFS:** The City will identify incentives for cool roofs in order to reduce urban heat.

- 7 INTEGRATION INTO OPERATIONS:** When companies make energy efficiency a priority, staff are empowered to better manage their buildings' energy, tenants can negotiate green leases, and projects can acquire financing—while improving the businesses' bottom line.
- 8 ENERGY EFFICIENCY AND REPORTING AND DISCLOSURE ORDINANCE:** Boston's energy reporting and disclosure ordinance will give energy data on about 65 percent of Boston's LBI square footage, enabling market recognition of efficient buildings and targeted outreach to less efficient buildings. The City aims to get 120 million s.f. of large buildings to reduce their GHGs 15–40 percent.
- 9 SOLAR PANEL INSTALLATION:** The City aims to install 10 MW of additional solar power, as well as green and living roofs enabled by Article 89, on large buildings. The City will also push for grid decarbonization across the region.
- 10 SMART GRIDS AND NEW BUILDING TECHNOLOGIES:** Boston has piloted net-zero homes, which generate as much energy as they use, through the E+ program. The City will work with builders and university researchers to pilot net-zero, or carbon-neutral principles in the construction of large buildings.
- 11 INVESTING IN PEOPLE:** Peer learning, working groups, and technical exchanges for both executives and staff, such as the Green Ribbon Commission and A Better City's Challenge for Sustainability, are important tools to cut emissions. Educational exchanges with local colleges and green skills training will further embed low-carbon principles into Boston's economy.





6

5

10

7

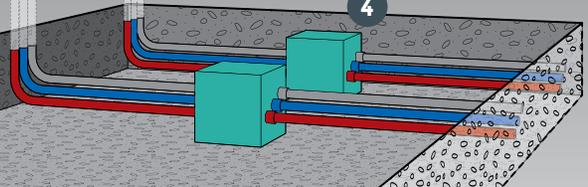
9

8

11

4

 ENERGY CO.



# LARGE BUILDINGS AND INSTITUTIONS

## 2020 Goals and Targets

### PROGRESS TO DATE

- 1 LBI and institutions have decreased energy use by 4.1%
- 2 Steam provides roughly 10% of LBI use
- 3 Installed 14.3 MW of solar citywide



Boston is home to thousands of large buildings, including commercial buildings, industrial facilities, university and hospital campuses, cultural institutions, and civic facilities. Climate action from the Large Building and Institution (LBI) sector will play a crucial role in achieving a 25 percent reduction in carbon emissions by 2020. Together, the LBI sector contributes approximately 50 percent of Boston’s greenhouse gas emissions. A large percentage of Boston’s total building square footage and carbon emissions is concentrated in a relatively small number of buildings. Thus, the LBI sector presents an opportunity to achieve significant emissions reduction by engaging a relatively focused set of businesses and institutions.

## Strategies and Actions

### BUILDINGS AND ENERGY

#### 1.1 MAINTAIN AND EXPAND ENERGY EFFICIENCY PROGRAMS

Energy-efficiency programs in Boston are coordinated by Renew Boston, a partnership between the City, energy utilities, and service providers. Through a multi-stakeholder process, this program must be expanded with new incentives in order to connect more buildings into energy efficiency programs. Buildings in the LBI sector will in turn benefit from targeted outreach, better connections to utility programs, new financing mechanisms, and new incentives for equipment replacement and efficiency in commercial tenant space.



*E Positive (+) Highland Park homes in Roxbury generate more energy than they use annually.*

### 1.1 ACTIONS

#### 1.11 Expand engagement for targeted efficiency



Work with third-party organizations to engage building owners with opportunities for energy efficiency, and communicate to utilities when permits are issued for building renovations.

#### 1.12 Support financing for energy efficiency



Assess and address LBI energy efficiency financing needs and, at the state level, support on-bill utility financing and C-PACE programs.

#### 1.13 Facilitate equipment upgrades



Work with utilities to incentivize replacement of inefficient equipment before end-of-life, and facilitate the bulk purchasing of efficient equipment.

#### 1.14 Develop tenant fit-out incentives



Work with utilities to identify efficiency incentives for the fit-out of commercial tenant space.

#### 1.15 Develop oil heat efficiency program



Work with the Commonwealth to develop a program for more efficient oil systems and transitions to lower-carbon sources, including, for example, a fuel oil surcharge to provide funding.

## LARGE BUILDINGS AND INSTITUTIONS *continued*

### 1.2 ENGAGE AND FACILITATE VOLUNTARY ENERGY EFFICIENCY ACTIONS

The City will encourage deep carbon reductions and conduct targeted outreach to building stakeholders. In particular, efficiency in tenant spaces is an important area of focus. In addition, the City will help facilitate learning within sectors, so that successful examples can be communicated to peer organizations.



On May 31, 2014, Mayor Martin J. Walsh showcased inaugural members of the Mayor's Carbon Cup: Massachusetts General Hospital–Partners HealthCare, Brigham and Women's Hospital–Partners HealthCare, Harvard University, and Boston University See description box at right, "Current Energy Efficiency Programs for LBI" for more information.

#### 1.2 ACTIONS

##### 1.21 Expand recognition of deep reductions

Use programs like the Mayor's Carbon Cup to recognize organizations that achieve deep GHG reduction goals, including those that adopt Boston's climate goals as their own.



##### 1.22 Engage tenant efficiency

Encourage and recognize efficiency in tenant spaces.



##### 1.23 Expand engagement for voluntary efficiency actions

Encourage energy-efficient actions, such as purchasing high-efficiency equipment and nightly lighting shut-off.



##### 1.24 Facilitate peer-to-peer learning

Enable institutions within each sector to learn about successful efficiency work through pilots, workshops, and case studies.



##### 1.25 Identify incentives for load shifting

Work with utilities to develop incentives for thermal and battery storage to shift peak-hour demand.



##### 1.26 Conduct audit outreach

Work with LBI organizations to encourage their staff and students to perform home energy audits.



##### 1.27 Lead by example on carbon reduction

Explore raising the 2020 municipal GHG reduction goal, and accelerate installation of efficient street lighting and building energy efficiency projects.



### Current Energy Efficiency Programs for LBI

On May 31, 2014, Mayor Martin J. Walsh showcased four large institutions that have joined the Mayor's Carbon Cup by each committing at least one million square feet of building space to a 35 percent reduction in greenhouse gas emissions intensity by 2020. These institutions collectively committed roughly 15 million square feet to the Cup and, if successful, will remove over 75,000 metric tons of CO<sub>2</sub>e from a 2005 baseline, equivalent to weatherizing close to 60,000 housing units. The Cup continues to seek additional commercial real estate, hospitals, and universities to participate.

Before participating in the Cup, a number of free resources are available for those interested in lowering their bills. A Better City's Challenge for Sustainability, for example, gives technical assistance, peer learning networks, data tracking services, and additional services for commercial real estate to become more sustainable. A Better City also offers resources on transportation management and climate preparedness. Utility incentives are available to any property in the City that wants to get started on energy efficiency. With the passage of the Building Energy Reporting and Disclosure Ordinance, the City aims to enroll 120 million square feet in some climate action.

## LARGE BUILDINGS AND INSTITUTIONS *continued*

### 1.3 PILOT HIGH-PERFORMANCE BUILDINGS

Over the past few years, the City has helped pilot net-zero homes; that is, homes that generate as much energy as they use. Looking ahead, the Commonwealth has identified strategies for all new buildings to be net-zero in 2030.<sup>19</sup> To lead these efforts, Boston will work to pilot net-zero commercial buildings. In addition, the City will explore establishing climate model districts where new buildings will be required or incentivized to meet advanced energy and preparedness standards.

#### 1.3 ACTIONS

##### 1.31 Pilot net-zero buildings

Utilize incentives, vacant City land, and current programs for pilots of net-zero buildings across different sectors.



##### 1.32 Explore climate model districts

Examine the potential for districts with comprehensive high-performance and preparedness requirements for new buildings.



### 1.4 FACILITATE INNOVATION IN ENERGY EFFICIENCY

Faculty at the region's many architecture and engineering schools, as well as clean-tech research and development institutions, can play an important role in researching new building technologies. In addition, the City will bring stakeholders together to test new approaches to green leasing, in which both the landlord and tenant benefit from an energy-efficient building. Finally, the City will also identify incentives for the deployment of cool roof technologies.

#### 1.4 ACTIONS

##### 1.41 Pilot new building technologies

Work with utilities to incentivize pilots of building technologies, and engage with Boston-area institutions on research.



##### 1.42 Explore green leasing

Work with LBI stakeholders to examine innovative green leasing strategies.



##### 1.43 Explore incentives for cool and green roofs

Explore incentives for cool roofs and green roofs on new and existing buildings in order to mitigate urban heat islands.



*By making use of harvested rainwater, Boston Properties' Atlantic Wharf building is designed to use 15% less water in building HVAC systems compared to a typical building. This illustration shows the flow of harvested water through the building.*

### 1.5 IMPLEMENT ENERGY CODES AND REPORTING REQUIREMENTS FOR EXISTING BUILDINGS

The Commonwealth is responsible for developing building energy codes, including the Stretch Energy Code, which is a more advanced alternative that Boston has adopted. Boston needs to ensure that current codes are well-enforced, and that the next Stretch Energy Code will encompass renovation and tenant fit-out, both of which would be key to improving the efficiency of existing buildings. The City continues to implement the Building Energy Reporting and Disclosure Ordinance (BERDO), and by 2019, many buildings covered by the ordinance will be required to conduct either an energy assessment or implement building energy efficiency actions. The results of these five years can help inform the need for additional retrofit programs or requirements.

## LARGE BUILDINGS AND INSTITUTIONS *continued*

### 1.5 ACTIONS

#### 1.51 Ensure implementation of energy codes

Improve enforcement of current codes through training of inspectors.



#### 1.52 Work with the Commonwealth on the new Stretch Energy Code

Ensure that stretch code includes standards for building renovation and tenant fit-out.



#### 1.53 Connect energy reporting with efficiency programs

Continue to implement the Building Energy Reporting and Disclosure Ordinance, and connect reporting buildings with Renew Boston and other efficiency programs.



#### 1.54 Evaluate effectiveness of BERDO-required assessments

Study results of the first five years of BERDO-required assessments to evaluate ways to increase energy efficiency.



#### 1.55 Retrofit municipal buildings

Implement all cost-effective energy efficiency measures in municipal building projects.



### 1.6 INCREASE REQUIREMENTS FOR NEW BUILDINGS

Boston's new buildings will need to use significantly less energy in order for the city to achieve emissions reduction goals. In addition to pilots of high-performance and net-zero buildings, building requirements need to set a higher standard for energy performance. This will include requirements for using the U. S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) green building rating systems criteria, potential performance-based requirements that are oriented toward net-zero and solar-readiness standards. Because transportation is a major component of the city's emissions, Boston's new buildings will also need to foster sustainable transportation choices for workers and residents.



*The George Robert White Environmental Conservation Center (GRWECC) is a LEED Platinum certified building. It consumes 30% less energy than a conventional building, uses fewer natural resources, and creates a safer, healthier space for occupants.*

### 1.6 ACTIONS

#### 1.61 Study expansion of Article 37 LEED requirements

Examine lowering building size threshold for Article 37 compliance, raising the LEED standard to Silver, or both.



