# Development of an Energy Reduction Plan for the Town of Auburn

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by

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The Town of Auburn, MA

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## Abstract

The goal of our project was to draft an Energy Reduction Plan (ERP) for the town of Auburn, MA. In recent years many communities have developed their own Energy Reduction Plans due to the increasing use and cost of energy. The development and creation of this plan will help Auburn be more energy aware and save money. We distributed surveys and held interviews to understand the opinions of Auburn residents and business owners regarding energy reduction options. Our findings will help the town in developing the Energy Reduction Plan and save energy in the future.

## Acknowledgements

We would like to take this section to thank all of the people who have aided us in the past semester. Our final project would not have been possible without the contribution of the following people.

First we would like to thank our project sponsor Adam Burney. Adam is Auburns town planner and without his support, three WPI project teams would not have been able to have such successful projects. Adam set up contacts with us with local business owners around auburn, which gave us great information. We would also like to thank Adam for helping us reach a level of professionalism within our project that without his unwavering support and advice we would not have been able to achieve.

We would also like to thank the entire Auburn School District. Dr. Maryellen Brunelle, the superintendent of Auburn schools, allowed us to distribute our surveys within the Auburn schools. Without her approval of our project, we would not have received the amount of substantial information we collected. To all the teachers that assisted us with distributing and collecting surveys to the students, a big thank you. And lastly thank you to the secretaries that assisted us when we dropped off and received the completed surveys.

Also, thank you to Karen Ares, the Auburn High School environmental club advisor. She allowed our team to organize an event an Earth Day event for Auburn High school. With her help we were able to spread the message of energy reduction in Auburn and gain interest in the green flag award for Auburn High School.

Additionally we would like to thank all of the business owners that took time out of their busy schedules to talk with us. They were very helpful in dispensing information on how the commercial sector of auburn handles energy reduction.

Finally we would like to thank our advisors Corey Dehner and Dominic Golding. Throughout the entire course of the semester they helped us develop a project from concept all the way to completion. Their help and guidance in all aspects of our project has been incredible. Without their constant revisions, weekly meetings, and immense amount of work, we would not have this final product about which we are so proud.

## Executive Summary

Climate change is a controversial topic with staunch opponents and supporters on both sides of the argument. Some believe that climate change is occurring while others do not. Some individuals agree that climate change is occurring but it is an inevitable process, while others argue its anthropogenic nature and call for immediate action. Climate change refers to any substantial change in measures of the climate over a period of time. On a global level, the 2000-2010 decade was the warmest decade on record. Since 1970, the Earth's average annual temperature has increased by 2°F (North America Space Association 2010). If no action is taken, the advanced temperature and Green House Gas (GHG) effect could create devastating storms, lengthen mosquito seasons, and stunt crop production.

Fossil fuels, including coal, oil, and natural gas, emit hazardous pollutants when burned. These pollutants rise into the Earth's atmosphere and contribute significantly to the total GHG effect. Fossil fuels can be referred to as nonrenewable resources. These energy sources require millions of year to form and waste billions of dollars each year to transport (Energy Story 2012). Renewable resources emerged as a green alternative to burning fossil fuels. These resources generate electricity from the wind, sun, earth, and water. Currently, only 9% of the United State's energy is generated from renewable resources (EPA 2013). This can be attributed to a need for further engineering and production improvements. Nonrenewable resources are currently used in everything from plastic production to international transportation and trade and their use is unlikely to cease (IER 2013). Therefore, the best way to currently save fossil fuels is by conserving energy.

In response to concerns about fossil fuels and pollution, various policies have been created on international, national, and local levels to combat the issue. ICLEI, Local Governments for Sustainability, is an international organization that serves to help local governments take responsibility of their community's energy consumption by providing them with resources to create customized Climate Action Plans. ICLEI provides a five-milestone process towards environmental sustainability. These milestones include: conducting baseline emissions, adopting an emissions reduction target, developing a local action plan, implementing policies, and monitoring results.

Our project was to complete the third milestone of the ICLEI process for the town of Auburn, MA. Two previous WPI project groups completed the first and second milestones for us. They left us with Auburn's emissions inventory and a set of project recommendations. The most useful recommendation suggested that our group create an Energy Reduction Plan rather than a Climate Action Plan for the town. We yielded to their suggestion and accordingly changed our goal to the creation of an Energy Reduction Plan for the town. We broke this goal into four separate objectives. Our objectives were as follows: identify key energy reduction strategies, solicit feedback from stakeholders, develop the Energy Reduction Plan, and promote awareness of energy reduction strategies. A second goal for our project was to aid Auburn High School towards receiving the Green Flag Award. This is a prestigious award given out by the National Wildlife Federation that recognizes schools who are leaders of environmental sustainability.

Methods and Findings

Our first objective was to identify key energy reduction strategies. We did this by reviewing Auburn's emissions inventory and reviewing previous CAP and ERPs. This gave us a generalized idea about the entailments of our project.

Our second objective was to solicit feedback from various stakeholders. To do this we interviewed with municipal employees and business owners. We also sent 1800 surveys home to the parents of all five Auburn elementary and middle school students. This was the bulk of our project as it provided us with Auburn specific statistics that were used to create the plan.

Our third objective was to develop the Energy Reduction Plan. We accomplished this by reviewing and incorporating a document written by previous WPI project member, Ilya Chymkh. This document outlined energy saving strategies for homeowners. The second document we used was an Energy Reduction Plan written by Auburn's town planner, Adam Burney. This plan focused on the municipal sector of the town. Our survey and interview results dramatically influenced our plan, allowing us to include Auburn-specific suggestions and statistics.

Our fourth objective was to promote awareness of energy reduction strategies. To do this, we created and distributed a brochure that elucidated energy reduction facts and

strategies residents could incorporate into their daily lives. Additionally, we created a commercial educating Auburn resident about vampire energy.

To complete our secondary objective, the passage of the Green Flag Award our team met with Karen Ares, Auburn High School's Environmental Club advisor, and worked with her to plan an Earth Day Event to promote environmental awareness and gain Green Team membership.

Recommendations

Our project has given the town of auburn useful information and data to further develop and implement their Energy Reduction Plan. We have formulated these additional recommendations for those individuals who plan to continue our work in aiding the town of auburn in the continuing development of their Energy Reduction Plan.

- Continue gathering community support for the ERP by holding community meetings, public forums, and conducting additional surveys.
- Conduct additional business owner interviews to reach out to the commercial sector of Auburn about energy reduction.
- Additional meetings with the wind energy committee to gain their support in championing this plan.
- Meet with the town's Board of Selectman to gain their support of Auburn's ERP.
- Hold an Auburn Earth Day event to reach out to the Auburn community, which would benefit Auburn High Schools efforts towards the Green Flag Award.

With these recommendations taken into consideration, our team is confident that Auburn can successfully pass and implement an Energy Reduction Plan.

## Authorship

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## 1.0 – INTRODUCTION

If no action is taken, the climate of New England will likely resemble that of North Carolina by the end of 2099 (Climate Change: Northeast, 2012). There is a strong consensus in the nation and international scientific communities that climate change is occurring. The United States Environmental Protection Agency agrees with this claim, and that human activities are the main contributor to increasing green house gas emissions (USGCRP, 2009). Some of the adverse impacts of increased green house gas emissions can range from the melting of the polar ice caps to sea level rise to the prolonged mosquito, tick, pollen and mold seasons in New England. In order to prevent the effects of ongoing climate change, immediate action must be taken.

Despite the immense gravity of this issue, the United States government has yet to make any meaningful commitment to addressing climate change. However, states and municipalities are not waiting for the federal government to act. Organizations such as International Council of Local Governments for Sustainability (ICLEI) have emerged and are working with local governments to lower carbon dioxide emissions. ICLEI is an association of international, national and local governments comprising 12 mega-cities, 100 super-cities and urban regions, 450 large cities as well as 450 small and medium-sized cities and towns in 84 countries. ICLEI provides a five-step framework for creating, implementing and evaluating a climate action plan (CAP) (ICLEI 2012).

Our team helped to facilitate local action by drafting an Energy Reduction Plan (ERP) for the town of Auburn, Massachusetts. An ERP is a document that details what the towns' residents, businesses and municipal sectors can and will do to reduce greenhouse gas emissions and energy consumption. Though ICLEI's framework is intended for use in the development of "climate action plans," (CAPs) we focused more narrowly on the

development of an energy reduction plan (ERP) for Auburn (see section 2.7), since this was deemed more practical for Auburn's needs and more likely to gain political support and traction. Political support is essential, since the Energy Reduction Plan, must be approved by the town before it can be implemented. The ERP will help the town of Auburn become more energy efficient, thereby improving the environment and reducing the town's energy costs. We worked closely with Auburn's town planner, Adam Burney to accomplish this goal. Mr. Burney has been leading the energy reduction efforts for the town of Auburn, and championed the initiative for Auburn to become an ICLEI member.

Promoting energy reduction requires raising awareness about energy consumption and potential energy saving measures. As part of the effort to raise awareness, our team assisted Auburn High School (AHS) in moving towards the Green Flag Award. The Green Flag Award is a highly prestigious honor awarded to schools whose students and faculty show exemplary efforts in environmental conservation and energy reduction. Currently, only ten K-12 schools have received this award nationwide. Even though our influence was limited given the time available, we believe that we helped bring enthusiasm about the Green Flag Award to Auburn High School especially by recruiting many students to join the effort.

In the following chapters we contextualize our project describing some of the background behind climate action and energy reduction plans and our proposed methodological approach to the project. In chapter 2.0, we discuss some of the causes and impacts of climate change as well as state, regional and municipal level initiatives to counteract climate change. Also in chapter 2, we explain the ICLEI framework for drafting a climate action plan. In chapter 3.0 we describe our methodological approach to drafting Auburn's ERP and working with the AHS to achieve a Green Flag Award. The findings from our surveys and business owner interviews have identified numerous opportunities for residents and businesses to save money by reducing energy. Our separate draft energy

reduction plan highlights some of the major energy reduction options as well as the strategies the town of Auburn may pursue to encourage residents and businesses to adopt them. The successful passage of Auburn's Energy Reduction Plan will help residents and business owners save money, reduce local carbon emissions and set an example for other towns. Every little step makes a difference and if Auburn supports the ideas of energy reduction and awareness, this plan has the promise of serving as a model for other municipalities.

## 2.0 – BACKGROUND

Climate change is a politically charged topic about which there are many conflicting opinions. Some individuals argue that immediate action must be taken to stop climate change while others deny its significance. Some believe it is happening but do not care enough to change, while others believe it is happening but do not believe that humans are the primary cause and therefore there is little we can or should do to try to control it. The goal of this project was to draft an Energy Reduction Plan for the Town of Auburn, Massachusetts that will benefit Auburn residents both financially and environmentally.

We begin with a broad discussion of climate change and then move to a discussion on different types of energy sources. In section 2.3, we discuss government action taken to combat climate change, beginning at the international level with a discussion of various United Nations policies, including the Kyoto Protocol. Then we move on to a discussion of national efforts within the United States Environmental Protection Agency, and finish with a focus on the efforts within the state of Massachusetts including the Mass Save program and Green Communities Act. We discuss nongovernmental efforts such as Regional Greenhouse Gas Initiative (RGGI) and Local Governments for Sustainability (ICLEI). In section 2.4 we discuss the importance of climate change mitigation and provide details about efforts in Auburn, Massachusetts specifically. In section 2.5, we discuss a variety of different Climate Action Plans and address their similarities and innovations. In section 2.6 we discuss the Green Flag Award and explain its utility for Auburn's Energy Reduction Plan. We conclude in section 2.7 with an explanation of the efforts of the previous WPI students who worked with the town on development of its' Energy Reduction Plans they will elucidate the starting point of our efforts.

