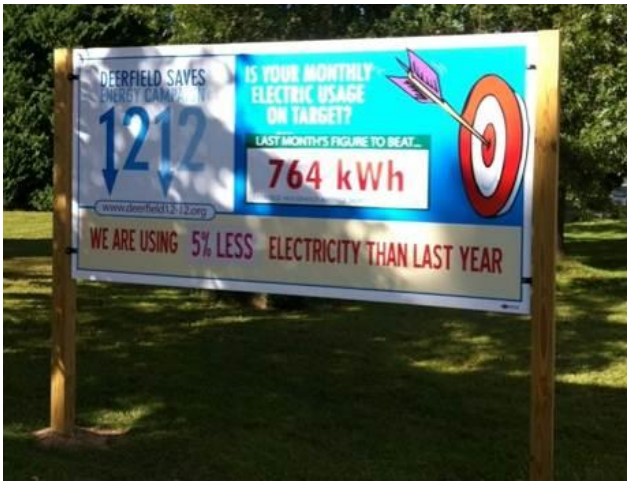
SUSTAINABLE FRANKLIN COUNTY

Chapter 7: Energy



INTRODUCTION

Energy is an essential part of our daily lives, from the food we eat and the water we drink to the electricity and fuels we use in our homes, businesses and vehicles. Extraction, transportation, refinement and combustion of fossil fuels all have impacts on our environment, economies, national security, and quality of life. Fossil fuels are our main source of energy and are a limited resource. As such, dependence on them is not sustainable over the long term. The clean and renewable energy movement is active and growing in the region. In fact, our region is a leader in the nation, and we are in an excellent position to maintain this momentum and take the next steps towards a more sustainable future. These actions will align with the Massachusetts Clean Energy and Climate Plan for 2020 that presents ambitious, yet attainable efforts to cut climate change emissions by 25% by 2020 and 80% by 2050.[1] These goals will be achieved by targeting buildings, electricity use and supply, and the transportation sector.

Our vision is to create a Sustainable Franklin County that is robust and resilient to the effects of climate change, while actively reducing greenhouse gas emissions in the region and improving energy self-reliance. This will be achieved by decreasing energy use while replacing fossil fuels with local energy production.

Through public workshops and surveys conducted as part of the public outreach process for this Regional Plan for Sustainable Development, three top energy goals were identified to promote a sustainable region.

The goal of this chapter is to develop an energy plan for Franklin County that accepts responsibility for Franklin County's portion of the State's Clean Energy and Climate Action Plan for 2020. The chapter is organized to present readers with a sense of how energy and sustainability are connected and highlights a select group of regional energy achievements. Some basic energy definitions are presented for readers who may be new to the energy conversation and those definitions are followed by some background information about emissions and climate change. Following the discussion of the local and global impacts of emissions, documentation of Franklin County's emissions is presented. From there, the chapter drills down to more specific aspects of emissions; energy use and energy sources. The chapter culminates with a discussion of some of the barriers to a green power future and ends with a set of action items for progress.

Top Sustainable Energy Goals

1. Promote energy conservation and efficiency;
2. Increase the quantity of locally-produced clean energy; and
3. Reduce the use of fossil fuels.

ENERGY & SUSTAINABILITY

Energy is intricately connected to the three pillars of sustainability: community livability, the environment and economic development. High costs for home heating, electricity, and water directly impact housing affordability because inefficient housing results in more money being spent on utilities. If the utilities or associated housing costs are not affordable, residents may be forced to sacrifice money otherwise spent on food, healthcare, or other essential needs. Furthermore, inefficient housing can also lead to uncomfortable and unhealthy living conditions such as extreme heat/cold and poor indoor air quality.

Land use trends such as sprawl result in increased transportation related energy expenditures and less opportunity for the use of alternative forms of transportation such as public transit, walking, and

[1] Massachusetts Office of Energy and Environmental Affairs, Massachusetts Clean Energy and Climate Plan for 2020, December 2010.

bicycling. The condition of aging and inefficient infrastructure – whether it is water, sewer, or telecommunications infrastructure – has direct impacts on increased energy use. Reliance on foreign fuels can negatively impact the regional **economy** as the majority of the money spent on those fuels leaves the region at a time when more local jobs and economic resiliency are needed in Franklin County. Losing prime farmland and forests to development reduces the region's ability to cope with increased emissions, extreme weather events, and climate change and decreases our food self-sufficiency. Failure to preserve cultural and scenic landscapes can result in increased sprawl and unsustainable development patterns, which can lead to increased energy used for transportation, and reduced tourism, sense of place, and quality of life. These are just some of the ways in which energy is interconnected with every other chapter of this plan.

REGIONAL ENERGY SPOTLIGHT

Massachusetts has been named the leading state on the East Coast for clean energy innovation, investment, employment, and jobs[2] and Franklin County has been a strong contributor to that title. Additionally, in 2012 Massachusetts was recognized as being first in the nation in improved energy efficiency, according to the American Council for an Energy-Efficient Economy (ACEEE).

At the regional and local levels, Franklin County has an impressive portfolio of energy related accomplishments. The work done by tireless volunteers, town committees and professionals has helped establish the region as a leader in green, clean and renewable energy. The following section highlights just two of our energy related regional accomplishments.

[2] A Future of Innovation and Growth: Advancing Massachusetts' Clean Energy Leadership, Clean Edge, April 2010, Massachusetts Clean Energy Center.

Through the Green Communities Program, to date, more than half of all municipalities in Franklin County have been designated and have committed to reducing energy use by over 29,225 MMBTUs of energy. This is equivalent to taking over 226 homes off the grid, permanently.

- The **Pioneer Valley Clean Energy Plan** was published in January 2008. It provides a critical benchmark of the region's energy profile and a plan to become more energy self-sufficient. The plan focused on four clean energy goals that have been highlighted and woven into this plan and include:
    - Reduce energy use
    - Replace fossil fuels
    - Reduce global climate change emissions
    - Create local jobs

The first three goals are highlighted and supported in this chapter while the last goal is addressed by the Chapter 6: Economic Development. The Pioneer Valley Clean Energy Plan was a crucial step in planning for energy in the Pioneer Valley and continues to influence policy.

- The Green Communities Division of the *Massachusetts Department of Energy Resources* (DOER) was created in 2008 by the Green Communities Act. The goal of the division is to "guide all 351 cities and towns along a path of enhanced energy efficiency and renewable energy toward zero net energy." The **Green Communities Program** has helped municipalities across the Commonwealth achieve significant reductions in energy use and improve energy efficiency in buildings and vehicles. The Green Communities Division also administers the Green Communities Grant Program which awards grant

funding for energy efficiency improvements in municipal facilities to communities meeting a set of five criteria. Among these criteria are a commitment to reduce municipal energy use by 20 percent within five years of signing onto the program; adoption of the Stretch Energy Code to improve building efficiency; and providing as-of-right siting for some forms of renewable energy generation or clean energy research, development, or manufacturing. In meeting these requirements, municipalities across the state are not only reducing municipal energy use, but are also decreasing energy use in non-municipal buildings. To date, 15 of the 26 Franklin County communities have been designated Green Communities and they have received over $2 million dollars in grant funding and committed to reducing municipal energy consumption by at least 29,225 MMBTUs. This is the equivalent of taking over 226 homes off of the grid, permanently[3]. These funds have helped improve energy efficiency and created local jobs in Franklin County.

- The **John W. Olver Transit Center** is the nation's first zero-net energy transit center. Since its opening in May 2012, it has received accolades worldwide promoting it as a model for future development. This facility is designed to maximize energy efficiency and produce enough renewable energy to meet its annual operating needs. To do so, designers, engineers and architects incorporated numerous livability and sustainability elements into the design and construction of the building. The ultimate goal – a regional intermodal transportation center that maximizes functional public space, increases public transportation options, and minimizes the use of limited resources.