#### 1.62 Evaluate performance-based standards for net-zero goals

Explore the role of energy-use intensity standards, with goal of net-zero new buildings by 2030 in most sectors.



#### 1.63 Require new buildings to be solar-ready

Develop specific standards requiring that new buildings be able to accommodate solar installation, with flexibility for site suitability.



#### 1.64 Explore increased municipal LEED requirements

Explore requiring new municipal buildings to achieve LEED Gold.



#### 1.65 Require new large buildings to facilitate low-carbon transportation choices

Develop requirements for new buildings to foster biking, transit, walking, and car-sharing options for workers.



## LARGE BUILDINGS AND INSTITUTIONS *continued*



*In 2013, Harpoon Brewery installed a co-generation system at their Boston Brewery to simultaneously generate electricity and heat.*

### **1.7 EXPAND ON-SITE RENEWABLE ENERGY, DISTRICT ENERGY, AND COMBINED HEAT AND POWER**

In addition to becoming more energy efficient, Boston's buildings must transition to renewable energy and eliminate on-site combustion of oil. To address this, the City will promote and lead by example with the installation of on-site renewable energy and CHP systems, which provide combined on-site heat and electricity generation. Many large buildings in Boston are connected to a district energy system which provides efficient, centralized heating and cooling. Expansion of these networks and the creation of new district energy systems can provide a significant improvement in energy efficiency and carbon emissions.

#### **1.7 ACTIONS**

##### **1.71 Address grid issues**

Work with utilities and state to address problems of interconnecting renewables into the grid, focusing on downtown grid.



##### **1.72 Promote on-site combined heat and power and renewables**

Encourage commercial CHP, solar, and ground-source heat pumps.



##### **1.73 Facilitate expansion of district energy**

Expand district heating, cooling, and microgrids, through district-level planning and a potential requirement for new large buildings to study costs and benefits of connection.



##### **1.74 Expand municipal installation of renewables, CHP, and district energy connections**

Evaluate feasibility for all municipal buildings, and install solar where possible.



### **Gas Leaks in Boston**

New England has the oldest pipeline infrastructure in the country and high concentration of cast iron pipe, which is especially leak-prone. While it is currently unclear just how much gas is released into the air, these leaks release methane, which has on average 21 times the global warming potential of CO<sub>2</sub> and can pose safety risks. If residents smell gas leaks at any time, they should immediately call 1-800-233-5325.

In July 2014, new legislation was passed to accelerate gas leak repair, which enables municipalities to request information on gas leaks from the Department of Public Utilities. The City of Boston is a full partner in aiding with these leak repairs. The City of Boston Utility Coordination Software is a best-in-class process for repairing gas leaks, so that any time a street is repaved or major construction work occurs, all utilities are notified in order to allow for repair of leaks that pose safety and health concerns.

## LARGE BUILDINGS AND INSTITUTIONS *continued*

### 1.8 TRANSITION TO CLEANER, LOW-CARBON FUEL SOURCES

Carbon emissions from buildings depend on the types of fuels being used. In recent years, many LBI buildings and district steam providers have switched from fuel oil to cheaper, lower-carbon natural gas. To preserve the benefits of this fuel-switching, the City will work with state and utility partners to eliminate gas leaks and prevent spikes in the price of natural gas. Natural gas has served as a temporary “bridge” toward long-term carbon neutrality; however the City must work on transitioning toward renewable energy, leading by example with its municipal buildings. An examination of carbon fees in other cities will also help inform the City’s long-term strategy for moving toward carbon neutrality.



*In 2012, the City of Boston installed solar panel arrays on the roof of the City Public Works Facility to apply green technologies to power the emergency operation of traffic control systems at 18 intersections along the City of Boston’s evacuation route.*

#### 1.8 ACTIONS

##### 1.81 Support regional transition to low-carbon fuels

Work with the Commonwealth to develop a low-carbon fuel standard and increase the supply of carbon-free energy in the region.



##### 1.82 Promote green power purchasing

Promote renewable energy purchasing, including buildings that have linked off-site renewable projects.



##### 1.83 Study solutions to prevent natural gas spikes

Support technical or regulatory solutions to preserve the fuel-switching that has happened.



##### 1.84 Work to expedite gas leak repair

Work with utilities and the state to expedite the replacement of leak-prone pipes.



##### 1.85 Increase municipal green power purchases

Expand renewable energy purchasing and use of electricity and renewable fuels for the municipal vehicle fleet.



##### 1.86 Study policies on carbon fees in other cities

Evaluate the potential for a municipal or regional carbon tax or fee.



## WASTE AND CONSUMPTION

### 2.1 EXPAND ORGANIC WASTE DIVERSION

According to the Massachusetts Department of Environmental Protection, food materials and organics make up 21 percent of the current municipal waste stream.<sup>14</sup> Organic waste collection and composting has been piloted through farmers’ markets and at events in Boston. The state has also implemented a new commercial food waste ban. Boston must build on these efforts to bring composting and other means of organic waste diversion to all large buildings and institutions.

#### 2.1 ACTIONS

##### 2.11 Develop organics diversion program

Establish organic diversion programs for residential and commercial buildings.



##### 2.12 Explore requiring new buildings to provide organic waste separation

Explore requiring large new buildings to provide facilities for disposing organics.



##### 2.13 Implement organics diversion program in municipal buildings.

City departments, especially Boston Public Schools, should lead by example and pilot organics diversion composting programs.



## LARGE BUILDINGS AND INSTITUTIONS *continued*

### 2.2 EXPAND COMMERCIAL RECYCLING

Increasing commercial recycling can reduce carbon emissions, engage citizens in an easy sustainability action, and help raise environmental consciousness. While commercial recycling is largely overseen and regulated by the Commonwealth, the City can work with the state to create and implement new policies and programs. The City can also play a more direct role with respect to large residential, and municipal buildings and public spaces.

#### 2.2 ACTIONS

#### 2.21 Explore requirements for recycling and organic waste collection

Examine requirements for residential buildings, commercial buildings, and public events.



#### 2.22 Promote recycling at LBI facilities

Conduct outreach in partnership with businesses, tenants, universities, and the MBTA.



#### 2.23 Ensure all municipal buildings provide recycling

Provide recycling in schools, City buildings, public housing, and public spaces.



#### 2.24 Examine requirements for recycling construction waste

Explore a requirement that all waste be recycled or salvaged at large construction sites.



### 2.3 PRODUCER RESPONSIBILITY

The City is a major purchaser of various equipment and supplies. To lead by example, the City will update its purchasing policies to expand the use of sustainable options.

#### 2.3 ACTION

#### 2.31 Expand municipal green purchasing

Update the City's green purchasing policy.



#### Commercial Food Waste Ban

On October 1, 2014, the statewide commercial food waste disposal ban regulations went into effect. The ban, regulated by the Massachusetts Department of Environmental Protection (MassDEP), requires any entity that disposes of at least one ton of organic material per week to donate or re-purpose the useable food. Any remaining food waste must be shipped to an anaerobic digestion (AD) facility, where it is converted to clean energy or sent to composting and animal-feed operations.



*The City of Boston undertook a pilot program in 2013 that allowed Boston residents to drop off compostable food scraps for free at three farmers' markets: Harvard-Allston, Egleston Square, and Bowdoin-Geneva.*