## 2.1 - Climate Change

Climate Change refers to any substantial change in measures of climate over a period of time, such as changes in temperature, precipitation, and wind patterns (Glossary of Climate, 2013). On a global level, the 2000-2010 decade was the warmest decade on record. According to the National Oceanic and Atmospheric Administration, 2012 was the hottest year on record for the United States (NOAA, 2012) and the average annual temperature in the northeastern United States has risen by 2° F since 1970 (North America Space Association 2010). These temperature increases may appear small, but they can have severe adverse impacts on ecosystems (USGCRP, 2009). These changes in temperature are attributed to the increase of greenhouse gases in the atmosphere, primarily from human activity.

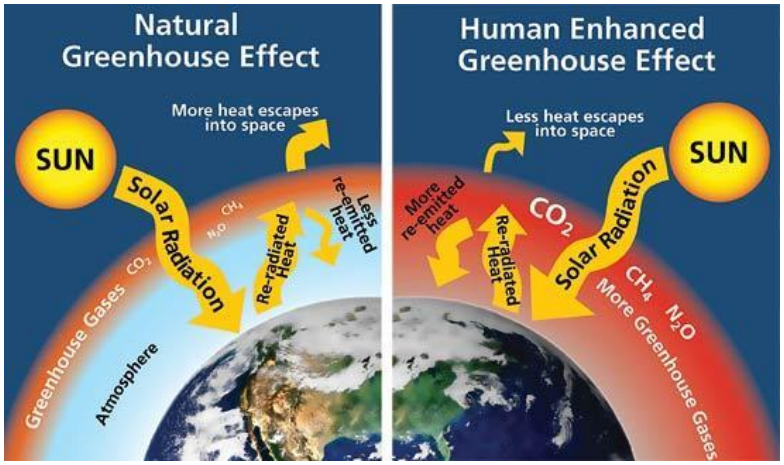


Figure 1

"The Greenhouse Gas Effect"
Source: (Elder, 2012)

### 2.1.1 - Greenhouse Gases

The Greenhouse Effect is the result of heat radiating from the sun, to the Earth, then back to the atmosphere. Once that heat is in the atmosphere the greenhouse gases (GHGs) trap it and re-radiate it back down to Earth, as shown in Figure 1. The greenhouse

effect is actually essential for life on Earth; since without it global temperatures would be about 0° F instead of the current 57°F average (Global Warming, 2007). GHGs are composed of carbon dioxide, methane, nitrous oxide, and various fluorinated gases (Green House Gas Overview, 2012). The continuous burning of fossil fuels increases the amount of GHGs in the atmosphere, thus increasing the Earth's temperature, as shown if Figure 2 (Causes of Climate Change, 2013).

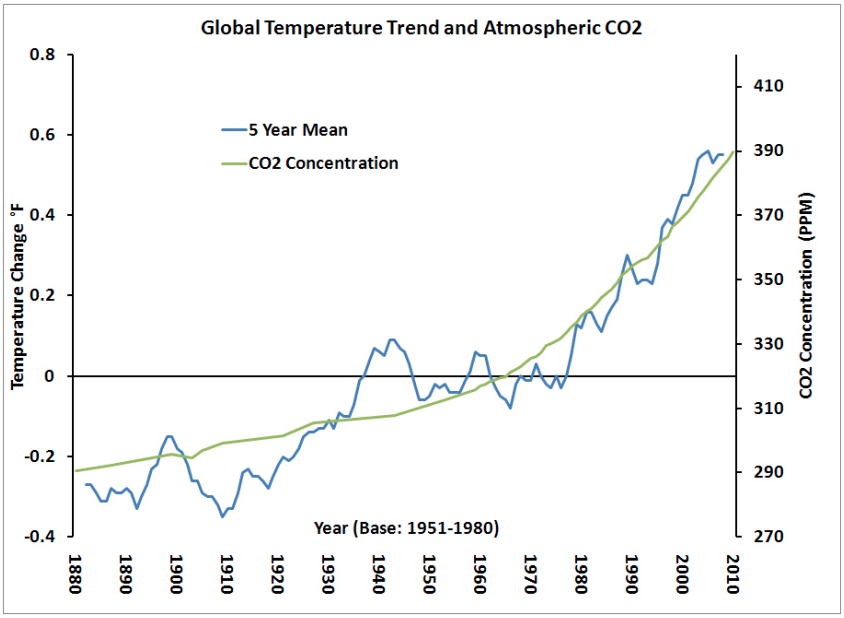


Figure 2

"Global Temperature Trend and Atmospheric $CO^2$"
(Center for climate and Energy Solutions, 2012)

### 2.1.2 - Effects of Climate Change

In 2009 many scientists and researchers collaborated to compile a comprehensive report on climate change entitled Global Change Impacts in the United States. According to this climate assessment and as shown in Figure 3, over the next 100 years Boston could

experience a substantial increase in the number of days with temperatures above 90°F,(USGCRP, 2009). The increase in the number of warmer days could have a serious impact on human health, the environment, and the economy.

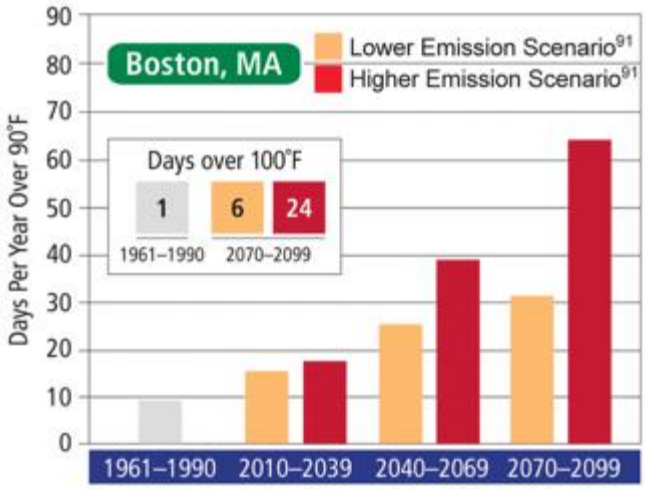


Figure 3

"The Trend of Hotter Weather in Boston, MA"
(USGCRP 2009)

### 2.1.3 Human Health Impacts

The Center for Disease Control and Prevention warns that in days of extreme heat, the elderly, young children, and people with chronic illness are more prone to heat-related illness (Extreme Heat, 2011). In New Jersey each year, more than 1,200 people are treated for heat related illnesses, and upwards of 170 have been hospitalized, the majority of which are males between the ages of 65-84 (New Jersey Department, 2008). If the number of hot days increases as predicted in Figure 3, an increase in hospitalizations and deaths due to the extreme heat can be expected.

West Nile virus is a potentially life threatening illness caused by infected mosquitos and is prevalent during the warmer months of summer into fall in the Northeast US. This illness has the ability to induce high fevers, tremors, convulsions, paralysis, and even coma.

Mosquito season will increase due to the prolonged warm season. If this occurs, humans and animals will be at an increased risk of West Nile virus, especially in Massachusetts where the mosquito population is abundant during the warmers seasons. (Climate Change: Northeast, 2012).

A key finding in the 2009 National Climate Assessment, completed by a team of climate scientists operating under the power of the Federal Advisory Committee Act, was that many United States coastal areas are at increased risk of flooding, pollution and storm damage because of the increasing sea levels. Seventy-five percent of Americans live within 50 miles of a coastline, as sea levels continue to rise due to melting ice caps and increased rainfall, these areas are in the risk zone (USGCRP 2009). This risk is not imagined or abstract, but is very real, as we saw during the October 2012 Hurricane Sandy. This storm caused a record surge of 13 feet in New York City that flooded properties and subways in lower Manhattan (Climate Change and Hurricane Sandy, 2012). These events reveal the tremendous damage that rising sea levels and increased storms may have in the Northeastern United States..

Rising sea level could also contaminate the coastal freshwater wetlands, placing the surrounding ecosystem at risk (Responses of Coastal, 2002). Rising sea levels will bring salt water into coastal wetlands and dramatically alter the fauna and flora, and likely lead to excessive coastal erosion.

If something is not done to curb the increase in GHG emissions within the next century, the climate of New Hampshire could become similar to that of North Carolina (USGCRP, 2009). This climate shift impacts everybody. People who once relied on the northern climate for work will have to search for new employment opportunities. It is expected that rising temperatures will have dramatic impacts on the skiing industry,

agriculture, and forestry in the northeast. This recent realization of the harm that GHGs do to our environment has led to interest in different ways of acquiring energy.

## 2.2 – Sources of Energy in the United States

"Energy makes change possible" (EIA 2012). Without energy, cars would be immobile, homes would be cold in the winter and warm in the summer, and modern day lighting would not exist. Energy sources fall into one of two distinct categories: renewable and nonrenewable resources. Both of these resources have the ability to generate electricity, power vehicles, and provide heating, cooling, and light. Despite their similarities, significant differences exist between the two types. These differences are displayed in Table 1, and explained in the following sections.

*Table 1: Comparing Renewable and Nonrenewable Resources in the U.S.*

| | **Renewable Resources** | **Nonrenewable Resources** |
|---|---|---|
| Examples | • Sun<br>• Earth<br>• Water<br>• Wind<br>• Biomass | • Coal<br>• Oil<br>• Natural Gas<br>• Nuclear Energy |
| Lifetime | Replenished indefinitely through naturally occurring processes | Require millions of years to create |
| Domestic or Foreign | Generated and used domestically | 11% of total oil is produced by U.S. the rest we purchase from foreign sources |
| Cost | Relatively expensive installation costs | Low retrieval cost |
| How are they obtained? | • Dams<br>• Windmills<br>• Farming<br>• Drilling | • Mining (Strip and subsurface)<br>• Drilling<br>• Splitting Uranium atoms |
| Energy Used Nationwide | 9% from Renewable Energy | 85% from Oil, Natural Gas, and Coal<br>6% from Nuclear Energy |

(EPA 2013)

### 2.2.1 - Renewable Resources

Renewable resources are energy sources that are replenished continuously (National Atlas 2013). Renewable sources harness energy from water, wind, plants, sun, and the Earth's core. As long as human life remains prevalent on this plant, these resources will be around and will be able to be sustained indefinitely. Today, only approximately 9% of American energy comes from renewable resources (National Atlas 2013).

### 2.2.2 - Nonrenewable Resources

There are two forms of nonrenewable resources: fossil fuels and nuclear energy (Darvill 2012). Coal, oil, and natural gas are deemed "fossil fuels" because they originate from the remains of prehistoric plants and animals (Darvill 2012). Nuclear power stations generate energy by splitting atoms of uranium, which is a heavy metal mineral mined in various parts of the world (Darvill 2012). Nonrenewable energy sources cannot be replenished in a thousand lifetimes. Once depleted, it will take millions of years for more to form naturally (Nonrenewable Energy 2013). Currently, 86% of United States energy is derived from these sources (Nonrenewable Energy 2013).

