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Green Communities Act

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Making Holden, MA a Green Community

An Interactive Qualifying Project Report
Submitted to the Faculty of
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Abstract:

This Interactive Qualifying Project Report assists Holden, Massachusetts in meeting the requirements of Massachusetts' Green Communities Act. Using the data collected from town officials on energy usage, we are able to identify which buildings would be targets to implement energy saving measures. By touring Town owned buildings, it became clear that lighting changes are the best way to reduce Holden's energy consumption. We demonstrate Holden's progress on each criterion, and what can yet be done to reach the overall goal.

Executive Summary:

Background:

An increase in global greenhouse gases, as well as the rising costs of energy has caused many individuals and organizations to look into programs to promote the reduction of energy consumption and use of alternative energy sources. The Commonwealth of Massachusetts is in many ways leading the way when it comes to governments promoting energy efficiency and conservation. One of the programs introduced in 2008 is the Green Communities Program. This program provides funding to municipalities who commit themselves to certain energy reduction and alternative energy criteria. When a municipality becomes eligible, funding from the state starts around $125,000 and rises based on its proposed solutions and needs.

The Criteria:

There are five criteria that municipalities are judged by when applying for Green Community Status. These are:

1. As-of-Right Siting – This criterion may be met by a municipality by providing zoning for any of three kinds of facilities: renewable or alternative energy generation facilities, renewable or alternative energy research and development facilities, or renewable or alternative energy manufacturing facilities. This zoning cannot be subjected to unreasonable regulations or require special permitting.
2. Expedited Permitting – This criterion means that no permits for the “as-of-right" siting take longer than a year to be issued.
3. Energy Reduction Plan – This criterion requires that the town develop a plan to reduce energy usage by 20 percent over five years. The town must first choose a “baseline” year to measure from. This year can be up to three years in the past. Most often the funding that is granted by receiving Green Community designation is used to implement the strategies in the energy reduction plan.
4. Fuel Efficient Vehicles – This criterion requires that the town promise to purchase fuel efficient vehicles in the future when replacing old ones. A “fuel efficient vehicle” is based off of the Environmental Protection Agency's standards. Many “heavy duty” vehicles are exempt from this requirement because of the huge costs and impracticalness of buying a fuel efficient fire engine for example.
5. Adoption of Stretch Codes – This criterion requires that the town adopt a code that requires new construction of homes to use energy efficient standards to reduce the use of energy in homes. The easiest way to do this is to pass the stretch code set in the Massachusetts State Building Code. These codes are updated every few years where the current “Stretch Code” becomes the regular standard, and a new stretch code is created.

Methodology

The group's initial step to move forward with the project was to meet with town officials from Holden to determine if the Green Communities program was something they were interested in pursuing, and if it “made sense” for Holden. From the two meetings with these town officials we gathered that the Town is pretty environmentally conscious, which can be seen in the new public safety building and use of solar panels on the Senior Center. Despite this, they had not made an attempt at applying for Green Community designation, and expressed some concerns regarding the requirements and feasibility of the Act. They recommended that we create a “roadmap” of some kind to help them move forward. Our group then set out to gather information from

the Town by analyzing energy usage data, speaking further to town officials and visiting town facilities to try and determine just what needed to be done to move forward with each part of the Act.

Results and Recommendations

Criterion 1 – According to the Town Building Inspector, Dennis Lipka, Holden has no restrictions on the zoning for renewable or alternative generation facilities. Holden also has an area of land that has shown reasonable potential for one of the qualifying facilities, solar photovoltaic, for renewable energy or alternative energy generation. In order to complete this criterion, Holden needs to write a letter confirming that the Town of Holden allows for renewable energy or alternative energy generation facilities on this designated site.

Criterion 2 – Holden's current permitting process has rules in place which make most certifications occur between 60 and 70 days. These rules established in the Town Bylaws meet the requirements of "Expedited Permitting" and thus this criterion. In order to complete the criterion, Holden must send a letter to the Department of Energy Resources detailing the Town's regulations and procedure to prove their compliance with this criterion.

