

Renewable Communities

*Massachusetts cities and towns leading the way towards
100 percent renewable energy*



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Executive Summary

Massachusetts has the resources, the technology, and the know-how to obtain 100 percent of the energy we need from clean, renewable sources. Shifting to 100 percent renewable energy would make our communities safer and healthier while boosting the state's economy and creating local jobs.

For decades, Massachusetts has been a leader in promoting clean energy and fighting climate change. A statewide commitment to 100 percent renewable energy would continue Massachusetts' record of climate leadership and set a positive example for other states and countries to follow.

The good news is that Massachusetts communities are already leading the way towards 100 percent renewable energy. Cities and towns large and small, in all parts of the Commonwealth, are setting ambitious goals for reducing their energy usage and promoting clean energy. These communities are moving quickly to cut carbon emissions from their municipal facilities, while creating innovative programs to help residents and businesses connect with clean energy and energy efficiency opportunities.

Achieving 100 percent renewable energy for Massachusetts will require continued leadership on the local level, as well as strong state-level, regional, and national commitments and policies. This report presents data on local clean energy and energy efficiency programs, highlights some of the towns and cities that are doing the most on clean energy, and identifies steps that local and state leaders can take to move Massachusetts more quickly towards 100 percent renewable energy.

Massachusetts has the resources to achieve 100 percent renewable energy.

- Solar energy could provide at least twice as much electricity as the entire state uses each year.¹ A study from the National Renewable Energy Laboratory estimates that rooftop solar installations alone could provide 47 percent of Massachusetts' electricity.²
- The development of offshore wind farms off the coast of Massachusetts could provide a vast amount of clean energy. Offshore wind could produce enough electricity to meet the state's needs 11 times over.³
- Clean energy has grown rapidly in recent years. Solar has increased more than 200-fold in Massachusetts since 2006.⁴



Offshore wind facilities, such as the Sheringham Shoal Offshore Wind Farm pictured here, are already common in Europe. Later this year, the first offshore wind farm in the United States, off the coast of Rhode Island, is expected to go into operation.

Photo: Sheringham Shoal Offshore Wind Farm via Wikipedia, CC BY 2.0. Work attributed to NHD-INFO.



Electric vehicles, along with improvements to public transportation and walking and biking infrastructure, will help enable a zero-carbon transportation system by the middle of this century.

Photo: Nissan Leaf via Wikipedia, CC BY 2.0. Work attributed to eVgo Network and Mariordo.

Game-changing innovations will help us expand clean energy more rapidly.

- New technologies, such as LED lighting fixtures and “intelligent efficiency” systems, can significantly reduce building energy use. Air-source and ground-source heat pumps and solar thermal systems allow buildings to be heated and cooled without the use of gas or oil.
- Electric vehicles and improvements to public transportation create the possibility of a transportation system powered by clean electricity rather than oil. Transit-oriented development, along with better bicycle and pedestrian infrastructure, will help more residents travel without the use of cars. Ultimately, a zero-carbon transportation system can be achieved by the middle of this century.⁵

100 percent renewable energy is feasible and affordable.

- A review of seven detailed studies from academics, government agencies, and non-profits shows that there are no insurmountable technological or economic barriers to achieving 100 percent renewable energy.⁶
- Economists estimate that we can reach 100 percent renewable energy globally at costs comparable to or less than what we would spend to maintain our current fossil-fuel-powered energy system.⁷

Achieving 100 percent renewable energy will bring major benefits to our environment, our health, and our economy.

- Climate change, driven by emissions from fossil fuels, is already having an impact on Massachusetts. Extreme snowstorms and rainstorms in Massachusetts have become 81% more frequent since 1948, and scientists predict the effects of global warming will become much worse unless we rapidly transition off of fossil fuels.⁸
- A shift to clean energy will reduce pollution that harms our health. Each year, air pollution kills an estimated 200,000 Americans.⁹
- The clean energy industry already employs more than 98,000 Massachusetts residents, with 73 percent of full-time workers earning more than \$50,000 per year.¹⁰ Increasing the amount of clean energy in Massachusetts will help create more opportunities for clean energy companies and workers.

Communities across Massachusetts are leading the way towards 100 percent renewable energy.

- We conducted a survey of 191 Massachusetts municipalities on their clean energy and energy efficiency practices, and found

that city and town leaders are taking ambitious steps to reduce energy usage and promote clean energy.

- Statewide programs — such as the Green Communities program, administered by the Massachusetts Department of Energy Resources (DOER), and the Solarize Massachusetts program, a partnership between DOER and the Massachusetts Clean Energy Center (MassCEC) — are helping communities to set and achieve their clean energy and energy efficiency goals.
- Citizen activists and volunteers play an essential role in advocating for and implementing local energy programs. Cities and towns can accelerate their clean energy and energy efficiency progress by hiring an energy manager.

Cities and towns are using renewable electricity to meet their energy needs.

- 42.9 percent of the communities responding to our survey had installed solar panels on at least one municipal building or property, and 16.8 percent had installed another renewable energy technology such as wind, hydroelectric, or geothermal.
- Northampton is building a 3.3-megawatt solar project on the city's former landfill, which will produce enough energy to meet close to 40 percent of municipal electricity demand. The city has also installed solar panels on school buildings.
- Through its municipal utility, Holyoke has played a major role in developing 6.3 megawatts of solar capacity. The city is also using historic hydropower facilities on the Connecticut River to provide approximately two-thirds of the electricity used by residents and businesses.
- The Cape and Vineyard Electric Cooperative (CVEC) works with 17 towns and cities and two counties to install clean energy projects. CVEC's most recent round of solar

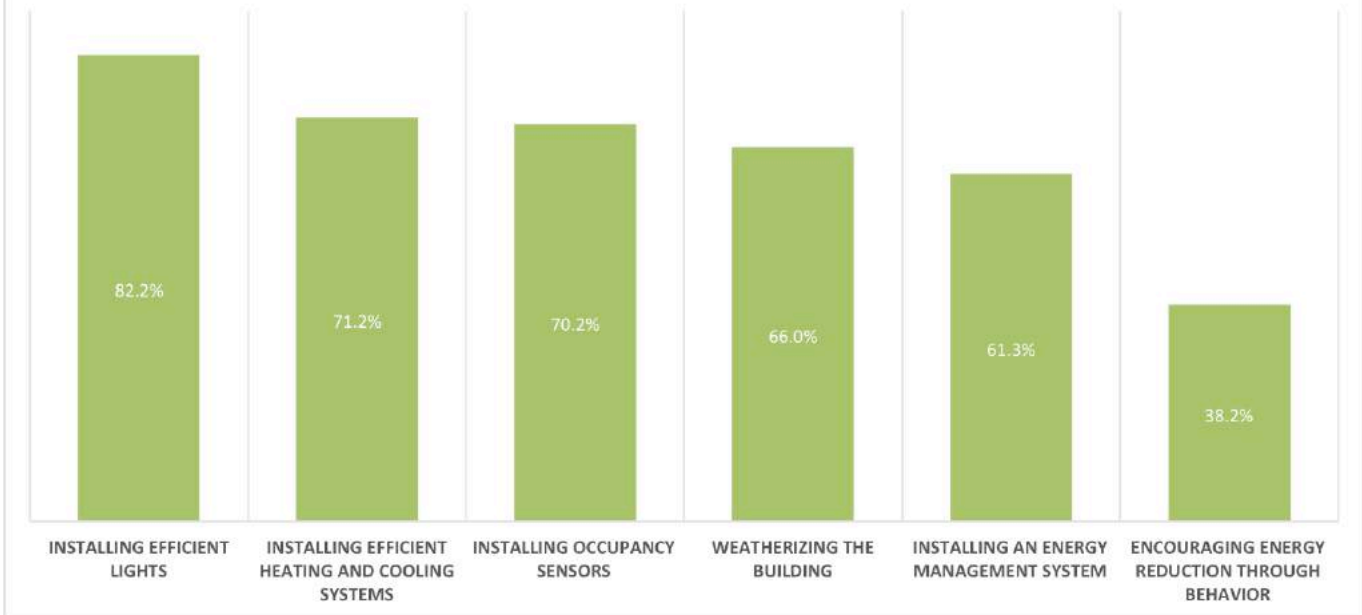
projects installed 12 megawatts of solar, helping to offset municipal electricity bills.

- Gloucester's municipal government purchases net metering credits from two wind turbines within city limits, saving \$750,000 in energy costs since 2012.

Cities and towns are taking steps to improve the energy efficiency of their municipal facilities, reducing the investment needed to achieve 100 percent renewable energy.

- 88.0 percent of responding communities said that they had completed an energy audit in at least one of their municipal buildings in the past ten years to identify energy-saving opportunities.
- Some of the most common energy-efficiency measures adopted by municipalities include upgrading to LED or high-efficiency fluorescent lighting fixtures (82.2 percent), installing high-efficiency heating and cooling equipment (71.2 percent), and weatherizing a building (66.0 percent).
- Belchertown reduced its municipal energy usage by 20 percent between 2010 and 2014. Using a Green Communities grant, the town installed a digital energy management system at Chestnut Hill Elementary School. Belchertown has also replaced windows and installed a new heating, ventilation, and air conditioning (HVAC) system at Town Hall.
- Palmer has retrofitted its heating systems and installed energy management systems to reduce waste. The town also converted interior lights to LED fixtures and weatherized its older public buildings.
- Worcester has completed an energy audit of its 171 municipal facilities, and invested \$75 million in energy efficiency measures to date.

FIGURE ES-1: ENERGY EFFICIENCY EFFORTS IN MUNICIPAL BUILDINGS



Municipal leaders are helping to connect residents and businesses with clean energy and energy efficiency programs.

- 33.5 percent of responding cities and towns have participated in Solarize Mass or have created a similar program for their community.
- Auburn, Sutton, and Millbury host an annual energy fair that educates local residents about clean energy and energy efficiency options.
- Lowell’s BetterBuildings Lowell Efficiency Upgrade (BLEU) program helps bring energy efficiency upgrades to multi-family and commercial buildings in the Downtown Historic District.
- The Newton Energy Savers and Newton Business Energy Savers programs are connecting Newton residents and businesses with energy efficiency upgrades. Newton officials aim to have 1,000 residents complete home energy audits by the end of 2016.

Municipalities are choosing a greener electricity supply for their residents and businesses.

- Municipal aggregation enables town and city leaders to choose a default electricity supplier for their residents. On its own, municipal aggregation does not necessarily involve a larger commitment to clean energy. But increasingly, communities are opting for “green municipal aggregation,” which adds at least 5 percent Class I renewable energy (from recent clean energy projects in New England) on top of the state’s minimum requirements.
- 13.6 percent of the cities and towns that responded to our survey said that they have a green municipal aggregation program or are actively considering one.
- Melrose became the first city in Massachusetts to adopt a green municipal aggregation program. Melrose was able to add 5 percent more Class I renewable energy than is required by state law, while securing an electricity rate that is comparable to National Grid’s basic service rate.

Cities and towns are helping to reduce emissions from transportation.

- 39.3 percent of responding communities said that they have purchased fuel-efficient vehicles or electric vehicles for their fleets, and 20.4 percent have installed electric vehicle charging stations that are available for the public to use.
- 31.4 percent of responding communities have adopted a Complete Streets policy or a similar policy to improve facilities for pedestrians and cyclists.
- More than a third of the 70 vehicles in New Bedford's municipal fleet are now electric vehicles. The city has installed 27 electric vehicle charging stations, ten of which are available to be used by the public for free.

Cities and towns are encouraging innovative clean energy technologies.