3 Massachusetts Department of Energy Resources (DOER), Green Communities Division.

The Pioneer Valley Clean Energy Plan, Green Communities Program and the zero-net energy John W. Olver Transit Center are just a few examples of the many accomplishments occurring throughout the region. Energy champions exist in every Franklin County community and they are working every day to spread awareness about energy related issues. Local energy committees are leading efforts to improve energy efficiency in their communities through outreach efforts, workshops, clean and renewable energy tours, audits, and roundtable discussions. The Franklin County energy committees meet regularly to share ideas and continue the advancement of conservation and efficiency throughout the County and have achieved many results. The combination of efforts at the individual and local levels along with the adoption of policies and implementation of strategies identified herein will help guide Franklin County towards a more sustainable energy future. Each of these components is critical to achieving success. By replacing fossil fuels with green energy and reducing energy use, Franklin County can achieve significant gains in building energy resiliency and reducing climate change emissions.

ENERGY TERMS AND DEFINITIONS

Energy can be a very complex topic, so it is important to understand some of the terms that will be used throughout this chapter. [4] This is a short list of terms that are based on definitions provided by the U.S. EPA, unless otherwise noted.

- **Biofuel:** A type of fuel produced from plants or other forms of biomass. Examples include ethanol, biodiesel, and biogas.

[4] United States EPA, A Student's Guide to Global Climate Change website, <http://www.epa.gov/climatechange/kids/glossary.html>, accessed June 5, 2012.

- **Biomass:** Material that comes from living things, including trees, crops, grasses, algae, animals, and animal waste.
- **Carbon Dioxide:** A colorless, odorless greenhouse gas. Carbon dioxide (CO_2) is being added to the atmosphere, mostly by burning fossil fuels and is the main cause of climate change.
- **Clean Energy:** Renewable energy resources that are inexhaustible resources, many of which produce no air emissions during generation, and include sun, wind, water, biomass (both from plants and other organic material), fuel cells and other sources.[5,6]
- **Combined Heat and Power (CHP):** Also known as cogeneration, CHP is an efficient, clean, and reliable approach to generating electric power and thermal energy from a single fuel source.
- **Emissions:** The release of a gas (such as carbon dioxide) or other substances into the air.
- **Fossil Fuels:** Fossil fuels are fuels containing carbon – coal, oil and gas – that were formed over millions of years through the decay, burial and compaction of rotting vegetation on land, and of marine organisms on the sea floor. Burning fossil fuels is the major way in which humans add to the greenhouse gases in the atmosphere.
- **Geothermal:** Heat from inside the earth.
- **Greenhouse Gas (GHG):** Also known as 'heat trapping gases,' greenhouse gases are natural or manmade gases that trap heat in the atmosphere and contribute to the greenhouse effect. The three greenhouse gases that are emitted during the combustion of fossil fuels are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).
- **Green Power:** The subset of renewable energy that represents those renewable energy resources and technologies that provide the highest environmental benefit. The US EPA defines green power as electricity produced from solar, wind, geothermal, biogas, biomass, and low-impact small hydroelectric sources.
- **Hydroelectric:** The energy derived from moving water to produce electricity.
- **Methane**: A colorless, odorless greenhouse gas. It occurs both naturally and as a result of people's activities. Methane (CH_4) is produced by the decay of plants, animals, and waste as well as other processes. It is also the main ingredient in natural gas.
- **Nitrous Oxide**: A colorless, odorless greenhouse gas. Nitrous Oxide (N_2O) occurs both naturally and as a result of people's activities. Major sources include farming practices (such as using fertilizers) that add extra nitrogen to the soil, burning fossil fuels, and certain industrial processes.
- **Nonrenewable Sources:** Natural resources that cannot be produced, regrown, or reused fast enough to keep up with how quickly it is used. Fossil fuels such as coal, oil, and natural gas take millions of years to develop naturally. Uranium, the main fuel for nuclear power plants, is also a nonrenewable fuel.
- **Renewable Resource:** A natural resource that can be produced, regrown, or reused fast enough to keep up with how quickly it is used. Wind, tides, and solar energy

[5] Massachusetts Clean Energy Center (CEC), What is Clean Energy Webpage, < http://www.masscec.com/index.cfm/page/What-is-Clean-Energy/pid/11139>, accessed 9/10/12.

[6] Some definitions of Clean Energy may include Nuclear Power. To clarify, the Pioneer Valley Clean Energy Plan does NOT include nuclear power as a clean energy source.

are in no danger of running out and can be consumed by people virtually forever.

- **Solar Energy:** Energy from the sun, which can be converted into other forms of energy such as heat or electricity.

ENERGY, EMMISSIONS, GLOBAL WARMING, AND CLIMATE CHANGE

Most of the energy we use for heating and cooling our homes and businesses, running our appliances and machinery, and transporting ourselves and the products we need or want come from fossil fuels - coal, oil and natural gas.

All fossil fuels contain carbon, which is released to the atmosphere as carbon dioxide (CO_2) when they are burned. Coal releases the most CO_2 and natural gas releases the least. But they all release too much. This is because atmospheric CO_2 is a powerful greenhouse gas (GHG), which means that it traps heat in Earth's lower atmosphere, altering Earth's energy balance.

While CO_2 has received significant attention as its contribution to global warming, new research is also highlighting the role of methane (CH_4) to global warming. Methane is a principal component of natural gas and is released in significant quantities through the process of obtaining natural gas by cracking shale (a.k.a. "fracking"). Methane is also formed and released to the atmosphere by biological processes occurring in anaerobic environments, such as diseased trees. Once in the atmosphere, methane absorbs terrestrial infrared radiation that would otherwise escape to space.

Without the "natural" greenhouse effect Earth would be a frozen planet, but the human induced "enhanced" greenhouse effect may irreparably change the natural environment in which human civilization has emerged and upon which human civilization depends.

Before the industrial revolution, the concentration of CO_2 in the atmosphere was 280 parts per million (ppm).[7] Today it is over 392 ppm and rising rapidly.[8] The atmospheric concentration of CO_2 has never been above 300 ppm over at least the last 800,000 years.[7]

This rapid rise in atmospheric CO_2 is causing global temperatures to rise at rates unprecedented in human history. Earth's climate sensitivity is such that 450 ppm is expected to yield a temperature increase of 2°C – the internationally accepted "safe" limit.[7, 9] By century's end a temperature rise of 6°C is possible, equivalent to the temperature rise from the last glacial period to the present.[7] Since carbon dioxide is very persistent in the atmosphere, its impacts will be with us for centuries to millennia to come.

When temperatures reach critical tipping points, there are many natural feedback loops which will release additional GHGs. One of these feedbacks is CO_2 emissions from the oceans and land vegetation as they flip from being carbon sinks, which absorb CO_2, to carbon sources, which emit CO_2. Other feedbacks include CO_2 emissions from wildfires and the decay of boreal forests as the permafrost beneath them melts. Methane, which is 25 times more powerful as a GHG than CO_2, is also being released from melting permafrost and from methane hydrates, which are a form of frozen methane on the ocean floor.

Also, changes in Earth's albedo, or reflectivity, due to melting sea ice, ice caps, glaciers, and snow pack allow land and water to absorb much more solar radiation, significantly contributing to Earth's temperature rise.

The impacts of global warming, and resulting climate change, will be profound. Global warming is already

[7] Global Climate Change Impacts in the United States, U.S. Global Change Research Program.
[8] Mauna Loa Observatory, Hawaii, National Oceanic and Atmospheric Administration, Earth Systems Research Laboratory, Global Monitoring Division.
[9] Intergovernmental Panel on Climate Change, Fourth Assessment Report (2007).

