

"Get people out of their cars to reduce pollution—encourage biking, walking, and transit."
Roxbury resident via community workshop

Energy & Environment

Boston will continue to be a global leader in reducing carbon emissions and preparing the city for climate change.

Climate Ready Boston

Climate Ready Boston has set Boston’s climate preparedness agenda by developing a climate adaptation strategy to enable Boston to thrive in the face of climate change. It presents a thorough analysis of Boston’s climate risks and describes the initiatives the City and its partners should undertake to manage these risks. Climate Ready Boston presents five layers of initiatives to create a more climate-ready city: 1) a climate-projection consensus to underpin decision making, 2) empowered communities that are prepared for risks, 3) protected shores, 4) resilient infrastructure, and 5) adapted buildings. Climate Ready Boston’s initiatives are guided by principles that produce multiple benefits, leverage building and investment cycles, create layers of protection, incorporate local involvement, and design for flexibility and adaptability.

Boston is contending with major climate risk factors including sea-level rise and coastal storms. Like many other cities in the Northeast, it also must prepare for extreme precipitation and temperatures.

As the climate changes, more frequent and intense climate events will result in more impactful coastal flooding and other hazards, like stormwater flooding and extreme heat. More people and assets will also be at risk in the future. However, if the city leverages this moment of growth—and the public and private resources and ingenuity it brings—Boston can adapt and effectively manage climate risks.

Boston is taking a combined approach to addressing climate change that encompasses both reducing emissions and adapting to climate-related hazards. The following initiatives will enable us to prepare our communities, buildings, infrastructure, and shoreline for climate risks. They will also provide our neighborhoods with cleaner air and water, as well as more affordable energy. Investments in climate readiness will support new and improved open space and continued greenhouse-gas reduction will aid a growing economy of green-energy jobs at all skill levels. By acting now, Boston can strengthen its role as a bold leader in emissions reductions and climate adaptation.

This is what inspires us to act.

Boston has a history of exposure to extreme weather. Since 1991, Boston has experienced 21 events that triggered federal or state disaster declarations, including power outages during Hurricane Irene in 2011 and high winds and coastal flooding during Hurricane Sandy in 2012. During the winter snows of 2014-15, hourly workers and others experienced a loss of income due not only to the closure of businesses but also due to the public transportation shutdown that prevented many from getting to their jobs.

Global efforts to curb emissions of greenhouse gases will have a significant impact on the impact of climate change in Boston. Citywide, greenhouse-gas emissions in 2014 were 17 percent lower than they were in 2005.³⁷ Climate Ready Boston’s Climate Projection Consensus is using three emissions scenarios from the

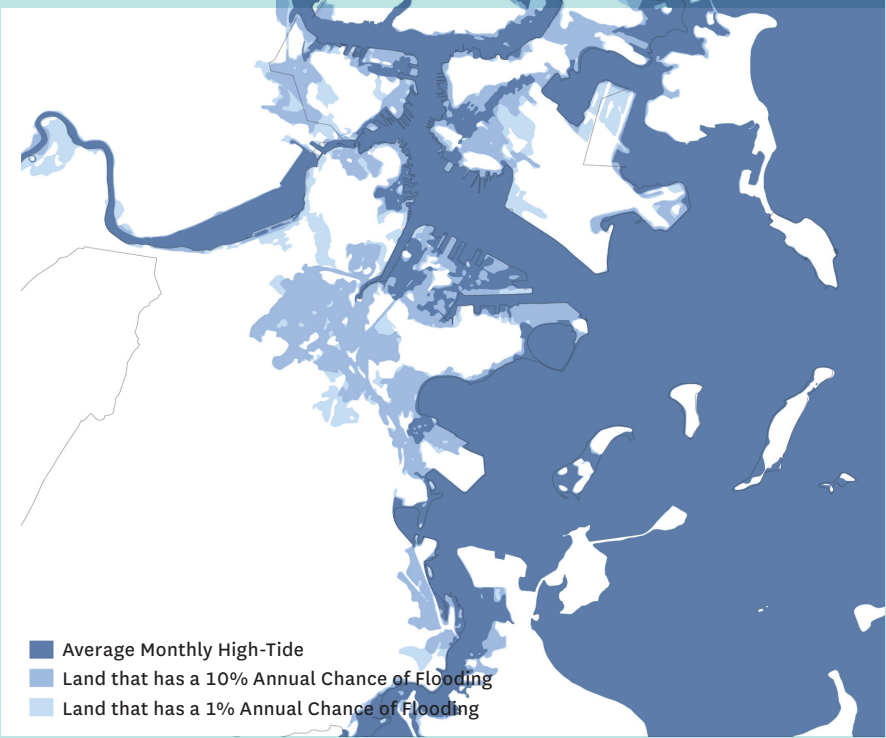
International Panel on Climate Change. In the next few decades, these projections are relatively consistent for these emissions scenarios. As we look further into the future, we can see the impact of increasing our emissions on a global scale, continuing business as usual or reducing global emissions significantly.