### 2.2.3 - Comparative Advantages

As illustrated in Table 2 (below), both renewable and nonrenewable resources have significant advantages. Since the Earth continuously replenishes renewable energy sources, there is no fear of running out of energy. They do not release significant pollution and do not directly harm human health (National Atlas 2013). Since technology is continuously improving, renewable energy promises a great deal of potential for future advancement and

job creation (Energy Story 2012). Renewable energy sources are manufactured domestically and increasing their use would lessen U.S. dependence on foreign oil (EIA 2013).

Nonrenewable resources, specifically fossil fuels, are easily extracted from the Earth and transported through underground pipelines (Energy Story 2012). Oil is extremely useful and is used in fertilizers, clothes, and nearly all plastics (Energy Story 2012). Oil is called the "transportations fuel" as it moves people and goods around the world. It has had a profound impact on current societies, transforming business and trade by easily flowing through pipelines around the world (IER 2013). Additionally, oil refineries can be built anywhere that raw oil can be delivered (Darvill 2012). These refineries produce usable energy in the form of gasoline, 24 hours a day, 365 days of the year, regardless of weather or other conditions (EIA 2013).

*Table 2: Comparative Advantages*

| Renewable Resources | Nonrenewable Resources |
|---|---|
| • Continually replenished by Earth<br>• Do not release pollutants<br>• Sustainable for the long term<br>• Breadth of opportunities not yet tapped (or something similar)<br>• Do not harm human health, directly or indirectly | • Produced continuously<br>• Unlimited locations<br>• Low cost of burning fossil fuels<br>• High energy yield and efficient<br>• Easily transported |

### 2.2.4 - Comparative Disadvantages

As expected, both renewable and nonrenewable energy resources also have profound disadvantages that are displayed in Table 3.

Solar panels require wide tracks of land to absorb a substantial amount of sunlight. These effect the natural environment by disturbing the vegetation and animal life in selected areas (Energy Story 2012). The production of photovoltaic cells uses toxic chemicals that can leach into the environment (Energy Story 2012). Hydroelectric dams generate electricity, but drown communities, farmland, and forests (Energy Story 2012). Dams can also prevent fish migrations, change downstream chemical, biological, and physical characteristics of rivers and land, and may result in earthquakes (Energy Story 2012). Wind energy requires 17 acres of land to produce 1 megawatt of electricity, which powers between 750- 1000 homes (Energy Story 2012). This is a vast amount of land, however, it can be used to raise cattle or as farmland, diminishing its negative effects. Biomass also requires a great deal of land and releases greenhouse gasses during its production process. However, replanting of crops closes the carbon dioxide cycle, making biomass an environmentally friendly option (Energy Story 2012).

Similarly, non-renewable resources have their share of disadvantages. Significant disadvantages of nonrenewable resources are the Greenhouse Gas Emissions that result from burning fossil fuels as well as water pollution from the mining retrieval process (Davill 2013). The consequences of this are explored in section 2.1. Once oil is retrieved, it must be transported to its desired destination using extensive pipeline networks, trains, boats, and trucks, all of which use gas (Energy Story 2012). In 2000, the United States spent $109 billion importing crude and refined oil (Energy Story 2012). Increasing usage of domestic energy sources, such as renewable energy, could drastically decrease this number. Imported or domestically-produced crude oil must be refined. Oil refineries cost billions of dollars to

implement and many millions more to maintain (EIA 2013). When considering maintenance, employee, and land costs, non-renewable energies end up costing more than renewable energies (EIA 2013).

*Table 3: Comparative Disadvantages*

| Renewable Resources | Nonrenewable Resources |
|---|---|
| • High initial costs<br>• Require Installment<br>• Weather and location dependent<br>• Geothermal energy can surface toxic chemicals<br>• Dams affect wildlife | • Release smog-precursors such as sulfur dioxide, nitrogen oxides, carbon dioxide, and carbon monoxide<br>• Sub-ocean oil drilling destroys marine life<br>• Coal mining induced erosion and destroy natural habitats<br>• Transportation of oil is a wasteful process |

Overall, a perfect energy source does not yet exist. Renewable energy holds potential for many improvements, particular with regard to environmental impacts. As renewable energy technology advances, its use will become more widespread (IER 2013). Nonrenewable energies, specifically fossil fuels, are used in production and transportation. Their use is unlikely to be eliminated in the near future, so for now, the best way to minimize the use of fossil fuels is to conserve energy. Which is what will be discussed in the next section.

### 2.3 - Government Action

In response to concerns about fossil fuels and pollution, various policies and programs have been created on international, national, and local levels.

### 2.3.1 - International

According to the Intergovernmental Panel on Climate Change (IPCC), human emissions have increased by 70 percent between 1970 and 2004 (IPCC 2007). The first international action taken towards addressing climate change did not occur until 1992. On May 9, 1992, the United Nations Framework Convention on Climate Change (UNFCCC) passed the Kyoto Protocol, which was signed by an overwhelming majority of nations, including the United States over the subsequent months (UNFCCC 2013). The treaty's purpose was to propose a voluntary, legally non-binding pledge that developed countries would create action plans to reduce their greenhouse emissions to 1990 levels by the year 2000 (CRS 2007).

By the year 1995, international climate advocates deemed UNFCCC actions insufficient and proposed a more forceful approach that became known as the Kyoto Protocol (UNFCCC 2013). The objectives of this agreement were similar to the UNFCCC and aimed to combat the greenhouse gases compiled from 170 years of industrial emissions. However, unlike the UNFCCC, the Kyoto Protocol proposed legally binding emission reduction targets (UNFCCC 2013). Currently, 191 states have signed and ratified the protocol. Unfortunately, the United States is not included on this list.

In 1998, President Clinton submitted the protocol to the Senate for approval, but it did not pass. In March 2001, the Kyoto Protocol was sent to the Bush Administration, which rejected it. Instead, the administration announced that the United States would rely on voluntary "greenhouse gas intensity" reduction actions to reduce emissions by 18% within the next 10 years (CRS 2007). The lack of binding measures leaves ample room for inaction. The United States has failed to commit to climate action. For this reason, more localized actions must be taken to reduce greenhouse emissions

### 2.3.2 - United States

The Environmental Protection Agency (USEPA), established via executive order in 1970, is a United States agency that is charged with protecting human health and the environment by implementing numerous federal environmental statutes (EPA 2013).

When Congress passes an environmental law and charges the EPA with administering it, the EPA implements the law by passing regulations, which often set national standards for compliance. These standards are then imposed on state and tribal governments. In some states, the state environmental agency will be given control, in addition to the EPA, over enforcing the particular regulatory requirements; in other states, the USEPA solely retains that right (EPA 2013).

The Clean Air Act (CAA) is a federal law that regulates the air emissions of all states and is overseen by the EPA and other state environmental agencies. Pursuant to the CAA, the EPA has established National Ambient Air Quality Standards (NAAQS) to protect public health. Each state has its own implementation plan to appropriately fit specific and unique aspects. Many of these hazardous emissions come from mobile sources and specifically automobiles. If a majority of drivers are operating fuel-efficient vehicles, then they can cut down on their emissions significantly (EPA 2013). The EPA is also developing "Common-sense Regulatory Initiatives" to reduce the greenhouse gas emissions and increase the efficiency in their regulation. They have also been partnering with private energy and climate programs that volunteer their help. Together they have reduced over 345 million metric tons of greenhouse gases in 2010 alone. This saved consumers and businesses about $21 billion. In addition the EPA is monitoring emissions from their own energy use with a goal of reducing their emissions by 25% by the year 2020.

The U.S. Global Change Research Program (USGCRP) is a program that coordinates and integrates Federal research on changes in the global environment and their

implications for society. The USGCRP is a collaborative effort involving thirteen Federal agencies to evaluate the current and future impacts of climate change, inform policy-makers and the public about scientific findings, and investigate effective ways to reduce greenhouse gas emissions and deploy cost-effective clean energy technology. Established by the Global Change Research Act of 1990 the USGCRP is also responsible for executing the quadrennial National Climate Assessment, a comprehensive inventory of climate-change-related impacts, vulnerabilities, and efforts across the United States (USGCRP 2011).

### 2.3.3 – Massachusetts

Massachusetts has been promoting many different ways to reduce energy use and encourage the use of sustainable energy. This ranges from the passing of the Green Communities Act to the programs in place such as Mass Save.

#### *2.3.3.1 - Green Communities Act*

Massachusetts has taken strides to address and shown its awareness of climate change. The Green Communities Act (GCA), signed by Deval Patrick in 2008, was a step in the direction of change. This act encourages the building of green structures, towns and cities, businesses and the use of renewable energy. The GCA requires utilities to increase their investments in energy efficiency. It also requires that the recognized Green Communities design and implement three-year energy efficiency plans for gas and electric utilities. Another requirement of the GCA is that by 2020, 15 percent of the electricity supplied to these communities comes from renewable power utilities. As part of the GCA, funding for efficiency measures is to come from the auction of earnings from power plant pollution (Reid, S., & Cleveland, S. 2013).

Massachusetts has also created the Global Warming Solutions Act, which is a grouping of suggested methods for reducing greenhouse gas emissions and energy use. This works in part with what the EPA and certain separately operated programs, such as Mass Save.

#### *2.3.3.2 - Mass Save*

Mass Save is an initiative sponsored by the gas and electric utilities suppliers and energy efficiency service providers of Massachusetts. They help anyone from homeowners, to businesses and other industries. The Mass Save program provides homeowners and business owners with many ways to help you save energy. Mass Save offers new construction and equipment as well as building or equipment upgrades. Mass Save offers free home energy assessments to help save energy in the most cost effective way. These free energy audits come from a portion of the monthly utility bill that customers pay to energy companies that sponsor the Mass Save program. When conducting these energy audits the auditor gives the homeowner energy efficient light bulbs, programmable thermostats, and low flow showerheads at no additional cost to the homeowner. These energy companies that do business with Mass Save include NSTAR and National Grid. Mass Save could also qualify homeowners with no-cost loans if they apply. There are also other money saving incentives offered for saving energy such as discounted appliances and rebates on home insulation and possibly even home solar panels (Mass Save, 2013).

Mass Save has incentives for contractors that partner with them as well. One of the incentives offered is installation of energy efficient equipment for participation in Mass Save programs (Mass Save, 2013). Mass Save is only one program that helps to reduce the use of energy among residents, but there are many other organizations that hope to achieve the same goal but at a bigger scale.

## 2.4 - Nongovernmental Action

Some organizations have taken notice of the problems at hand and chosen to step in and try to make a difference. Some of these programs are the Regional Greenhouse Gas Initiative and Local Governments for Sustainability.

### 2.4.1 - Regional Greenhouse Gas Initiative

The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort among nine states in the northeast, including Massachusetts, which has the goal of reducing the amount of greenhouse gases in the atmosphere. The severity of this reduction depends on each state's specific goals. RGGI creates a regional cap on the amount of $CO_2$ emissions that power plants can release by the creation of tradable $CO_2$ allowances that are then traded in auctions (About the Regional, 2012). This program is a very innovative way of thinking about $CO_2$ emissions, because the proceeds of the auctions go back to the states and are reinvested in consumer benefit programs such as renewable energies, improved energy efficiency, and other greenhouse gas reduction programs ($CO_2$ auctions, 2012). In the 2009 auctions alone, Massachusetts yielded more than $50 million, the majority of those proceeds went to electric utility-administered efficiency programs which were run by Cape Light Compact, National Grid, NStar, Unitil and Western Massachusetts Electric Co. The rest of the proceeds went towards more energy efficiency and renewable energy programs such as the Green Communities Program (Summary of Investment, 2012).