In 2008, the largest emitters of carbon dioxide (CO_2) emissions were the transportation and building sectors.

causing dramatic changes in Earth's climate, and these changes are predicted to accelerate over the coming decades. Much of the natural environment will not be able to adapt to these rapid changes. Species extinctions, already at levels far above the natural background rate, will accelerate. Heat waves, drought, and heavy rainfall events will become more common, causing wildfires, desertification, flooding, and erosion. Tropical storms and hurricanes will become more powerful. Sea levels will rise, resulting from both warming oceans and melting ice caps and glaciers, impacting coastal ecosystems, fresh water aquifers, coastal cities and other coastal infrastructure. Ocean temperature rise and acidification from CO_2 absorption may push many coral reefs and ocean fish populations to extinction.

Current climate models do not provide detailed projections at the scale of Franklin County. However, over this century, under Business-As-Usual emissions scenarios, the climate of Franklin County may transition to one more like that of the Carolinas today. Generally we can expect less snow, more heavy precipitation and flooding, longer dry seasons, more wildfires, and hotter temperatures. Our maple, beech, and birch forests will transition to oak and hickory.

Water management, agriculture, power generation, transportation, community development and much more will all need to adapt to those changes which are now inevitable, and we must significantly reduce future GHG emissions.

To mitigate GHG emissions, we must first reduce our energy demand and increase our energy efficiency. These changes are the cheapest and fastest mitigation measures, but they will not be sufficient. It is imperative that we transition from fossil fuel sources of energy to sustainable non-fossil fuel sources.

The worst climate change projections need not occur. We can change the way we produce and use energy. We can change the way we transport ourselves and other materials. We can change the way we build, heat, cool and illuminate our homes, offices, and factories. We can change the way we produce things. We can change the way we grow our food. We have the knowledge, technology, and skills. We can learn to live on the earth sustainably.

CARBON EMISSIONS INVENTORY

As previously documented, carbon dioxide (CO_2) is the primary greenhouse gas accounting for about 84 percent of all U.S. greenhouse gas emissions from human activities.[10] Gaining an understanding of carbon emissions, the most significant contributor to global warming, in Franklin County is critical. A joint partnership between two government agencies, the National Aeronautics and Space Administration (NASA) and the Department of Energy (DOE), to quantify fossil fuel carbon dioxide (CO_2) has resulted in the Vulcan Project. The Vulcan Project is a "valuable tool for policymakers, demographers, social scientists and the public at large."[11] This project is directly beneficial to the Regional Plan for Sustainable Development because it includes carbon emissions data for Franklin County and the Pioneer Valley from 1999 to 2008. Additional data analysis for subsequent years will be performed as the data becomes available.

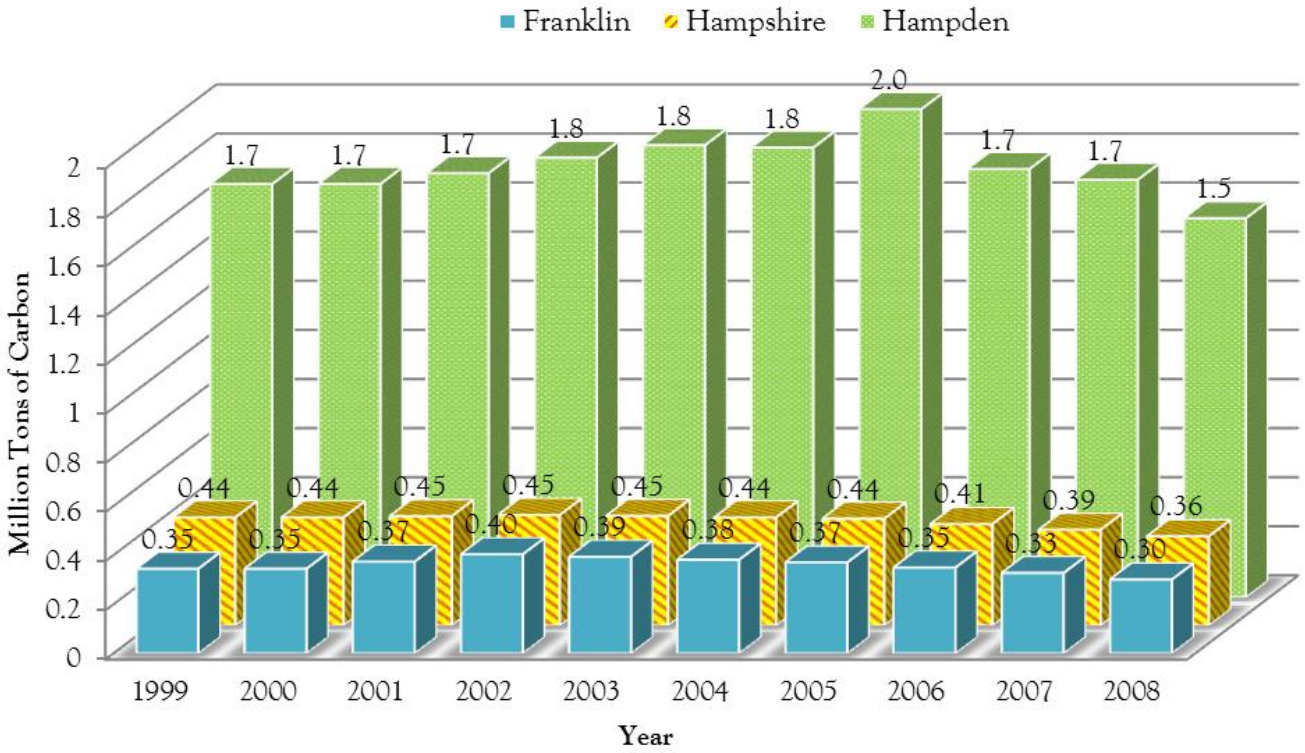
[10] US EPA, Greenhouse Gas Emissions Webpage, www.epa.gov/climatechange/ghgemissions/gases/co2.html , accessed August 2012.
[11] Vulcan Project, About Project Vulcan website, http://vulcan.project.asu.edu/, accessed August 2012.

The breakdown of carbon emissions, by category, has been compiled for the Pioneer Valley region. This level of detail is not available for Franklin County but a snapshot of the surrounding Pioneer Valley can be indicative of what is happening in Franklin County. In 2008, it appears that the largest carbon emissions came from the transportation sector (45%). Electricity production (21%) and the residential sector (19%) represent the next largest carbon emitters. The industrial and commercial sectors represent the smallest emitters of carbon emissions in the Pioneer Valley. However, if we look at energy use in buildings, which includes energy for heat, electricity, lighting, and appliances, buildings are likely tied with transportation as the largest carbon emitters.

More specific data is available for Franklin County which shows carbon emissions over time, between 1999 and 2008. Franklin County's carbon emissions were lower in 2008 than in 1999 which would appear to be good news. Furthermore, Franklin County's total carbon emissions are lower than neighboring counties of Hampshire and Hampden counties, as shown in Figure 1.

A closer look at the data has revealed two trends that are not cause for celebration. Comparing year 1999 data to year 2008 carbon data in isolation would show that carbon emissions decreased during this time.

Figure 1: Pioneer Valley Carbon Emissions by County, 1999-2008



Source: Vulcan Project: http://vulcan.project.asu.edu/, August 2012

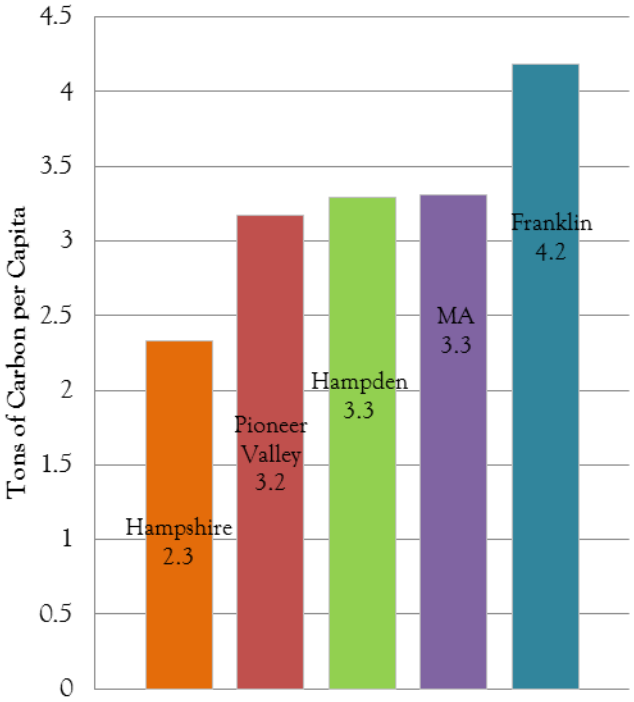
However, between 1999 and 2008 carbon emissions increased significantly before dropping back down, as shown in Figure 1. Carbon emissions jumped from 0.345 million tons of carbon in 1999 and 2000 to 0.404 million tons of carbon in 2002. Following 2002 carbon emissions began to slowly decline each year and finally reached a low of 0.301 million tons of carbon in 2008. Franklin County needs to actively and consistently be reducing its carbon emissions each year.