Criterion 3 – In order to try to reduce energy consumption in Holden by 20 percent, we traveled to different municipal buildings to determine where there are inefficiencies and where upgrading could occur. It is while doing this that we came across the 2006 Energy Audit Reports that were very helpful to us in pointing out potential energy and cost savings. Some of the common changes that could be made throughout the buildings are switching to natural gas heating, installing programmable thermostats and allowing for zone heating, and updating all lights to fluorescents or LEDs. Other recommendations we made were to pursue LED streetlights, and better insulating the DPW garage.

Criterion 4 – To complete this requirement the Town of Holden must write a letter promising to purchase only fuel efficient vehicles. The strictest standard for this requirement is 29 miles per gallon for a 2 wheel drive car. The Town already has a list of vehicles that will just need to be kept up to date.

Criterion 5 – In order to complete this requirement the Town needs to pass a new building code that meets the requirements of the Stretch Code. This will have to be put to a vote at a town meeting, and will likely require lobbying from the town to convince citizens to pass it.

Background:

Introduction:

Green House Gas emissions and the rising cost of energy in the 21st Century led the Commonwealth of Massachusetts on a path towards promoting renewable energy and energy efficiency. The clean energy sector is the fastest growing in Massachusetts and the Commonwealth is the number one state in the nation for energy efficiency policy (Eldridge, 2012). In order to promote the clean energy agenda, Governor Deval Patrick signed the Green Communities Act in July 2008. Statistics show the Green Communities Act is effective in increasing growth in the clean energy industry. Deval Patrick stated,

> *The clean energy industry grew nearly 7 percent in Massachusetts last year, and added thousands of kilowatts of renewable generation and thousands of jobs – not by accident but because we passed the Green Communities Act and joined the world's fundamental shift towards efficiency and renewable energy* (Nash, 2012).

The ambitious Act's goals are to boost energy efficiency in electricity generation and consumption, attain the cheapest sources of energy, and to continue to promote the growing clean energy industry. Under the Green Communities Act, the law:

- Requires investor owned utilities to increase investment in energy efficiency measures, which reduce demand and deliver savings to customers
- Mandates the design and implementation of three year energy efficiency plans for gas and electric utilities
- Provides funding for efficiency measures via the auction of power plants' pollution allowances through the Regional Greenhouse Gas Initiative
- Requires that 15 percent of electricity be supplied by new renewable power facilities by 2020

- Establishes a pilot program for utilities to enter into long term contracts with renewable energy developers to facilitate financing for the projects and to lock in predictable prices for clean energy for customers
- Encourages green building design through updated codes, training, and assistance (Conservation Law Foundation, 2012).

The Act also promotes the production of renewable energy in Massachusetts through numerous means, including:

- Requiring utility companies to enter into 10 to 15 year contracts with renewable energy developers to help developers of clean energy technology acquire necessary financing
- Promoting "net-metering," which allows the owners of wind turbines and solar generated power to sell their excess electricity into the grid at favorable rates for installations up to 2 megawatts
- Authorizing utilities to own solar installations for use on customers' roofs for up to 50 megawatts apiece (Beveridge & Diamond, P.C., 2008).

Under the Act, an incentive program and the Green Communities Division in the Department of Energy Resources (DOER) were also established. The Green Communities Division was created to assist the Commonwealth's municipalities and other local governmental bodies to reduce energy consumption and costs, reduce pollution, facilitate the development of renewable and alternative energy resources, and create local jobs related to the building of renewable and alternative energy facilities and the installation of energy efficient equipment (Energy and Environmental Affairs, 2012). The Division supplies communities designated as a Green Community with grant money to continue with green initiatives.