- Somerville has partnered with Greentown Labs and the MIT Climate CoLab to develop and implement innovative ideas to reduce carbon emissions. Through the city's GreenTech program, local entrepreneurs have installed solar-powered cell phone charging stations and weather stations in public places and on city-owned buildings.
- Pittsfield has installed a combined heat and power (CHP) system at its wastewater treatment plant, powered by methane gas produced by the waste sludge. The city also installed an inline hydro-turbine at the Coltsville Flow Station, capturing excess water pressure to produce clean energy.

Ambitious goals help to drive local clean energy progress.

- Cambridge has set a goal of reducing emissions from the building sector by 70 percent by 2040. The city's Net Zero Action Plan, developed in collaboration with a diverse set of civic and business leaders, sets out a roadmap for Cambridge to become a net zero community.
- Boston has committed to reduce carbon emissions citywide by 80 percent by 2050. The city has taken a number of steps towards achieving this goal, including upgrading its municipal vehicle fleet, improving bicycle and pedestrian infrastructure, and installing solar panels on city buildings.

Local and state leaders should accelerate the move towards 100 percent renewable energy.

- State officials should commit to a goal of 100 percent renewable energy statewide. Cities and towns should make local commitments to 100 percent renewable energy.
- Local leaders should continue taking steps to improve the energy efficiency of municipal facilities and install clean energy on municipal properties. They should also adopt green municipal aggregation programs, encourage low-carbon transportation, and help to connect residents and businesses with clean energy and energy efficiency opportunities.

Introduction

Since the 1990s, Massachusetts' leaders have taken significant steps to expand clean energy and reduce carbon emissions from fossil fuels. Despite recent progress, we still have a long way to go to reduce our emissions to the level scientists say is necessary to avoid the worst impacts of global warming.

Already, global warming is contributing to changing weather patterns in Massachusetts. Extreme storms have become 81% more frequent in Massachusetts since 1948.¹¹ The snow storms of 2015, which dumped a record-breaking 108.6 inches of snow in the Boston area and caused widespread disruption for weeks, are a taste of what we might expect as climate change continues.

As a result of global warming, days of extreme heat, defined as above 100 degrees Fahrenheit, are predicted to increase from the modern average of 2 per year all the way to 28 per year by the end of the century.¹² By 2070, under a high carbon emission scenario, Massachusetts' climate could resemble the modern Carolinas.¹³ This will have an enormous impact on many plant and animal species, as well as the New England maple syrup industry. A report from the Massachusetts Division of Fisheries and Wildlife identified fir forests, coldwater lakes and ponds, and tidal flats among the habitats in critical danger as a result of climate change.¹⁴

Sea level rise resulting from global warming is a major threat for Boston and other coastal communities. A recent report from University of Massachusetts scientists suggests that the sea level could rise up to 10 feet by 2100, significantly higher than previous predictions.¹⁵ Higher sea levels mean that even moderate storms could flood large areas of Boston.

To avoid the worst impacts of climate change, experts agree we must move quickly to reduce our carbon emissions and replace fossil fuels with clean energy. Massachusetts has a long history of leadership in the fight against climate change. In 2001, Massachusetts became the first state in the nation to set enforceable limits on carbon pollution from power plants, helping to pave the way for national power plant carbon limits under the Clean Power Plan.¹⁶ Massachusetts' Global Warming Solutions Act and Green Communities Act, among other policies, have led to significant reductions in carbon emissions. Currently, thanks to the state's Renewable Portfolio Standard, Massachusetts gets approximately 11 percent of its electricity from local renewable energy sources such as solar and wind.

Clean energy and energy efficiency are growing rapidly, and prices are falling. Massachusetts has both the resources and technology to achieve 100 percent renewable energy statewide. A statewide commitment to 100 percent renewable energy would drive clean energy progress across Massachusetts, and set an example for other states and countries to follow.

As our report shows, cities and towns around Massachusetts are already leading the way towards 100 percent renewable energy. Municipal leaders, working in partnership with state agencies and local activists, have taken major steps to reduce energy consumption and promote renewable energy. With further action on the local level, and with strengthened commitments from state officials, Massachusetts can achieve 100 percent renewable energy and continue to lead the way towards solutions to global warming.

100 Percent Renewable Energy is Within Reach for Massachusetts

Massachusetts has sufficient clean energy resources to power our homes and businesses, heat and cool our buildings, and drive our transportation system without the use of fossil fuels. New technologies are making it easier than ever before to achieve 100 percent renewable energy.

Studies show that an energy system powered by 100 percent renewable energy is feasible, and can be built at a cost comparable to or less than what it will cost to continue our dependence on fossil fuels.

The effects of climate change are becoming clearer with each passing year, and the health and economic benefits of switching to renewable energy are hard to deny. The sooner we can put Massachusetts on a path towards 100 percent renewable energy, the sooner we will realize those benefits.

Massachusetts has the resources to achieve 100 percent renewable energy.

Massachusetts has more than enough clean energy resources to meet all of the energy needs of the Commonwealth's businesses, residents, and institutions.

Solar energy could provide enough electricity to power the state twice over.¹⁷ A study from the National Renewable Energy Laboratory (NREL) suggests that rooftop solar panels alone could handle 47 percent of Massachusetts' electricity.¹⁸

Offshore wind could also be a major energy source for Massachusetts in the near future. Offshore wind could produce eleven times as much electricity as the entire state uses.¹⁹ An area of ocean off the coast of Massachusetts, recently leased for development, could yield up to 2 gigawatts of offshore wind energy, enough to provide power for nearly 700,000 homes.²⁰ The first offshore wind farm in the United States is set to begin operation this fall in the waters off of Rhode Island, and offshore wind has long been accepted in Europe as a valuable resource. Onshore and offshore wind energy is now the third largest power source in the European Union, accounting for 15.6% of total electricity capacity.²¹



Solar energy has grown rapidly in Massachusetts in recent years. Pictured here is a solar installation along Route 44 in Carver, Mass.

Photo: MassDOT

While solar and offshore wind are likely to play the largest role in meeting Massachusetts' energy needs, other renewable technologies may also contribute, such as geothermal and tidal energy. The Marine Renewable Energy Collaborative is installing a facility to test tidal turbines in the Cape Cod Canal, and the organization is also working with Edgartown on a proposed 5-megawatt tidal energy facility in the Muskeget Channel off of Martha's Vineyard.²²

Clean energy has grown rapidly in recent years

Renewable energy is growing rapidly in Massachusetts. Today, Massachusetts has more than 200 times as much solar installed as in 2006.²³ In 2015, Massachusetts ranked sixth in the nation for the total amount of solar installed.²⁴ Massachusetts' solar industry is growing at the fourth fastest rate in the nation.²⁵

Wind energy has grown at a more modest pace in Massachusetts, but the development of offshore wind has the potential to change that in the coming years. In 2015, the U.S. Department of the Interior auctioned 742,000 acres of ocean off the coast of Massachusetts for offshore wind development.²⁶ DONG Energy, the world's largest offshore wind developer, has acquired the rights to develop part of that area.

Massachusetts has made progress on energy efficiency as well. Between 2010 and 2012, energy efficiency programs in Massachusetts saved more than 1.4 million tons of greenhouse gases from being emitted.²⁷ The American Council for an Energy Efficient Economy has ranked Massachusetts as the top state in the nation for energy efficiency policies five years running.²⁸

Game-changing innovations will help us expand clean energy more rapidly

New technologies and ideas will help Massachusetts to reduce energy use and expand clean energy, making it easier than ever before to

achieve 100 percent renewable energy in all sectors.

By replacing conventional lighting fixtures with LED (light-emitting diode) bulbs, residents and businesses can reduce lighting electricity use by up to 75 percent.²⁹ In addition to interior lighting applications, LED fixtures are increasingly found in streetlights and parking garages as well.

"Intelligent efficiency" technologies help to reduce energy usage by automatically turning off appliances and electronics when they are not needed. These technologies can also monitor energy usage in real time, identifying sources of energy waste and providing information on how to use equipment more efficiently.

Renewable heating and cooling technologies — including air-source heat pumps, ground-source (or geothermal) heat pumps, and solar thermal systems — can eliminate the need to burn gas or oil to heat a building.

Advances in building technology are facilitating the construction of zero net energy (ZNE) buildings, which use so little energy that all of their needs can be supplied with on-site renewable energy. The new field headquarters of the Massachusetts Division of Fish and Wildlife, a 45,000-square-foot building completed in 2014, is one of the many ZNE buildings that have cropped up in Massachusetts in recent years.³⁰

In the transportation sector, improvements to public transit, combined with transit-oriented development, can help more Massachusetts residents get where they need to go without driving. New transportation tools, such as carsharing and bikesharing, can also play a role in reducing energy use associated with transportation. Electric vehicles can significantly reduce carbon emissions from transportation, especially when the electricity used to charge them comes from renewable sources.

Using these tools and technologies, we can achieve a zero-carbon transportation system by the middle of this century. A study from the Frontier Group estimates that we can reduce the energy demand from light-duty vehicles in urban areas by approximately 90 percent by 2050, enabling us to power our transportation system efficiently with clean, renewable energy.³¹

Clean energy will bring major benefits to our environment, our health, and our economy

Clean energy has already made a difference in reducing the carbon emissions that are fueling global warming. Total greenhouse gas emissions in Massachusetts declined by 15% between 1990 and 2011, thanks in part to renewable energy expansion.³²

Beyond addressing global warming, eliminating dirty fuels will also improve air quality for human health. Air pollution is estimated to kill 200,000 Americans each year, including 50,000 from pollution from vehicle traffic and 50,000 from power plant pollution.³³ Pollution from fossil fuels contributes to respiratory and cardiovascular disease. A study from the Union of Concerned Scientists found that exposure to ozone can lead to shortness of breath and permanent lung damage.³⁴ Transitioning to 100 percent renewable energy will help to address these health hazards.

Clean energy also represents a major economic opportunity for Massachusetts. Unlike fossil fuels, which come from other states or countries, clean energy has the potential to bring major economic development opportunities to Massachusetts communities.

According to a study from the Massachusetts Clean Energy Center, there are already nearly 6,500 clean energy companies in Massachusetts, employing close to 99,000 workers. That figure includes 26,850 residents working in renewable energy and 69,460 in energy efficiency.³⁵ Clean

energy jobs have increased by 40,000 since 2010, and now account for 3.3 percent of the total Massachusetts workforce. Of full-time clean energy workers, 73 percent earn more than \$50,000 per year, well above the Massachusetts average.³⁶



The Brayton Point Power Plant in Somerset is Massachusetts' last remaining coal-fired power plant. The plant is scheduled to shut down in 2017. Replacing the plant with clean energy rather than fossil fuels will help ensure greater health and climate benefits.

Photo: Brayton Point Power Station, CC BY-SA 3.0. Work attributed to user Wikimaster97commons.

100 percent renewable energy is feasible and affordable

While transitioning away from fossil fuels will present many challenges, there are no insurmountable obstacles to achieving 100 percent renewable energy.

A recent review of seven studies conducted by academics, nonprofit organizations, and government agencies suggests that we can reach 100 percent renewable energy with technologies available today.³⁷ These studies propose addressing the intermittent nature of many renewable energy technologies by investing in diverse energy sources, building a better transmission system to carry power over longer distances, and improving energy storage technology.