While Franklin County exhibited the lowest overall carbon emissions among the three Western Massachusetts counties, it is also the least populated.

To be able to make a direct comparison across counties, carbon emissions can be expressed in terms of carbon emissions per capita. When expressed in this manner, Franklin County's carbon emissions are the highest of the three counties and are also higher than the statewide average, as shown in Figure 2. This is likely a direct result of the amount of driving we do in Franklin County. With a high rate of carbon emissions per capita and a growing number of registered motor vehicles, emissions will continue to be a challenge for Franklin County. As previously discussed, emissions have a direct impact on climate change and global warming. At the local level, emissions directly impact the air quality and public health of our residents in Franklin County.

In 2008, Franklin County's carbon emissions, per capita, were higher than Hampden and Hampshire Counties as well as the statewide average.

Figure 2: Pioneer Valley Carbon Emissions per Capita, 2008



Source: Vulcan Project: http://vulcan.project.asu.edu/, August 2012

In keeping with the Massachusetts Clean Energy and Climate Plan for 2020,[12] Franklin County must make a commitment to reducing emissions within the same parameters as the statewide plan. This would mean that Franklin County would strive to reduce greenhouse gas (GHG) emissions by 25 percent below 1999 levels by 2020 – on the way toward an 80 percent reduction in emissions by 2050. The intent of these statewide goals is to achieve annual reductions in carbon emissions each year. Franklin County's carbon emissions trends have not traditionally decreased. Therefore, the first goal for Franklin County carbon emissions is to reduce carbon emissions each year. The next question becomes, 'by how much?'

Since 1990 emissions data is not available at this time for Franklin County, 1999 was used as the baseline. Between 1999 and 2008, Franklin County achieved an overall reduction of nearly 13 percent of carbon emissions. To meet the 2020 goal, Franklin County must achieve an additional reduction of approximately

[12] Massachusetts Office of Energy and Environmental Affairs, Massachusetts Clean Energy and Climate Plan for 2020, December 2010.

12 percent below 1999 levels. Long-term, Franklin County must aim to reduce carbon emissions by 80 percent below 1999 levels by 2050. To achieve these targets, Franklin County will need to act quickly to reduce carbon emissions and should look to targeting transportation and building emissions first and foremost. The most significant elements of reducing Franklin County's carbon emissions are also the top goals for energy in Franklin County and they are:

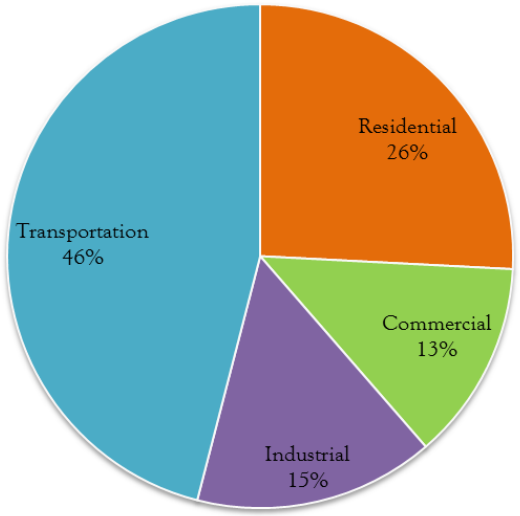
- **Reducing energy consumption.** Using less energy will automatically result in fewer emissions.
- **Improving energy efficiency.** Reducing the amount of energy that is wasted will directly reduce energy consumption.
- **Reducing dependence on fossil-based fuels.** Fossil based fuels are the largest emitters of carbon emissions. Reducing dependence on fossil based fuels by replacing fossil fuel use with green energy will decrease emissions in combination with reduced consumption.

Carbon emissions and energy use are intricately connected. The more energy we use from fossil fuels, the greater emissions will be. The next section presents Franklin County's energy demand.

ENERGY USE IN FRANKLIN COUNTY

It is projected that U.S. energy demands will increase by more than one-third by 2030, with electricity demand alone rising by more than 40 percent. Massachusetts has the fourth highest electricity prices in the country.[13] The financial and environmental costs of energy are expected to increase dramatically, resulting in increased financial burdens on households and businesses and making it more difficult to attain clean air and a healthy environment.[14] This means that the current average amount a household spends on energy of $4,600 per year will likely increase unless significant energy conservation is realized by households and businesses.[13] To prepare for decreased energy supplies, more volatile energy costs and the effects of emissions and climate change, Franklin County needs to gain an understanding of its current and historical energy use.

Figure 3:Franklin County Energy Consumption, by Sector (2010)

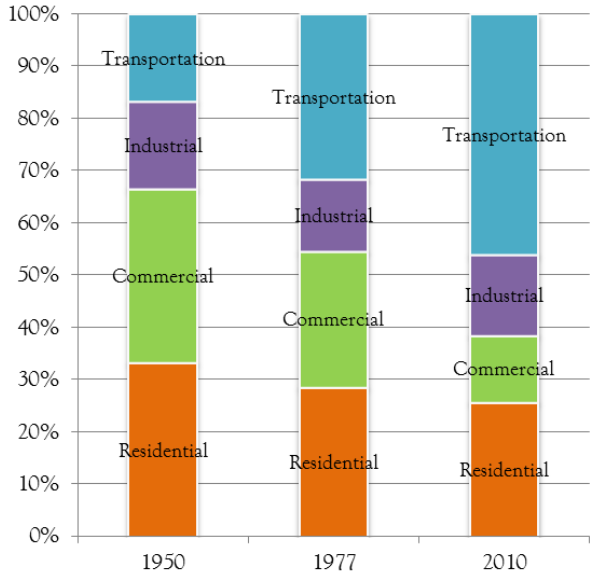


Source: UMass Amherst, Fall 2011 Landscape Architecture and Regional Planning Graduate Studio.

[13] Massachusetts Office of Energy and Environmental Affairs, Massachusetts Clean Energy and Climate Plan for 2020 Public Presentation, accessed online on 1/9/2013, <http:///www.mass.gov/eea/docs/eea/energy/2020-clean-energy-plan-presentation.pdf>

[14] US DOE and US EPA, National Action Plan for Energy Efficiency, July 2006.

Figure 4: Historical Energy Use in Franklin County, by Sector



Source: UMass Amherst, Fall 2011 Landscape Architecture and Regional Planning Graduate Studio.

The last time a comprehensive analysis of energy use was conducted at the regional level for Franklin County was in 1979 in the Franklin County Energy Study.[15] An updated comprehensive Energy Use Baseline Inventory would be ideal and is a primary recommendation of this chapter. However, such an endeavor requires resources that are beyond the scope of this Plan, however it would be incredibly advantageous for the region to develop a Climate Action Plan to more accurately document baseline energy data and establish an adaptation plan for the impacts of climate change on the region. Therefore, while this chapter of the Plan presents an energy use overview for the County, the focus is on identifying strategies for a more sustainable energy future for Franklin County. To do so, we must first gain a general understanding of our past and present energy use.