# TRANSPORTATION





## TRANSPORTATION

54 2020 Goals and Targets

55 Strategies

55 Fuel Economy

55 Reduce Vehicle Miles Traveled

57 Development, Zoning, and Land Use

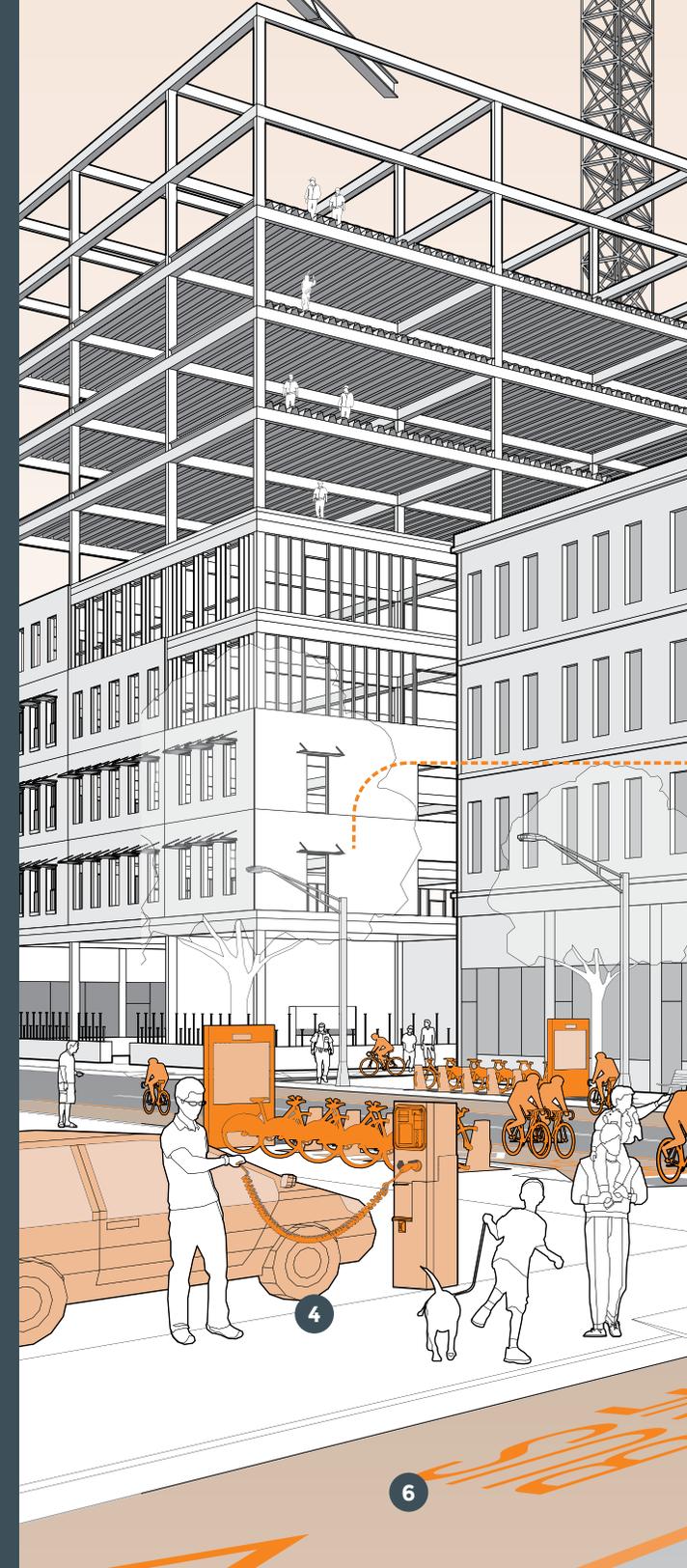
57 Data and tracking systems

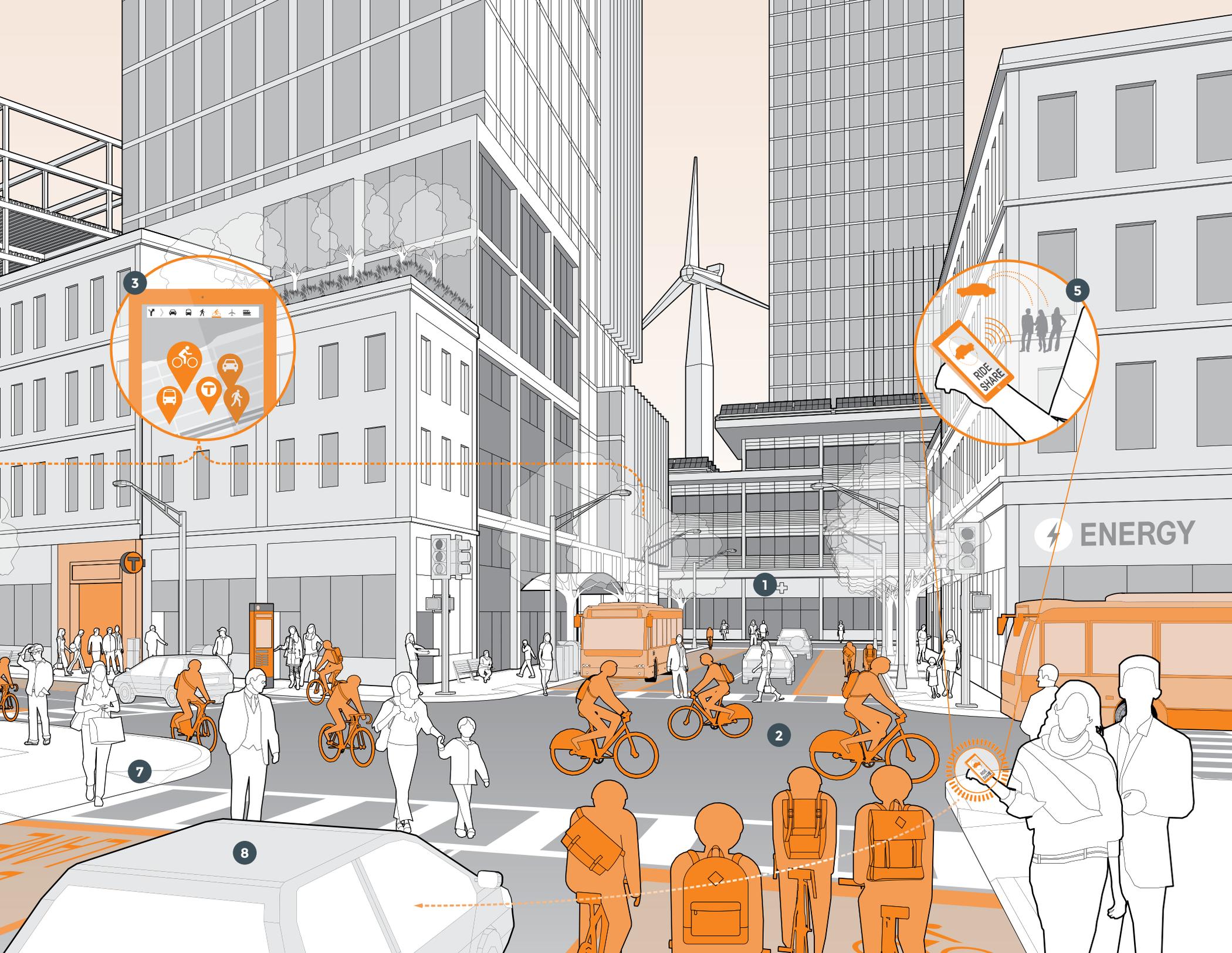
# TRANSPORTATION

The City has launched **Go Boston 2030**, a mobility visioning and planning process to be completed in 2016. The **Climate Action Plan** has set high-level goals and focus areas for reducing transportation emissions, which **Go Boston 2030** will expand on.

- 1 COMPLETE STREETS:** Published in 2013, Boston's Complete Streets book adopted smart, green, and multimodal principles as design standards for Boston's streetscape. The City will implement these standards through 2020 and beyond.
- 2 BIKE NETWORK:** Boston's goal is to increase bike commute mode share from 2 percent to 10 percent by 2020. The Bicycle Network Plan set a target of building 356 miles of bike lanes, cycle tracks, and paths by 2043. Improvements in bicycle safety are also a critical component of increasing the number of cyclists in the city. (The Green Links project will also help people access parks via modes of active transportation.)
- 3 SMART MOBILITY HUB:** The Smart Mobility Hub concept, to be developed further in Go Boston 2030, aims to provide multiple transportation options—including Hubway, car-sharing, public transit, and pedestrian wayfinding—in a single location in an accessible, smart, and convenient way.

- 4 LOW-EMISSIONS VEHICLES:** Raising the fuel economy (e.g., miles per gallon rating) of Boston's freight trucks and passenger vehicles will have the biggest impact on climate emissions. New federal standards will raise the fuel economy for all vehicles, but Boston will aim for a higher target through increased adoption of hybrid and alternative fuel vehicles.
- 5 CAR/RIDE-SHARING:** Mobile technologies and transportation innovation have accelerated car-sharing and ride-sharing, and will continue to play a role in fostering a reduction in car ownership.
- 6 BUS PRIORITY LANES:** Dedicated bus lanes and priority signalization will play a strong role in making public transit more efficient and reliable, while providing a low-cost means of organizing traffic and relieving congestion.
- 7 LOW-STRESS STREETS:** Biking and walking are more likely to occur on "low-stress" streets, which minimize close interactions with vehicle traffic.
- 8 CONTINUED PARKING FREEZE:** Boston will continue the parking freeze in the Downtown and South Boston neighborhoods, while also exploring innovative parking technologies and programs.





3

5

1

2

7

8

ENERGY

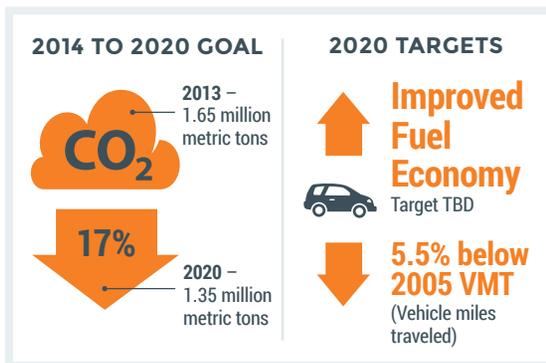


# TRANSPORTATION

## 2020 Goals and Targets

### PROGRESS TO DATE

- 1 Reduced VMTs 0.5% per capita 2005 to 2012
- 2 Residency rate increased from 35.2% to 37.8% between 2005 and 2012



From the country's first electric streetcar, to the Big Dig, to the launch of Hubway, Boston's transportation system continues to balance its historic landscape and the need to adapt and evolve to the changing times. Today, Boston faces new challenges. The city is rapidly growing, but its transportation system must accommodate this growth in a way that drives down carbon emissions and helps us prepare for the impacts of climate change.

To address these challenges, the City launched Go Boston 2030, an 18-month process to develop a citywide mobility vision and plan. Boston must ensure that its transportation system is not only able to handle continued growth but that it also proactively upholds three

priorities for the City: social equity, economic development, and climate mitigation and preparedness.

Boston's Climate Action Plan will continue to inform transportation decision making through Go Boston 2030. Unlike other chapters of this Climate Action Plan, the transportation section will provide only high-level targets that will inform Go Boston 2030, which will develop specific strategies over the next year. These strategies and implementation details will be reflected in the Web version of the Climate Action Plan, which will be continuously updated.

The sections below describe four focus areas for climate, on which Go Boston 2030 will elaborate: vehicle fleet fuel economy (e.g., miles per gallon ratings), vehicle miles traveled (VMTs), performance measurement, and regional land-use planning.

The most substantial carbon reductions will be achieved by increasing Boston's fuel economy above the new federal corporate average fuel economy (CAFE) standards. The 2011 CAP established a 2020 goal of reducing vehicle miles traveled by 7.5 percent from 2010 levels. However, due to greater efficiency gains from fuel economy standards and further analysis, the City has reduced this target to a more achievable 5.5 percent VMT reduction below 2005 levels by 2020.

Public transportation, walking, biking, carpooling, and car-sharing will all play a role in achieving this reduction goal. The City maintains its goal of increasing cycling mode share to ten percent from roughly two percent today. Implementing the 2013 Boston Bike Network Plan, which also adopted the 2011 CAP's ten percent commuter mode share goal, will be critical as well.



Go Boston 2030 solicits community input about improving Boston's transportation future.

## TRANSPORTATION *continued*

As we move toward implementation, Boston must have a clear understanding of how policies and programs are helping Boston to achieve these targets. Go Boston 2030 will develop a set of measures as part of a Mobility Index, which will incorporate measures that can track fleetwide fuel economy and vehicle miles traveled, along with equity and economic development metrics in Boston.

However, it is already understood that Boston needs to work regionally to address the needs of more than 300,000 daily Boston commuters. More than 70 percent of morning and afternoon commute traffic derives from people who do not both live and work in Boston—meaning they are either commuting from outside the city into Boston or are reverse commuting out of

Boston. As more jobs are brought into the greater Boston region, it is crucial for the City to work with surrounding municipalities, suburbs, regional entities, and the Commonwealth to ensure a regional approach to land use and transportation. Housing affordability in Boston and a top-tier public school system, for example, would encourage more residents to live closer to a job in Boston instead of commuting from afar. A coordinated transportation management and public transportation program that provides compelling transportation options not only to Boston residents, but also to those living through the Greater Boston area, will strengthen the entire region while reducing Boston's carbon footprint.

## Strategies

### FUEL ECONOMY

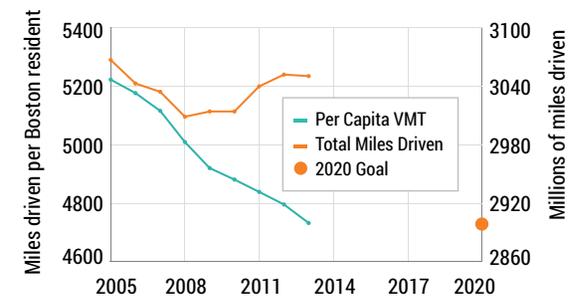
#### 1.1 ESTABLISH A FUEL ECONOMY TARGET AND A STRATEGY TO ACHIEVE IT

New federal fuel economy standards will increase fuel economy of new cars by more than 40 percent. Boston aims to do more. Raising fuel economy, even by a small percentage, results in significant carbon reductions. Go Boston 2030 will establish a fuel economy target that allows for transportation to reach its GHG targets and will devise a strategy to target specific groups and technologies for education and outreach. A marketing campaign about hybrids, for example, or a stakeholder group around efficient freight trucks can significantly increase fleetwide fuel economy.



Ad campaign designed to help reduce fuel wasted from idling vehicles.

FIGURE 18: Per Capita Vehicles Miles Traveled (VMTs) vs. Total VMTs



People in Boston have continuously driven less since 2005, but Boston has been growing at a rapid pace since the Great Recession ended. Growth is the source of nearly all the City's VMT.

### REDUCE VEHICLE MILES TRAVELED

#### 2.1 REDUCE VEHICLE MILES TRAVELED 5.5 PERCENT BELOW 2010 LEVELS BY 2020



The 2011 Climate Action Plan set a target of reducing vehicle miles traveled (VMTs) by 7.5 percent under 2010 levels by 2020. From new data, the City, through Go Boston 2030, will aim to decrease VMTs 5.5 percent below 2005 levels, and, more important, detail how travel mode share (percentage of people driving, biking, walking and taking public transit) must change for this goal to be met. A draft analysis using data from the Census, for example, estimates that Boston must shift about 15,000 drivers (four percent of those that currently drive alone to work) to other modes of transportation.