### 2.4.2 - ICLEI

In 1990 ICLEI, Local Governments for Sustainability was established when over 200 local governments from 43 countries met at the United Nations in New York City. 'Local Governments for Sustainability' is the world's leading association of cities and local governments dedicated to sustainable development.

> *"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs." (*WCED, 1987)

Since its establishment, ICLEI has helped 12 mega-cities, 100 super-cities and urban regions, 450 large cities as well as 450 small and medium-sized cities and towns in 84 countries develop more environmentally friendly economies (ICLEI 2008).

ICLEI USA is its own independent organization that helps Americans along with 1000 local governments worldwide create a cleaner environment. Figure 4 shows all the local governments across the United State that work with ICLEI to prevent future impacts of climate change and aid in energy reduction measures. The map shows that many of town and cities throughout the New England states support the ICLEI process to help their communities become more energy efficient.


Figure 4

"A Map of ICLEI Communities in America"
(ICLEI 2013)

Communities across the globe can become a part of ICLEI by joining the Cities for Climate Protection (CCP). In order to join the CCP a community's local government must

pledge to reduce greenhouse gas emissions throughout the community. Once a town or city is part of the CCP, ICLEI will help that community lower its greenhouse gas emissions. ICLEI has organized a process that can help a town become more energy efficient. This process is called the Five Milestones for Climate Mitigation. By following the five milestones that ICLEI lays out, local governments worldwide can lower the amount of greenhouse gas emissions that they released into the atmosphere (ICLEI 2013).

### *First Milestone- Conduct a Baseline Emissions Inventory and Forecast*

The first milestone consists of calculating all the greenhouse gas and carbon emissions that the town releases into the atmosphere. "The calculations capture emissions levels from all municipal operations (e.g., city owned and/or operated buildings, streetlights, transit systems, wastewater treatment facilities) and from all community-related activities (e.g., residential and commercial buildings, motor vehicles, waste streams, industry)" (ICLEI 2013). All these calculations can be deduced by using the ICLEI Clean Air Climate Protection software. The software allows for the user to put all the emissions data that was received from the town into a computer to calculate the amount of emissions used that year. This value is known as the base year. Next they take the base year value to project what the emissions value will be in the future; this is known as the forecast year. With both the base year and forecast year provided a municipality can visualize the severity of that particular community's energy usage (ICLEI 2013)

### *Second Milestone - Adopt an Emissions Reduction Target for the Forecast Year*

The second milestone is aimed at the forecast year. In the second milestone the target community must establish the percentage of emission reduction that the community wants to achieve for its forecast year. This percentage provides the community with a goal around which the climate action plan will be created.

### *Third Milestone - Develop a Local Action Plan*

The third milestone is to develop an action plan for how the town hopes to reduce its' energy consumption. An action plan is a written document with specific energy reduction or emission measures that town hopes to accomplish. In many communities, this milestone has been accomplished by breaking the action plan down into subsections categorized by sectors including transportation, residential, municipal, and commercial. Once there is a written document the town must vote on the plan before moving on to the fourth milestone.

### *Fourth Milestone- Implement Policies and Measures*

After the town passes the plan, it is time to implement the action plan into the community, the fourth ICLEI milestone. Implementation involves taking what is in the plan and putting it into action. Municipal officials can now enforce the approved action plan within the community. For example, increasing energy efficiency in municipal buildings, calling for increased public transportation options. Milestone four is the starting point toward reducing the amount of greenhouse gas released by the town (ICLEI 2013).

### *Fifth Milestone- Monitor and Verify Results*

The final milestone involves monitoring the town and verifying the requirements stated in milestone two. The fifth milestone is a check on the success of the action plans implementation. . This milestone begins once the entire town meets the standards of the Climate Action Plan. Milestone five is an ongoing process that helps make improvements to the town as it strives to become a more energy efficient community.

## 2.5 Climate Action Plan Components

Towns and cities all over the United States are turning to ICLEI and its' five-milestone framework to help them reduce their greenhouse gas emissions. This allows local

communities to create unique approaches to reduce their impact on climate change based on location and population. The climate action and energy reduction plans of Milton, Montague, Worcester, and Belmont, Massachusetts, the state of New Hampshire and Berkeley, California all used ICLEI's five-milestone format to generate their Climate Action Plans. A compilation of data from these plans can be viewed in Appendix A. Since the CAPs all used the same format there are many similarities among them. For example, a many climate action plans share the same goal of reducing energy emissions by 80% by the year 2050 and 20% within five years of implementation. However, due to the different wants and needs of each community, each plan is tailor made to the particular town or city.

The most common objectives present in the aforementioned CAPs include: (1) increasing energy efficiency of buildings, (2) reducing vehicle emissions, and (3) educating the public about energy conservation and climate awareness. We discuss each of these objectives in turn. Additionally, most CAPs addresss energy saving measures specific to four sectors: residential, industrial, commercial, and municipal.

### 2.5.1 Maximizing Energy Efficiency of Buildings

The energy efficiency of buildings encompasses lighting, heating, ventilation, control equipment, refrigeration, building shell and windows, water usage, and renewable energy systems. Inefficient buildings are a leading contributor of greenhouse gas emissions (US Department of Energy, 2008). Common solutions included changing incandescent lights to fluorescents and improving insulation. The town of Belmont, Massachusetts proposed decreasing the number of workdays per week, thereby requiring less heat and lighting (Kruse 2009). New Hampshire promoted the use of combined heat and power systems as on-site power plants or boilers. These boilers simultaneously produce heat and electricity, reducing fuel consumption by up to 30%. Additional suggestions include lowering office temperatures

on off days, completely unplugging all electronic devices when not in use, and providing shuttle transit to work (New Hampshire, 2007).

### 2.5.2 Reducing Vehicle Emissions

According to the EPA, motor vehicles are the second largest contributor to greenhouse gas emissions (Causes of Climate 2013). Multiple Climate Action Plans promote the use of public transportation, carpooling and Zip cars. Berkley, California is promoting the use of alternative transportation by increasing parking fees, and implementing fees on people who own more than one car. Another way they address the transportation issue is by creating incentives for residents with zero or low emission vehicles (City of Berkeley 2009). Most CAPs agree that walking and biking are the most effective way to reduce carbon emissions.

Another way to help reduce vehicle carbon emissions is to improve traffic light efficiency. The efforts required to remobilize a stopped vehicle is much greater than the energy required to keep a vehicle in motion (Nantucket Climate Action, 2010). Since more energy is required to start a stagnant car than to keep a moving vehicle in motion, the town of Nantucket, Massachusetts planned to install sequentially timed streetlights throughout the town (Nantucket Climate Action, 2010).

Nantucket also proposed an anti-idling policy. In promoting this policy, officials reference the City of Denver's success in reducing idling by 35% and reducing carbon emissions by 10% by following a policy similar to the one proposed. "According to the ICLEI Climate Air Pollution Planning Assistant (CAPPA) tool, reducing daily idling by one hour results in an annual savings of 900 gallons of fuel, or approximately $2,500 and 9 metric tons (mT) of CO2" (Roggeveen, P. 2010).

### 2.5.3 - Innovations

In addition to more typical approaches, certain cities and towns came up with innovative approaches to energy reduction. Renewable resources are one of the leading ways that both cities and towns can save money. There are many different ways that communities can reduce the amount of non-renewable resources used in its economy. The town of Milton, Massachusetts substituted non-renewable resources for renewable resources in the municipal sector. Milton Public Schools were awarded a $270,000 grant from MTC New England Wind Fund, for a 67 KW solar system with 250 solar panels that are located on the roofs of two of its public schools. The town expects to save approximately $12,000 per year with this system in place. The town of Milton also decided to invest in a 1.8 MW wind energy project. The wind turbine is expected to generate 4,600,000 kWh of electricity per year (Maclean, H. 2010). Many other cities and towns are using renewable resources in their communities to eliminate non-renewable resources (Milton 2010).

Along with incorporating solar panels and wind turbines into the city; Worcester, Massachusetts suggested installing a 100 KW hydro-powered turbine be installed at the city's water filtration plant. According to Canyon Hydro, an implementation cost of 300,000 dollars and an annual saving of 63,072 dollars would only take the city 4.8 years to completely pay for the turbine (Williams 2009). A

### 2.5.4 - Educating the Public

One tool that is consistently used in many CAPs is education of the public. Another way to achieve the education component is to reach out to younger generations to instill climate consciousness at an early age. Both the Milton and Montague, Massachusetts Climate Action Plans educate students and get them involved in environmentally friendly activities (Milton). Milton also managed to earn EPA's energy star label. Worcester educated its youth

by adding a renewable energy and energy efficiency section to their curriculum to better the students' understanding of energy usage and climate change. They also created an energy theme to the school's annual project fair (Williams2006).

One example of how a climate action plans is to be tailored to its specific community is displayed in the plan for Nantucket, MA. The town of Nantucket had suggested a "Proper Tire Inflation Program" to teach people how they can inflate their vehicles' tires to an ideal pressure. Properly inflated tires would help the fuel economy of vehicles up to 3.3% (Nantucket Climate Action, 2010). A crucial part of public education is outreach. We detail one method for outreach in the section below.

## 2.6 - Green Flag Award

An important part of the implementation of a climate action plan is education of the residents of the community. A good way to ensure education in any the community is outreach and connection with the families in a town, often the anchor of any community. A municipalities public school system provides an easy, efficient method for reaching a large and, often, vocal portion of a town's residents. One way in which this can be accomplished is for a school to try and attain National Wildlife Federations Green Flag Award.

The Green Flag Award is part of the "Eco- Schools" program, brought forth by the Foundation for Environmental Education in 1994, and adapted by the National Wildlife Federation in 2008 ("About Eco Schools", 2013). The Green Flag Award is awarded to a school that shows exemplary effort in the ways of environmental sustainability and knowledge. This achievement is not an easy task, as proof of this only ten schools have received this award nationwide ("Green Flag Awardees", 2013). One requirement of the award is for the students to involve the town's community, which in turn leads to the public becoming better educated in the ways of energy reduction and environmental sustainability.

## 2.7 - Town of Auburn

The Town of Auburn is a bedroom community of the city of Worcester, Massachusetts. According to the 2010 United States Census, Auburn has a population of 16,188. The town has worked with previous Worcester Polytechnic Institute student groups to complete the first two ICLEI milestones. The previous groups have provided us with baseline emission data for the town of Auburn, now we are here to draft a Climate Action Plan for the town.

Adam Burney is the Acting Director of Development and Inspectional Services and has been Auburn's Town Planner for four years. He became the Assistant Director in May 2011 and was promoted to Acting Director in October 2012. Mr. Burney has largely spearheaded the efforts to create and pass a Climate Action Plan in the Town of Auburn.. We will be picking up where the previous project group left off and will be pursuing milestone 3. Due to the conservative nature of Auburn the previous WPI students faced opposition to their efforts while referring to this plan as a Climate Action Plan. Because of this we will refer to our plan as an Energy Reduction Plan.