In 2010, Franklin County used approximately 14.1 Trillion British Thermal Units (BTU) of energy. The majority (46%) of energy use, as shown in Figure 3, was consumed by the transportation sector. Residential energy use was the next largest consumer of energy in Franklin County, accounting for approximately 26 percent of the County's total energy use. The industrial and commercial sectors used approximately 15 percent and 13 percent, respectively.

As shown in Figure 4, energy consumption by sector has changed significantly over time with the greatest increase occurring in the transportation sector that grew from 17 percent of total energy use in 1950 to 46 percent of the total energy use in 2010. To better understand the cause(s) for this increase, vehicle registration was examined. A comparison between 1975 and 2010 was made which revealed a surprising statistic. During this time there was a modest population increase of 8,035 people, whereas the number of registered motor vehicles increased significantly by 28,913 vehicles. In other words, the number of registered motor vehicles increased at more than 3.5 times the rate of population increase during this time.

Between 1990 and 2010, the number of registered motor vehicles increased by 23,532 while population only increased by 1,280 people.

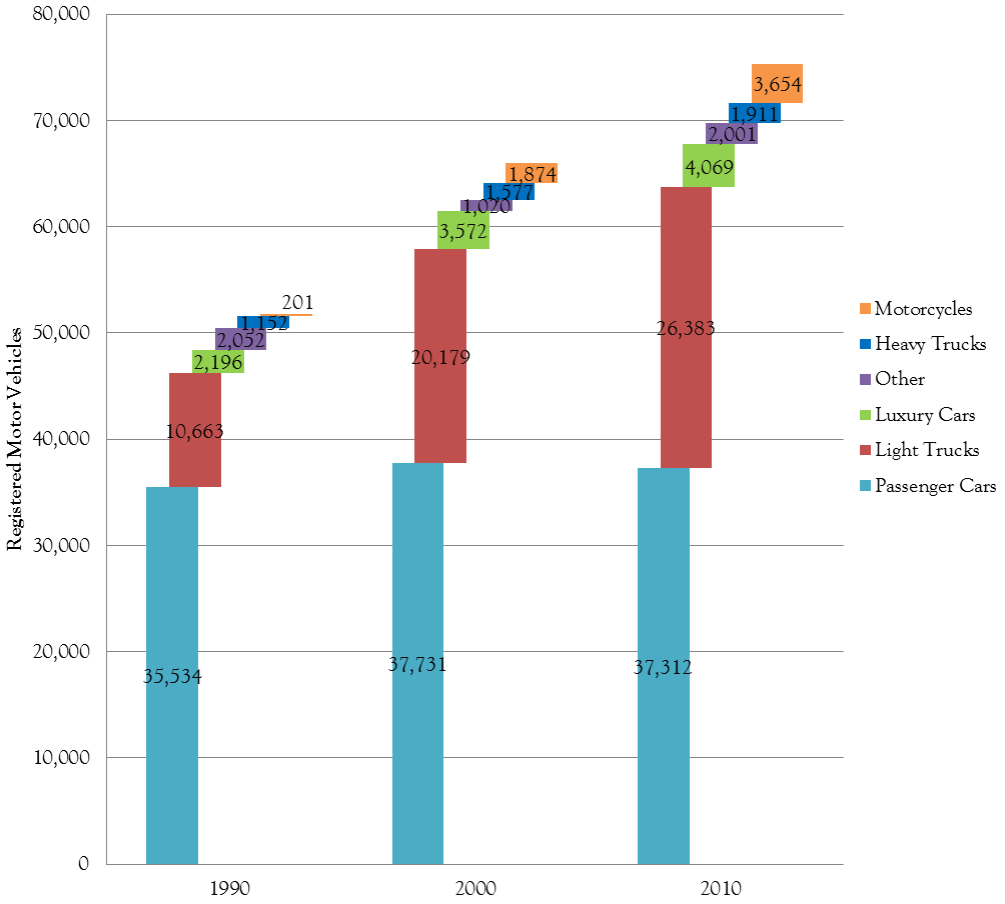
There may be several reasons for this trend. Rural sprawl and the development of land located away from town and urban centers results in more travel. Commuters are driving more than ever as homes are located further away from employment centers, where housing prices are typically lower. Other social factors may also be contributing to this trend including the growth of women in the workforce and more women

[15] University of Massachusetts Amherst Future Studies Program, Franklin County Energy Study: A Renewable Energy Future, April 1979.

driving than in the 1950s. Furthermore, the use of personal automobiles for single occupancy travel (versus family trips) has become more common.

While fuel efficiency standards have improved between 1950 and 2010, there are significantly more vehicles on the road than ever before in Franklin County. Furthermore, the composition of vehicle types has changed over time with a large shift from passenger cars to light trucks (vans, mini-vans, pickups and sport utility vehicles). Light trucks typically have lower fuel efficiency than passenger cars, resulting in increased fuel consumption and emissions. Figure 5 shows how this changed between 1990 and 2010. This increase in registered motor vehicles, combined with an increase in the percentage of light trucks has accounted for the majority of this increase in transportation sector energy use. In short, there are more vehicles on the road than ever before, many of which are larger, less fuel efficient models. If five percent of these registered motor vehicles (passenger cars and light trucks) were replaced with more fuel-efficient vehicles, such as replacing a 20 MPG vehicle with a 30 MPG vehicle, that would save the owner of the vehicle $813 annually and Franklin County an estimated $2.6 million each year.[16] This is more money in the wallets of residents and business owners that can be saved or spent in the local economy.

Figure 5:Registered Motor Vehicles in Franklin County, by Type (1990-2010)

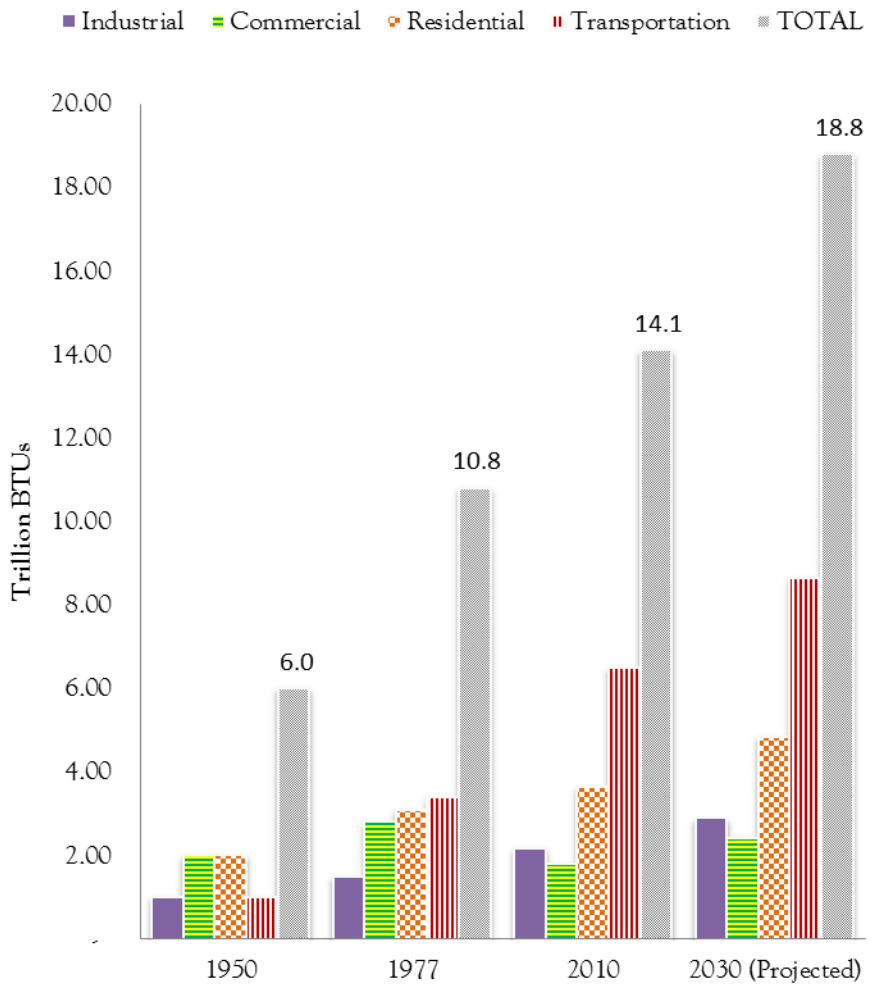


Source: Massaschusetts Registry of Motor Vehicles

Given this huge increase in energy use and emissions in the transportation sector, it is the most obvious area to target for energy and emissions reductions. Specific strategies identified in Chapter 5: Transportation in this Plan are aimed at achieving these reductions.