As sea levels rise and storms become more intense, a larger share of our residents, economic value, and land area is exposed to the 100-year flood. Over the entire twentieth century, sea levels rose about 9 inches relative to land. By the 2050s, the sea level could be at least one-and-a-half feet higher than it was in 2000, and 3 feet or higher by the 2070s. Three feet of sea-level rise would mean more than 88,000 residents are exposed to the 100-year flood.³⁸

[See opposite page → Flood Map, 36 inches of sea level rise \(2070s or later\)](#)

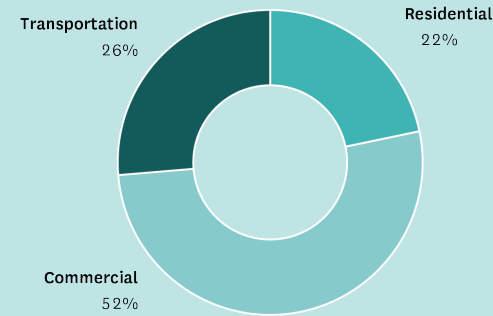
Another name for the “1 percent annual chance flood” is the “100-year flood.” Experts prefer not to use the “100-year” term, since it gives the impression that a certain level of flooding will only occur once every 100 years. In fact, it has a 1 percent chance of occurring in any given year, and can even occur two years in a row. Over a 30-year period, there is almost a 1 in 3 chance that a 1 percent annual chance flood will occur at least once. The average monthly high tide is the area expected to be flooded about once a month even without a storm.

Flood map, 36 inches of sea level rise (2070s or later)

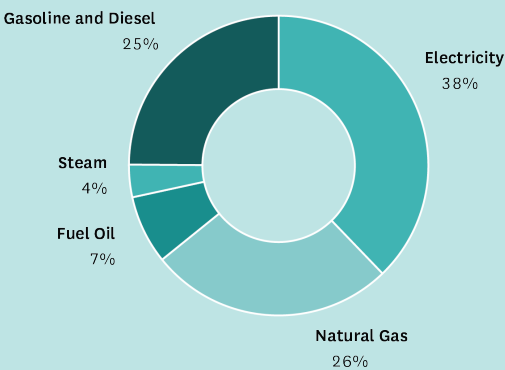


Source: Climate Ready Boston

Community-wide Greenhouse-Gas Emissions by Energy Sector



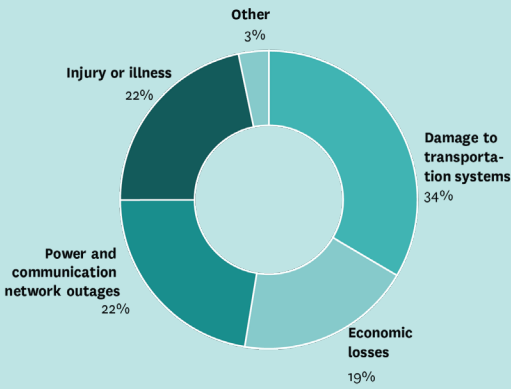
Community-wide Greenhouse-Gas Emissions by Energy Type



Boston’s current greenhouse-gas emissions predominantly come from electricity, natural gas, gasoline and diesel, with a majority contribution from commercial emissions, followed by transportation and residential sources.

Source: Greenovate Boston, data from 2014

When asked, "What potential consequences of extreme weather, flooding, and heat waves do you worry about?" Boston residents replied:



Source: 7,421 surveys; 7,070 comment cards through street teams, 153 website responses, 198 Imagine Boston Forum responses (respondents asked to rank choices; above answers were ranked #1)

Sea-Level Rise and Flood Scenarios

As sea levels rise and storms become more frequent and intense, a larger share of our residents, property value, and land area is exposed to the 100-year storm.