### Hubway Bike Share

Since 2011, Boston has been home to Hubway, a bike-share program operated by City of Boston and surrounding communities. To date, 140 stations with nearly 1,300 bikes are distributed throughout the Boston area. The program currently has more than 12,000 active members and more than 6,000 rides taken daily.

Since its inception, the program has mitigated nearly 350 tons of CO<sub>2</sub> and allowed thousands of Bostonians to increase their comfort level with biking as a real and practical transportation option in Boston. Moving forward, expanding bike services equitably to all neighborhoods and all groups are critical parts of the City's bike plan.

### 2.2 CREATE POLICIES THAT PUT ALTERNATIVE TRANSPORTATION OPTIONS ON AN EQUAL FOOTING WITH DRIVING



Many strategies from the 2011 CAP continue to be implemented, such as the parking freezes in Downtown, and South Boston and transportation access plan agreements (TAPAs) for development projects greater than 50,000 square feet. Go Boston 2030 will detail actions that continue the progress made in the past few years and reflect the complete social costs of driving a car.

### 2.3 ENCOURAGE MORE BIKING AND WALKING



The 2011 Climate Action Plan set a ten percent mode share target for cycling by 2020. Through efforts by Boston Bikes, Boston Transportation Department, Department of Public Works, cycling advocacy groups and other community partners, biking in the City has increased from less than one percent to roughly a two percent commuter mode share for Boston residents in 2012. The Boston Bike Network Plan details actions to reach nearly 200 miles of bike lanes by 2020 while reducing the number of accidents by 50 percent. Hubway is also rapidly expanding into the neighborhoods, bringing access to bike sharing to more and more Bostonians. Complete Streets design guidelines have also been published, providing principles for building safer environments for both walking and biking.

### 2.4 CONTINUE TO EXPAND PUBLIC TRANSPORTATION COVERAGE AND SERVICE



Public transit is the backbone of the transportation system in Greater Boston, serving 1.3 million riders on a daily basis. The Greater Boston area has one of the highest rates of transit ridership in the country. To reach Boston's targets, the City must work with the MBTA to ensure that it develops a world-class level of service for current and future riders over the next five years and is able to increase its mode share through increasing network coverage and service.



2013 Bike Week kickoff event.

### 2.5 INCREASE OPPORTUNITIES FOR CARPOOLING, RIDESHARING, AND CARSHARING



Carpooling, ride-sharing, and car-sharing are key modes for reaching the Climate Action Plan goals, especially for those who commute long distances to access jobs in Boston. In the long term, by densifying the urban core and maintaining housing affordability, the City hopes to decrease the number of long-distance commuters. However, the City must persuade more of those driving alone from outside Boston to participate in carpools or other ridesharing services. While carpooling has declined significantly (from 10.7 percent in 1990 to 7.9 percent in 2012), new technology-enabled services and private buses make ridesharing more viable.

## TRANSPORTATION *continued*

### DEVELOPMENT, ZONING, AND LAND USE

#### 3.1 REGIONAL PLANNING

Many of Boston's VMTs are generated by drivers whose trips originate outside of Boston. If we can reduce these commutes by only a few miles each week, we can achieve vast congestion and carbon reductions. To accomplish this, Boston and the surrounding region need a long-term strategy to provide more housing near jobs and public transportation. Boston can take the lead in supporting the Metropolitan Area Planning Council's (MAPC) regional planning efforts and further encourage mixed-use zoning and transit-oriented development in and around Boston.



#### 3.2 ADOPT A RESIDENCY RATE TARGET OF 45 PERCENT



Transportation systems are intricately tied to land use patterns and where people live and work. Bostonians who live and work in Boston, for example, are twice as likely to not drive to work as those who work and live elsewhere in the Greater Boston area. By attracting additional jobs and residents to Boston and raising the "residency rate"—the proportion of workers in Boston who also live in Boston—transportation carbon emissions can be reduced substantially. In 2010, Boston's residency rate was at 39 percent. Increasing

the rate means both providing more jobs for residents who currently live in the City, and providing housing to those who work in the City, while ensuring continued housing affordability and accessibility for current Boston residents. Neighborhood gentrification, for example, will have mixed and possibly negative effects on the residency rate because smaller, wealthier households usually replace larger households in the process, making neighborhoods less dense.

### DATA AND TRACKING SYSTEMS

#### 4.1 IMPLEMENT TECHNOLOGY AND DATA SYSTEMS THAT ENHANCE OUR UNDERSTANDING OF TRAFFIC AND VEHICLE TRAVEL IN THE CITY



The City's means of tracking fuel economy, commuter mode share, and vehicle miles traveled is limited. Much of the analytical work done for the Climate Action Plan used estimates and modeled data. Without clear measures that can be tracked year-over-year, progress toward the Climate Action Plan goals is impossible to track. Go Boston 2030 will work to create better and more regular data systems.



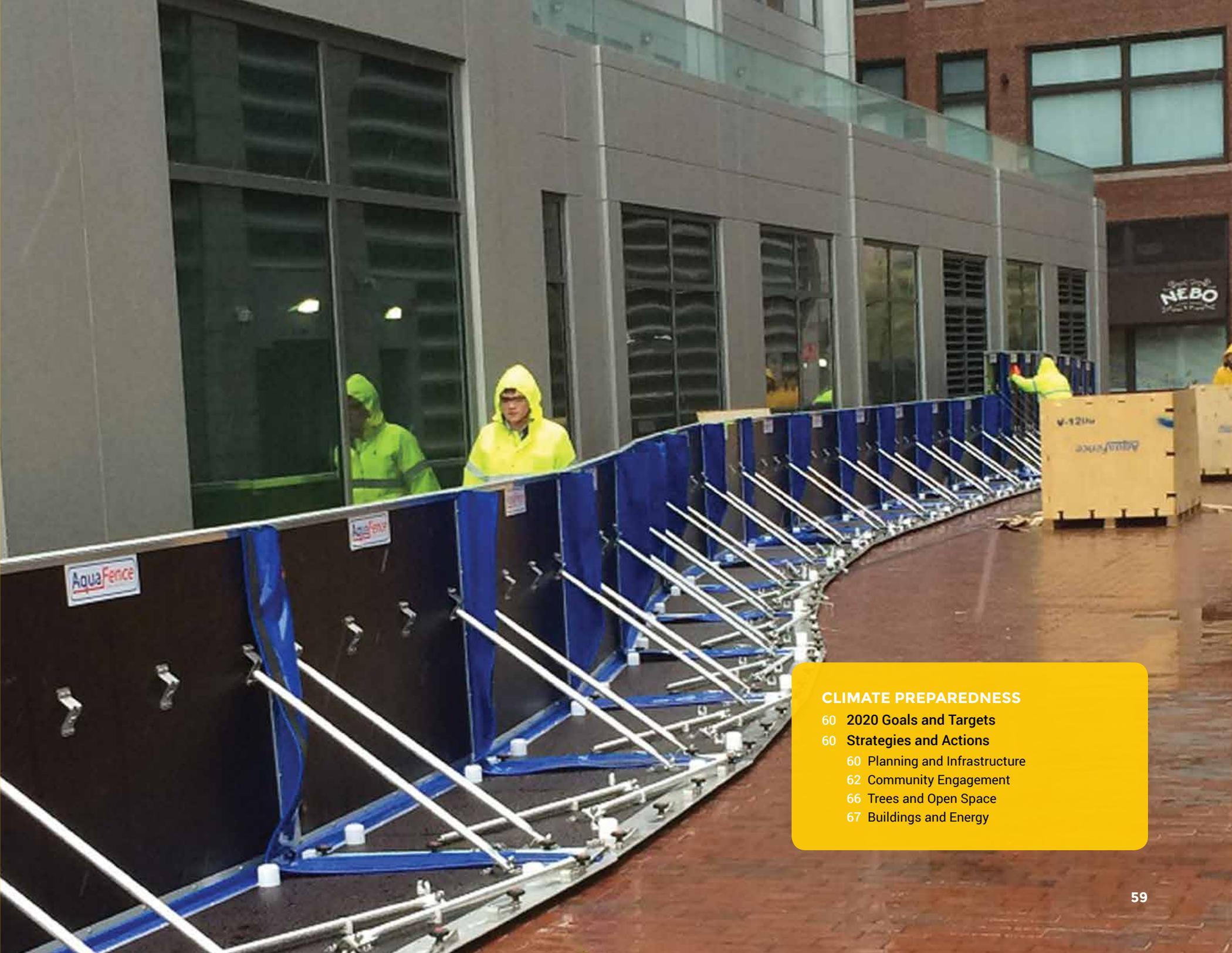
Post Office Square electric vehicle charging station.



As of 2014, Fleet Hub, the City of Boston's shared vehicle fleet, is home to its first plug-in hybrid.

# CLIMATE PREPAREDNESS





## CLIMATE PREPAREDNESS

60 2020 Goals and Targets

60 Strategies and Actions

60 Planning and Infrastructure

62 Community Engagement

66 Trees and Open Space

67 Buildings and Energy

# CLIMATE PREPAREDNESS

## 2020 Goals and Targets

Whatever success Boston and the rest of the world have in reducing emissions of greenhouse gases, because of the accumulation of past carbon emissions, the climate will continue to change for many years. And the effects experienced in Boston—including rising sea-level, more frequent and intense heat waves, more intense storms, and other phenomena—will continue to grow in magnitude or frequency. Projections of climate change are usually expressed as ranges, (e.g., “between 16 and 29 additional days over 90 degrees every year by mid-century”), yet the direction and rough magnitude of changes are clear. Furthermore, the effects of climate change are visible in Boston now. We must adapt to the changes that have already occurred and begin preparing for those to come.

The 2014 Update continues the 2011 Plan’s theme of integrating climate preparedness into all planning, program development, and project reviews undertaken by the City. It also advances implementation through increased community and intergovernmental engagement. Lastly, as it has for many years, the City will strive to lead by example in preparing its own facilities and systems.

Because the City already touches the lives and businesses of its residents and visitors in so many ways, preparedness is tied with other programs that address public health, economic development, emergency planning, energy, and trees and open space. This work will include incorporation of climate change criteria in



*An artist's depiction of future sea-level rise along the East Boston waterfront.*

existing programs, information, guidelines, and other resources for individuals, businesses, and neighborhoods taking action on their own and, in some cases, new regulations or legislation. A vital aspect of climate preparedness is its long-term framework, anticipating the climate and environment of 25 or more years from now, while ensuring that Boston is ready for the risks that it faces now.

Unlike climate change mitigation, where the total amount of greenhouse gases emitted serves as the overriding measure of progress, there is no single

indicator that measures climate preparedness. The City will continue to monitor measures of risk, including sea-level averages, average annual temperature, number of days over 90 degrees Fahrenheit, and precipitation patterns. Some useful metrics are available in specific areas, such as the size of the city’s tree canopy, the proportion of impermeable pavement, and the number of people who have participated in outreach programs. The City is working with local researchers and other cities to understand and develop better indicators of urban and community preparedness that can be used to establish more concrete goals.