[16] U.S. Department of Energy, Choosing A More Efficient Vehicle webpage, accessed 1/9/2013, <www.fueleconomy.gov/feg/choosing.shtml>

Figure 6: Historical and Projected Energy Consumption



Source: UMass Amherst, Fall 2011 Landscape Architecture and Regional Planning Graduate Studio.

The commercial sector has seen the greatest decrease in energy use, as a percentage of the county's over all energy use. In 1950 the commercial sector accounted for approximately 33 percent of the overall energy use and decreased to 26 percent and 13 percent in 1977 and 2010, respectively. This is attributed to a decline in the size of the commercial sector more so than reductions in energy use in this sector, over time. The residential sector also decreased between 1950 and 2010, though not as much as the commercial sector. Between 1950 and 2010, residential sector energy use decreased from 33 percent of the overall to 26 percent. Industrial sector energy remained between 14 percent and 17 percent between 1950 and 2010. These decreases in percentage of energy use, by sector, are attributed mostly due to the increasing share of the transportation sector's role in energy use and emissions since 1950.

In addition to shifts in energy consumption, by sector, overall energy use has also changed over time. More specifically, energy use has grown steadily in Franklin County, as shown in Figure 6. In 1950, Franklin County consumed 6.0 Trillion British Thermal Units (BTU) of energy and by 2010 this amount had more than doubled to an estimated 14.1 Trillion BTUs. The EIA estimates that U.S. energy demands will increase by more than one-third by 2030. If Franklin County continues to follow national trends that will result in an annual projected energy use of 18.8 BTU by 2030.

Population data was examined since energy consumption has more than doubled in Franklin County since 1950. The results of this comparison between energy use and population show that energy use has increased much faster than population between 1950 and 2010. While energy use more than doubled, population growth only increased by about 35 percent. If Franklin County continues to follow

national trends, it will result in a projected increase in energy use of 33 percent while population is only expected to grow by less than seven percent.

To put these figures into perspective, residential energy use was compared to the number of households in the county to gain a better understanding of average energy use per household. The national average energy use per household in 2010 was 89.6 MMBTU but the Northeast average was higher at 107.6 MMBTU per household, which may be attributed to higher home heating requirements. Franklin County ranked right in line with the Northeast average at 107.8 MMBTU per household. Franklin County's residential energy consumption rates are consistent with those of the Northeast and the Massachusetts statewide average (109.8 MMBTU/HH). National data also demonstrates slightly higher energy consumption rates in rural areas versus urban areas, which also impacts much of the region's energy use. Residential energy consumption in Franklin County is close to the state and regional averages. Furthermore, Franklin County residential energy use (MMBTU/HH) has decreased between 1980 and 2010, from 115.6 to 107.8 MMBTU/HH. This reduction in residential energy intensity is a positive trend for Franklin County. To maintain this downward trend, Franklin County will need to continue to reduce residential energy use. Otherwise, if Franklin County were to increase energy consumption at the projected rate of 33 percent by 2030, average residential energy consumption per household could jump to nearly 145 MMBTU per household. Increasing energy consumption trends are not sustainable for Franklin County.

While there are obvious environmental incentives for reducing energy consumption in Franklin County, there are just as many financial incentives. Among them is the ability to keep more money in the local economy and more money in the pockets of residents and businesses. In fact, it is estimated that the statewide annual cost savings for residential, business, and municipal energy customers will be $6.3 billion by 2020.[17] More specific to Franklin County, energy conservation measures in homes and businesses will have an immediate impact on our local economy. For example, if a quarter of all Franklin County households did four simple things (install programmable thermostats, replace 15 traditional light bulbs with energy saving bulbs, used an electric power strip to turn off electrics when not in use, and added landscaped trees around the home) Franklin County would save over $3 million each year. That money would stay right here in Franklin County, instead of flowing out of the region and the state.[18]

In summary, this section documents that the percentage of energy used by each sector has changed over time due to population, land use and cultural changes. These changes have been coupled with a documented trend of increasing energy use over time.

The Pioneer Valley Clean Energy Plan outlined the goal to reduce our region's energy consumption to 2000 levels by the end of 2009 and reduce that by 15 percent between 2010-2020 while supporting the growth of new business and industry.[19] Consistent with this goal, Franklin County will aim to reduce the region's energy consumption by 15 percent below 2010 levels by 2020.

Reducing the County's energy consumption will also play a significant role in reducing the region's carbon and GHG emissions. In order to achieve a 25 percent reduction in GHG emissions by 2020 and an 80 percent reduction in greenhouse gas emissions by

[17] Massachusetts Office of Energy and Environmental Affairs, Massachusetts Clean Energy and Climate Plan for 2020 Public Presentation, accessed online on 1/9/2013, <http:///www.mass.gov/eea/docs/eea/energy/2020-clean-energy-plan-presentation.pdf>

[18] U.S. Department of Energy, Top 11 Things You Didn't Know About Saving Energy At Home: Summer Edition webpage, accessed 1/9/2013, < http://energy.gov/articles/top-11-things-you-didnt-know-about-saving-energy-home-summer-edition>

[19] Pioneer Valley Clean Energy Plan, January 2008.

2050, energy use has to stabilize and then immediately decline. Achieving these emissions targets cannot be realized without reducing energy consumption. Strategies to reduce energy consumption must address all aspects of our energy use.

GREEN POWER AND FOSSIL FUELS

In order to achieve a sustainable energy future in Franklin County, we need to reduce energy consumption and GHG emissions. Energy efficiency measures and behavior modification as well as the implementation of new technologies (e.g. improvements in vehicle mpg ratings and renewable energy) will help reduce consumption and GHG emissions. While the reduction of the consumption of fossil fuels will have a significant impact on Franklin County's GHG emissions, we also need to replace the fuel used with green power in Franklin County. This will not only cut GHG emissions, but will also have many added benefits to the regional economy and energy resiliency.

When assessing the "greenness" of an energy source, all aspects of the energy must be included, from extraction, to delivery and use. The energy industry is just starting to be held accountable for GHG emissions.

Franklin County has a long history of developing green energy and marketing it throughout the state. For example, the canal built in Turners Falls in 1798 for river travel, was reconstructed in 1869, along with a dam, for power generation, which was used directly by the mills along the canal. In 1914, the Cabot hydro plant was built. It was the first electricity generated to be sold for commercial purposes. Today that plant has a 50MW capacity. Combined with hydro plants on the Deerfield and Millers Rivers, Franklin County has the capacity to generate 110MW. Today that power is owned by several multinational companies and sold to the New England Power Pool. It is interesting to note that our hydro capacity is over twice Franklin County's electric needs. Hydropower, with its many dams and generating facilities, has environmental impacts on fish and other wildlife. Efforts to overcome some of those drawbacks have resulted in fish ladders, which often do not achieve all of their desired results.

The Pioneer Valley Clean Energy Plan has the goal of siting sufficient new capacity to generate the equivalent of 28.7 MW of clean energy annually in the Pioneer Valley by the end of 2009 and another 59.1 MW by 2020[20]. Franklin County's population is approximately ten percent of the Pioneer Valley's. Assuming that Franklin County is responsible for 10 percent of Pioneer Valley's goal would translate into a regional target of siting 2.87 MW of capacity by the end of 2009 and an additional 5.9 MW of capacity by 2020.