Source: Climate Ready Boston

We will:

Partner with federal, state, and private entities to invest in nature-based and hard-engineered flood protection

These defenses will protect our neighborhoods and strengthen our shoreline. As we develop this new infrastructure, we will prioritize shoreline investments that integrate cobenefits, such as open space, and support infrastructure investments including improved stormwater infrastructure, as part of public and private capital projects.

Support “carbon-neutral climate-ready” neighborhoods for climate preparedness and adaptation

We will encourage the growth of neighborhoods that create minimal emissions, offset the emissions they do create, and have the infrastructure and open space needed to adapt to a changing climate, which will include the construction of neighborhood flood protection where relevant.

Facilitate neighborhood energy planning in Boston's neighborhoods

We will explore resilient, low-carbon energy sources including district energy, local energy generation, and microgrids that will provide critical alternative-energy sources if Boston's energy system is compromised. This redundancy is especially important for supplying energy to critical facilities like pharmacies, supermarkets, and housing for older adults. We will explore developing microgrids in neighborhoods where large numbers of our most vulnerable residents live.

Expand green-infrastructure and other nature-based systems

We will collaborate with Boston Water and Sewer Commission (BWSC) to expand green-infrastructure systems such as rain gardens and the tree canopy, to improve Boston's ability to manage stormwater, reduce runoff to improve water quality, and mitigate the urban heat-island effect.

Develop and implement climate-ready zoning

These upgrades will prepare buildings for future risks. We will utilize the insights of forward-looking flood maps and encourage retrofits in buildings with near-term risk and buildings that serve public purposes such as libraries and community centers. We will promote affordable flood insurance for property owners who need it. We will continue to support net-zero and net-positive energy buildings that dramatically reduce emissions and make us climate ready. We will encourage preservation guidelines that prepare Boston's historic buildings for climate change.

Improve air quality

We will expand Boston's tree canopy and encourage mode shift to reduce vehicle emissions.

Take steps toward ensuring all Bostonians drink clean water

We will eliminate lead service lines from existing water-delivery systems in the public way and incentivize homeowners to do the same with their privately owned pipes.