Mark Jacobson, a professor at Stanford University, has created 100 percent renewable energy blueprints for every state as well as 139 coun-

tries. His plan for Massachusetts includes 7.2 percent rooftop solar, 22.3 percent large-scale solar, 13 percent onshore wind, 55 percent offshore wind, and small amounts of hydroelectric, tidal, and wave energy.³⁸

Experts suggest that we can achieve 100 percent renewable energy at costs comparable to or less than what we would pay to maintain the current

fossil-fuel-reliant energy system over the coming decades. The International Energy Agency estimates that holding the global temperature increase to 2 degrees Celsius would require an investment of approximately 1% of global GDP each year. This investment would save more than \$115 trillion dollars in fuel expenses by 2050, resulting in a net savings of \$70 trillion.³⁹

Local Clean Energy Efforts Are Widespread

Communities across Massachusetts are taking major steps to reduce their energy usage and promote clean energy. Municipal leaders, working in partnership with state agencies and local activists, have made significant progress in transitioning to 100 percent renewable energy.

We distributed a survey on clean energy and energy efficiency practices to municipal staff and elected officials in all 351 towns and cities in Massachusetts, and received completed surveys from 191 communities. Below, we present findings from our survey, alongside descriptions of common steps that municipalities can take to promote clean energy and energy efficiency.

Renewable energy in municipal facilities

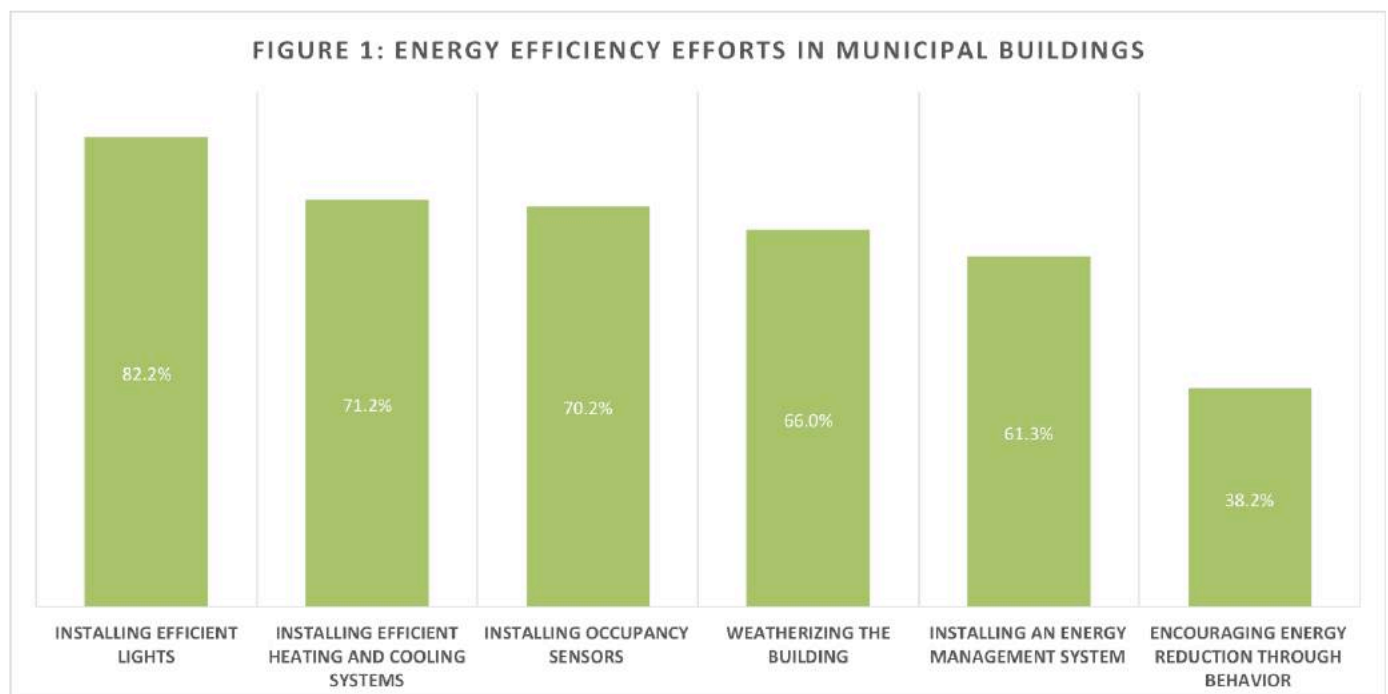
One of the most common steps that towns and cities can take to promote clean energy is to in-

stall renewable energy technologies, such as solar photovoltaic panels, on municipal buildings and properties. Schools and municipal office buildings often have flat, sunny roofs that are ideal for solar installations. Many communities have installed solar panels on land that would otherwise go unused, such as closed landfills and brownfields.

Of the communities that responded to the survey, 42.9 percent have installed solar panels on at least one municipal building or property. 16.8 percent have installed another renewable energy technology on municipal property, such as wind, hydroelectric, or geothermal.

Energy efficiency in municipal facilities

Cities and towns can take major steps to cut their energy use by improving the efficiency of



municipal buildings, which will reduce the investment required to transition to renewable sources of energy. In many communities, public buildings such as schools and city halls are decades old and have inadequate insulation, inefficient lighting fixtures, and antiquated heating and cooling systems. Even newer buildings can benefit from energy efficiency upgrades, given the rapid pace of improvement in building technology. Many buildings can realize energy efficiency improvements at little cost — for example, by reprogramming HVAC equipment control systems to operate more efficiently.

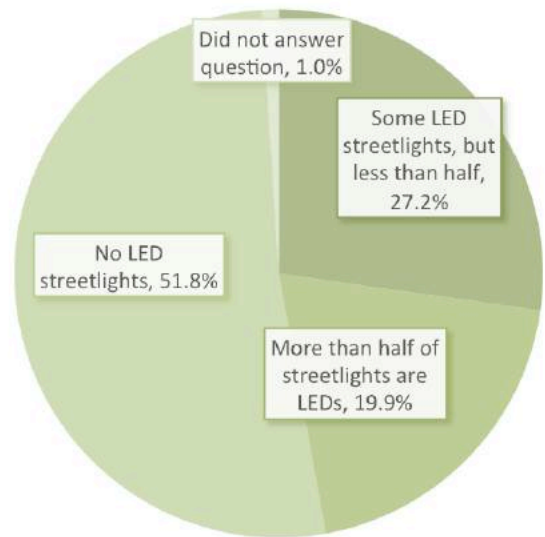
An energy audit is often the first step to identify opportunities for energy efficiency improvements. 88.0 percent of communities responding to the survey said that they have completed an energy audit in at least one of their municipal buildings in the past ten years.

The most common step that communities have taken to improve the energy efficiency of municipal buildings is to upgrade to LED or high-efficiency fluorescent lighting fixtures (82.2 percent). Other common practices include installing new, high-efficiency heating and cooling equipment (71.2 percent), installing occupancy sensors to turn lights on and off automatically as needed (70.2 percent), weatherizing a building with improved insulation (66.0 percent), and installing an energy management system (61.3 percent).

Additionally, 38.2 percent of communities have instituted a program to encourage their employees to reduce energy usage through their behavior, such as turning equipment off when not in use.

Some cities and towns have worked to make new municipal buildings meet high standards for energy performance. One common certification for green buildings is LEED (Leadership in Energy and Environmental Design). Under the LEED system, buildings may receive certification at the silver, gold, or platinum level depending

FIGURE 2: LED STREETLIGHT INSTALLATIONS



on how many criteria they meet. The Collaborative for High Performance Schools (CHPS) provides a similar certification program for school buildings.

19.4 percent of communities responding to the survey said that they require new or renovated municipal buildings to meet LEED or other energy efficiency standards, and 19.9 percent said that at least one municipal building has received LEED certification or CHPS Verified recognition.

Upgrading streetlights to LED fixtures is another common way for municipalities to reduce their energy consumption. Switching to LED fixtures can be complicated by the fact that utility companies, rather than municipal governments, own the streetlights in many communities. Nevertheless, 47.1 percent of cities and towns said they have switched at least some of their streetlights to LEDs, with 19.9 percent saying that more than half of their streetlights are now LEDs.

Renewable energy programs for residents and businesses

Solarize Massachusetts, a program of MassCEC and DOER, works with cities and towns to make it easier for residents and businesses to install

solar panels. Communities select a designated solar installation company, and local volunteers work to spread the word to homeowners and businesses. Typically, residents and businesses that sign solar installation contracts through the Solarize Mass program are able to obtain better prices than would otherwise be available.

A total of 51 communities have participated in Solarize Mass since 2011, resulting in 2,700 installations totaling 17 megawatts of solar.⁴⁰ Many cities and towns that have not participated in the official Solarize program have opted to create similar initiatives in their communities.

Of the cities and towns responding to our survey, 33.5 percent have either participated in Solarize Mass or created a similar program for their community.

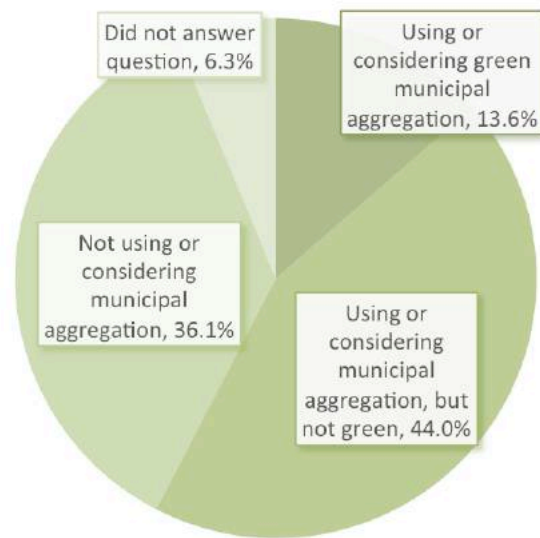
Municipal aggregation

In Massachusetts, cities and towns not served by a municipal utility may choose to enter into a municipal aggregation agreement. Under municipal aggregation, town or city officials choose a default electricity supplier for residents and businesses in their community. Communities choose to enter into municipal aggregation for a variety of reasons, often because it can help to reduce and stabilize electricity costs.

On its own, municipal aggregation does not necessarily mean that a community has agreed to purchase more renewable energy. When combined with an increased commitment to renewable energy, however, municipal aggregation can be one of the most powerful tools available to cities and towns looking to reduce carbon emissions, since it leverages the energy purchasing power of the entire community.

“Green municipal aggregation,” a concept promoted by the Mass Energy Consumers Alliance and other groups, calls for at least 5 percent additional Class I renewable energy beyond what the state requires. Class I renewable energy

FIGURE 3: MUNICIPAL AGGREGATION EFFORTS



comes from recent clean energy projects located in New England or neighboring states and Canadian provinces. Purchasing Class I renewable energy credits (or RECs) rather than cheaper RECs from other parts of the country helps to guarantee that the investment results in additional clean energy development.

57.6 percent of cities and towns responding to the survey said that they either are currently using municipal aggregation or are actively considering it. 13.6 percent of all responding communities have or are considering a green municipal aggregation plan that requires at least 5 percent additional Class I renewable energy.

Transportation

Cities and towns can reduce the carbon emissions associated with transportation by improving the fuel efficiency of their municipal fleet of vehicles. 39.3 percent of communities said that they have purchased fuel-efficient vehicles or electric vehicles for their municipal fleet. 20.4 percent said they have installed electric vehicle chargers on municipal property that are available for the public to use.

Historically, planners have often designed streets with a goal of moving automobile traffic as quickly as possible, with little thought given to pedestrians and cyclists. As a result, zero-carbon forms of transportation like walking and bicycling may become inconvenient or unsafe.

Cities and towns with “Complete Streets” policies pledge to take into account the needs of all users when building new streets or redesigning existing streets. In practical terms, this often means more and better sidewalks and bike lanes. 31.4 percent of towns and cities responding to the survey have adopted a Complete Streets policy or a similar policy to improve facilities for pedestrians and cyclists.