# 3.0 – METHODOLOGY

Our project had two related goals, both of which could help the town of Auburn become a leader in energy reduction and save residents, business owners and the town money. The primary goal of our project was to develop an Energy Reduction Plan (ERP) for Auburn. The secondary project goal was to help Auburn High School make progress towards receiving the National Wildlife Federation's Green Flag Award. In essence, the secondary goal is the grassroots complement to our primary top-down goal.

In order to achieve our first goal and draft an ERP, we identified four objectives that focused on the residential and commercial needs of Auburn[1]. In section 3.1.1 we describe our first objective, to review previous energy reduction and climate action plans and identify key energy reduction strategies that would be applicable to Auburn. In section 3.1.2 we describe our second objective, to solicit feedback from relevant Auburn stakeholders on their knowledge of and willingness to take energy reduction measures. Our third objective, described in section 3.1.3, was to draft an Energy Reduction Plan tailored to Auburn. Finally, our fourth objective, described in section 3.1.4, was to raise awareness of energy reduction strategies and the proposed Auburn ERP to the Auburn residential and commercial sectors. Our secondary goal, detailed in section 3.2, was to advance Auburn High School towards the Green Flag Award.

## 3.1 - Primary Goal: Developing an ERP for the Town of Auburn

### 3.1.1 – Objective One: Identify key energy reduction strategies

[1] In order to gain Green Communities Act funding, Auburn had to create an Energy Reduction Plan focusing on the municipal sector.

Our first objective was to identify key energy reduction strategies. We did this by reviewing Auburn's emissions inventory as well as previously written Climate Action and Energy Reduction Plans. These gave us an idea of what our end product would look like.

#### 3.1.1.1 – Emissions Inventory

We began our project by reviewing the emissions data generated by the previous Energy Reduction Team. This gave us a sense what sections of Auburn used the most energy. These emissions data were derived by using computer assisted audit program (CAAP) software that generated a review of Auburn's municipal, residential, commercial, and industrial sectors energy usage. The program reviewed data from 2007.

#### *3.1.1.2 – Review of Previous CAPs and ERPs*

Many local communities are beginning to take a stand against climate change. We began our project by reviewing previously written Climate Action and Energy Reduction Plans. Following the previous Energy Reduction team's advice, we decided to create an Energy Reduction Plan rather and a Climate Action Plan. An ERP concentrates more on the money saving aspect of energy reduction and is therefore a more tactful way to reach a wider audience.

### 3.1.2 – Objective Two: Solicit Feedback from Various Stakeholders

Our group identified town officials, business owners, and residents as three major stakeholders in energy reduction efforts. In section 3.1.2.1 we describe our meetings with municipal employees. Section 3.1.2.2 describes interviews with prominent business owners. And section 3.1.2.3 covers surveys created to reach the residents of Auburn.

#### *3.1.2.1 – Interviews with Municipal Employees*

As mentioned previously in section 2.7, Adam Burney is Auburn's town planner as well as our sponsor. During the term, we met with Adam regularly to receive feedback and

direction for our project. Mr. Burney informed us that in order to receive Green Communities funding, he already wrote an ERP for Auburn's municipal sector. Therefore, our group's focus became the residential and commercial sectors of Auburn.

In addition, our group presented our project to the Wind Energy Committee. This committee worked to implement a windmill into Auburn and was a candidate for who would take over the passage of the ERP once our team's time in Auburn was over.

#### *3.1.2.2 – Interviews with Business Owners*

In order to get a clearer understanding of Auburn's commercial sector's opinions of energy reduction measures and implementation of a town wide energy reduction plan, on April 2nd, 2013 we gave a brief presentation at Auburn's business roundtable meeting. The business roundtable is a group of prominent business and landowners in the town of Auburn. At this meeting, we collected eight contacts and met with each of them to talk about their business's energy reduction habits. We met with both small and large business owners as well as with owners of restaurants and stores. We asked owners about their business, whether they conducted energy audits, and how they reduce energy in their daily routines (our interview questions can be found in Appendix B). We also provided them with ideas about how they could further their savings through energy reduction measures which we described in an informational flier (see Appendix C).

#### *3.1.2.3 – Surveys*

In order to customize Auburn's Energy Reduction plan, we created surveys to find out about Auburn resident's energy usage and interest in suggested town improvements. We decided that the most effective way to receive a large amount of feedback in a short amount of time was to survey the parents of elementary and middle school children. After receiving approval from Auburn's superintendent, Dr. MaryEllen Brunelle, on Monday April 4, 2013,

we distributed 1800 surveys to all five elementary and middle schools in Auburn. These schools included: Auburn Middle School, Julia Bancroft School, Pakachoag Elementary School, Mary D. Stone Elementary School, and Bryn Mawr Elementary School. Along with our surveys we also included teacher instruction sheets indicating return dates and extra copies of surveys for students who misplace their copies. Surveys were picked up on both Thursday and Friday of the same week. No more time was allotted due to the school's spring break the following week. A copy of the survey instrument can be found in Appendix D.

We divided the survey instrument into four sections: home demographics, energy consumption, opinions about suggested town improvements, and audits. The home demographics section served as a baseline for our statistics. In order to tell how willing residents were to invest in long term home improvements we asked whether they own or rent their home, whether they live in an apartment, condominium, single or multi- family home, and the age of their home. We asked how many people live in the homes to see if there was a relation between number of tenants and energy consumption. We asked about the square footage and number of heating and cooling zones in the home, the purpose of this was to see if people in large homes are more energy conscious than those in smaller homes. Lastly, we asked respondents to indicate the number of incandescent, CFL, and LED light bulbs in their home to gauge their current energy efficiency.

The second section of our survey asked residents about their home energy usage to indicate the areas most in need of improvement. Questions topics included electricity, water, transportation, and recycling, and questions were phrased in such a way as to simultaneously provide readers with new energy reduction ideas.

The third section of the survey gauged resident support of proposed town improvements. Potential improvements included:

- Improve sidewalks and pedestrian access of Drury Square

- Bicycle Lanes
- Car Sharing Programs
- Expanded Bus Routes
- Solar Panels on Auburn Mall
- Low-Flow Toilet Installation in Hotels and Restaurants

The responses to this section shaped the recommendations included in Auburn's ERP.

The last section of the survey asked if respondents were aware that part of their monthly electricity bill goes towards free energy audits from Mass Save. This question was intended to identify what portion of the public has had an audit, and whether or not they are interested in this service. If the survey reveals that relatively few homeowners have had audits, this implies that the ERP should emphasize the value of audits and promote Mass Save programs.

### 3.1.3 – Objective Three: Develop the Energy Reduction Plan

Our review of CAPs and ERPs conducted in other communities revealed an extensive list of energy reduction options that might be adopted and promoted in Auburn. From this comprehensive listing, we chose those items that were most applicable to Auburn and most likely to deliver the greatest energy reductions. Since energy reduction efforts for Auburn's municipal sector were already underway, we focused on the commercial and residential sectors.

Two documents that provided a great amount of structure for Auburn's ERP were a document created by a previous project member (Chymkh, 2013) and Auburn's ERP for the municipal sector (Burney, 2012). Ilya Chymkh a member of the previous Energy Reduction team, created a comprehensive document that detailed Mass Save incentives for household appliances. These suggestions were compressed and included into the "plan summary"

section of the ERP. The second document used to structure the ERP was an Energy Reduction Plan written by Adam Burney that outlined municipal energy reduction (Burney, 2012). This document provided us with necessary information about the Town of Auburn.

The last, and arguably most important, resource used to draft the plan was our survey and interview results. We reviewed responses and created graphical representations of data that were included in our ERP to promote its passage.

### 3.1.4 – Objective Four: Promote Awareness of Energy Reduction Strategies

The purpose of an Energy Reduction Plan is to promote energy efficient habits, decrease energy spending, and increase the use of renewable resources. In addition to intertwining energy reduction ideas with survey questions, we also created a brochure that is described in section 3.1.4.1 and a commercial described in section 3.1.4.2.

#### *3.1.4.1 – Brochure*

The first way our team decided to educate residents about energy reduction strategies was by creating a brochure. The brochure included energy reduction tips for three areas: appliances, transportation, and household methods (see brochure in Appendix E). The intention of these tips was to educate readers about everyday habits they could implement that would both reduce energy consumption and save money. The brochures also provided contact information for Adam Burney and Mass Save. Brochures were distributed to numerous Auburn locations including the library, Shaw's Emerson Realty, Auburn Mall, Town Pizza, various local restaurants, and the main offices of schools with the intention of reaching as many readers as possible.

#### *3.1.4.2 – Commercial*

As per our sponsor's suggestion, our team created a commercial to educate residents about energy reduction strategies that would save them a substantial amount of money. The commercial was aired on Auburn's public access channel. We used survey results to determine energy reduction facts which Auburn residents knew least about and created a complementary commercial to teach about said topic. Our commercial coupled humor and information to reach a wide viewer base.

### 3.2 – Secondary Goal: Passage of the Green Flag Award

The secondary goal of our project was to help Auburn High School advance towards the Green Flag Award. This lengthy process is described in Appendix F Our team met with Karen Ares, Auburn High School's Environmental Club advisor, to find out how close the school was to getting the award. Mrs. Ares informed us that her Environmental Club consisted of only two members, so our first priority became increasing student involvement. We did this by planning an Earth Day Event at the school during lunchtime. This event featured energy reduction ideas, information about E-Waste, a Tap Water Challenge, and posters made my Mrs. Ares's environmental science class. This event taught students about environmental issues and increased Environmental Club involvement.

# 4.0 Findings and Analysis

In this section of our report we discuss the findings from our various data gathering and outreach activities. We begin in section 4.1 by talking about the information we gathered while surveying and interviewing Auburn residents and local business owners. In section 4.2 we discuss the strides we took to help Auburn High School move one step closer in achieving the green flag award.

## 4.1 Business and Residential Sector Energy Usage

Our team used surveys and interviews to gather information about Auburn's energy usage. We distributed 1,800 surveys on April 8th, 2013 to the four elementary and one middle school in Auburn. We received a total of 539 completed surveys, giving us a response rate of 30%. While this may not seem like a high response rate it is actually quite good for these kinds of surveys and the responses provide a wealth of information. In our limited time, we were forced to distribute the survey the week prior to Massachusetts's school vacation, which may have suppressed the overall response rate.

In order to keep the survey short and encourage participation, we chose not to collect extensive socio-demographic data from our respondents, such as age, income, or gender, but we did ask for home ownership and type of accommodation. We found that most of our respondents (90.5%) lived in single-family homes, 4.5% in multiple family homes, 1.9% in condominium, 1.7% in Apartments and 1.5% in other types of accommodations. Most of our survey respondents were homeowners (88.4%), while 10.3% were renters. According to census data 17% of Auburn residents are renters. Not surprisingly our survey include a lower proportion of renters since people with children in schools are more likely to be homeowners.

We conducted interviews with local business owners in order to discover how the commercial sector handles energy reduction. We interviewed eight business owners and found that the majority of these owners have been in business for over thirty years. Some of these business owners own more than one business and several of them own multiple properties in Auburn.

Our survey and interview questions focused on gathering information about Auburn residents' and business owners' approach to energy reduction measures; specifically those which deal with electricity usage, heating, and transportation.

### 4.1.1 Electricity Usage

The surveys revealed some interesting findings about Auburn residents' electricity usage. One question asked residents about home lighting. We asked participants to designate the number of incandescent, CLF, and LED light bulbs they have in their homes. However, after analyzing our results we found it much more useful to use this data to interpolate the number of residents that had each kind of light bulb, instead of the quantity of each in their home.