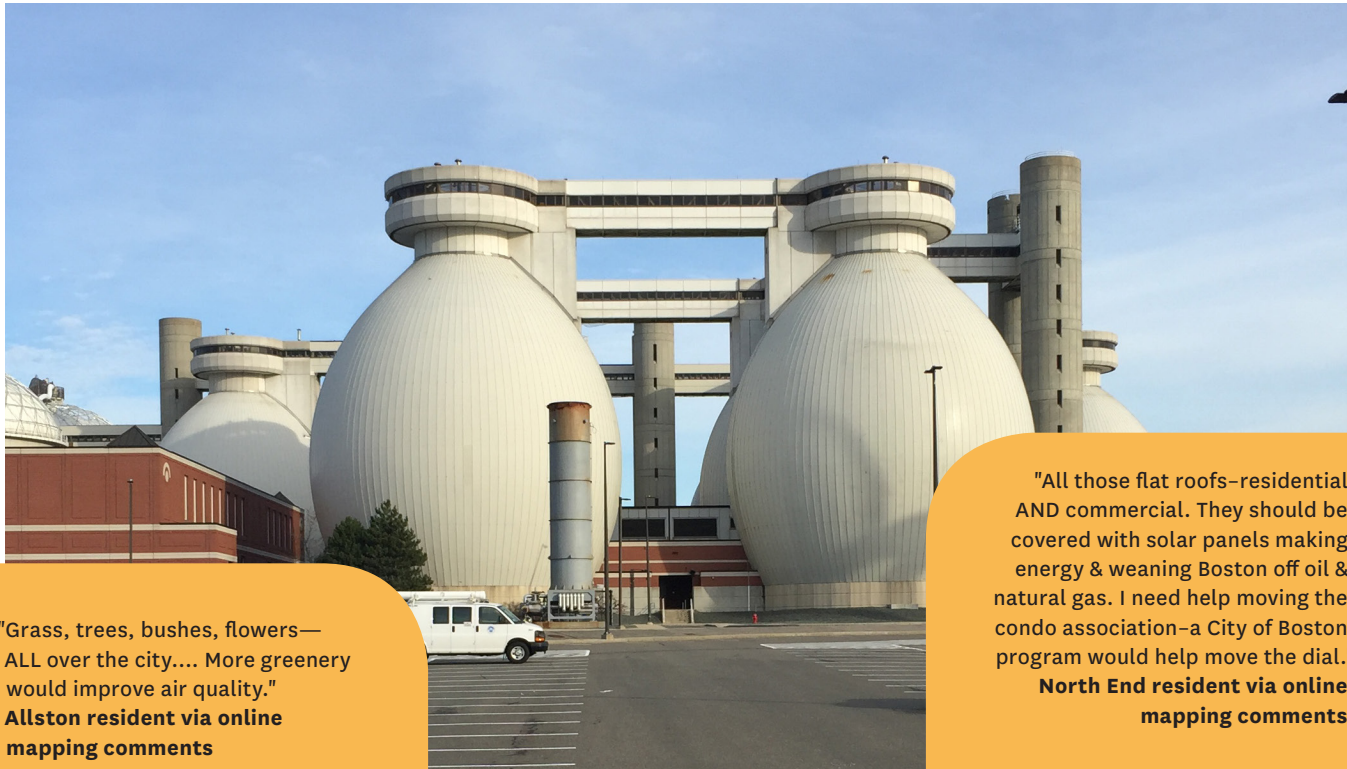
Lo Presti Park, East Boston ↓



In online and in-person conversations in the summer of 2016, residents stressed the importance of reducing energy use, producing more energy locally (such as rooftop solar panels), and building streets and open spaces that help absorb stormwater and cool the city during heat waves.

One Charlestown resident urged the city to launch an “awareness building campaign about impact of climate change on the city and consequences of inaction.”

Deer Island ↓



“Grass, trees, bushes, flowers— ALL over the city.... More greenery would improve air quality.”
Allston resident via online mapping comments

“All those flat roofs—residential AND commercial. They should be covered with solar panels making energy & weaning Boston off oil & natural gas. I need help moving the condo association—a City of Boston program would help move the dial.”
North End resident via online mapping comments

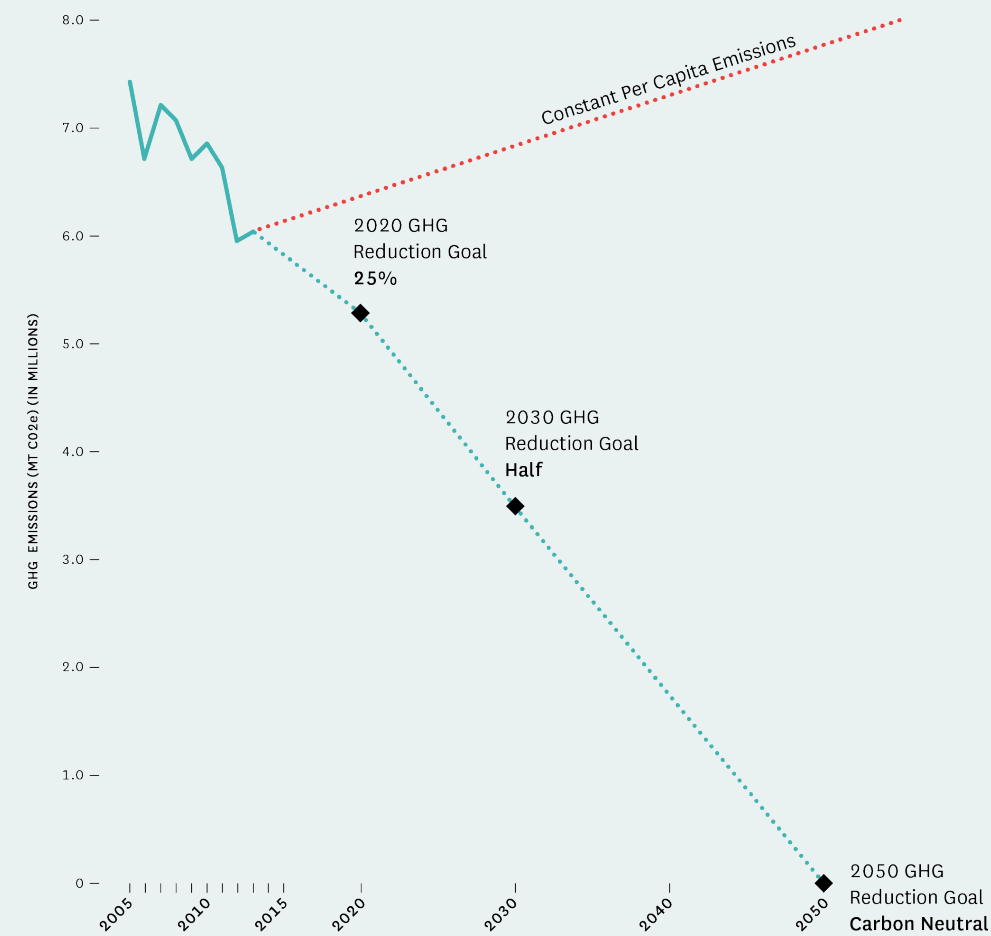
Greenhouse Gas Reduction Approach

The City of Boston has pledged to be carbon-neutral by 2050.