State and local initiatives

The DOER’s Green Communities Division helps cities and towns in Massachusetts to adopt energy efficiency and renewable energy projects. Cities and towns that apply for Green Communities designation can receive grants to finance local projects such as installing efficient heating equipment or converting streetlights to LED fixtures. In order to become a Green Community, a

town or city must meet five criteria, including making a plan to reduce municipal energy use by 20 percent over five years.

Currently, 155 cities and towns have received Green Communities designation.⁴¹ 53.4 percent of the cities and towns responding to our survey said that they have been designated as Green Communities.

Many communities have found that hiring an energy manager, or designating a staff person to monitor and seek opportunities to reduce energy consumption, helps to accelerate local energy efforts. 24.6 percent of communities have hired an energy or sustainability manager, and 39.8 percent do not have an energy manager but have another staff person whose responsibility it is to pursue energy efficiency and clean energy projects.

An active, volunteer-based energy or sustainability committee can also play a large role in driving forward municipal clean energy projects. 58.6 percent of cities and towns said that they have such a committee.

Cities and Towns Are Leading the Way Towards 100 Percent Renewable Energy

Across Massachusetts, communities big and small are taking action on energy efficiency and clean energy. This section profiles some of the cities and towns that are doing the most to promote clean energy, improve the energy efficiency of their buildings, connect their residents with energy-saving opportunities, make ambitious commitments and forward-thinking plans, and implement innovative technologies and programs. We also profile the Cape and Vineyard Electric Cooperative, an organization composed of 17 cities and towns and 2 counties that are working together to implement clean energy projects.

While in most parts of the state, we have a long way to go to achieve 100 percent renewable energy, these communities are showing that it is possible to make rapid progress today, and that the tools and technologies to achieve 100 percent renewables are already in widespread use.

Arlington

In 1998, residents of the town of Arlington founded Sustainable Arlington, a local group dedicated to “promot[ing] climate stabilization and other environmental goals.” In the years since, the town has continued to lead the way toward a renewable future. Arlington became one of the state’s first Green Communities in 2010, a result of town officials and citizens advocating for clean energy.

Today, six schools in Arlington schools have solar panels on their roofs, with a total capacity of

718 kilowatts.⁴² Several schools have also been retrofitted with fault detection diagnostic (FDD) systems. These FDD systems detect large sources of wasted energy in real time, allowing staff members to take immediate action. These systems have had a significant impact on energy use in Arlington. As the Arlington Town Manager, Adam Chapdelaine, explains, the chilling system on the roof of one school had been improperly installed, such that the air conditioning was continuously on. In a different building, the heat was operating at full strength every night, with nobody around to need it. The FDD systems were able to identify these energy wasters and allow town officials to remedy them.

Arlington has begun the process of entering into a green municipal aggregation agreement, with a default option of 5 percent additional Class I renewable energy. While citizens are able to opt out to a lower level of renewable energy, the program also allows for entering into a significantly higher percentage of renewables. The largest promoter of the agreement was the local chapter of Mothers Out Front, a climate action group. By holding a number of educational seminars, Mothers Out Front members spread awareness of the environmental and economic advantages of green municipal aggregation. As a result of the group’s efforts, the green municipal aggregation proposal is currently up for approval by the Board of Selectmen.

Other planned initiatives include upgrading the municipal fleet to include alternative-fuel and electric vehicles. Town Manager Chapdelaine already drives an electric vehicle and hopes other departments around town will follow his lead. The town will also install more public electric vehicle chargers, making it easier for local residents to switch to electric vehicles. Additionally, the town plans to reduce energy typically wasted when lights, computers, and other appliances are left on, by installing automated systems and by fostering a sense of friendly competition between departments.

Auburn

Since 2011, when town officials began exploring the potential for wind energy, Auburn has pursued opportunities to increase renewable energy and reduce energy use. The town became a designated Green Community in 2012, and has used grants from the program to make significant energy efficiency improvements. Some of the steps taken include retrofitting the heating and cooling equipment in Town Hall, installing automated energy management systems, and instating an automatic computer shutdown program. Designation as a Green Community also required the adoption of the Fuel Efficient Vehicle Policy for municipal vehicles. In 2015, the town built the new Auburn Middle School to meet the Collaborative for High Performance Schools standards for green design.

Auburn recently hired an energy manager to work with the energy committee and town manager to pursue additional clean energy opportunities. While the energy manager position was originally funded by a DOER grant, an adder from the new Auburn green municipal aggregation program now makes this position self-sustaining.

Auburn has also worked closely with neighboring communities, partnering with Sutton and Millbury to organize the Central Massachusetts Energy Fair in 2015. In its first year, the fair fo-

cused on residential renewable energy such as solar, with its 4 sponsors and 20 vendors reaching an audience of around 150 citizens. This year, the fair will coincide with the local Fall Festival at the Auburn High School on October 1, which is expected to bring an audience of nearly 500 people to learn about clean energy.

Auburn's Energy Manager, Eric L'Esperance, says that this year's fair will aim to teach homeowners and residents about the advantages of purchasing renewable energy, as well as how to reduce energy consumption. The fair will also offer workshops and educational materials about composting, rain barrels, and local agriculture.

As far as Auburn has already come, the town is poised to make even more progress. Town officials expect to conclude their wind turbine feasibility study around the end of this summer. Depending on the findings, wind power could be developed at a significant scale in Auburn in the coming years. Along similar lines, the town is looking into the possibility of a large-scale solar installation on a capped landfill.

Additionally, Auburn recently entered into a Memorandum of Understanding with the Metropolitan Area Planning Commission (MAPC), funded by DOER's Municipal Energy Technical Assistance Grant Program. MAPC will be performing an LED streetlight conversion cost-benefit and feasibility study on behalf of the town.

Belchertown

For years, forward-thinking officials in Belchertown, working with the regional Pioneer Valley Planning Commission, have recognized the potential in clean energy technology. The Belchertown Energy Committee, including the directors of the Public Works and School Buildings and Grounds departments, was established to administer energy conservation and renewable energy programs, develop local energy policy,

and promote energy education programs. With strong support from the community, the committee led Belchertown to apply for the first round of Green Communities designation in 2010 and begin working on energy efficiency projects.

By December 2014, Belchertown was one of seven communities to achieve a 20 percent reduction in energy usage compared to the town's 2010 levels. Belchertown achieved this goal by aggressively pursuing opportunities for energy efficiency. In 2010, a Green Communities grant gave Belchertown the resources to install a digital energy management system at Chestnut Hill Elementary School, significantly reducing wasted energy. The town has also weatherized many municipal buildings to reduce wasted energy from the heating system. For example, the town replaced windows and installed a new HVAC system in Town Hall.

In 2014, local residents Barbara and Richard Greene, owners of a golf driving range, decided to convert the property into a 1.5-megawatt solar facility. Not only does this solar farm provide enough electricity to power 120 homes, it also brings in an additional \$20,500 of tax revenue for the town, with an annual increase of 2 percent, for the next 20 years.⁴³ Over the duration of the contract, the town will receive more than \$525,000 in tax benefits from the solar installation.

Belchertown has made an effort to welcome other solar installations. A 1.2-megawatt facility owned by Altus recently came online, while Nexamp is about to begin construction on a 5-megawatt commercial solar energy project. According to Town Planner Douglas Albertson, the town also expects residential solar installations to increase in the coming years.

Boston

As the capital of Massachusetts and the largest city in New England, Boston's policies hold

enormous importance for the entire region. Boston has long been a leader on climate action, starting with then-mayor Thomas Menino's 2007 Executive Order on Climate Action, which called for a 25% reduction in greenhouse gas emissions by 2020 and 80% by 2050.

As a coastal city with many low-lying neighborhoods, Boston is particularly vulnerable to rising sea levels, extreme storms, and other effects of global warming. In the fall of 2012, Hurricane Sandy struck the Northeast, causing 117 deaths and billions of dollars in damage.⁴⁴ Though Boston escaped the worst of the storm's damage, city officials saw Hurricane Sandy as a call to double down on their efforts to reduce carbon emissions and prepare for the effects of climate change.

Since Mayor Martin Walsh came into office in January 2014, the city has continued to play a leading role in addressing climate change. Boston's Climate Action Plan describes the progress the city has made so far in reducing its carbon emissions and sets goals for future actions. The plan, updated every three years, addresses energy use and emissions across all sectors, and also lays out a strategy for the city to prepare for the effects of global warming.

To reach Boston's Climate Action Plan goals, the city has initiated several programs to encourage energy efficiency in buildings. The Renew Boston program, launched in partnership with Mass Save, Eversource, National Grid, community-based nonprofits, and Mass Save-approved contractors, helps Boston homeowners, landlords and tenants make their properties more energy efficient. Boston was also the first city in the nation to set a LEED standard for all new large-scale building projects.

Boston's Building Energy Reporting and Disclosure Ordinance (BERDO) requires large and medium buildings track their annual energy and water usage and report it to the city. This ordinance provides valuable public data on building

energy performance for landlords and tenants. BERDO data has been used to identify inefficient buildings and coordinate targeted outreach to help building owners save money and reduce energy consumption.

In addition to promoting energy efficiency, Boston is looking to increase the percentage of energy supplied from renewable and low-carbon sources. The 2014 Climate Action Plan calls for further investments in renewable technologies such as solar, as well as higher efficiency sources such as co-generation (also known as “combined heat and power”). The city already owns over 200 kilowatts of solar capacity and nearly 5 megawatts of co-generation units, and is looking to do more in both areas. The Boston Community Energy Study, conducted by the Boston Redevelopment Authority, has identified further opportunities for renewable energy generation, district energy, and microgrids.

City officials are also working to reduce emissions from the transportation sector. While there is more work to be done, Boston has made significant progress in upgrading its municipal fleet with more efficient vehicles. With the exception of first responders and heavy-duty trucks, the city only purchases hybrid vehicles. The Boston Public School Department of Transportation (BPS-DOT) has worked to reduce carbon and particulate emissions from its school buses, thanks in part to a \$3.25 million grant from the EPA.

The city is also working to make it easier for residents to travel by foot and bicycle instead of by car. Boston’s Complete Streets Initiative, launched in 2009, aims to make it safer for pedestrians and cyclists to travel in the city. The Hubway bike share program now provides more than 600 bicycles and 60 stations located around the city. In 2013, the City announced its plan to add more than 75 miles of new bike lanes in the following five years.⁴⁵

Since entering office, Mayor Walsh has sought to position Boston as a national and international leader on climate change and share ideas with other cities across the world. Mayor Walsh attended a climate conference at the Vatican and an urban climate summit in Beijing, and has embraced Boston’s role as a leader on urban climate adaptation. In 2016, the American Council for an Energy Efficient Economy (ACEEE) ranked Boston as the most energy efficient city in the United States for the second year running.⁴⁶

Cambridge

In densely populated Cambridge, nearly 80% of greenhouse gas emissions come from buildings rather than transportation.⁴⁷ City officials, local activists, and business leaders have worked together to make Cambridge a leader in addressing carbon emissions from the building sector.

In 2010, Cambridge passed amendment to zoning standards that required buildings larger than 25,000 square feet to be LEED-certifiable.



Cambridge officials are working to encourage biking, walking, and other low- or zero-carbon forms of transportation.

Photo: Parking-protected Bike Lane in Cambridge, Massachusetts via Wikimedia CC0 1.0

In 2013, a group of Cambridge residents working with Green Cambridge, a local advocacy group, introduced a petition to require all new large buildings to be net zero energy. The petition led the city to convene the Getting to Net Zero Task Force, which brought together a diverse set of stakeholders to discuss how Cambridge could become a net zero community.