How is Franklin County progressing towards achieving these goals? Since there is no regional database for Franklin County, progress was estimated using data provided by the Massachusetts Clean Energy Center's (MassCEC) project databases. While this data only represents projects that received funding through MassCEC it reveals that Franklin County is making excellent progress.

First, let's examine the goal to site 2.87 MW of capacity by the end of 2009. An analysis of all projects contained in the MassCEC project database for Franklin County completed before 2009 shows that with these projects alone, Franklin County has surpassed this target. Where the target was 2.87 MW of new capacity in Franklin County, the estimated amount sited was at least 3.18 MW of capacity.

The second goal, to site an additional 5.9 MW capacity by 2020, has already been surpassed. The same database shows that Franklin County has already sited 18.8 MW of capacity since the beginning of

[20] The Pioneer Valley Clean Energy Plan presents these targets in terms of million kilowatts per year. They were converted into MW using EPA conversion factors.

2010. This is largely due to the addition of four major projects which consist of the following:

- Berkshire East Wind Turbine (2011) - 0.9 MW capacity;
- Northfield Mountain First Light & Power Solar Farm (2011) – 2 MW capacity;
- Greenfield Landfill Solar Farm (2012) – 2 MW capacity; and
- Hoosac Wind Power Project, Monroe Portion Only (2012) – 13.5 MW capacity.

Again, the data only represents projects contained in the MassCEC project databases. A thorough inventory of all green power projects in the County may reveal even greater progress towards achieving these goals. The region has emerged as a leader in green power with more projects in the pipeline.

Siting for new green power will require investments in infrastructure as well as revisions to local zoning and permitting requirements. As these technologies become more common and more of the impacts are known, communities will be able to make more informed decisions. Ensuring that the proper regulations are in place will help accomplish this objective while protecting and enhancing our communities and the environment.

OBSTACLES TO SUSTAINABLE ENERGY

Despite the many energy related accomplishments in Franklin County, there are still obstacles, such as limited public awareness, social attitudes, cultural norms, new and emerging technologies and the relative immaturity of certain technologies. Furthermore, many people may support green power as a concept but have concerns about the proper siting of large scale facilities. The following obstacles are just a sample of some of the real and perceived barriers in Franklin County, as mentioned throughout the Sustainability Workshops:

- **Proper Siting**. There are limited areas zoned for large-scale industrial facilities including renewable energy electric generating facilities. Consequently, towns are working to identify suitable locations and appropriate siting standards for large-scale solar or wind facilities. In addition, many towns are working to streamline land use regulations for on-site small scale renewable energy facilities that can support a home, farm or business.

- **Implementing Recommendations in Residences.** A surprising, yet common, challenge has been getting residents to sign up for an energy efficiency program (such as MASS SAVE) and in executing the recommended improvements. Pre-weatherization obstacles such a knob and tube wiring, asbestos and vermiculite, and existing moisture problems often impede the HEAT loan and subsequent weatherization services for households served through the residential MASS SAVE program. It is up to the home owner to have repair and abatement issues resolved prior to securing a HEAT Loan and having the MASS SAVE work completed. In addition to out-of-pocket costs that households may be unable to afford, there can also be a lack of experience in securing contractors who can do the mitigation services. Most applicants have little or no experience securing bids or estimates for this type of home repair.

  On the low-income side of the program there is repair money available through the Community Action network to take care of many of these pre-weatherization obstacles at no cost to the customer. The Community Action agency takes care of all bidding and job specifications and can generally use a combination of federal and utility efficiency

funds as long as the repairs lead directly to the installation of energy improvement materials.

- **Funding.** Funding has almost always been a constraint for residents, businesses, and municipalities. While an investment in energy efficiency upgrades will result in energy savings, they are often not implemented because of high capital costs and long payback periods as well as uncertainty about the future price of energy. The major obstacle is knowing about existing funding and follow-through. Implementing programs, such as MASS SAVE and the HEAT Loan Program and Energy Performance Services Contracts that provide funding to help defray the upfront costs, will be critical in moving forward.

- **Renter Constraints.** As shown in the Housing Chapter of this Plan, there are many residents who rent in Franklin County. Furthermore, given the quality and age of the rental housing stock there are concerns about energy efficiency. Renters typically have little opportunity to make energy efficiency upgrades in rental units. In order to move towards a more sustainable Franklin County, energy efficiency programs will need to be implemented that target rental units to improve the quality, safety and efficiency of the rental housing stock.

- **Transportation.** People are driving more than ever before. As cities become more expensive, rural communities can become more popular as people move away from urban centers in search of more land and lower housing costs. More fuel efficient vehicles and policies that guide development towards employment centers can reduce transportation fuel consumption.

CONCLUSIONS

Franklin County has made significant strides in the fields of clean and renewable energy, which have established a strong foundation for future work. However, there is much more work to be done to reduce dependence on fossil fuels and GHG emissions while also creating jobs and improving the economy. If successful, the payback for the County will be significant.

If, however, Franklin County continues with 'business as usual' energy consumption, we will experience negative impacts to our economy, environment, and quality of life. A more sustainable future for Franklin County requires us to strive to reduce energy use related to transportation as well as residential and commercial energy consumption in buildings.

The goals in this Plan align with the Massachusetts Clean Energy and Climate Plan for 2020 and the Pioneer Valley Clean Energy Plan. Reducing GHG emissions can be achieved through reductions in energy use as well as with replacing fossil fuels with green power sources for energy. Reaching these targets will be achieved primarily by addressing the building energy consumption, electricity sources and reductions in the transportation sector, as demonstrated in Figure 7.[21] To move towards a more sustainable future, Franklin County must achieve the following:

- **GHG Emissions:** Franklin County must achieve an additional emissions reduction of approximately 12 percent below 1999 levels by the year 2020. Long-term, Franklin County will aim to reduce carbon emissions by 80 percent below 1999 levels by 2050.
- **Energy Use:** Franklin County will aim to reduce the region's energy consumption by 15 percent below 2010 levels by 2020; and

[21] Massachusetts Office of Energy and Environmental Affairs, Massachusetts Clean Energy and Climate Plan for 2020, December 2010.

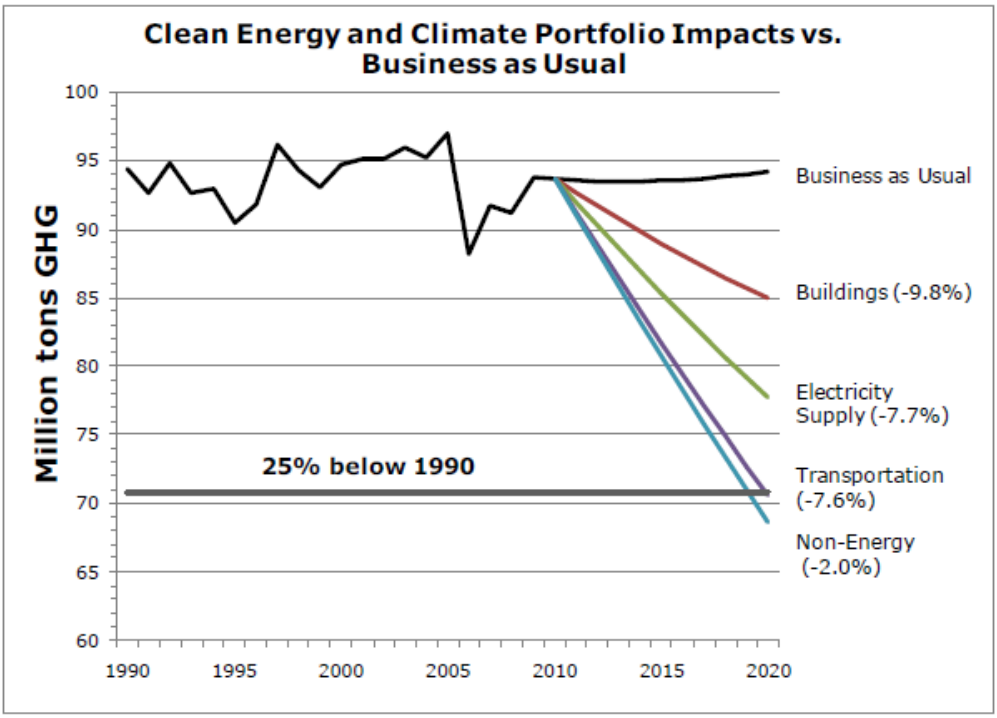
- **Green Power:** Continue to site additional green power across Franklin County that replaces fossil fuel use.