## Strategies and Actions

### PLANNING AND INFRASTRUCTURE

#### 1.1 INTEGRATE PREPAREDNESS INTO ALL ASPECTS OF CITY PLANNING, REVIEW, AND REGULATION

Under the CAP Update, this integration will be continued, strengthened, and expanded, with a goal of ensuring that every opportunity to improve Boston’s preparedness for climate change is exploited. All multi-year planning, permitting and other review processes will include analyses of and preparations for the effects of climate change. The City will coordinate these activities—for example, making sure that all offices are using similar climate projections and planning horizons—by ensuring that employees are appropriately trained and that high-level management is in place to establish cross-departmental consistency.

## CLIMATE PREPAREDNESS *continued*

### 1.1 ACTIONS

#### 1.11 Coordinate and prioritize citywide preparedness efforts

Raise the priority of climate preparedness as a key component of all City planning and ensure citywide coordination.



#### 1.12 Establish a long-term planning framework

Start planning for the end-of-century effects of climate change.



#### 1.13 Incorporate preparedness into all project and permit reviews

Continue to integrate climate preparedness into zoning, all project and permit review and licensing, and the regulations and guidelines that govern these processes. Review and improve waterfront development zoning.



### 1.2 COORDINATE PREPAREDNESS EFFORTS REGIONALLY AND WITH STATE AND FEDERAL GOVERNMENTS

The City of Boston lacks the authority to address many climate preparedness concerns because 1) important natural features and built infrastructure extend beyond Boston's boundaries (e.g., the Charles River or MBTA subway lines) or 2) legal authority is specifically reserved for another level of government (for example, state responsibility for the building code and regulation of energy utilities). Although informal staff contacts and semi-formal stakeholder groups involving the City,

neighboring municipalities, regional authorities, Commonwealth offices, and others have done much, the rising priority of and increasing activity around climate preparedness requires a stronger and more formal structure, which the City will lead. This work must go beyond planning documents and regulations to include active partnerships to identify and prepare vital regional infrastructure. Furthermore, regional coordination will encompass private property owners and businesses (see strategy 2.4) and the higher education community, which has interests in protecting its long-term physical presence in Boston and in generating, testing, and applying knowledge.

### 1.2 ACTIONS

#### 1.21 Convene a regional climate preparedness summit

Work with metro-Boston cities and towns, the Commonwealth, and regional authorities to align and accelerate regional preparedness planning, development of regulatory requirements, infrastructure investment, and other programs and policies.



#### 1.22 Develop city-university research partnerships

Develop a partnership with research universities to develop, analyze, test, and implement new climate-preparedness strategies; create a pipeline of green education and workforce opportunities for students.



### CROSS-CUTTING THEME

#### Economic Development

Climate preparedness is closely linked to economic development at both the large and the small scale. At the large scale, businesses will not choose to invest in Boston for the long term, and individuals and families will not choose to live here if the integrity of buildings, streets, public services, and essential infrastructure cannot be assured. On the other hand, climate preparedness will require investment in maintaining, upgrading, and modifying buildings, roads, parks, pipes, river beds, and much more, in projects large and small. The City will design programs and work with stakeholders to make those investments in ways that spur the creation of local, well-paying jobs and businesses. Finally, economic development in itself generally increases preparedness, because a strong, prosperous community has more individual and community resources with which to meet the stresses that come with climate change.

## CLIMATE PREPAREDNESS *continued*

### 1.3 LEAD BY EXAMPLE

The primary reason for the City of Boston to continue increasing the climate preparedness of its own operations is to ensure that City agencies can serve residents, workers, and visitors under all circumstances. For this purpose, the City will use the priorities identified in the October 2013 report *Climate Ready Boston: Municipal Vulnerability to Climate Change* as important factors in its capital budget decisions. The City's work on its facilities will also serve as examples and provide motivation for other property owners who may be struggling to determine what steps they should take. Furthermore, the City can use its facilities to serve as pilots for relatively new or innovative approaches such as, the use of district energy or combined heat-and-power installations as a general preparedness measure or the combination of photovoltaics with storage batteries as a source of emergency power.

#### 1.3 ACTIONS

##### 1.31 Address municipal vulnerabilities

Address municipal building, infrastructure, and operational vulnerabilities identified in the 2013 assessment, and report on progress annually.



##### 1.32 Pilot preparedness solutions

Use City-owned facilities and land to provide climate-preparedness examples and pilot innovative solutions.



## COMMUNITY ENGAGEMENT

### 2.1 USE CLIMATE PREPAREDNESS TO SPUR ECONOMIC DEVELOPMENT AND CREATE JOBS

Boston's energy programs have already had success in fostering local business creation and job growth while reducing energy use and greenhouse gas emissions. The City will ensure that its preparedness programs have a similar mindfulness to the potential for combining climate and economic goals. Just as with energy efficiency, climate preparedness (e.g., tree plantings, urban agriculture, infrastructure construction) requires work on the ground. Furthermore, neighborhoods that are healthier and stronger—in community cohesion, economic vitality, and public health—are, for that reason alone, better prepared for climate change and other stresses.

#### 2.1 ACTIONS

##### 2.11 Focus on neighborhood-level strategies

Work with community leaders, community development agencies, and others to create neighborhood-based programs and projects that increase climate preparedness for vulnerable populations, while supporting job training and job creation.



##### 2.12 Invest locally

Invest in smaller-scale resiliency interventions and pilots in particularly vulnerable areas and environmental justice communities.



*Rendering of a community garden and solar array atop a proposed Energy Positive development in Mission Hill.*

## CLIMATE PREPAREDNESS *continued*

### 2.2 TARGET ASSISTANCE TO LOW-INCOME RESIDENTS, SMALL BUSINESSES, AND OTHER VULNERABLE POPULATIONS AND ENTITIES

Although all segments of the Boston community face increasing risks from climate change, some segments are more vulnerable because of socioeconomic factors. The City of Boston will increase its efforts to inform particularly these groups about climate preparedness and to identify resources that could assist them in taking action. Small businesses also, in general, are more vulnerable to the increasing risks from climate change than large ones, and the City will reach out to them. In both cases, the City will try to build on existing programs that already serve these groups—through, for example, the Public Health Commission and the Department of Neighborhood Development. A final group that will require specific attention is workers, especially those who work outside and could suffer in extreme weather. The City will bring together stakeholders to explore formal and informal means of ensuring worker safety as the climate changes.

#### 2.2 ACTIONS

##### 2.21 Collaborate with public health

Add climate preparedness elements to public health programs already aimed at vulnerable populations and low-income households.



##### 2.22 Identify potential resources

Explore opportunities to provide financial and technical assistance to vulnerable populations and low-income households in reducing current vulnerabilities.



##### 2.23 Support the resiliency of small businesses

Work with Main Street programs and other stakeholders to assist small businesses in increasing preparedness and developing business continuity plans.



##### 2.24 Protect outdoor and manual workers

Work with unions, businesses, the Commonwealth, and other stakeholders to protect workers in extreme weather.



#### CROSS-CUTTING THEME

### Social Equity

The more vulnerable and lower-income populations in Boston tend to have more reliance on public services and fewer resources with which to take action to prepare or respond to the stresses of extreme weather. Therefore, the overall climate preparedness of the city, including its transportation, energy, and water infrastructure, is critical. More specifically, vulnerable populations are less likely, for example, to have air conditioning or are able to leave the city quickly in emergencies; this makes the preparedness of the City's emergency shelters and cooling centers, and the ability of these facilities to operate in extreme events, vital. Preparedness is a key component of community resilience and is defined by broader indicators of equity, health, safety, education, and economic vitality. The preparedness strategies for community engagement (see strategies 2.1 and 2.2) are intended to ensure that the needs of communities are heard and that public investments in preparedness are used, whenever possible, to increase their overall economic and social health.

## CLIMATE PREPAREDNESS *continued*

### 2.3 PROVIDE INFORMATION THAT ENABLES COMMUNITIES TO TAKE ACTION AND INFLUENCE PROGRAMS AND POLICIES

Climate change projections are generally stated as ranges (for example, between two inches and six feet of average global sea-level rise by 2100) associated with corresponding probabilities of certainty. This often makes planning and decision making difficult on such long horizons. To establish a consistent basis for preparing for climate change, the City of Boston will establish a set of climate scenarios (amounts of change at a given time) to be used for planning and other actions. These scenarios, however, only outline the risks that the city faces. The City will also develop a set of indicators that provide some objective measures of how well Boston is prepared to face those risks, and establish preparedness goals based, at least in part, on those indicators. Both sets of information—scenarios and indicators—will be important tools for informing the community about climate vulnerability, establishing bases for action, and providing a common understanding for citywide and neighborhood-specific discussions of preparedness priorities.

### 2.3 ACTIONS

#### 2.31 Provide accessible climate data and projections



Ensure that all municipal offices and the community have up-to-date climate change projections and planning levels (scenarios) in sufficient detail to support neighborhood-level planning and design.

#### 2.32 Establish preparedness indicators



Develop a set of indicators to provide quantitative measures of the preparedness of the Boston community, set goals in terms of these indicators, and report on them annually.

#### 2.33 Improve and expand neighborhood engagement



Expand public outreach to neighborhood groups to inform and motivate all sectors of the community around preparedness, and better understand neighborhood needs and priorities.



*As part of the Massachusetts Arborists Association's annual Arbor Day of Service, Boston Parks and Recreation Department and the Friends of the Public Garden dedicate a tree to Henry Davis (pictured) for his lifetime of work towards the preservation of trees on the Boston Common.*

## CLIMATE PREPAREDNESS *continued*

### 2.4 SUPPORT PROPERTY AND BUILDING OWNERS AND INSTITUTIONS IN TAKING PREPAREDNESS ACTION

Property owners, businesses, and institutions have an essential role in climate preparedness because they must take responsibility for protecting their own material interests. In many cases, they also contribute directly to the preparedness of the community by providing services or places of refuge. Especially in the next couple of decades when climate changes are relatively small (compared with what is likely by the end of the century), changes to individual buildings and operating practices can improve preparedness significantly. The City will work with diverse stakeholders to provide practical information, raise awareness, and explore resources, especially for smaller property owners and businesses. The insurance and financial sectors, in particular, must be engaged. They often have considerable influence in, and can provide financial incentives for, establishing better practices, especially for existing buildings. The City must also pay special attention to businesses and properties with toxic or hazardous materials. Although it is the responsibility of the owners to ensure the security of these materials, the City—in an extension of the scrutiny it already gives such properties through its public safety offices—will re-examine their vulnerability in light of climate change.

#### 2.4 ACTIONS

##### 2.41 Provide preparedness information

Work with property owners, neighborhood groups, and other stakeholders to establish building preparedness priorities, best practices, guidelines for implementation, and cost/benefit information.



##### 2.42 Increase awareness of vulnerabilities and actions

Ensure that all property owners and tenants are specifically aware of their climate-change vulnerabilities.



##### 2.43 Expand resources

Explore mechanisms to provide property owners financial and technical support for increasing climate preparedness.



##### 2.44 Align insurance policies

Work with the Commonwealth, the insurance and finance sectors, and property owners to identify modifications to building codes, and align insurance policies and incentives, and underwrite loans to increase building resiliency.



##### 2.45 Assess vulnerabilities of hazardous materials and sites

Determine the vulnerability of sites with inventoried toxic/hazardous materials and other sites that may create greater vulnerability to the community and ways to increase their preparedness.