Becoming a carbon-neutral city reinforces Boston’s position as an international leader in addressing climate change and creates an opportunity to grow economic sectors, such as energy-efficiency research, technology, and design that support carbon-reduction goals. To

support its goal of being carbon-neutral by 2050, Boston is working toward interim targets of a 25 percent greenhouse-gas reduction by 2020 and half by 2030, relative to its 2005 baseline.

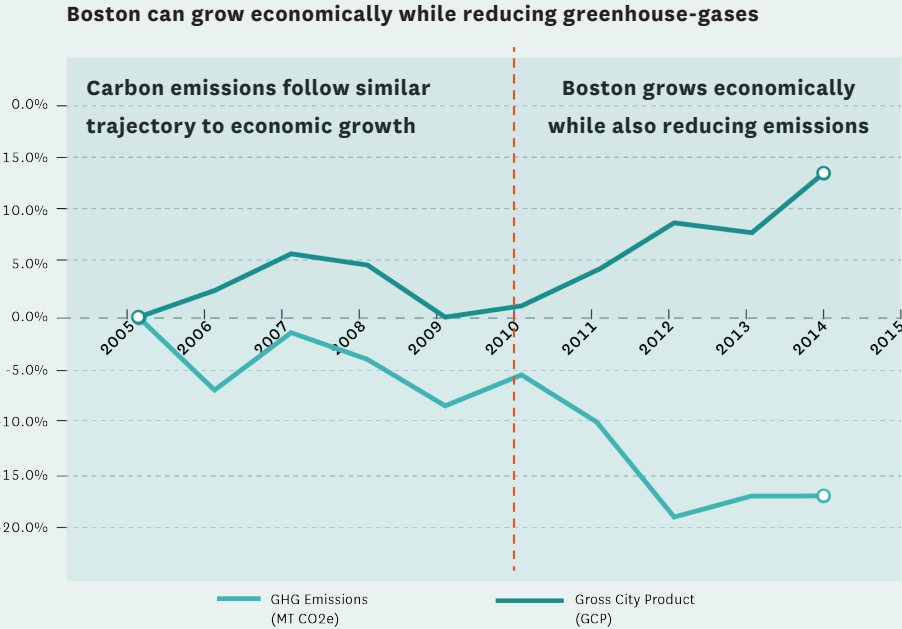
Greenhouse Gas Reduction Chart



If per capita greenhouse-gas emissions remain unchanged, even with the lower per-capita emissions of the past decade, projected population growth would lead to a marked increase in greenhouse-gas emissions in Boston.

“More solar energy—good for environment and good for local economy.”
Allston resident via traveling display feedback

Boston’s economic growth, as measured by Gross City Product (GCP), has sometimes moved with emissions. However, since 2010, it is clear that these are not coupled: Boston can grow economically while reducing GHGs. Mitigation initiatives can provide multiple platforms for economic stimulation through innovative technology, design, local jobs, and expertise.



Strategies to Reduce GHG Emissions by Source

Greenhouse-gas mitigation strategies across four primary emissions sources are expected to play a role in achieving carbon neutrality by 2050. These efforts will be described at greater length in the Carbon Free Boston report and the Climate Action Plan Update. →

Power

The City aims to harness and employ lower-carbon electricity sources such as solar, wind, hydro, and biogas power. This involves shifting from the traditional electrical grid systems to a more localized energy distribution structure that incorporates microgrids, combined heat and power outputs, and district energy plans.

Transportation

Boston aims to achieve a citywide mode shift toward low-carbon transit methods such as walking, biking, and public transit. Other priorities include encouraging electric power and renewable fuel sources for cars and public transit, in addition to expanding electric-vehicle charging stations and carbon-neutral public-transit infrastructure.

Waste

Although a small source of emissions, more effective waste management can enable the City to reduce waste by diverting plastic, paper, and organics from landfills.