In April 2015, the task force issued the Net Zero Action Plan, which lays out a variety of strategies to reduce building emissions over the next 25 years. The plan establishes a timeline of incentive programs, policy requirements, and internal review to reduce building emissions by 70 percent by 2040. Some of the steps laid out in the plan include setting a LEED Gold standard for new buildings and advocating for the upgrade of the stretch building code. The city's Building Energy Use Disclosure Ordinance, which tracks the energy use of larger buildings, will provide detailed data to help inform sustainability initiatives.⁴⁸

The Net Zero Action Plan operates in tandem with Cambridge's existing climate protection goals and objectives. The city's original Climate Action Plan, adopted in 2002, included detailed strategies to reduce emissions from the electricity, transportation, and building sectors. A recent commitment to the Compact of Mayors obliges the city to develop a new climate action plan.

The Cambridge Energy Alliance, a city program, works to inform residents and small businesses about energy efficiency and renewable energy opportunities. Additionally, Cambridge has teamed up with several companies to promote energy efficiency. The city's partnership with WegoWise, a technology firm based in Boston, provides citizens with free advisory services and a year of energy tracking services. WegoWise specializes in identifying energy savings opportunities and helping owners make informed decisions about how to improve efficiency.

The city has also worked closely with EnergySage and Zapotec as part of the Sunny Cambridge campaign. In Cambridge, the diversity of building types and the large percentage of renters can make it difficult to identify the ideal solar installation for any particular location. "We wanted a solar program that said yes to everyone," says Meghan Shaw, Outreach Director for the Cambridge Energy Alliance. Sunny Cambridge helps residents receive and compare solar estimates to find the right installer for them. As City Manager Richard Rossi puts it, "programs like Sunny Cambridge help position our city as a national leader in clean energy development and serve as an example for other communities around the county to replicate."⁴⁹

Although transportation is a relatively small part of Cambridge's energy consumption compared to other communities, the city has also taken significant steps to reduce transportation emissions. In 2012, Cambridge received a DOER grant to install 10 charging stations for electric vehicles. These charging stations are used by the municipal fleet, which now includes more than 25 hybrid and electric vehicles, and are also available for use by the public. Cambridge is also aiming to reduce miles traveled in vehicles by 10 percent, by increasing access to public transportation and improving pedestrian and bike infrastructure. Cambridge's zoning policies aim to encourage denser development around transit, and the city has committed to a Vision Zero program to protect pedestrians and cyclists.

Cape and Vineyard Electric Cooperative

In 2007, the Cape Light Compact established the Cape and Vineyard Electric Cooperative (CVEC), with a goal of developing renewable energy resources, encouraging energy conservation, and acquiring the best price for electricity supply. In the years since its formation, CVEC has made major progress in advancing clean energy. In recognition of its efforts, the Cooperative received the Outstanding Environmental-Energy Technology Achievement Award from the Envi-

ronmental Business Council of New England in 2015.

CVEC is a cooperative whose members include Barnstable County, Dukes County, and 17 towns and cities on Cape Cod and Martha's Vineyard. By pooling their resources through CVEC, these towns and counties are able to expand clean energy more rapidly and at a lower cost than if each community acted alone.

One of the Cooperative's top priorities has been the growth of solar energy. The organization ran three original initiatives to install solar, in 2010, 2011, and 2012.⁵⁰ The initial round installed 750 kilowatts of solar capacity at seven sites. In 2011, CVEC significantly expanded its efforts, installing 16 megawatts of solar across the Cape and Vineyard, mostly through large-scale installations on capped landfills. These projects produce enough power to handle the demand of more than 3,000 homes. The most recent solar program, in 2014, installed an additional 12 megawatts.

CVEC is also working to take advantage of the region's wind energy potential. While some wind projects have met local opposition, the Cooperative is currently working on a four-turbine project in Plymouth, with approximately 3.1 megawatts of energy from the project to benefit CVEC members. One of the turbines is currently operational, with the other three expected to come online soon.

One of the next projects on CVEC's agenda is to develop a battery backup system at the Dennis-Yarmouth Regional High School, which also serves as the designated community emergency shelter. In the event of a blackout or damage to the electric grid, a combination of rooftop solar panels and battery storage would power the building's essential functions. CVEC is conducting a feasibility study and working to raise \$150,000 in initial funds, in combination with a \$1.4 million pledge from the Department of Energy Resources.

The Cape Light Compact, a sister organization to CVEC, offers energy efficiency programs to communities on the Cape and Vineyard. The Compact provides technical and financial assistance for those wishing to upgrade their homes and businesses with energy efficiency measures. Those energy efficiency programs have already saved residents more than \$635 million since 2001, and a recent LED-retrofitting project will save communities over \$800,000 per year moving forward.⁵¹

Gloucester

America's oldest seaport, Gloucester is known for its working waterfront, its arts community, and its beaches. Increasingly, the city is also known for its efforts on clean energy.

Through the leadership of Mayor Sefatia Romeo Theken's office and the cooperation of the Clean Energy Commission, the Department of Public Works, and the Community Development Department, Gloucester has made significant progress in energy efficiency and clean energy.



Three wind turbines were installed in Gloucester in 2012. Energy from two of the turbines helps to offset municipal energy bills.

Photo: Wind turbines in Gloucester, Massachusetts via Wikimedia, CC 3.0. Work attributed to user Fletcher6

Perhaps the most visible signs of Gloucester's clean energy commitment are the three wind turbines located within the city. These turbines are among the largest in the state, with a total capacity of 6.5 megawatts. The city has a power purchase agreement with Equity Industrial Turbines to purchase net metering credits from two of the turbines. Since they came online in December 2012, those two turbines have produced 25 million kilowatt-hours of clean electricity and saved the city \$750,000 in energy costs. City officials played an active role in making the turbine project possible, including commissioning technical assistance and feasibility studies.

Beyond wind power, the city has taken other steps to reduce its reliance on fossil fuels. Gloucester joined the Green Communities program in 2010. Since then, the city has received a total of \$690,000 in grant funding through the program to support energy efficiency projects. Those projects include converting streetlights to LED fixtures, updating boiler and HVAC systems, and upgrading interior lighting.

Since Gloucester joined the Green Communities program, the city's energy reduction strategy has cut municipal carbon emissions by 800 metric tons annually.

Gloucester is also taking steps to reduce emissions from transportation. The city's fleet includes six electric vehicles, which are used by the inspectional services team. Gloucester has one electric vehicle charging station open to the public at the City Hall Annex, and is working to install a second one at City Hall. The cars and the charging stations were funded through MassDEP's Electric Vehicle Incentive Program (EVIP).

As city officials have moved to switch to clean energy, local residents and businesses are following suit. Since January 2014, Gloucester has seen more than \$9 million in private solar installations. City leaders credit public outreach campaigns, including TownGreen2025's Solar

Challenge program, with the rapid growth of solar in Gloucester. The Solar Challenge program offers free assessments to allow residents to consider different solar installation options before making a commitment. Studies by the local group have recorded at least 3,000 homes that have the potential for solar.⁵²

Going forward, Gloucester intends to continue its progress toward a sustainable energy economy. This month, the City Council approved a municipal aggregation plan that is expected to lower the cost of electricity for citizens and offer stable prices, while also increasing the use of Class I renewable energy.

Holyoke

Holyoke's canals and dams, developed beginning in the 19th century, powered the rapid expansion of the city and its paper industry. Since then, Holyoke has retained its hydropower resources and rededicated them to other projects. Today, the turbines on the Holyoke Dam generate about 32 megawatts of electricity, providing approximately two-thirds of the annual consumption by Holyoke residents and businesses⁵³. While hydropower can cause significant interruption to a river's ecosystem, Holyoke has taken steps to allow migrating fish and mussel species to pass through safely. According to the Holyoke Gas and Electric (HG&E) website, these upstream and downstream bypass structures are the first of their kind in New England.

These abundant hydroelectric resources have made Holyoke attractive for many technology companies. The Massachusetts Green High Performance Computing Center, a joint venture of UMass, MIT, Harvard, Boston and Northeastern Universities, opened in a former textile mill in 2012. With a large supply of renewable energy, the Center is able to run millions of experiments for researchers each month without carbon emissions.

Solar installations, combined with Holyoke's hydropower resources, bring the city's electricity sales to more than 85% carbon-free. HG&E, the municipal utility, has had a major hand in developing 6.3 MW of solar capacity. These solar projects reduce emissions by the equivalent of taking over 1,000 cars off of the road.⁵⁴

HG&E has also taken steps to improve energy efficiency. Publications on their website recommend energy-saving tips for residential and commercial buildings. Grants from the Green Communities program, which Holyoke joined in 2010, have funded interior and exterior LED conversion and modern heat management systems. These investments have seen immediate results: municipal energy load has decreased by 21% since 2010.

In June 2016, in recognition of the city's efforts, Holyoke Mayor Alex Morse received an honorable mention in the Mayor's Climate Protection Awards at the U.S. Conference of Mayors. Responding to the award, Mayor Morse said, "Maximizing our generation of carbon-neutral electricity and minimizing municipal electrical consumption are clear examples of our commitment to taking a leadership role in addressing climate change."

Lowell

Lowell, the fourth largest city in the Commonwealth, was originally developed as a center for the manufacture of textiles. Following the decline of the city's textile mills, Lowell has sought to reinvent itself as a green community.

As a city with many historic buildings and a legacy of industrial pollution, Lowell has faced challenges in creating a sustainable future. City leaders responded by adopting strong clean energy and energy efficiency programs. Lowell was one of the first communities to adopt the optional stretch code, which requires new buildings to meet higher standards for energy efficiency. The city has also retrofitted historic

and municipal buildings to improve energy efficiency, and supported the expansion of public and private renewable energy installations.

In the spring of 2013, following data collection and public outreach, the city finalized its Sustainable Lowell 2025 plan. The plan details the city's overarching sustainability objectives along with a detailed plan to achieve those goals. The plan's objectives include developing walkable neighborhoods, integrating natural and urban spaces, facilitating the consumption of locally grown food, and increasing renewable energy production.

Since the release of this plan, Lowell has continued to move forward on renewable energy. Solar installations have grown significantly, with over 2.5 megawatts of municipal solar capacity installed in Lowell, including a 1.5-megawatt solar project on a former landfill as well as smaller installations on school buildings. The landfill solar project lowered the city energy bill by 25 percent, while also saving the carbon equivalent of 1,270 acres of forest.⁵⁵ The 6,000 panels on the landfill are expected to save the city between \$1.5-2.5 million each year over 20 years.

Lowell has also taken significant steps to improve energy efficiency. In 2008, Ameresco completed an energy audit and found enormous potential for energy efficiency improvements in city buildings. In response, Lowell invested \$21 million in energy efficiency projects, including insulation, roof replacements, and efficient heating and cooling equipment.

Building on their success in improving the energy performance of municipal facilities, city officials launched the BetterBuildings Lowell Efficiency Upgrade (BLEU) program to bring energy efficiency upgrades to multi-family and commercial buildings in the Downtown Historic District. The city used \$5 million in federal seed funding to help building owners upgrade their boilers, insulation, lighting, and other building systems.⁵⁶ In the first three years of the pro-

gram, Lowell was able to save 1,688,744 kilowatt-hours of electricity, 356,078 Therms of natural gas, and 4,558 gallons of oil.

Melrose

Melrose has long been an energy-conscious town. As early as 2005, citizens formed the Melrose Energy Commission to help residents save energy. This group helped residents perform energy audits on their homes to find significant opportunities to reduce energy use. In 2010, Melrose participated in the first wave of Green Community designations.