*Ceremonial opening of Green Alley, a joint project between Boston Architectural College (BAC) and Halvorson Design Partnership. Since its opening in October 2013, the Green Alley has captured almost all of the stormwater to recharge groundwater supply.*

## TREES AND OPEN SPACE

### 3.1 EXPAND GREEN INFRASTRUCTURE AND ECOSYSTEM-BASED APPROACHES TO ADDRESS CLIMATE VULNERABILITIES

Green infrastructure—parks, trees, wetlands, beaches, and other open space—is a valuable tool in climate preparedness, particularly for mitigating heat and stormwater, as well as for all the other benefits it brings. The City already enforces legal requirements for green infrastructure through, for example, protection of wetlands under the Commonwealth’s Wetlands Protection Act and of street trees under a municipal ordinance. It also has policies and programs that strongly encourage and facilitate green infrastructure, including Complete Street guidelines, stormwater management requirements under Boston Water and Sewer Commission regulations, the urban agriculture zoning code and programming, and tree-planting goals and initiatives. Of particular importance will be determining the appropriate ways of incorporating projected sea-level rise into legislation or regulation to both allow climate-prepared development where appropriate, and protect and expand coastal resources.

#### 3.1 ACTIONS

##### 3.11 Expand green infrastructure requirements

Explore legislative and regulatory means of expanding requirements for green infrastructure and coastal protection, such as through a local wetlands ordinance.



##### 3.12 Grow the urban tree canopy

Develop and implement a clear plan for significantly increasing tree-canopy cover.



##### 3.13 Explore a community-wide stormwater fee

This fee can be based on a property’s permeable surface area and stormwater management efforts.



##### 3.14 Accelerate neighborhood stormwater management actions

Explore a pavement-to-parks/water absorption plan for neighborhoods.



##### 3.15 Increase support and space for urban agriculture

Expand urban agriculture and study the resilience of Boston’s regional food system.



### Growing the Urban Forest

The urban forest is an important feature of Boston. Trees provide public health benefits like cleaner air, they keep us cool, absorb stormwater, and even increase property values and have been proven to reduce crime rates. However, growing and maintaining an urban forest is challenging. Trees often struggle in the city. They get damaged by people and cars, their roots are crushed by the weight of roads and sidewalks, and they often have a hard time getting water through concrete and pavement.

The City of Boston uses a variety of tools and resources throughout the community to support the city’s urban forest. Tree planting is considered in the Article 80 review process for new developments. The Parks Department is the agency with regulatory and operational responsibilities for public shade trees, including pruning, disease control, removals, and storm damage repairs. Community partnerships are critical for this work—from private developers or residents planting new trees, to citizens caring for street trees through the Adopt-a-Tree program, to community organizations, such as Boston Natural Areas Network, Southie Trees and the Boston Tree Party. This Plan calls for enhanced collaboration and partnerships to help Boston reach its tree canopy goal of 35 percent.

Learn more about how to get involved at [AdoptATree.GreenovateBoston.org](http://AdoptATree.GreenovateBoston.org).

## CLIMATE PREPAREDNESS *continued*

### BUILDINGS AND ENERGY

#### 4.1 EXPAND ENERGY EFFICIENCY, SOLAR AND OTHER TYPES OF DISTRIBUTED ENERGY AS A RESILIENCE MEASURE

The expansion of energy efficiency, renewable energy, and district energy are key components of the CAP's strategies to reduce greenhouse gas emissions. They also contribute to climate preparedness, because they make the city less reliant on the regional energy network, which itself will confront greater stresses with climate change (for example, greater demands for electricity during heat waves, greater physical stresses from more intense storms). This strategy and its actions call for increased recognition of the benefits that climate mitigation offers for climate preparedness.

#### 4.1 ACTIONS

##### 4.11 Expand distributed energy systems

Expand district energy, combined heat and power, and other types of distributed energy and storage, particularly in districts with vulnerable populations and critical facilities.

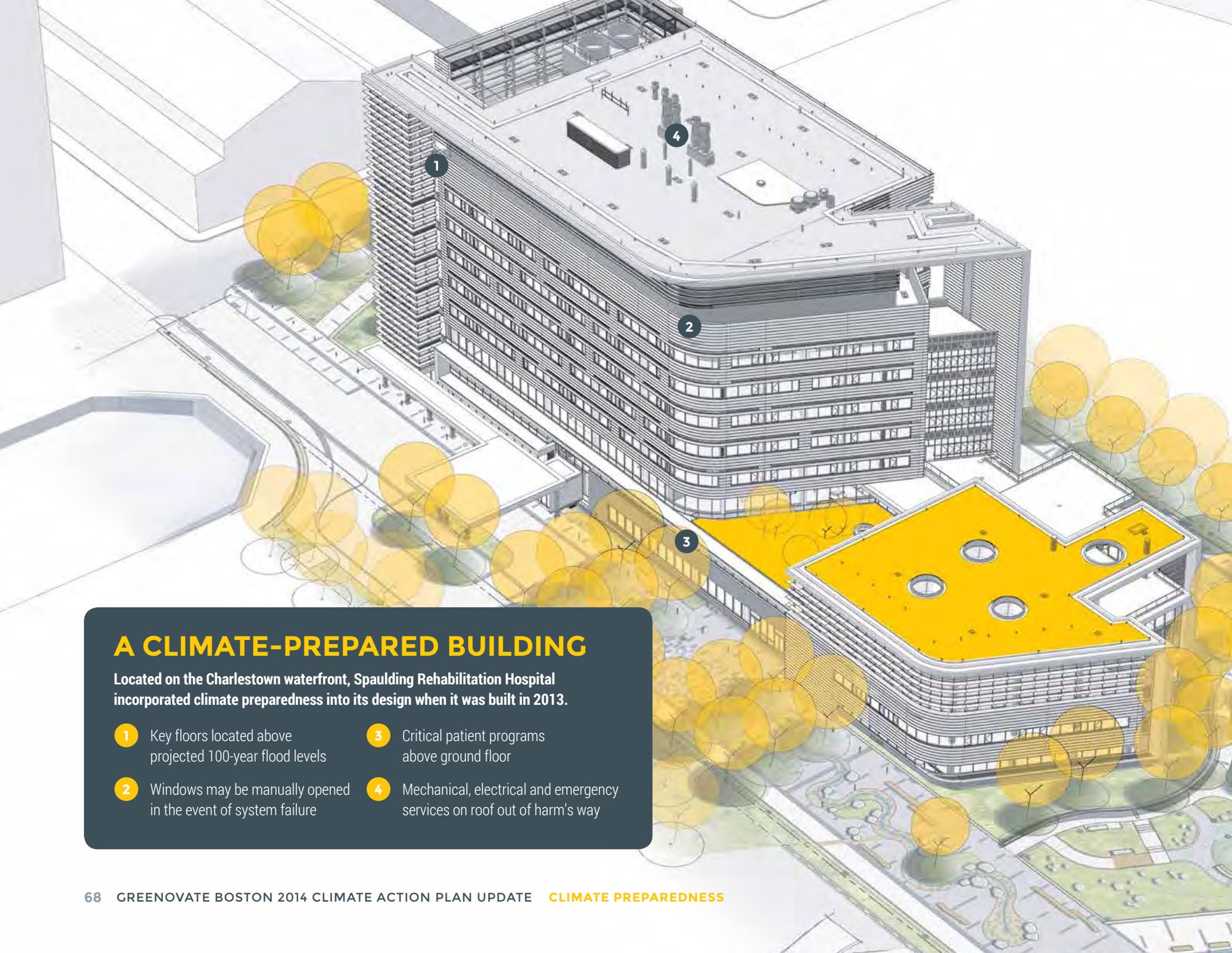


##### 4.12 Expand and align outreach to residents

Include climate preparedness as a consideration in Renew Boston's energy programs and its outreach activities.



Former Mayor Thomas Menino announces a new residential solar assistance program in 2011.



## A CLIMATE-PREPARED BUILDING

Located on the Charlestown waterfront, Spaulding Rehabilitation Hospital incorporated climate preparedness into its design when it was built in 2013.

- 1 Key floors located above projected 100-year flood levels
- 2 Windows may be manually opened in the event of system failure
- 3 Critical patient programs above ground floor
- 4 Mechanical, electrical and emergency services on roof out of harm's way

FIGURE 19: COORDINATING CLIMATE PREPAREDNESS EFFORTS

	 <b>BUILDINGS</b>	 <b>TRANSPORTATION</b>	 <b>LAND USE &amp; NATURAL SYSTEMS</b>	 <b>ENERGY</b>	 <b>WATER INFRASTRUCTURE</b>	 <b>EMERGENCY MANAGEMENT</b>
<b>CITY</b>	Building permits and inspections Zoning Energy reporting requirements	Local roads and sidewalks Complete Streets design guidelines Parking	City parks and urban wilds Street trees Open space planning Wetlands protection Floodplain regulation	Permits infrastructure developments Develops district energy, energy efficiency programs	Retail water distribution, waste water and storm water collection (BWSC) Groundwater overlay district (zoning)	Local emergency response Public safety Emergency shelters and cooling centers
<b>STATE</b>	Building code Insurance regulation	MBTA system State highways and parkways Airport and seaport	DCR Parkland (Muddy River; Charles River) Dams; Access to waterfront	Energy utility regulation Energy efficiency and renewable energy incentives	Wholesale water supply and waste water treatment (MWRA, Deer Island)	Regional emergency response (backup for cities)
<b>FEDERAL</b>	Flood insurance	Airport and railroad Federal highway standards Coast Guard regulations	Boston Harbor Islands National Recreation Area Designation of floodplain	Regional electricity grid (transmission) Power plant regulation Energy efficiency and renewable energy incentives	Clean Water Act	Federal emergency response (backup for states)

# 80x50





## **80X50**

### **72 Core Objectives and Long-term Strategies**

72 Carbon-neutral and resilient visioning

75 Interim carbon target

76 Ongoing research and learning

77 A transformation of the environmental awareness of all Bostonians

# 80X50

Although much work remains to be done, Boston has made significant progress toward its 2020 GHG reduction goal. The investments we make in energy and other infrastructure today will have longer-term consequences. Therefore, it is important that we start to consider about how Boston can position itself to reach its long-term goal of reducing greenhouse gas

emissions 80 percent by 2050 (80x50), while creating a more vibrant, sustainable, and equitable city. This section begins to envision what a carbon-neutral and resilient Boston might look like in 2050 and identifies medium-term actions that explore paths to achieve this vision.



Thousands of Boston residents attended the People's Climate March in New York City on September 21, 2014.

## Core Objectives and Long-term Strategies

### CARBON-NEUTRAL AND RESILIENT VISIONING

Boston's 80x50 vision will serve as a guide for the development of integrated policies and projects across public and private sectors. Boston may have to considerably change how it uses energy in its buildings and transportation system and how that energy is produced in order to achieve a 80x50 GHG reduction. The City will ensure that this long-term goal is included in transportation, housing, and other planning efforts so that this transformation is embedded into all aspects of Boston life.