In order to become recognized and designated as a Green Community, a municipality must meet the five criteria of the Green Communities Act. It is important to note that communities served by municipal light departments can become eligible to participate in the grant program. The communities served by municipal light departments need to adopt the renewable energy charge. Holden has adopted the renewable energy charge as of 2009 (MassCEC, 2012). However, Holyoke is the only community out of the 110 designated as a Green Community to be served by a municipal light department.

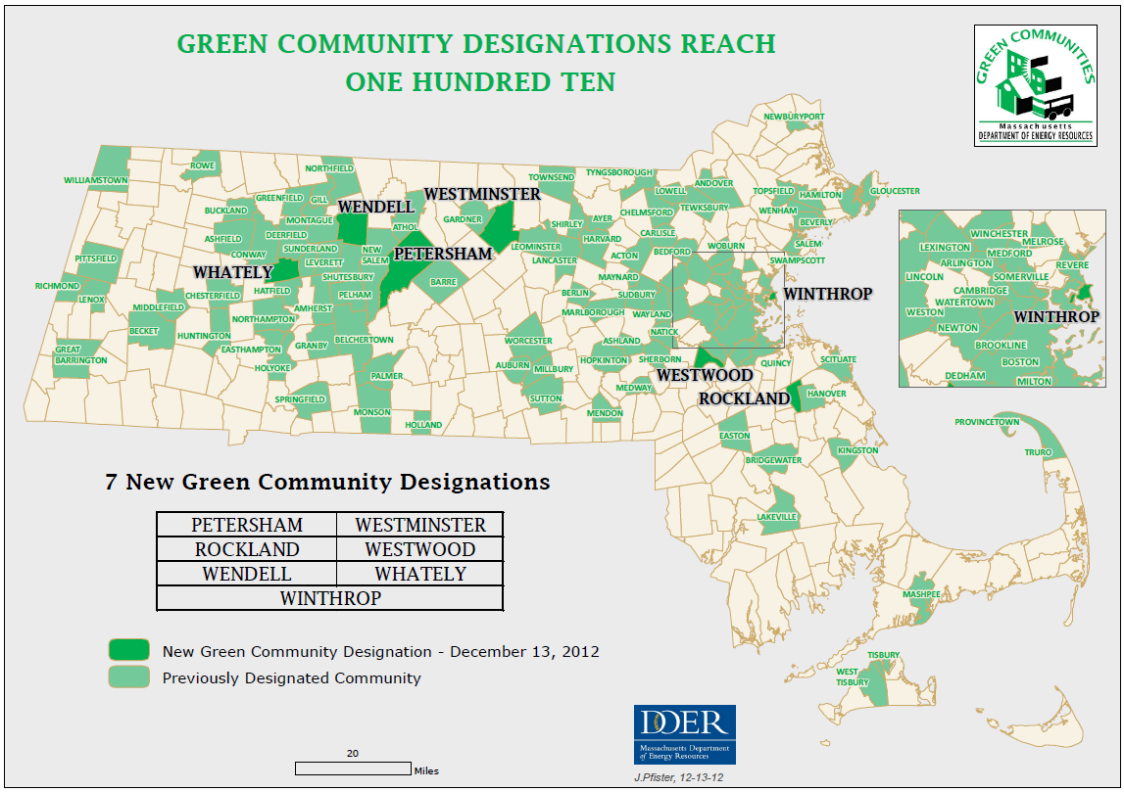

Figure 1

As a group composed of members from different backgrounds, sustainability and green initiatives have brought us together to investigate the implementation of the Green Communities Act. In our Interactive Qualifying Project (IQP) we hope to pursue the overall goal of assisting, in any way possible, Holden, Massachusetts in becoming a Green Community. In choosing to work with the Town of Holden, we wanted to remain local to be able to witness changes that we may have instilled in the Town. One of our members has also been a resident of Holden for nearly twenty years, and with family members in the local government, Holden seemed a reasonable and feasible choice for the project site.

The following criteria need to be met in order to become designated as a Green Community.