Table 4 below is a chart of the results of our questions. It shows the percentage of each demographic that uses each kind of light bulb. We concluded that homeowners and residents who already completed an energy audit were more likely than renters to use more energy efficient light bulbs such as CFL or LED. Because of this statistic we decided to include in the draft ERP the benefits of the more energy efficient light bulbs.

*Table 4 : Auburn Residents Light bulb Usage*

| | **Home Owners (n=315)** | **Home Renters (n=27)** | **Residents Who Have Completed an Energy Audit** (n=125) | **All Survey Results (n=340)** |
|---|---|---|---|---|
| **Incandescent Light bulbs** | 70.5% | 81.5% | 55.2% | 72.4% |
| **CFL Light bulbs** | 73.3% | 59.3% | 64% | 73.2% |
| **LED Light bulbs** | 31.5% | 22.22% | 36.8% | 31.5% |

In our business interviews we discovered that the majority of the businesses upgraded their lighting fixtures as well. The owners said that upgrading to CFL fixtures, T-5 and T-8 ballasts provided a substantial decrease in their energy bills.

Another key finding from our surveys was that 73% of participants almost never unplug electronics when they are not in use. Because of this statistic we thought it was necessary to inform residents on the issue of vampire power. Vampire power is the act of leaving an unused electronic device plugged into a power source. Electronic devices pull energy from the power source when they are in 'off' modes, and may significantly increase energy bills. Emphasizing this fact in Auburn's ERP will inform residents of the unfavorable outcomes of keeping electronics plugged into the outlets and in turn help the residents to be more aware of their energy consumption

In our survey we asked residents about their habits regarding air conditioners. Thirty-eight% of responders said that they use their air conditioners sparingly during the summer. We interpret this finding to mean that the majority of respondents do adjust their air conditioners to be more energy cautious. During warmer months, using an air conditioner frequently will lead to a massive increase in ones energy bill, so this statistic is helpful in

formulating the energy reduction plan. If residents are mindful of how they use their cooling units they have the potential to save a substantial amount of money. While this will help residents during the summer, we also wanted to find out their habits and behaviors when they have to heat their homes during the winter.

### 4.1.2 Heating

Regarding heating, 66% of residents reported that they turn down the heat at night and when they leave the house. This statistic shows us that many Auburn residents are already proactive about reducing heating costs, although people often over-report behaviors that they believe to be socially positive. We include heating in our ERP and emphasize the benefits of switching from a standard thermostat to a programmable thermostat. The majority of respondents who completed energy audits reported that changing to a programmable thermostat was very beneficial for them and saved them a substantial amount of money.

Business owners were also very proactive about making improvements to reduce heating costs in their businesses. Several of the business had programmable thermostats that lowered the heat when the buildings were vacant, but all of them reported that they made sure their office temperatures were turned down to 68°F in order to save money. During an interview, one business owner told us about his newly installed infrared tubing heating system. This energy efficient heating system heats the floor, allowing heat to rise and penetrate objects. He claims that he keeps his thermostat set to only 45°F during the winter.

Another survey question asked how often residents take hot showers lasting less than 5 minutes. Only 10% of residents responded with almost always. Although many energy reduction plans recommend that people try to take shorter showers, we decided to take a

more realistic approach and instead suggest the use of low-flow showerheads to correct for this behavior.

### 4.1.3 Transportation

Our review of energy reduction plans from around the country revealed many communities emphasize the greater use of public transportation to cut back on fuel emissions. We learned that Auburn was very different than other towns such as Berkley, California as stated in section 2.5.2.

As stated in section 2.7, Auburn is a small bedroom community of Worcester. In Figure 5 below, there is data about our survey questions. One of these figures is that 42% of residents would like to see bike lanes improved in Auburn. 50% of responders said they almost never walk or bike to destinations, and 42% of them said they sometimes walk or bike to destinations. In a later question we asked if they would like to see improvements to sidewalks and pedestrian crosswalks in Drury Square, a central location for Auburn. Our response for that question was that 54% would like to see these improvements while 42% of people were indifferent about this. We believe that if these improvements were made to Auburn that more people would be more willing to walk around instead of using their cars. In our time in Auburn we tried to walk around Drury Square and found it to be very difficult because of lack of crosswalks, broken crosswalk signals, and crumbling sidewalks.

When asked about public transportation, 96% of Auburn residents responded with that they almost never use public transportation in Auburn. This can be attributed that the infrastructure for public transportation in Auburn does not exist. The bus routes are very limited and due to the kind of town Auburn is, the public transportations would primarily be

used to transport people from surrounding towns to the Auburn mall, which currently a bus stop.

We asked survey takers a number of questions about making improvements in Auburn and whether or not they would be in support of these changes, these questions can be viewed in Figure 5. Below you can see that 26% of survey participants strongly agree that more bus routes should be implemented in Auburn, and 65% of respondents were indifferent about the question. We believe that if public transportation was increased in Auburn that more people would utilize the service.

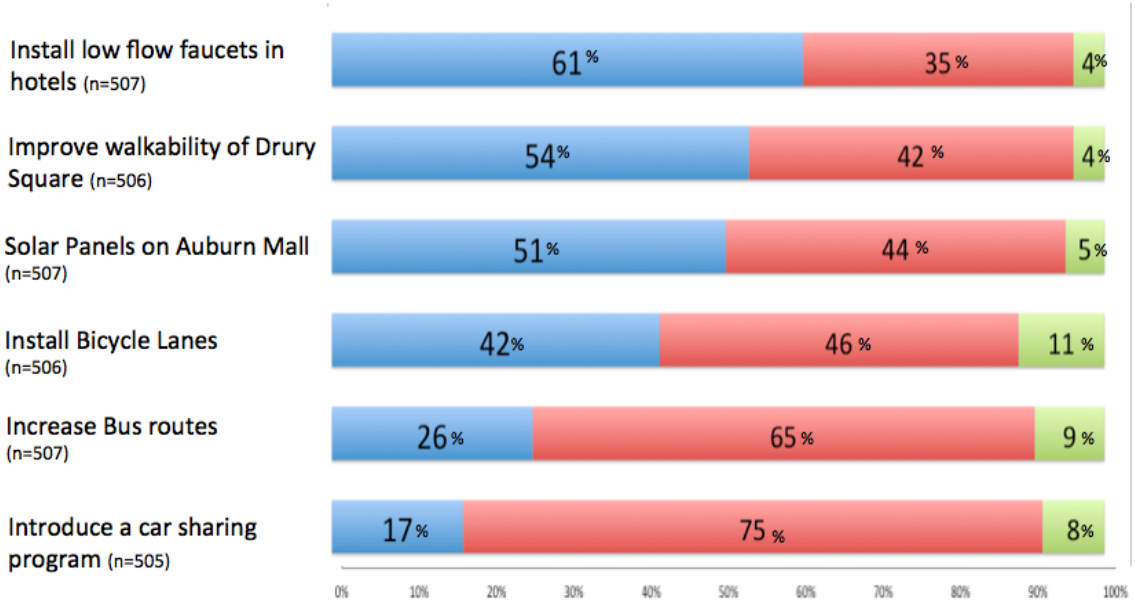


Figure 5

"Survey Responses- Auburn Improvements"

Figure 5 shown above shows many useful pieces of information for the town of Auburn. This can be used in the future for helping the town see which improvements the residents would be most in support of. An important finding that we discovered was that 54% of respondents would like to see improvements to Drury Square. Drury square is an area in Auburn, which is a center point of the town. This area has a 2-mile radius and includes the Auburn mall, Auburn High School, and many local businesses. Currently the

sidewalks are crumbling, some crossing signals are broken, and over all it is very difficult to maneuver around this sector. We believe that if improvements are made to this area such as improved sidewalks, more crossing areas, and improved crossing signals, this will bring more foot traffic to this area. This increased foot traffic would help local businesses and could potentially reduce the amount of traffic in this area.

Eighty eight percent of people responded that they do not carpool to work. This statistic, along with the public transportation results lead us to the fact that in Auburn, people prefer to drive their own cars. Instead of trying to convince them of switching that behavior through the ERP, we suggest that the town use the ERP to educate them on how they can be smart about conserving energy in their own car. Fifty percent of residents said they never idle their cars for more than 5 minutes, 42% responded with sometimes and 9% said they almost always idle their car. Subsequently, by educating them on how they can reduced fuel consumption by simply shutting off their cars and restarting them we can have a greater impact on Auburn residents than trying to make them give up their cars.

### 4.1.4 Energy Audits

In our surveys we asked residents if they know that with each energy bill, they pay into a Mass Save program that grants them free energy audits. The results of this question are displayed in Figure 6 below.

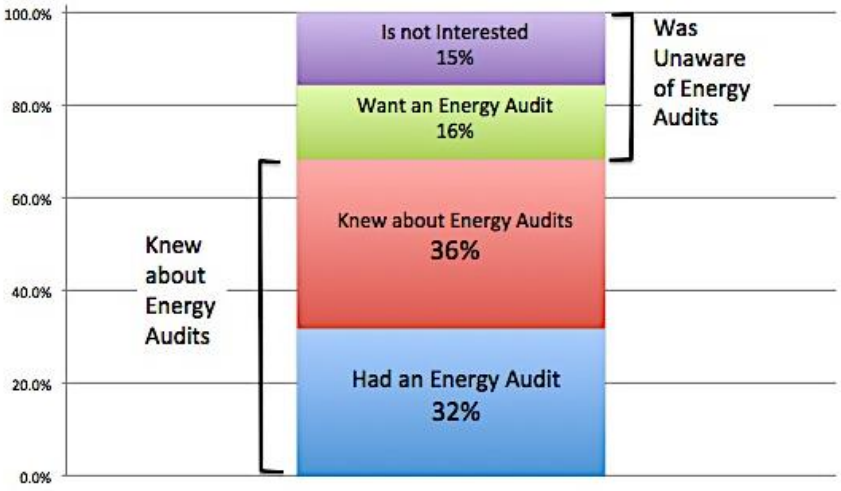


Figure 6

"Auburn Residents Knowledge about Energy Audits (n=506)"

Through our surveys we determined that 68% of respondents knew about the energy audit program, but only 32% actually received them. However 31% of survey participants were unaware of the energy audit program, but 16% percent of those who were unaware are now interested in the program. Similar energy reduction plans encourage their residents to complete these energy audits, and we encourage Auburn to encourage their residents as well.

We also found that 44 % of survey takers who completed an energy audit lived in homes older than 50 years old, as seen in Figure 7 below.

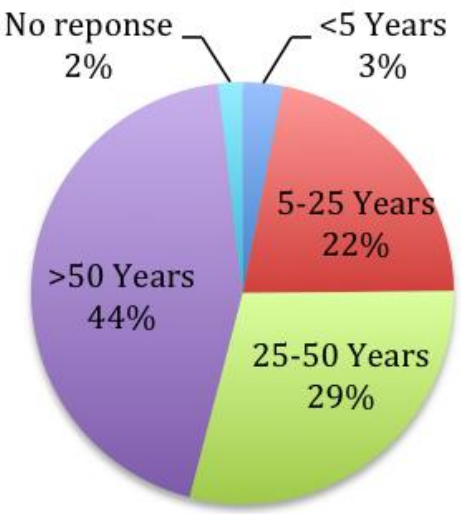


Figure 7

"Home Age- Residents who have completed Energy Audits (n=160)"

This piece of information can be a very helpful tool to convince homeowners in Auburn to have an energy audit because older homes tend to have outdated insulation, windows, and building material. This could lead to their homes being less energy efficient, making energy audits more useful for these residents.