#### De-carbonizing the Grid

There are some policies and programs already in place that, if operated under a shared 80x50 vision, could help Boston and the broader region make significant progress toward this goal. The Regional Greenhouse Gas Initiative (RGGI) is the region's cap-and-trade system for carbon emissions. If the cap on power plant emissions continues to be lowered, Boston's electricity supply will become less carbon-intensive. Nonetheless, energy efficiency will remain critical because, based on current technology and energy demand projections, a fully de-carbonized grid is unlikely (e.g., renewable energy supply sources, such as solar, often fluctuate and are unable to consistently meet demand). We must reduce Boston's energy consumption so that the energy required going forward can be met with clean, renewable energy sources.

## 80x50 continued

Progress is also being made on the state-level. The Commonwealth of Massachusetts has adopted an 80x50 goal through the Global Warming Solutions Act. In June 2014 the Massachusetts Department of Public Utilities (DPU) issued an order to modernize the electric grid, requiring all electric distribution companies to submit a ten-year grid modernization plan within the next six months. This order requires utilities to describe their progress toward reducing the effects of outages, optimizing demand by reducing system and customer costs, increasing distributed resources such as renewables, electric vehicles and microgrids, and improving workforce and asset management.

Boston can also work toward creating local, district-level energy systems to help achieve the 80x50 goal. These systems enable greater control over fuel sources and can incorporate local renewable energy. While there are currently some regulatory barriers to this strategy, the City and the State are making progress. For example, on January 1, 2015, a new state law went into effect that promotes the use of clean energy for heating and cooling buildings. The bill provides financial incentives through “alternative energy credits” for investing in local renewable energy sources, among others, and will lead to statewide reductions in carbon emissions. While the market for renewable electricity has grown rapidly, identifying renewable sources for heating, which is close to 60 percent of residential energy use, requires more research and development and is crucial for reaching the 80x50 goal.

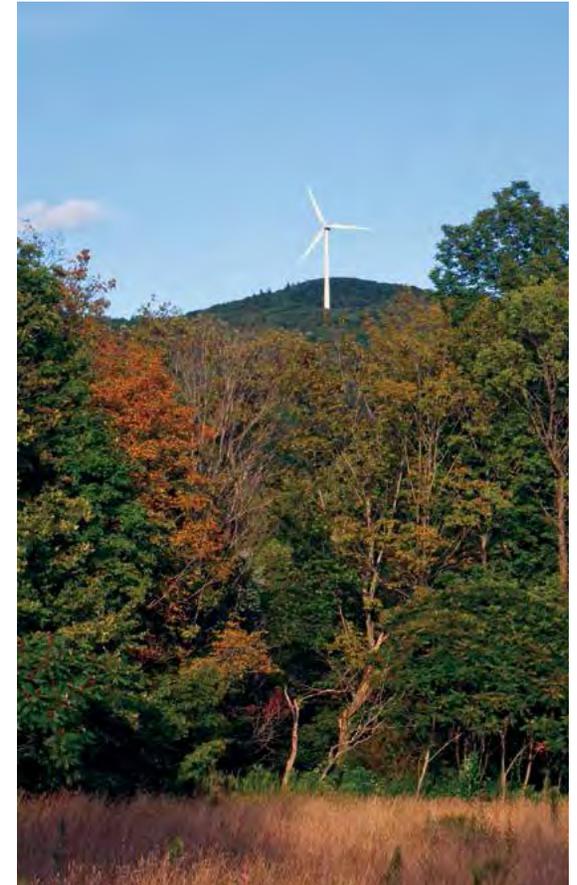
### Boston’s Long-term Energy Planning

Boston is pursuing a long-term energy infrastructure management and resiliency strategy. The City is currently conducting a citywide energy study—the first to be done in New England. This study will inform the potential for job opportunities from energy investments, how much energy the City will demand in the future, and how much capital the City can keep locally for energy services. This will help Boston identify investment opportunities for reliable, local energy resources.

The City is also engaging in other energy planning efforts, including a pilot microgrid development project, a legal analysis of Microgrid ownership in Massachusetts, and a multi-stakeholder planning process for microgrid business models.

In the next ten years, the City will explore the following:

- A carbon-neutral district energy system;
- The feasibility of district cooling, particularly through the use of ocean water;
- Expanded funding mechanisms for district energy;
- District heating and cooling for municipally owned facilities.



*A wind turbine generates renewable energy in Western Massachusetts, helping supply the electricity grid with renewable energy.*

## 80x50 continued

The City will also work with the Commonwealth and other government bodies and stakeholders to explore:

- Removal of any legal and regulatory impediments to district energy and renewables;
- Standardized rules, minimal fees, and an adequate feed-in tariff for grid interconnection;
- Continued lowering of the cap on greenhouse gas emissions through RGGI;
- Measures to ensure that PV owners can interconnect to the grid with standardized rules, minimized fees, and reasonable feed-in tariffs;
- More aggressive state-wide clean energy goals, and the use of those goals to evaluate proposals for energy infrastructure;
- A citywide or regional carbon tax.

### Low-carbon Transportation

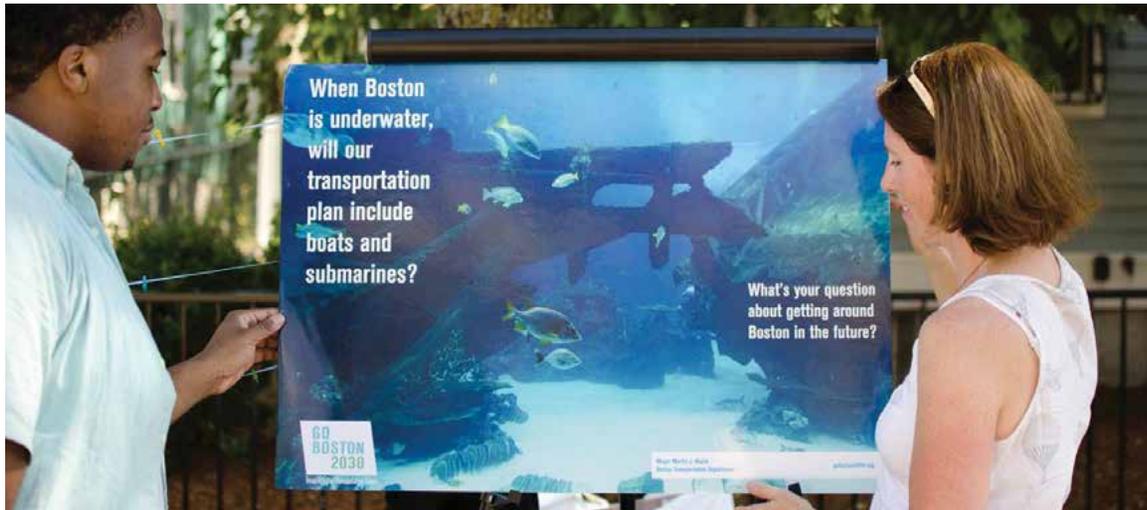
If Boston achieves a low-carbon electricity grid, electric transportation options will then be low-carbon as well. While Boston will continue to pursue strategies for reducing automobile travel throughout Boston, it is likely that the car and other personalized transportation will still be a substantial part of Boston's mode share in 2050. The City must work with state and regional partners to advance an all-electric and fossil fuel-free transportation system, including electric vehicles and electric public transportation. This will require major infrastructure investments that should be considered in the next ten years. Boston must also support research for other low-carbon and innovative transportation alternatives, such as hydrogen vehicles, self-driving vehicles, and time-based pricing.

In the next ten years, the City will explore the following:

- Expanded public and private infrastructure to support electric vehicles;
- A zero-carbon municipal vehicle fleet by 2030;
- Additional public transit measures (for example, a City-run bus or shuttle fleet) to supplement the MBTA system;
- Other zero-carbon vehicles (for example, hydrogen-powered) and associated infrastructure to support them.

The City will also work with the Commonwealth and other government bodies and stakeholders to explore:

- City of Boston representation on the board overseeing the MBTA;
- A tax-and-invest program in public transit alongside a state carbon tax;
- The transition of the MBTA to net-zero carbon energy sources.



Through Go Boston 2030, Bostonians consider what the city's transportation system will look like in 2030.

## 80x50 continued

### Intergovernmental Coordination

Boston will not be able to achieve 80x50 without federal, state, and regional support and cooperation. The utility companies and their regulatory bodies, such as the Department of Public Utilities, must play a significant role. The 80x50 goal must be a core consideration in all investments and policies that impact the built environment, especially large infrastructure investments that tend to have long lifespans.

In the next ten years, the City will explore the following:

- Create a formal mechanism for coordination and alignment of state, regional, and city climate planning.

### INTERIM CARBON TARGET

Planning for 2050, can be challenging due to the high levels of uncertainty for factors such as population and job projections and new technologies that could alter the landscape. Boston must establish an interim planning goal for the period between 2020 and 2050. 2030 is an appropriate next horizon, especially given other 2030 planning efforts such as the City's mobility and housing plans—Go Boston 2030 and Housing a Changing City. A 2030 interim carbon reduction target that sets Boston on track to achieve 80x50 will be an important part of these planning efforts, especially as we move toward implementation. This interim target will be a major focus of the next CAP Update in 2017.



Mayor Walsh is joined by U.S. Senator Ed Markey, U.S. Department of Energy Secretary, Dr. Ernest Moniz and U.S. EPA Administrator, Gina McCarthy to talk with New England Aquarium's ClimaTeens on Earth Day 2014.

## 80x50 continued

A 2030 goal will also help guide policies and program decisions to be made in the next ten years and establish a framework for developing sector-specific targets, similar to what we now have for 2020. As growth projections and a vision for Boston in 2030 are developed, a 2030 GHG reduction goal will be important. The 2030 goal, and targets that follow it, should maintain an eye toward the 80x50 goal. Further research must be conducted to determine exactly what this interim goal should be.

In the next ten years, the City will explore the following:

- The use of indicators of success beyond traditional measures of economic growth;
- A consumption-based greenhouse gas inventory that accounts for emissions associated with things we buy and consume;
- A focus on carbon neutrality by 2050, and the integration of this goal into all planning activities;
- Developing 80x50 sector goals;
- Zero-carbon standards for new development.

## ONGOING RESEARCH AND LEARNING

Boston is not the only entity thinking about a shift to a low-carbon and resilient economy. European cities are leading examples of this effort, but the Commonwealth of Massachusetts, New York City, New York State, the City of Seattle, and many others in the U.S. have similar goals.

Copenhagen, for example, is planning to be the world's first carbon-neutral city by 2025. Carbon neutrality provides the framework and the vision to make the city not only greener but healthier, more livable, safer, smarter, and more prosperous for all of its residents. To meet this ambitious goal, the city will reduce energy and heat consumption through highly energy-efficient construction standards alongside innovative financing models, and create a digital city infrastructure for monitoring and conserving energy. Copenhagen will move toward citywide, carbon-neutral district heating, build 100 new wind turbines, convert power stations to biomass, and, in so doing, will create many local green jobs. To reduce car dependence, the City will expand bike and public transit networks, intelligent traffic management, and infrastructure for electric vehicles.

In December 2013, New York City released an 80x50 report called *PlaNYC New York City's Pathways to Deep Carbon Reductions*. It found that meeting this goal would require "change at an unprecedented scale" and would be dependent on large investments in energy efficiency and clean energy infrastructure, low-carbon transportation systems, and "transformation of the



*Learning from peers at the Greenovate Boston Community Summit, May 2014.*

solid waste sector." The study concluded that achieving 80x50 is likely dependent on achieving a 30 percent carbon reduction by 2020. New York City recognizes the need to find solutions to connecting large-scale renewable energy sources and restructuring the current power utility regulatory model, in addition to almost entirely shifting away from cars that run on fossil fuels. In working toward 80x50, New York City would create new jobs, expand economic activity, and increase resiliency through distributed generation and retrofitting power plants—but it notes that it cannot do it without the support of federal and regional regulation.