The following recommendations and strategies presented in this Plan support the move towards a self-sufficient energy future for Franklin County. This is a future that envisions decreased energy consumption and lower emissions as well as a diversify of clean energy sources, increased energy efficiency, and improved resiliency to the impacts of climate change. A more sustainable energy future for Franklin County is urgently needed and will result in increased energy security with positive implications for the environment, economy, and livability.

RECOMMENDATIONS AND STRATEGIES

The following table summarizes the strategies and recommendations to continue Franklin County's path toward a more sustainable energy future. Many of the recommendations presented herein will relate to and have an impact on other chapters of this Plan.

Figure 7: Massachusetts' emissions reductions by sector



Source: Massachusetts Clean Energy and Climate Action Plan for 2020

Table 1: Recommendations and Strategies for Energy	Implementation					Partnering Organization(s)*
	In Progress / Ongoing	0-5 Years	6-10 Years	11-15 Years	16-20 Years	
Reduce energy consumption across all sectors – transportation, residential, commercial and industrial – without sacrificing quality of life or economic opportunities						
Establish comprehensive energy use and emissions baseline inventories		X				FRCOG, Towns, MassCEC, DOER
Expand efficient transit service throughout the County	X	X	X	X	X	FRTA, FRCOG
Increase frequency and extend transit service hours during evenings and weekends		X				FRTA, FRCOG
Advance and promote passenger rail service and/or bus service for the north-south and east-west routes	X		X		X	FRTA, FRCOG, PVPC, MRPC
Promote ridesharing		X	X	X	X	FRCOG
Increase options for walking and bicycling	X	X	X			FRCOG, MassDOT, DCR, Towns
Invest in energy efficient mass transit options and low-carbon fuels		X	X			FRTA, MassDOT, FRCOG
Implement an Alternative Transportation Marketing Campaign	X	X				FRCOG, MassRIDES, MassDOT
Encourage telecommuting and flexible working for municipal employees	X	X	X			Towns
Develop a regional energy use campaign that educates and addresses user behavior	X	X				FRCOG, Towns, Energy Committees, Regional Energy Committee
Offer priority/free parking for Ultra Low Emissions Vehicles	X	X				Towns
Restrict idling throughout the County	X	X	X	X	X	Towns, Schools, Businesses, and Hospitals
Increase the number of Green Communities	X	X				Towns, DOER, FRCOG
Increase the use of solar hot water and electricity in homes and businesses		X	X			Housing Authorities, Towns
Decrease average daily time for street light operation	X	X				WMECo, National Grid, Towns
Install LED and induction lighting (street lights, facility lights, etc.)	X	X	X			Towns, Schools, Businesses, and Hospitals
Offer push mowers to residents at subsidized rates		X				Towns

See Page 18 of Chapter 4: Housing for a key to the Partnering Organizations abbreviations

Table 1: Recommendations and Strategies for Energy	Implementation					Partnering Organization(s)
	In Progress/ Ongoing	0-5 Years	6-10 Years	11-15 Years	16-20 Years	
Improve energy efficiency so as to reduce wasted energy						
Increase the number of Green Communities	X	X				Towns, DOER, FRCOG
Increase the number of communities adopting the Stretch Energy Code	X	X				Towns, DOER, FRCOG
Extend and enhance financing for energy efficiency improvements for homes, rental housing and businesses		X	X	X	X	Towns, MASS SAVE, Community Action, Housing Authorities, Franklin County Home Care
Increase the number of Towns with Energy Committees	X	X				Towns, FRCOG, Regional Energy Committee
Develop tree planting efforts to reduce Heat Island Effect in Town Centers	X	X				Towns
Require disclosure of energy efficiency at point of residential and commercial sale		X				Realtors, Local Realty Associations
Develop strategies to incentivize energy efficient appliances in residential and commercial properties		X	X			Towns, MASS SAVE, Utilities
Develop a county-wide marketing strategy for weatherization programs and workshops	X	X				Towns, Energy Committees, Regional Energy Committee
Provide a system of recognition for new construction and renovations which voluntarily exceed minimum standards for energy conservation		X	X			Chamber of Commerce, Regional Energy Committee
Establish small business grants for energy efficiency upgrades		X	X	X	X	Business Associations, Towns
Encourage greater participation in energy efficiency and conservation programs		X	X			Community Action, MASS SAVE, Towns
Continue to retrofit energy efficiency measures to public housing	X	X	X			Community Action, Housing Authorities
Reduce the impacts of emissions and extreme weather events						
Promote urban tree planting to increase shading and to absorb CO_2		X				Towns, Energy Committees
Implement green yard campaigns and eliminate the use of chemicals/pesticides and fertilizers in lawns and parks		X				Towns, Energy Committees
Maintain healthy forests		X	X	X	X	DCR, Towns
Adopt Low Impact Development (LID) Bylaws in Towns		X	X			Towns
Protect land dedicated to food production	X	X	X	X	X	Towns, MDAR, CISA, Land Trusts

Table 1: Recommendations and Strategies for Energy	Implementation					Partnering Organization(s)
	In Progress / Ongoing	0-5 Years	6-10 Years	11-15 Years	16-20 Years	
Reduce waste						
Implement a pay-as-you-throw collection for non-recyclable trash	X	X				Towns
Implement community-wide organics and yard debris collection and composting	X	X				Towns
Offer rain barrels and composting bins to residents at a subsidized rate		X				Towns, Franklin County Sewer & Water District
Adopt a water conservation ordinance		X				Towns
Implement free household electronic/hazardous waste disposal programs	X	X				Towns
Install water-saving toilets and showers in municipal buildings and public housing		X				Housing Authorities, Towns
Promote water conservation activities in homes and businesses	X	X				Towns, Housing Authorities, Energy Committees
Site new green energy and support the local economy						
Offer incentives to foster renewable energy installations in the community		X	X			Towns
Adopt a 'buy local' purchasing policy in schools and municipalities		X				Towns, Schools
Promote community clean energy use through green power purchasing or on-site renewable technologies	X	X	X	X	X	Towns, MassCEC
Create a website outlining sustainability issues and providing information on local green businesses, jobs and training opportunities		X				GCC, FHREB

BENCHMARKS

In order to ensure that the energy goals of this Plan are implemented, the following benchmarks are suggested as milestones. The benchmarks are data-driven and can be evaluated in various contexts over time.

TABLE 2: Energy Benchmarks

Performance Measure	Unit of Measurement	Desired Trend	
Carbon Emissions	Percent change of emission levels	Decrease	
Overall Energy Use	Percent change	Decrease	
Residential Energy Use	Change in MMBTU/HH	Decrease	
Per Capita Vehicle Miles Traveled (VMT)	Percent change of VMT	Decrease	
Transportation Emissions	Percent change of emission levels	Decrease	
Green Power Facilities	Change in kWh	Increase	
Green Communities	Number of Green Communities	Increase	
Community-Wide Energy Programs	Number of Communities with Programs	Increase	
Stretch Energy Code	Number of Communities Adopting	Increase	
Energy Efficiency Upgrades	Number of Buildings with Completed Projects	Increase