We asked if people who completed an energy audit noticed a reduction in their utility bill. The results of this question are shown below in Figure 8.

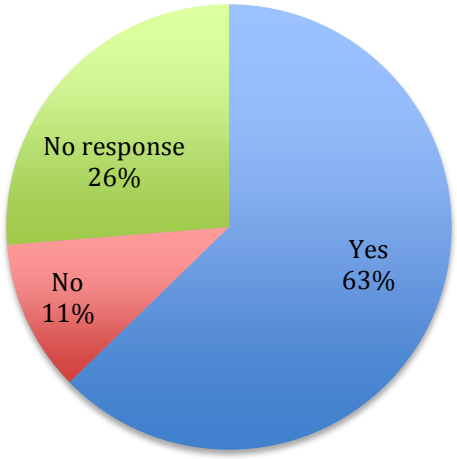


Figure 8

"Did having the energy audit reduce your utility costs? (n=105)"

Sixty three percent of those who completed an energy audit stated that it reduced their utility costs. 11% of residents said that it did not reduce their utility costs, however many reported that their energy and heating rates are increasing so it is unclear why the audit did not help them reduce their bill. This is useful in the ERP because it shows that they will still save money even though rates are increasing. Without energy saving measures, utility costs would be even greater.

Of the businesses we interviewed, 63% conducted energy audits and said that they reduced their energy costs. However this number is not indicative of how other businesses in Auburn act. These business owners volunteered to interview with us after we told them what our project entailed, so it is likely the reason they chose to speak with us was because they already took strides in energy reduction. However these experiences that we had with business owners can be shared with other business owners around Auburn to show them that they should conduct an energy audit of their own.

## 4.2 Auburn High School Earth Day Event

As previously stated in section 3.2, our secondary goal was to help Auburn High School advance towards the Green Flag Award. To do this we worked closely with Karen Ares, the Auburn High School environmental club advisor.

Our initial conversation with Ms. Ares revealed that the environmental club currently only has two active members. Because of the lack of student involvement we held an Earth Day Event to increase student participation and excitement about the Green Flag Award. Ms. Ares scheduled the event for April 23, 2013 during the school's lunchtime. Two WPI project teams were featured at this event. The first was our Energy Reduction Team, educating students about daily energy reduction measures they could take. Instead of bombarding them with information that was not relevant to people their age, we tailored our energy reduction strategies to teenagers. Some examples of this is informing them on vampire power and to unplug electronics, as well as some fuel saving tips when driving a car.

The second team was a project team who informed students about the dangers of electronic waste on the environment, and how to recycle them properly. We originally planned for another team to be there to talk about tap water and the detriments of using bottled water. However due to scheduling conflicts, they could not attend the event but they were very helpful and provided us with materials to use so we could still talk about their project. Other Earth Day displays included a sculpture made from water bottles, student science presentations, and raffles at which students could win reusable water bottles and movies about the water bottle industry.

This event was a huge success. We were able to get 27 new members to join the environmental club, which is a vast improvement over only two. With this new found support we are certain that Auburn High School has the potential to do great things in the ways of environmental sustainability and continuing to pursue the green flag award. We

spoke with the WPI green team and informed them that AHS was trying to receive this award and they were very kind and willing to lend a hand if they were able to. We left Ms. Ares with WPI's Green Team contact information to allow them to stay in contact and possibly work together towards the award.

# 5. 0 Recommendations and Conclusions

After completing our project in Auburn we would like to put forward several recommendations for future groups at WPI, the Town of Auburn, and anywhere else that is conducting similar assessments.

## 5.1 - Further Development of the Energy Reduction Plan

Our primary recommendation is that the town continues to develop, improve upon, and eventually pass the Energy Reduction Plan. When Mr. Burney finalizes this plan, we look forward to seeing the ultimate implementation of this plan in the town of Auburn, which will move them forward in their goals of energy reduction.

## 5.2 - Continue Data Collection

We recommend that when attempting to survey residents, that one allow for ample time to analyze the data. Surveys were a key component for us to get an understanding of what Auburn residents do to reduce their energy consumption. However, we did not distribute our surveys until week five of the seven-week term. This allowed students one week to have their families fill out the survey and return them to their teachers. We should have started to hand our survey by week three; this would have given us larger window to collect more surveys and receive more data.

We recommend that Auburn continue to gather information from a broader audience. If our surveys were completed by week three we would have had more time to refine and distribute them at additional locations and to other population segments. We chose to distribute our surveys to the Auburn school district because we knew it would give us the best response rate in our limited time frame. We recommend that the town holds

community meetings, public forums, or other surveys in order to gain more support and promote the Energy Reduction Plan. These outlets for outreach would be helpful to gain more information from other key Auburn demographics such as the business community, older citizens, and other Auburn residents not associated with the school systems.

### 5.3 - Conduct Additional Business Owner Interviews

We suggest that the Town of Auburn meets with other business owners and representatives throughout the town and interviewing them. Auburn has about 78 restaurants and we only met with two restaurant owners. This does not provide us with a complete understanding of the Auburn business owners' energy habits and levels of support for an Auburn ERP.

An additional recommendation we present is if there continues to be data gathered about local businesses, they incorporate more educational aspects into the interviews. When speaking to different type of businesses a flier should be handed to the business owner describing energy reduction measures that would be tailored to this specific type of business. This would have made the interviews more beneficial to the owner because they would have had a written reminder of energy reduction measures we detailed in our conversation. After the interviews we sent them a thank you email which included a flier detailing ways to reduce energy, however in retrospect having a printed out flier would have been more beneficial.

### 5.4 – Meetings with the Wind Energy Committee

In the future we would advise another meeting to be held with the Wind Energy Committee in Auburn in order to gain more supporters of the ERP. Only a fraction of the Wind Energy Committee attended the meeting our group held earlier in the term. The Wind

Energy Committee's support would increase the chances town selectmen approving the ERP.

### 5.5 - Meet with the Board of Selectman

Another recommendation is for whoever continues to seek support of this Energy Reduction Plan, is for them to meet with the town's board of selectman. The purpose behind this would be to see if they are in support of the plan, and if not they can voice their opinions and tailor the plan so that it has a higher chance of being approved. It would be an extremely powerful statement for the town if the selectmen were in support of the Energy Reduction Plan for Auburn.

### 5.6 - Auburn Earth Day Event

Another suggestion is to plan a larger scale Earth Day event for the Town of Auburn. The event being sponsored by the town would give Karen Ares a great support system, and would aid in having Auburn High School obtain the Green Flag Award. We suggest that a future team contact the EPA and Mass Save and inquire for them to send speakers to the Earth Day event, who would further educate the people of Auburn. Our team was also interested in educating the youth of Auburn by creating games, to be held on Earth Day, for children to play that were informative on how to save energy making the event fun for all ages.

### 5.7 - Conclusions

Our time in Auburn can best be described as a challenging adventure that resulted in successful outcomes. We began our project with a working knowledge of Energy Reduction Plans and the ICLEI Five Milestone process and used recommendations and an emissions inventory left by the previous project group to shape our project.

We met frequently with our sponsor, Adam Burney, and also reached out to the Wind Energy Committee and business roundtable. In order to customize our Energy Reduction Plan to Auburn, we acquired necessary data by conducting eight interviews with local business owners and distributing 1800 surveys to Auburn middle and elementary schools.

We hope through more outreach to the community through public forums, community meetings, and additionally surveys, Auburn can successfully pass and implement their Energy Reduction Plan. Collecting information from additional Auburn business owners would help to educate the businesses and make them in favor of the Energy Reduction Plan for Auburn.

Likewise, through additional meetings with the Wind Energy Committee and the town's Board of Selectman we can gain more support with those who will be the ones championing this plan, and those individual who will ultimately pass this plan into legislature. Additionally in the future a larger Earth Day event held in the Auburn community, organized by Auburn High School would help the town gain support for their ERP and help the AHS towards achieving the green flag award.

If another team continues our project, we recommend continuing to educate and survey residents as well as further strengthening our relationship with Auburn High School's Green Team, helping them achieve success.

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## Appendix A: Climate Action Plan Table

-

| CAP | New Hampshire | Milton, MA | Montague, MA | Nantucket, MA | Tewksbury, MA | Berkley,CA | Belmont, MA | Worcester, MA |
|---|---|---|---|---|---|---|---|---|
| Population | 1,320,718 | 26,000 | 8,500 | 10,000 | 29,000 | 112,580 | 24,194 | 181,631 |
| Location type | Rural, forested | Town | Town | Town, Island | Town | City | Town | City |
| ICLEI member | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Major contributor to GHG | | Transportation | Transportation | Transportation | Municipal | Transportation | Residents | Commercial |
| Commercial Sector | | | | | | | Work fewer days | Upgrade lights, insulation and windows |
| Transportation | Promote alternative fuel | Alternative fuels and fuel reduction | Reduce energy used with traffic lights and idling | -Idling policy -Promotion of public transportation use | | -Increase public transit -Increase Bicycle lanes | Strive for public transport ex: buses, zip car | Post anti-idling signs at schools |
| Municipal | On-site power plant or boiler to simultaneously generate electricity and heat | Solar Panel System for 2 buildings | Replace water boiler at water pollution facility | -Energy audits -Energy efficient equipment upgrades | Installation of energy efficient equipment | -increased energy efficiency technologies -Develop Renewable energies | Unplug all utilities when finished using | City wide compost, Enable 5 min. shut for municipal trucks |
| Residential | Revise and implement new building codes | | | | | -Enhance recycling and composting programs | Upgrade boiler/furnace | |
| Innovations | On-site boilers that simultaneously produce heat and electricity | Wind Turbine Project | | | | Created incentives for electric or plug in cars | | Wind Turbine, Water Powered Turbine |
| Educating the public | Building awareness | | Information and goal of 100% renewable energy reduction generation | Proper Tire Inflation Program | Education on proper energy use and efficiencies | Launched a education campaign to mobilize residents, businesses and industry | | Energy Theme Science Fair, Add energy saving curriculum |

## Appendix B: Business Owner Interview Questions

Hello my name is … I am part of a WPI student team collaborating with the Auburn Town Planning Office to research how the town, its residents and businesses can save money by reducing energy usage. I would like to ask you a few questions about energy and energy reduction. Your participation in this interview is entirely voluntary and you can stop me at any time. We will be taking notes and would like to quote you in our final report, if you don't mind. We would give you an opportunity to review any quotations in advance. If you prefer, we can keep your comments anonymous.

1. Ease In
    a. Where are you from?
    b. Are you an Auburn resident?
    c. How long have you been working with **company name**?
    d. How many people does **company name** employ?
    e. What are your hours of operation?

2. Logistics
    a. Does your business have any **additional buildings**?
    b. What is the **square footage** of your business?
    c. How many **years** has your business been in Auburn?
    d. Does your company have any plans to **relocate**?
    e. Do you **own or rent** its building/ office space?
        i. (If Rent) Do you pay your utility bills or does the landlord?
    f. What **percentages** of your business's total expenditures are from energy and utilities?
    g. On average, how much does your business spend monthly on **electricity**? **Gas**?