Buildings

By regulating new construction and retrofitting existing buildings, and promoting conversions to clean energy sources for heating and power, Boston can improve energy efficiency and lower emissions. Buildings can switch to green fuel sources, such as solar and geothermal, and can implement distributed energy systems as well as energy-efficient features, such as combined heat and power. Buildings are both the biggest source and often the cheapest places to reduce emissions, which makes them a key opportunity for reducing emissions. City owned buildings offer a near term opportunity for retrofitting energy savings.

“Focus on the building sector as a major area to reduce emissions”
Resident via draft plan feedback

Source: “2014 Climate Action Plan Update,” Greenovate Boston

Since 2005, Boston has taken many steps to reduce the city's emissions.

The city’s greenhouse-gas emissions have declined as a result of strategic efforts. These types of programs and plans will continue to be critical to achieving long-term greenhouse-gas reduction targets.

"Promote a level playing field for businesses while reducing traffic congestion and diesel and climate emissions. A Zero Waste economy provides new opportunities for startups that fix, reuse, recycle materials, [and creates] family-sustaining employment, particularly for low-income residents without highly specialized education."

Comment via email in response to Draft Plan



The Roxbury Energy Positive (E+) Townhomes

The City is working to bring the next generation of green buildings to Boston. The E+ Townhomes in Roxbury are urban townhome prototypes completed in 2013 under the E+ Housing Initiative. They demonstrate that energy positive green homes and buildings can be constructed sustainably and cost-effectively. Solar thermal panels and energy and water efficient design elements enable these high-performance homes to generate more energy than they consume, showing the way forward for many more buildings citywide.

Boston’s Electric Vehicle Program

Since 2014, the City has required that all new developments over 50,000 square feet equip a minimum of 5 percent of parking spaces with electric-vehicle (EV) charging capability. In addition, another 10 percent of parking spaces must be wired to easily accommodate more EV charging infrastructure, without requiring an upgrade to electrical service or panels.

Zero Waste

As part of the City’s Climate Action Plan, Boston is launching its zero-waste planning process. Working with a broad range of stakeholders, Boston will develop a zero waste plan that will support waste reduction as well as increase opportunities for repair, reuse, recycling, composting, and remanufacturing. In the long run, the path to zero waste means a shift in our economy from a linear one to a circular one. In a circular economy, products are made, sold, repaired or reused, then recycled and remanufactured into new products. This reduces waste since discarded materials can become resources for others to use.

Carbon Free Boston

The City is collaborating with the Green Ribbon Commission and Boston University’s Institute for Sustainable Energy to produce the Carbon Free Boston report, which analyzes the most effective combination of technologies and policies to reduce greenhouse-gas emissions. The report will focus on electric power, buildings, transportation, and waste as primary sources where Boston can reduce emissions. Carbon Free Boston will inform recommendations within the City’s Climate Action Plan Update.

Metro Boston Climate Preparedness Commitment

In 2015, Boston, along with 13 partner cities and towns in Greater Boston that belong to the Metropolitan Mayors Coalition (MMC), set its most aggressive greenhouse gas reduction goal to date when it signed the Metro Boston Climate Preparedness Commitment, which pledges to achieve a carbon-neutral by 2050.

Greenovate Boston

Greenovate Boston is Boston’s initiative to get all Bostonians involved in eliminating the pollution that causes global climate change, while continuing to make Boston a healthy, thriving, and innovative city. Greenovate works with the broader community to implement the City’s Climate Action Plan, which is a roadmap to reduce our greenhouse-gas emissions 25 percent by 2020 and to be carbon neutral by 2050.

"High performance green buildings that save water, produce energy, enhance our health and productivity, and bring our communities closer together."
Jamaica Plain resident via text message