In 2011, Melrose hired Martha Grover as the city's first energy efficiency manager. Since joining the city staff, Grover has made Melrose a statewide leader for clean energy and energy efficiency. Recognized by Governor Baker in 2015 with the Massachusetts Leading by Example Award, Grover's work has significantly reduced the city's energy use and emissions, while also accelerating renewable energy sources and low-carbon transportation.⁵⁷

Grover spearheaded an effort that made Melrose the first city in Massachusetts to develop a green municipal aggregation program. Melrose's green aggregation program gets 16 percent of its energy from Class I renewable sources, 5 percent above the level required by the state. Melrose was able to adopt this higher standard for renewable energy while adding only 0.2 cents per kilowatt-hour to the already competitive rate they acquired for residents and businesses participating in the program. As a result, Melrose's program still offered savings to residents and businesses compared to National Grid's winter rate, even with the 5 percent additional renewable energy.

Additionally, Grover has worked to encourage solar installations in town through the 2012 Solarize Melrose program. Since Solarize Melrose, more than 200 residents, businesses and city buildings have installed solar panels. Altogether,

these panels produce over 1.5 million kilowatt-hours of electricity per year, the equivalent of powering more than 150 homes with clean energy.⁵⁸ The Melrose Energy Commission continues to help residents compare prices from different solar developers, allowing them to find the solar installation that best suits their needs through an online solar marketplace.

Melrose has taken other significant steps to reduce carbon emissions. The city adopted a fuel-efficient vehicle standard for municipal vehicles in 2010, and also adopted the state's more energy-efficient "stretch code" for new buildings. Since the spring of 2013, the Pedestrian and Bicycle Advisory Committee has worked to promote clean transportation in town. The city has purchased two fully electric vehicles, in the Fire and Electric Departments respectively, and installed a public electric vehicle charger in the City Hall parking lot.

Working closely with the Melrose Energy Commission, other city officials, and the Metropolitan Area Planning Council, Grover continues to foster reform throughout Melrose. The city has nearly finished converting its streetlights to LED bulbs, which is expected to significantly reduce energy use. In addition, Melrose is more than halfway towards its 2016 goal of 500 home energy assessments and upgrades through the Melrose Energy Challenge campaign. Melrose's public support for clean energy programs continues to move the city toward a 100 percent renewable energy future.

New Bedford

New Bedford, a city better known for its status as the top grossing fishing port in the nation, has quietly reinvented itself in recent years as a clean energy leader. Under Mayor Jon Mitchell, the city has pioneered a number of clean energy initiatives that have attracted increasing national and regional attention. Earlier this year, the U.S. Conference of Mayors recognized the efforts of Mayor Mitchell with the Mayors' Climate Pro-

tection Award. In receiving the award, Mayor Mitchell summarized the City's rationale for its strong commitment to clean energy: "We've tried to demonstrate that much can be accomplished when there is a strong local consensus and sustained commitment to big renewable energy goals."⁵⁹

Thus far, over 16 megawatts of solar power have been installed to support the electrical load of municipal facilities. City officials estimate that New Bedford is at or near the top for installed solar capacity among similar-sized cities in the United States. The city's efforts on solar are saving nearly \$1 million annually in municipal electricity costs, with total projected savings of \$22 million over the next twenty years.

As successful as New Bedford's solar program has been, New Bedford's municipal and business leadership have also made offshore wind energy a top priority. In 2013, city leaders worked with the New Bedford Economic Development Council to establish a Wind Energy Center to help plan for the port's anticipated role as a staging location for offshore wind projects. The waters off of Massachusetts' South Coast are home to the largest offshore wind area in the United States.

The city has also reduced its municipal greenhouse gas emissions by improving energy efficiency. New Bedford has entered into a \$45 million Energy Management Service Agreement with Siemens to introduce energy efficiency measures in municipal facilities, including the conversion of 8,000 street and traffic lights to LED technology.

In the transportation sector, 24 of the 70 vehicles in the municipal fleet are now electric vehicles, among the highest for any municipality in the Commonwealth. The city's Health Department, School Department, Department of Public Infrastructure and Harbor Development Commission are all beneficiaries of the switch to electric vehicles. The city has installed 25 Level

Two electric vehicle charging stations and 2 Level Three "Fast Chargers," and officials plan to add more. Ten of the Level Two chargers are available to be used by the public for free.

In 2015, the city launched its New Bedford Energy Now (NBEN) program to connect residents and local businesses with energy options. NBEN provides free guidance on energy efficiency and renewable energy programs and technologies.

Newton

Newton Mayor Setti Warren has made sustainability a priority since taking office in 2010. The city's efforts accelerated when, in 2013, Mayor Warren established the position of Sustainability Director. Since 2015, that position has been held by Andrew Savitz, who brought extensive experience working as a sustainability consultant to large corporations, and who had previously served as General Counsel for Massachusetts' Executive Office of Environmental Affairs.

According to Savitz, the Mayor seeks to implement energy programs that simultaneously achieve environmental, social and financial results. "The Mayor constantly stresses the financial benefits of Newton's environmental programs," says Savitz, "and always reminds people that environmental efficiency is good for your pocketbook, not just for the environment."

Prior to 2015, the city had focused on improving the sustainability of municipal buildings and operations. Solar in Newton has grown steadily in recent years. The city's original solar installations, on the Newton North and South High Schools, provided 92.2 kilowatts of clean energy. In 2013 and 2014, the city installed an additional 685.4 kilowatts of solar on four schools.⁶⁰ These first six installations significantly reduced the city's carbon footprint and saved approximately \$75,000 annually in energy costs.

Solar power continues to be a high priority for Newton. By the end of 2016, the city plans to

have an additional 3.5 megawatts of solar up and running on school rooftops, over municipal parking lots, and on top of the former landfill.

Mayor Warren charged Savitz with leading inclusive, citywide efforts on energy efficiency and clean energy. Savitz has partnered with diverse constituencies — including the schools and parent-teacher organizations, faith leaders, businesses, environmental and social justice organizations and the media — to bring clean energy and energy efficiency programs to the city's 89,000 residents and several thousand businesses. This approach has helped make Newton a statewide leader on clean energy and the environment.

The city has encouraged more solar installations on homes and businesses. The Newton Solar Challenge offered free consultations with two solar installation companies, who offered competing price quotes. Newton also partnered with local Village Bank to make it easier for residents to obtain loans for solar projects.

Even with these initiatives, many residents still face obstacles to switching to solar. Many rooftops are not suitable for solar panels, and some residents cannot afford the upfront costs. To reduce these barriers, the city is developing a community shared solar program that will enable residents to benefit from a solar installation in a central location.

The city has also worked to connect residents with opportunities to improve the energy efficiency of their homes. Launched in 2012, the Energy Smart Newton program offered free home energy audits, as part of the Mayor's goal of reducing electricity usage citywide by 20 percent by 2020. Between 2010 and 2015, these audits helped save residents a total of \$750,000 in energy costs.

In October 2015, Mayor Warren launched Newton Energy Savers, the next phase of the city's energy efficiency efforts, with a goal of doubling



Newton Energy Savers and Newton Business Energy Savers help connect residents and businesses with energy efficiency opportunities. The city has set a goal of helping 1,000 residents obtain home energy assessments by the end of 2016.

Photo: City of Newton

the rate of residential energy efficiency upgrades. The city, together with the citizen group Green Newton, are collaborating to help 1,000 residents obtain home energy assessments by the end of 2016.⁶¹ The local newspaper, *The Newton Tab*, is helping to spread the word about these opportunities by publishing a weekly story about energy efficiency and reporting on the total number of assessments to date.

A parallel effort, the Newton Business Energy Savers program, helps encourage energy efficiency measures on commercial buildings. Working closely with the Chamber of Commerce, city officials have set a goal of having 60 business commit to energy renovations by the end of 2016.

Northampton

Since becoming one of the first Commonwealth-designated Green Communities in 2010, Northampton has worked steadily to increase renewable energy and maximize opportunities for energy efficiency. City officials say that strong interest from the public is one of the main fac-

tors behind Northampton's leadership on clean energy.

The city has made extensive investments in solar energy. Along with several small-scale installations on schools and education centers, there is also a 106-kilowatt solar array on Smith Vocational and Agricultural High School. The savings from this project help to fund additional clean energy improvements in Northampton.⁶²

In 2013, Northampton participated in MassCEC's Solarize Massachusetts program, tripling the amount of residential solar installed within the city.

The city's largest solar project to date will soon be complete. Northampton selected Ameresco, one of the largest solar companies in Massachusetts, to construct a 3.3-megawatt solar project on the city's former landfill. This installation will handle close to 40 percent of municipal electricity demand. While the project was meant to save Northampton up to \$9 million in the next 20 years, the actual savings are contingent on the availability of state incentives. The city hopes to complete the project by December in order to qualify for the current incentive program.

Northampton has taken several other steps to reduce energy consumption. Parking meters located downtown are powered by solar energy. In the new senior center, the city installed geothermal heat pumps to reduce energy use further. The pumps use the Earth's interior temperature to heat and cool the building, saving nearly 400,000 kilowatt-hours per year versus a traditional HVAC system. The senior center achieved LEED Silver certification as a result of its construction materials and energy technology.⁶³

In addition, the city replaced the old HVAC system at the Adult Education Center with air-source heat pumps, significantly reducing carbon emissions.

City officials say that the success of clean energy programs in Northampton is largely thanks to the strong support of its citizens. When the city participated in the GreenUp program offering renewable energy sources, hundreds of businesses and residents signed up. At that time, the State's Renewable Energy Trust Fund matched the renewable purchases of these citizens and businesses with grants to their city or town. As a result, the city received over \$140,000 to spend on clean energy projects, more than any other community in Massachusetts. Part of this money allowed the city to hire Chris Mason as its Energy and Sustainability Officer. City officials saw so many benefits from having a staff position dedicated solely to energy programs that they decided to continue its funding with tax revenue.

The city also established an "Energy Concierge" in 2011 to assist local businesses to plan their energy improvements and access utility efficiency programs.

Even the city's schools have joined the effort. The local technology school offers courses on renewable energy technology and theory, giving its students the skills to join a growing industry.

The future continues to look bright for Northampton. A total conversion of streetlights to LED fixtures is on the horizon, complementing the ongoing efforts to improve energy efficiency. Two Resiliency Initiative projects funded by the Massachusetts Department of Energy Resources are also in the works in Northampton. These will include an estimated 300 kilowatts of additional solar at public sites, complete with battery storage systems to enable key functions to continue during power outages.

Palmer

Palmer developed from a collection of villages into a bustling town with the introduction of railroads and a textile mill in the 19th century. Today a community of 12,000 people, Palmer has made energy reduction a central objective

under the direction of its town manager, town council, and facility directors. The town's efforts began with a DOER energy audit in 2009 to identify large energy wasters. The following year, Palmer joined the Green Communities program.

Since then, Palmer has received more than \$400,000 in Green Communities grants. With this funding, Palmer was able to retrofit heating systems from oil to natural gas, as well as install energy management systems to limit waste.⁶⁴ In its first five years as a Green Community, Palmer cut municipal energy consumption by over 20 percent, one of only seven towns to achieve that goal. The town's energy efficiency programs have also included converting interior lights to LED fixtures, and weatherizing older public buildings to minimize heat loss. Additionally, the town installed a renewable energy project on its wastewater treatment plant in 2012, with support from DOER.

In early 2011, Palmer passed a large-scale solar ordinance that encouraged up to 25 megawatts of solar power through 10 separate projects. A 4.5-megawatt solar farm provides the town government with 100 percent of its net metering credits. Palmer is now home to 16.25 megawatts of installed solar capacity, and the town is interested in doing even more. Currently, a 4-megawatt solar photovoltaic project is under construction on Palmer's capped landfill.⁶⁵ The system is projected to come online by the spring of 2017.