The City of Boston is well positioned to learn from these studies and planning efforts, and must continue to leverage university and other research institutions to conduct similar work in Boston. In the near-term,

## 80x50 continued

Boston must explore how the city and the region can move toward a carbon-neutral grid, as well as carbon-free transportation systems. The City must also explore ways to support innovative business models and new financing mechanisms that help achieve the 80x50 goal.

In the next ten years, the City will explore the following:

- Research partnerships to solve climate mitigation and adaptation challenges;
- Supporting innovative business models and startups;
- Smart investments and new financing models to support large-scale neighborhood sustainability;
- Creating the educational base, green-STEM job skills and pipelines, businesses, and economic structures.

### A TRANSFORMATION OF THE ENVIRONMENTAL AWARENESS OF ALL BOSTONIANS

As noted throughout the plan, community engagement and individual action are important strategies for meeting even Boston's near-term climate goals. However, if the city is going to shift to a low-carbon economy, a much broader transformation is needed. Not only is environmental awareness important for driving participation in programs, it is also needed to support the tough policy decisions that will need to be made between now and 2050.



*New England Aquarium ClimaTeens talk about the impacts of climate change to Boston Harbor's marine life on Earth Day 2014.*

Continued efforts to focus on youth and environmental education will be critical. Boston must also maintain its focus on strategies that connect people to their local environments, but are not necessarily directly connected to carbon emissions, such as waste diversion efforts, maintaining open space and access to nature, water conservation and food access.

In the next ten years, the City will explore the following:

- New ways to involve the community in sustainability and climate preparedness decision-making, implementation, and evaluation;
- Explore the creation of self-sustaining and climate resilient eco-districts;
- A fully-integrated sustainability curriculum;
- Community-scale waste-to-energy pilots.

## CREDITS

### ACKNOWLEDGMENTS

In addition to the Steering Committee, five strategy committees, comprising more than 100 individuals, made significant contributions to the development of the 2014 Climate Action Plan Update. Beyond the formal committees, thousands more participated in online discussions, the Greenovate Boston Community Summit and other forums, and submitted comments on the draft, which was released for public comment in November. Non-profit groups, stakeholder organizations, and other groups also made extensive contributions of their time and ideas. The City of Boston thanks all who participated to shape and take responsibility for this plan and its implementation.

The Greenovate Boston 2014 Climate Action Plan Update and the Greenovate Boston Community Summit was supported in part by a generous grant from the Barr Foundation.

### CONSULTANT SUPPORT

Meister Consultants Group  
Kleinfelder  
Peregrine Energy Group  
Skanska

### CITY OF BOSTON STAFF

*Office of Environment, Energy and Open Space*  
Brian Swett  
Austin Blackmon  
Van Du  
Leah Bamberger  
Charles Zhu  
Bradford Swing  
Lourdes Lopez

### *Environment Department*

Nancy Girard  
Carl Spector  
Nikhil Nadkarni  
Maura Zlody  
Mia Goldwasser (intern, MIT)

The Climate Action Plan Update also benefitted from the essential participation of staff from the Transportation Department, the Department of Neighborhood Development, the Boston Redevelopment Authority, the Department of Public Works, and the Boston Water and Sewer Commission.

### DESIGN CREDITS

*Design:* One Visual Mind

*Website:* Rudi Seitz and Cedric Ruiz

*All photos provided by the City of Boston, except for the Greenovate Boston Photo Contest Participants:*

Cover Photo by Nicky McClung

p.11 Blue Thread photo by Eline B.

p.31 Curley School Students photo by Phoebe B.

p.33 Egleston Farmer's Market photo by Mike Steinhoff

p.39 Hanes House Solar Panels photo by Marta M.

p.34 Fresh Produce photo by Kelly E.

p.60 High Tide Marks photo by Susan I.

p.71 Boston Harbor photo by JM P.

Inside Back Cover Photo by Mike Steinhoff

### *Illustrations:*

Neighborhood, Large Buildings and Institutions and Transportation illustrations by Utile, Inc.

Spaulding Rehabilitation Hospital illustration courtesy of Perkins+Will

## ENDNOTES

- <sup>1</sup> Climate in 2013" report (July 2014), NOAA National Climatic Data Center's "State of the Climate: Global Analysis" (September 2014), and World Bank's "Turn Down the Heat" report (August 2013)
- <sup>2</sup> NOAA National Climatic Data Center, Billion-Dollar Weather/Climate Disasters in 2012, <http://www.ncdc.noaa.gov/billions/events>.
- <sup>3</sup> U.S. Global Change Research Program, 2014 National Climate Assessment Report (May 2014), <http://nca2014.globalchange.gov/highlights/report-findings/our-changing-climate>.
- <sup>4</sup> NOAA National Climatic Data Center, State of the Climate: Global Analysis for October 2014 (November 2014), <http://www.ncdc.noaa.gov/sotc/global/>.
- <sup>5</sup> U.S. Global Change Research Program, 2014 National Climate Assessment Report (May 2014), <http://nca2014.globalchange.gov/highlights/report-findings/our-changing-climate>.
- <sup>6</sup> Bulletin of the American Meteorological Society (BAMS), "Sea level variability and change," State of the Climate in 2013 (2014), <http://www.climate.gov/news-features/understanding-climate/2013-state-climate-sea-level>.
- <sup>7</sup> S. Hallegatte, C. Green, R. Nicholls, and J. Corfee-Morlot. "Future flood losses in major coastal cities," Nature Climate Change 3, 802-806 (2013).
- <sup>8</sup> City of Boston, 2013 Climate Ready Boston: Municipal Vulnerability to Climate Change
- <sup>9</sup> C. Mora et al. "The projected timing of climate departure from recent variability." Nature 502, 183-187 (2013)
- <sup>10</sup> E. Douglas, P. Kirshen, V. Li, C. Watson, and J. Wormser. "Preparing for the Rising Tide," The Boston Harbor Association (2013).
- <sup>11</sup> City of Boston, 2013 Climate Ready Boston: Municipal Vulnerability to Climate Change
- <sup>12</sup> Massachusetts Clean Energy Center, 2014 Clean Energy Industry Report, <http://www.masscec.com/content/2014-clean-energy-industry-report>
- <sup>13</sup> A full discussion of the inventories is available online at [GreenovateBoston.org](http://GreenovateBoston.org).
- <sup>14</sup> Massachusetts Department of Environmental Protection, Massachusetts 2010-2020 Solid Waste Master Plan: Pathway to Zero Waste, April 2013, <http://www.mass.gov/eea/docs/dep/recycle/priorities/swmp13f.pdf>.



The cover of this report was printed on 10 percent post-consumer recycled paper. The interior of this report was printed on 100 percent post-consumer recycled paper. Please pass this on or recycle.

community  
composting

Mayor Martin J. Walsh  
Contact: [oscar@boston.gov](mailto:oscar@boston.gov)  
617-635-3850  
#compostbos

CEREAL  
PASTRY  
compostable  
plastics/bags

**rice**  
bread  
pasta

vegetables  
coffee  
GROUNDS

**fruits**

cut /dry  
flowers

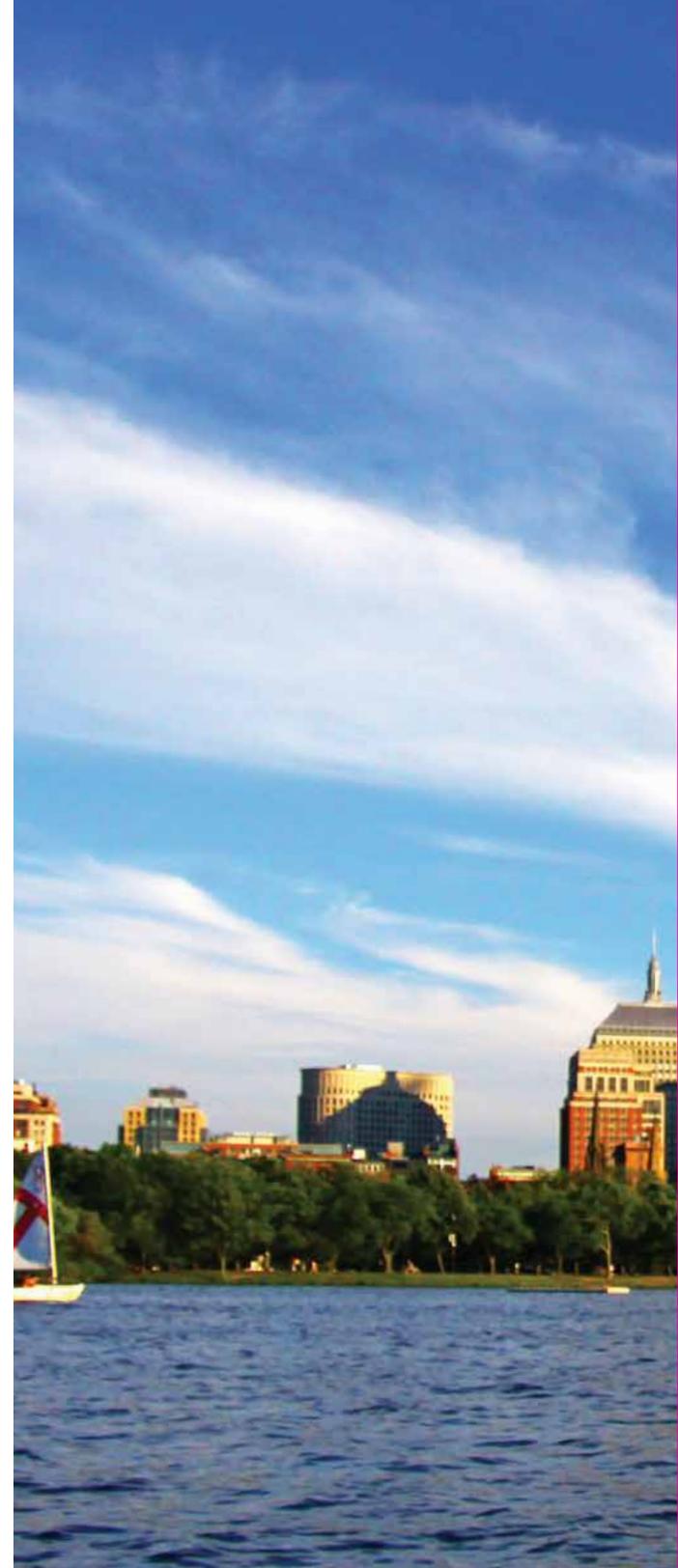
**EGG**  
shells



GREENOVATE  
BOSTON



**GREENOVATE BOSTON** is the City's initiative to reduce greenhouse gas emissions 25% by 2020 and 80% by 2050 and prepare for the impacts of climate change. It is a community-wide movement that seeks to engage all Bostonians in achieving these goals, while continuing to make Boston a thriving, healthy, and innovative city.



**GREENOVATE  
BOSTON**

[greenovateboston.org](http://greenovateboston.org) @GreenovateBos