3. Energy Audit- Mass Save
    a. Have you heard of the **Mass Save program**?
        1. You have for the energy audit, they give you suggestions and discounts
        ii. Do you know about Mass Save's incentives?
            1. Rebates
    b. Has your business conducted an **energy audit**?
        i. If so, **when**? And **by whom**?
        ii. If so, **why** did you decide to conduct the energy audit?
    c. Were you surprised by your results? Satisfied?
    d. Has your business taken any **steps** to reduce its energy usage?
    e. Have you noticed **significant decreases** to your business's utility bill as a result of these changes?

4. Energy Use
    a. Where do most of your employees live?
    b. Do you have a sense of whether any of your employees use public transportation, bike, walk, or carpool into work?
    c. Do you have any company vehicles?
        i. Are your drivers aware of the Massachusetts idling law?
    d. How do you heat your buildings?
    e. Does your business use programmable thermostats?
        i. Adjust temperature according to the time of day
        ii. Cost about $19
        iii. Saves ~$150 per year per thermostat
    f. What type of lighting does your business use?
        i. High efficiency lighting can save 30-50% in costs
    g. Does your business use motion sensor lighting?
        i. Save 5-10 cents per square foot
    h. Do you unplug unused electronics from wall sockets?
    i. Have you heard about vampire power?
        i. Vampire Power
        ii. Accounts for ~23% of home energy usage
    j. Does your business set your computers to sleep mode?
        i. Set sleep mode
        20 minutes of inactivity
        ii. Save $20-$75 per year
    k. Does your business recycle?

## Appendix C: Business Owner Flier

# Save Money for your Business !

| Category | Equipment | Action | Potential Savings | Payback Period |
|---|---|---|---|---|
| Lighting | LED exit signs | Switch from incandescent models to Energy Star LED models | $100 per year, per sign | 3 months |
| | Occupancy sensors | Install occupancy sensors to control lighting systems in office spaces | $0.05–$0.20/ft$^2$, per year | 6 months–5 years |
| | HIFs | Replace HIDs with HIFs | $133 per year, per lamp | 2 years |
| | Photocell sensors | Install photocell sensors to control exterior lights | $30 per year, per lamp | 2 years |
| | T8 lighting systems with electronic ballasts | Replace incandescent and T12 fluorescent lamps with T8 systems with electronic ballasts | Overall annual lighting energy consumption reduction of 35% | 3 years |
| HVAC | Programmable thermostats | Install programmable thermostats to control building temperatures | $150/year, per thermostat | 1 month |
| | Demand controlled ventilation | Install demand-controlled ventilation devices on existing ventilation systems | $0.05–$1.00/ft$^2$, per year | 3 months–3 years |
| | Premium economizers for RTU air conditioners | Install a premium economizer on RTU air conditioners | 2–9% of total building energy use | 5–7 months |
| Plug loads of equipment | All-in-one printer, copier, fax and scanner | Switch to Energy Star models | $4/year, per machine | Immediate |
| | Vending machines | Switch to Energy Star models | $171/year, per machine | Less than one year |
| | Computers | Switch from non-sleep mode–enabled standard computers to sleep-mode enabled Energy Star models | $47/year, per computer | Less than one year |
| | Monitors | Switch from a CRT monitor that is not sleep-mode–enabled to an Energy Star model that is sleep-mode–enabled | $44/year, per machine | 2 years |

**www.Masssave.com/Business**

**Mass Save can help your business save money.**
**On their website you can find useful information such as:**

**Incentives Programs**
-High Efficiency and Cooling
-Lighting and Controls

**Services**
-Whole Building Asessments
-Technical Assistance
-Financing

**& More Energy Saving Tips!**

**Notes:** BAS = building automation system; CRT = cathode ray tube; ft$^2$ = square foot; HID = high-intensity discharge lamp; HIF = high-intensity fluorescent lamp; LED = light-emitting diode; RTU = rooftop unit.

# Appendix D: Auburn Energy Reduction Survey

**Town of Auburn Energy Reduction Survey**

Dear Parent,

We are WPI students who are helping the Town of Auburn develop an energy reduction plan. We would be grateful if you would take a few minutes to answer some questions on energy usage.

Please ask your child to return the completed survey to their teacher tomorrow. Your participation in the survey is completely voluntary and you may skip any question you do not wish to answer. All of your answers will remain anonymous.

**Do you own or rent your home?** ☐ OWN ☐ RENT

**Do you live in a:**
☐Apartment ☐Condominium ☐Single-family house ☐Multi-family house

☐Other_____

**How old is your home?**
☐ < 5 years ☐5-25 years ☐25-50 years ☐ > 50 years

**How many people live in your home?**
Over 18 _____ Under 18 _____

**Approximately how large is your home? _____sq. ft**

**How many heating zones does your home have?_____ Don't Know ☐**

**How many cooling zones does your home have?_____ Don't Know ☐**

**About how many of the following light bulbs do you have in your home:**
Incandescent ___ Compact Fluorescent (CFL) ___ Light emitting diode (LED) ___

| **Please indicate how often you do each of the following:** | Almost Never | Sometimes | Almost Always | Not Applicable |
|---|---|---|---|---|
| Turn off the lights when you leave a room | | | | |
| Unplug electronic devices (e.g., TV, computer) from the outlet when not in use | | | | |
| In summer, I use the air conditioner sparingly | | | | |
| In winter, I turn the heat down at night | | | | |
| In winter, I turn the heat down when I leave my home for more than 4 hours | | | | |
| Use cold water when washing clothes | | | | |
| Air dry laundry | | | | |
| Limit hot showers to 5 minutes | | | | |

| | | | | |
|---|---|---|---|---|
| Let car idle for more than 5 minutes | | | | |
| Walk or bike to destinations within a mile | | | | |
| Use public transportation in Auburn | | | | |
| Carpool to work | | | | |
| Use the town's curbside recycling program | | | | |

| **Please indicate below how strongly you agree/disagree that the following should be implemented in Auburn within the next four years?** | Strongly Agree | Neutral | Strongly Disagree |
|---|---|---|---|
| Improve sidewalks and pedestrian access in Drury Square (area near Auburn Mall and Auburn High School) | | | |
| Install bicycle lanes on major roads | | | |
| Increase available car sharing services in Auburn (i.e. Zip car) | | | |
| Increase bus routes through town | | | |
| Install solar panels on Auburn Mall | | | |
| Install low-flow (water conserving) toilets in hotels and restaurants in Auburn | | | |

**Are you aware that part of your monthly electricity bill goes towards a Mass Save program that makes you eligible for a free energy audit?**

☐ YES, I have completed an energy audit for my home
☐ YES, but I have not completed an energy audit for my home
☐ NO, but I am interested in completing an energy audit in the future
☐ NO, I am not interested in an energy audit.

**If you have had an energy audit in the last 5 years, did you change any of your behaviors to reduce energy? (e.g. turn off lights, adjust thermostats at night, etc. )**

_____

_____

**If so, did you notice a reduction in your utility bills?**

_____

_____

**Thank you for taking the time to respond to our questions. Please have your son/daughter return the completed survey to his/her teacher tomorrow.**

# Appendix E: Energy Saving Brochure

**Shocking Facts about Energy Consumptions**

- Upgrading to energy efficient boilers or furnaces can save you up to 600 dollars a year.
- Setting the thermostat below 68 °F in the winter and above 78 °F in summer can save up to 20 percent in energy use.
- For the lifespan of a diesel vehicle that idle for one hour a day wastes about 500 gallons of fuel and damage the vehicles engine.
- Compact florescent light bulbs (CFLs) generate similar brightness, but use 80% less energy than incandescent bulbs. CFLs also last 12 times longer.
- Programmable thermostats can save you up to 150 dollars a year per thermostat if used correctly.
- Leaving turned off appliances plugged into the wall outlet accounts for 25% of the energy used in an American household.

Town of Auburn


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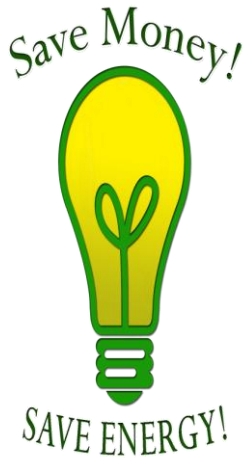
**Additional Helpful Websites:**

**Mass Save**
http://www.masssave.com/residential?gclid=CLetnrDr97UCFQyg4AodincASw
**Rebates that can be received for buying certain appliances**
http://www.we-energies.com/energy-saving_ideas/tips/101tips.htm
**Tips on ways residents can save energy**
http://www.epa.org/energy


***Saving Money is as easy as a Flick of a Switch***

## Save Money Believe It or Not

- Reduce your energy usage= Reduce your energy costs
- There are many different methods to reduce your energy usage
- The more methods you use= The more money you will save

## Methods to Reduce Energy

### Appliances

- Upgrade to Energy Star appliances
- Unplug all infrequently used appliances after usage
- Wash clothes with cold water
- Always run washing machine with a full load
- Air dry clothes when possible
- Use a dishwasher instead of washing dishes by hands
- Turn off heat/AC when on vacation or away from home
- Turn off all lights and appliances when not in use
- Switch to CFL light bulbs
- Take showers instead of baths

### Transportation

- Never let a vehicle idle for more than 5 minutes
- Carpool as much as possible
- Walk to destinations within a mile
- Use public transportation

## Methods to Save Money

### Household

- Double panel all windows
- Install walls with R-19 insulation
- Install ceilings with R-38 insulation for gas-heated homes and R-50 for electrically heated homes
- Place rugs on hardwood floors to reduce heat loss
- Close blinds in the summer to keep house cooler
- In the summer use ceiling fans
- In the winter open blinds when sun is out to naturally heat rooms
- Keep doors closed when heating or cooling the house
- Caulk all windows and doors
- Repair leaking faucets and tubs
- Use space heaters as much as possible
- Install solar panels on top of roof
- Install a programmable thermostat

## Appendix F: Explanation of the steps to become an Eco-School

In order to become an Eco-School an institution must complete and implement seven steps set forth by the Eco-Schools program.

The 1st step is to create an eco-action team, this is a team of both students and faculty members which are committed to being active and involved in this process.

The 2nd step is to complete an environmental audit of the school. This audit is a self-evaluation provided by Eco-Schools to give the school a baseline reading of the schools energy use or other wasteful or harmful practices (i.e.: water use, hazardous materials, transportation around the school, etc.).

The 3rd step is to create an eco-action plan, in which the team creates a number of realistic target goals to improve the environmental quality of the schools. Some previous schools have set goals of 10% energy reduction from last year or 30% waste reduction within 6 months.

The 4th is to monitor and evaluate the goals set by the team in the 3rd step.
The 5th step is for the faculty members to implement the efforts of the eco-schools program into their own curriculum; this can be done in all areas of study, not just science classes. Some examples provided by the NWF is to math teachers to help students conduct surveys, or English teachers to help the students to write letters to government officials about environmental problems.

The 6th step is to get the greater community involved in your efforts. An example of this can be the students putting together a newsletter to distribute to the community to inform them of their efforts. The last step for the students to do is to create a mission statement or "Eco-Code". This Eco-Code should be created by the students, and it should demonstrate how their commitment to improving their environmental sustainability.