The town is committed to taking further steps to reduce its use of energy. Palmer is pursuing a Complete Streets program to encourage walking as a carbon-free alternative mode of transportation. The town also intends to begin streetlight conversion to LED fixtures, although officials expect this will be a lengthy process.

Pittsfield

Over the past few years, Pittsfield has made environmental efforts a clear priority. In a recent

column, Pittsfield Mayor Linda Tyer and Medford Mayor Stephanie Burke said, "Increasing solar installations and energy efficiency investments are not only good for the climate, they mean jobs for Massachusetts workers."⁶⁶ In Pittsfield, solar installations on the local wastewater treatment plant and capped landfill add up to nearly 4.5 megawatts of clean energy capacity.

Within the wastewater treatment plant, the city installed a combined heat and power (CHP) system to significantly reduce energy consumption and make the entire facility net-zero energy. This system utilizes three 65-kilowatt micro-turbines that are powered by the methane gas produced by the natural anaerobic digestion process of the waste sludge. The heat produced by the CHP system is channeled back into the sludge, which accelerates the anaerobic digestion process to improve the efficiency of the entire system.

Pittsfield has implemented another innovative clean energy technology by installing an inline hydro-turbine in the Coltsville Flow Station. This facility adjusts the pressure of water entering the Pittsfield distribution system. The hydro-turbine captures excess water pressure to produce 66 kilowatts of otherwise wasted energy.

Local officials are taking further steps to reduce energy consumption citywide. By installing energy management systems in schools and municipal buildings, the city has dramatically reduced its energy consumption and expenditures. Additionally, the Powering Pittsfield initiative has pledged to meet a goal of 20 percent energy reduction across the community by 2020.

Local businesses and institutions in Pittsfield have also taken action. Berkshire Health Systems was the first company in Western Massachusetts to implement a large-scale LED lighting retrofit. Their new lighting system allows them to light their parking garages at only 25 percent the cost

of the old system. Nearby, Whaling Properties conducted an energy audit in their own buildings, which prompted the company to replace its heating and insulation systems and save 60 percent on energy costs.

Going forward, Pittsfield intends to continue reducing energy use. The city is working to adopt a Complete Streets policy this year, which would increase pedestrian-friendly infrastructure. The city is also planning to install four public electric vehicle-charging stations in a new parking garage downtown.

Somerville

Under the leadership of Mayor Joseph Curtatone, Somerville has embraced innovative technologies and policies, with a goal of becoming carbon neutral by 2050.

The city is home to Greentown Labs, an incubator that hosts more than 40 clean tech start ups and is a national leader in developing the next generation of sustainable technology. As Mayor Curtatone remarked, “Greentown Labs’ success... demonstrates how environmental sustainability and economic sustainability are not mutually exclusive — especially when government does its part to support innovation that is the foundation of the 21st century global economy.”

In 2015, Somerville announced its Somerville GreenTech program, allowing green technology innovators to partner with the city to adopt their technology on municipal properties.⁶⁷ Among the first companies to participate in the GreenTech program are WrightGrid, which builds solar-powered charging stations for cell phones, and Understory, which installs solar-powered weather stations. Both companies are based at Greentown Labs.

The city has partnered with MIT Climate CoLab to devise innovative ideas to reduce carbon emissions. Some of the top ideas include using wood construction to decrease the city’s net

carbon footprint, and creating a “Loop Transit System” of vehicles that travel planned routes to eliminate the need for personal cars.⁶⁸

Somerville has also taken advantage of more conventional technologies and funding opportunities. Working with more than \$600,000 in Green Communities grants, Somerville has significantly improved the energy efficiency of its municipal buildings, saving an estimated \$100,000 each year in energy costs. State grants have also enabled Somerville to install three electric vehicle charging stations for public use.

The Somerville Energy Efficiency Now program offers free energy assessments through Mass Save to identify opportunities for residents to improve the energy efficiency of their homes. The city also recently launched a Solarize Somerville campaign to promote residential solar.

The city will continue to reduce energy use and promote clean energy in the coming months. In January of this year, Somerville released a greenhouse gas inventory, which will help identify opportunities to reduce carbon emissions from homes, businesses, and municipal facilities. The city is also working to adopt a green municipal aggregation program, and will finish replacing all streetlights with LED fixtures this summer.

Sutton

Sutton, a rural town of about 9,000 residents in Worcester County, is home to Purgatory Chasm State Reservation, the 344-acre Manchaug Pond, and horse and dairy farms. In recent years, the town has positioned itself as a leader for clean energy and energy efficiency.

Led by a forward thinking town administrator and board of selectmen, Sutton became a Green Community in 2011, and has received a total of over \$440,000 in grants for energy projects.

In 2010, the 20-year-old roof of the local Simonian Center for Early Learning was in need of repair. The town fixed the roof and, using grant money from the state, installed a 200-kilowatt solar system, which began producing electricity within a year.

Sutton has also taken advantage of state grants to improve the energy efficiency of municipal buildings. Funding from the Green Communities program has helped the town install LED lighting fixtures, upgrade heating systems, and weatherize buildings. Doreen DeFazio, Sutton's Energy Manager, says that the town is also planning to improve insulation in the Senior Center, replace boilers in municipal buildings, and install programmable thermostats.

Recently, Sutton launched a Solar Challenge program in partnership with the town of Grafton. The two towns are working with Direct Energy Solar to offer group prices and discounts for solar installations. Residents can sign up to receive a free evaluation from Direct Energy Solar, including estimates of how much they can save by switching to solar.

Sutton is also collaborating with Auburn and Millbury to host the second annual Central Massachusetts Energy Fair on October 1. The fair is intended to educate residents about opportunities to install solar and energy efficiency technology. The fair will offer workshops on a variety of local sustainability initiatives.

Sutton's upcoming projects include converting the town's streetlights to LED fixtures and launching a community aggregation program in the fall.

Worcester

A manufacturing center in the early 20th century, Worcester lost nearly 20 percent of its population in the years following World War II. Toward the end of the century, Worcester expe-

rienced a revival by becoming a leader in biotechnology and healthcare.

The city has also undertaken a lesser-known renaissance, related to the implementation of sustainable policies and the rise in the use of energy efficient and renewable products since 2000. Responding to strong support from the community, the City Manager appointed the city's first Energy Task Force in 2006, charged with helping to move the city toward a sustainable future. The city's sustainability efforts allowed Worcester to be among the 36 municipalities designated as Green Communities in 2010, the inaugural year of the program.



The Worcester Regional Transit Authority (WRTA) has six fully electric buses in its fleet. Each bus is estimated to eliminate around 130 tons of emissions per year.

Photo: Mass.gov Energy Smarts blog

Worcester's Climate Action Plan, adopted in 2007, maps out the city's strategy to limit its energy consumption and waste in several key steps. In 2009, the city partnered with Honeywell International to complete an energy audit of its 171 municipal facilities. To date, the City has invested \$75 million to implement energy conservation measures recommended by the audit. By 2015, the city had modernized 92 municipal buildings with superior insulation, upgraded energy management systems, and installed 442 kilowatts of solar capacity on the roofs of two schools.⁶⁹

In its next phase of clean energy improvements, scheduled to be completed by the end of 2016, the city is installing an additional 1,018 kilowatts of solar capacity at four more of its schools, and is planning to complete an 8.1 megawatt solar project on top of a capped landfill.

Groups and institutions in the community have taken their own initiative to expand the renewable energy sector. Holy Name High School, a local Catholic school, was able to apply its religious aspirations of stewarding the planet to clean energy. In 2008, the school completed construction of a wind turbine that has matched 74 percent of the school's electricity consumption since installation. While the project cost around \$2 million to build, the turbine provides significant revenue to the school. The city government embraced this project by changing its zoning ordinance to allow for wind turbines, albeit with height restrictions appropriate within urban limits.

Worcester has also been a state leader in improvements to its transportation system. In 2014, the Worcester Regional Transit Authority (WRTA) became the first public transportation system in the state to use electric buses, with six fully electric buses in its fleet. These buses charge their batteries five times daily, and each bus is estimated to eliminate around 130 tons of emissions per year.⁷⁰

In the coming years, city officials intend to revise their climate action plan and update their clean energy goals. The city is also considering a municipal aggregation plan, as well as the feasibility of constructing an anaerobic digester. Worcester plans to replace all 14,000 streetlights with LED bulbs and intelligent controls within the next 18 months. The city will also retrofit Burncoat High School with LED lighting fixtures, thanks to a grant from the Green Communities program.

Recommendations

Local communities are leading the way towards 100 percent renewable energy, but we have a long way to go before we replace all fossil fuels with clean, renewable sources.

In the coming years, local officials should continue taking advantage of every opportunity to reduce fossil fuel consumption and promote clean energy. State leaders should support local efforts and adopt policies that will accelerate the growth of clean energy across Massachusetts.

Bold commitments will drive progress

Experience shows that when leaders make bold commitments to clean energy and support those commitments with pro-clean-energy policies, we can make rapid progress.

In 2007, then-Governor Deval Patrick set a goal of installing 250 megawatts of solar energy in Massachusetts in the next 10 years. At the time, many thought that the goal was overly ambitious. Nevertheless, in response to this target, officials adopted pro-solar policies and the solar industry grew to meet the demand. As a result, Massachusetts hit the 250-megawatt goal four years ahead of schedule.⁷¹ Governor Patrick then increased the goal to 1,600 megawatts of solar by 2020 — a goal that Governor Charlie Baker's administration has reaffirmed. If recent rates of growth continue, Massachusetts will likely hit reach this target by mid-2018, if not sooner.

State leaders should commit to a goal of 100 percent renewable energy for Massachusetts, and set out a roadmap to achieve that goal by 2050 at the latest. Officials in Hawaii have already committed to achieving 100 percent renewable energy for the electricity sector by 2045.⁷² State officials should ensure that the transition to 100 percent renewable energy

maximizes opportunities for locally-sited and community-owned sources of energy, and brings job growth, investment, and other tangible benefits to all communities in Massachusetts, including low-income communities.

Local leaders should make similar commitments to 100 percent renewable energy for their municipal operations and for their residents and businesses. Across the country, communities like San Diego, Greensburg, Kan., Burlington, Vt., and Aspen, Co., have already made 100 percent renewable energy commitments.

Communities in Massachusetts that make a commitment to 100 percent renewable energy should ensure that the renewable energy they use comes from new, local sources whenever possible. A good way to meet that standard is to purchase renewable energy from Massachusetts Class I sources, rather than renewable energy credits from other parts of the country.

Businesses, universities, and other institutions can also play a major role in the transition to 100 percent renewable energy. Major companies including Apple, Google, Johnson & Johnson, and Unilever have already committed to 100 percent renewable energy.⁷³ Hampshire College in Amherst, Mass., recently announced plans to become the first U.S. residential college to meet 100 percent of its electricity needs with on-campus solar installations.⁷⁴ Other businesses and institutions should follow their lead and commit to 100 percent renewable energy.

Cities and towns should continue to lead

There are many steps municipalities can take to reduce the use of fossil fuels and promote clean energy. Communities around the state are already taking action on clean energy, but there is more that can be done.

Using municipal facilities to drive clean energy progress

City and town officials should maximize the production of renewable energy on municipal facilities, by:

- Installing solar panels on suitable rooftops and other city- or town-owned properties, such as capped landfills.
- Exploring opportunities for other renewable energy technologies, including wind turbines and geothermal energy systems.