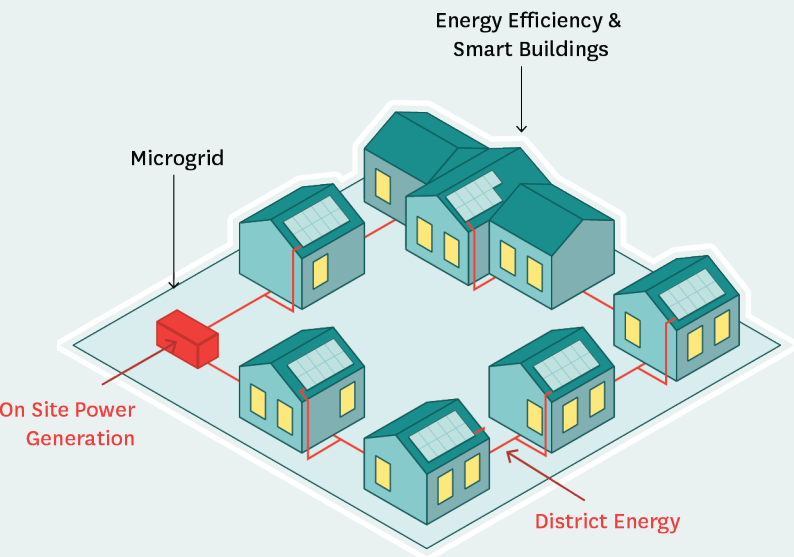
Resilience Districts and Microgrids

The City is exploring and piloting microgrid technology that can enhance resiliency while also providing economic and social benefits.

Neighborhoods that have lower education rates and are vulnerable to chronic joblessness and housing displacement are also among the most vulnerable to the effects of climate change. An effective way to protect neighborhoods against the impacts related to flooding, heatwaves, and cold snaps is to ensure continuous energy services for vulnerable populations.

Building resilient neighborhoods is beneficial beyond “keeping the

lights on” during a natural disaster. Resilient energy services can create local jobs, build technical skills, and lower energy costs—making the neighborhood more economically resilient through housing affordability and long-term employment opportunities. To mitigate climate change, resilient neighborhoods can embrace clean energy to reduce greenhouse-gas emissions and strains on natural resources.



"More multi user microgrids around Boston to increase climate resiliency and energy independence"
Mission Hill resident via text message

Climate Resiliency for Vulnerable Populations

A microgrid can protect against power outages, powering critical services when the larger grid goes down in a storm, flood, or heatwave.

Lower Energy Costs and Housing Affordability

Microgrids manage energy smarter, lowering peak demand and increasing energy efficiency. This protects customers from price surges and makes energy more affordable.

Economic Development and Social Resilience

The construction of microgrids attracts high-paying industry jobs because of specialized building and electrical trades. Reliable power is highly valued by businesses vulnerable to outages, like manufacturers, media, and tech companies.



A microgrid is an electrical distribution network with underground wires that serves multiple buildings in a local area and that can enter into “island mode” by separating from the larger electrical grid when there is a major outage. The microgrid self-supplies the connected buildings with locally generated electricity.



Local Efforts

Boston Community Energy Study

The Boston Community Energy Study identified 42 districts where microgrids have high potential based on a cluster of high energy demand buildings, projected impact, and co-location of critical facilities. The Boston Community Energy Study is a collaboration with MIT Sustainable Design Lab and MIT Lincoln Laboratory. The study simulated energy demand for every building in Boston, analyzed demand patterns with cutting-edge tools from the U.S. Department of Energy, and measured the impact of deploying microgrids in those districts.

Microgrids and District Energy can be more cost effective and impactful when implemented concurrently with new construction or when investments in existing neighborhoods already lead to streetscape construction and changes to utility infrastructure.

Lower Roxbury

Lower Roxbury was identified by the Boston Community Energy Study as an attractive area for feasible microgrid investment. As one of 42 potential areas identified by the Boston Community Energy Study, a microgrid in Lower Roxbury would provide continuous power to places of refuge for local residents and provide substantial avoided monetary losses during a power outage. Microgrid projects are also designed to help create local, high paying jobs and provide cost reductions for energy.

Raymond L. Flynn Marine Park

The Raymond L. Flynn Marine Park (RLFMP) is located in a flood-vulnerable area where greater resiliency of power systems is attractive to new businesses and existing economic activity. Additionally, RLFMP tenants are sensitive to power prices and quality. A microgrid in the RLFMP can cut energy costs by providing smarter management and higher efficiency equipment, while adding resiliency to the local power supply. It would also utilize source fuel more efficiently, increase revenue potential inside the park, and increase control over power quality for sensitive users (e.g., pharmaceutical, services, and advanced manufacturing companies). There is a potential for \$500,000-\$800,000 in annual cost savings according to U.S. Department of Energy analyses conducted for the RLFMP in 2014 and 2016.

"In large redevelopment areas (Allston, Andrew Square, Newmarket, parts of Dot Ave), encourage district energy or combined heat and power. Distributed energy would be more resilient."
South Boston resident via online postcard