Local officials should improve the energy efficiency of municipal buildings, by:

- Conducting energy audits to identify opportunities for energy savings.
- Completing energy efficiency upgrades. Some of the most common energy efficiency measures include replacing old lighting fixtures with LED or high-efficiency fluorescent fixtures, installing high-efficiency heating and cooling equipment, installing occupancy sensors to turn lights on and off automatically, and installing an energy management system.
- Installing an energy load management system to shut off systems during peak electrical use hours.
- Installing variable frequency drives (VFDs) to decrease motor speed in heating and cooling systems when possible.
- Instituting a program to encourage municipal employees to reduce energy usage through their behavior.

Communities may want to consider entering into an energy performance contract, in which towns and cities hire a contractor to identify and perform comprehensive energy efficiency upgrades, with energy savings typically sufficient to cover the costs of the contract.

Local officials should improve the energy efficiency of their streetlights by upgrading to LED fixtures, and consider reducing the amount of outdoor lighting where possible.

Finally, cities and towns should lead by example on energy efficiency and commit to achieve LEED certification or CHPS Verified recognition for all new or renovated municipal buildings.

Connecting residents and businesses with clean energy opportunities

Towns and cities should encourage residents and businesses to install clean energy and complete energy efficiency upgrades, by:

- Participating in MassCEC's Solarize Mass program, which helps to connect residents and businesses with solar companies and reduce the cost of installing solar panels. Some cities and towns that have not participated in Solarize Mass have created similar programs for their communities.
- Requiring new buildings to be built "solar ready," making it easier to accommodate solar panels at a later date.
- Creating an initiative like Northampton's energy concierge program, Newton's Energy Savers program, or New Bedford's Energy Now program to connect residents and businesses with energy efficiency opportunities.
- Helping to connect low-income residents and organizations serving low-income communities with clean energy and energy efficiency opportunities.

Communities should also set a goal for reducing energy use from the building sector, and consider adopting a roadmap like Cambridge's Net Zero Action Plan.

Finally, communities should adopt a green municipal aggregation plan, with at least 5 percent additional Class I renewable energy credits (RECs) on top of what the state Renewable Portfolio Standard already requires. Some communities are going above and beyond 5 percent. For example, Brookline recently voted at its town meeting to pursue a municipal aggregation plan with 25 percent additional Class I renewable energy.

Promoting clean transportation options

Local officials can encourage zero-carbon forms of transportation by adopting Complete Streets policies, which require streets to be designed with the needs of all users, including cyclists and pedestrians, in mind. These policies, paired with transit-oriented development, help to reduce the need for residents to drive. Wherever possible, cities and towns should also take steps to reduce the size of their municipal fleets and the total number of miles traveled by municipal employees.

Local governments should purchase electric vehicles for their municipal fleets. Communities may want to consider setting a specific goal, such as having electric vehicles make up half of their municipal fleets by 2025.

The Massachusetts Department of Environmental Protection (MassDEP) provides an Electric Vehicle Incentive Program (EVIP) to help towns and cities offset the cost of acquiring electric vehicles and charging stations. Many municipalities choose to make their electric vehicle charging stations available to the public to use for free, thereby encouraging the adoption of electric vehicles in the community. Towns and cities should add additional chargers for municipal employees to use, and should also encourage local businesses to offer workplace charging

to their employees. Municipal governments should also consider installing public charging stations in downtown areas and retail centers.

In addition to electric cars, electric and high-efficiency models are now available for transit buses and many other types of vehicles.

Taking advantage of state and local opportunities

The Green Communities Division of DOER helps communities adopt clean energy and energy efficiency projects. Cities and towns can receive Green Communities designation by taking a set of actions to encourage clean energy and energy efficiency, including developing a plan to reduce municipal energy use by 20 percent within 5 years. Cities and towns with Green Communities designation are eligible to apply for grants to fund energy improvements.

Many cities and towns have found that hiring an energy manager or sustainability manager has accelerated the pace of their clean energy and energy efficiency improvements. Where possible, cities and towns should consider hiring an energy manager or designating an existing staff member to monitor and seek opportunities to reduce energy consumption. Some communities have chosen to fund an energy manager position through their green municipal aggregation program.

In many communities, volunteers have played a key role in advocating for stronger clean energy policies and educating the public about available incentives and programs. Towns and cities should consider creating a volunteer-based energy or sustainability committee to help drive progress.

State officials should support local efforts and accelerate clean energy progress

State leaders can take several steps to encourage cities and towns in their efforts to promote clean energy. Additionally, state leaders should act to accelerate the deployment of clean energy and energy efficiency projects across Massachusetts. State officials should:

- Ensure that the state meets its commitments under the Global Warming Solutions Act, which requires economy-wide reductions in greenhouse gas emissions of 25 percent by 2020 and 80 percent by 2050. In particular, state officials should act quickly to adopt annual, declining limits on emissions as required by the Supreme Judicial Court decision in *Kain v. Dept. of Environmental Protection*.
- Commit to strengthening the Regional Greenhouse Gas Initiative (RGGI), which limits carbon emissions from power plants in Massachusetts and eight other northeastern states. Revenue from RGGI helps to fund energy efficiency and clean energy programs in Massachusetts. Massachusetts officials should support a 2030 cap of no more than 40 million tons of carbon pollution.
- Eliminate the caps on solar net metering and provide fair and full compensation for solar energy provided to the grid — including energy from municipal, low-income, and community solar projects.
- Strengthen the stretch energy code, to set higher targets for building energy performance in communities that choose to adopt the stretch code.
- Continue and strengthen the Green Communities program, and provide additional goals and recognition opportunities for cities and towns that have achieved the initial 20 percent energy reduction goal.
- Continue incentives available through MassEVIP to encourage more cities and towns to purchase electric vehicles and charging stations.

Methodology

We distributed a survey via email to officials in all 351 Massachusetts cities and towns, using contact information that we found on municipal websites. Where email addresses or online contact forms were not available, we called city and town offices to request contact information. After distributing the survey, we followed up repeatedly by phone and email to encourage local officials to fill it out.

We asked city and town officials to include school buildings in their responses to the survey if the schools were operated by a municipal K-12 or elementary district, but to leave out any school buildings operated by a regional school district.

We received completed surveys from 191 cities and towns, or 54.4% of all municipalities in Massachusetts.

Percentages listed in the report reflect the total number of surveys collected, including cities and towns that chose not to answer a particular question. For example, in response to the question, "Have you installed solar panels on any municipal buildings or municipal-owned properties," 82 cities and towns answered "yes," 107 answered "no," and 2 left the question blank. We calculated the percentage of yeses as: $100\% * (82 \text{ yeses}) / (82 \text{ yeses} + 107 \text{ nos} + 2 \text{ did not answer}) = 42.9\%$.

All findings from the survey represent the practices of the communities that chose to respond to the survey, and should not necessarily be assumed to reflect the overall rate of adoption of clean energy practices among all 351 Massachusetts cities and towns. Additionally, we did not attempt to verify the accuracy of the information that cities and town officials reported in their survey responses.

Appendix: Survey results

Note: We received completed surveys from 191 towns and cities in Massachusetts. Percentages may not add up to 100% because of rounding.

Renewable energy in municipal facilities

	Yes	No	Other/Did not answer question
Have you installed solar panels on any municipal buildings or municipal-owned properties?	42.9%	56.0%	1.0%
Have you installed any other forms of renewable energy on municipal properties, such as wind or geothermal energy?	16.8%	82.2%	1.0%

Energy efficiency in municipal facilities

	Yes	No	Other/Did not answer question
Have any of your municipal buildings received LEED Silver, Gold, or Platinum certification, or Collaborative for High Performance Schools (CHPS) Verified recognition?	19.9%	75.9%	4.2%
Do you require new or renovated municipal buildings to meet LEED or other energy efficiency standards?	19.4%	71.7%	8.9%
In the past ten years, have any of your municipal buildings received an energy audit to identify ways to improve the building's energy efficiency?	88.0%	7.9%	4.2%

	Yes	No	Other/Did not answer question
Have you adopted the following energy efficiency measures in any of your municipal buildings in the past ten years?			
• installing LED or high-efficiency fluorescent interior lights	82.2%	16.2%	1.6%
• installing occupancy sensors to automatically turn lights on and off as needed	70.2%	28.3%	1.6%
• installing new, high-efficiency heating and cooling equipment	71.2%	27.2%	1.6%
• installing an energy management system (a system that enables control of building systems, such as heating and cooling equipment, by computer in order to optimize the building's energy performance)	61.3%	37.2%	1.6%
• weatherizing the building (for example, by installing additional insulation or high-performance windows)	66.0%	32.5%	1.6%
• instituting a program to encourage building occupants to reduce energy use through their behavior, such as turning off equipment when not in use	38.2%	60.2%	1.6%

Have you installed LED streetlights?

27.2%: We have installed some LED streetlights, but less than half of our streetlights are LEDs.

19.9%: More than half of our streetlights are LEDs.

51.8%: We have not installed any LED streetlights.

1.0%: Other/Did not answer question

Renewable energy programs for residents and businesses

	Yes	No	Other/Did not answer question
<p>Have you participated in MassCEC’s Solarize Massachusetts program, which helps connect residents and businesses with solar companies and reduce the cost of installing solar panels?</p> <p>24.1%: We have participated in MassCEC’s Solarize Massachusetts program.</p> <p>9.4%: We have not participated in Solarize Massachusetts, but we have created a similar program for residents and/or businesses in our city/town.</p> <p>64.9%: Neither of the above.</p> <p>1.6%: Other/Did not answer question</p>			
<p>Does your city/town’s building code require new buildings to be “solar-ready”?</p>	4.7%	90.6%	4.7%
<p>Have you adopted the stretch energy code for new construction in your community?</p>	59.7%	36.1%	4.2%

Transportation

	Yes	No	Other/Did not answer question
<p>Have you purchased any fuel-efficient vehicles or electric vehicles for your municipal fleet?</p>	39.3%	58.6%	2.1%
<p>Have you installed any electric vehicle charging stations on municipal property that are available for the public to use?</p>	20.4%	78.5%	1.0%
<p>Have you adopted a “Complete Streets” policy or a similar policy that requires roads to be designed with the needs of all users, including cyclists and pedestrians, in mind?</p>	31.4%	66.0%	2.6%

Municipal aggregation

Is your city/town currently participating in municipal aggregation, which allows local governments to choose the default electricity supplier for the municipality?

27.7%: We are currently using municipal aggregation.

29.8%: We are actively considering entering into a municipal aggregation agreement.

36.1%: Neither of the above.

6.3%: Other/Did not answer question

If you are currently using or considering using municipal aggregation, do you require the electricity supplier to provide at least 5% additional Massachusetts Class 1 renewable energy credits (RECs) on top of what the state Renewable Portfolio Standard already requires?

13.6%: Yes

39.8%: No

46.6%: Other/Did not answer question

(Note: The percentages for this question are calculated out of the total number of communities that responded to the survey. Of the communities that said they are currently using or considering using municipal aggregation, 23.6% answered yes to this question and 69.1% answered no.)

State and local initiatives

	Yes	No	Other/Did not answer question
Is your city/town a Commonwealth-designated “Green Community”?			
53.4%: We are currently a Green Community.			
11.5%: We are in the process of applying for Green Community status.			
34.0%: Neither of the above.			
1.0%: Other/Did not answer			
Has your city/town hired an energy manager or sustainability manager?	24.6%	74.3%	1.0%
If you answered “no” to the above question, does your city/town have a staff person who is responsible for monitoring and seeking opportunities to reduce energy consumption?			
	39.8%	34.0%	26.2%
(Note: The percentages for this question are calculated out of the total number of communities that responded to the survey. 64.4% of cities and towns responding to the survey said that they either have an energy/sustainability manager or have another staff person responsible for monitoring and seeking opportunities to reduce energy consumption.)			
Does your city/town have an active, volunteer-based energy or sustainability committee?	58.6%	39.8%	1.6%

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