Criterion 1 – As-of-Right Siting:

Criterion 1 may be met by a municipality by providing zoning for one of three kinds of facilities: renewable energy generation facilities, renewable or alternative energy research and development facilities, or renewable or alternative energy manufacturing facilities. "As-of-right" is defined as siting that provides for the allowed use of these facilities and does not unreasonably regulate, or require a special permit or variance. "As-of-right" development projects that meet local zoning bylaws as well as state and federal laws cannot be prohibited.

In meeting the requirement for a renewable or alternative energy generation facility, the technology selected must be practicably available. It can be met by providing minimum requirements, depending on the type of project. For example, if a municipality provided zoning for an on shore wind turbine, the site must have applicable wind to generate a minimum of 600 kW. For a solar photovoltaic system, the minimum power output requirement is 250 kW (Department of Energy Resources, 2012).

An example for adopting the "as-of-right" siting occurred in Blandford with the implementation of a wind energy facility. In March 2009, the Department of Energy Resources (DOER) completed its Model As of Right Zoning Ordinance or Bylaw: Allowing Use of Wind Energy Facilities. Under the bylaw, the designated locations where wind energy facilities are sited "as-of-right" may be specified within a particular zoning district or as an overlay district. In order to qualify under the first criterion, the height and generating capacity must be rated with a capacity of at least 600 kW. These were considered in finding a location with applicable wind speeds. The wind power was practically available in three preliminary sites with a definite location at Blueberry Hill. The 400 foot tall, 1.5 megawatt wind turbine was approved in 2010 and produces 3,000 megawatt hours of electricity annually. This amount of power is estimated to power about 400 households with clean energy (Blandford Wind Turbine Moves Forward, 2010).

Criterion 2 – Expedited Permitting:

Criterion 2 applies to the facilities subject to the "as-of-right" siting of Criterion 1. A municipality must adopt an expedited application and permitting process that may not exceed one year from the date of initial application to the date of final approval. The municipality must have rules such that the decisions governing permits for the "as-of-right" facilities can be completed within one year. The standard process is different only in that it has the possibility to take more than one year (Department of Energy Resources, 2010).

Criterion 3 – Energy Reduction Plan:

The third criterion of the Green Communities program is a core part of the Act. Its success directly depends on the success of the other criteria of the Act. For a community to successfully implement an energy reduction plan, it must first establish its baseline energy use by compiling the energy usage for buildings, vehicles (both exempt and non-exempt), street lighting, and water pumping (Department of Energy Resources, 2012). There are buildings and utilities exempt from the cumulative baseline, such as regional school buildings. The expectation is that the baseline year will be the current year, but a town is allowed to set its baseline back three years. Towns are required to use energy monitoring software to establish the town's energy consumption over time. Useful software includes the DOER's own MassEnergyInsight program, Energy Star Portfolio Manager, and ICLEI software. A municipality must then create its plan to reduce this baseline energy consumption by 20 percent in five years. Furthermore, the municipality must report annually its success in reducing energy consumption. If the community does not lower its consumption by 20 percent in five years, it is not immediately barred from continuing as a Green Community – it need only demonstrate that they have done everything reasonably achievable to lower their energy use. The energy reduction plan has been shown as one of the most difficult criteria for towns to implement because of the time and effort that must be expended (Kajano, Kellogg, McCarron, & Osley, 2010).

Criterion 4 – Energy Efficient Vehicles:

The fourth criterion involves the adaptation of fuel-efficient vehicles in the near future. The EPA has documented that burning oil contributes carbon dioxide to the atmosphere in a 20-to-1 ratio to the quantity of oil burned (United States Environmental Protection Agency, 2013). Reducing a town's carbon footprint through

efficient vehicles has a positive impact on the environment and saves money in the long run. The DOER specifies the mile per gallon requirement by type of car, so that full-size trucks adhere to looser regulations than sedans. The requirements for this criterion are adjusted as more fuel efficient vehicles become common in the market. Larger cities with limited budgets can find this criterion daunting because it is expensive to replace town vehicles. Many town vehicles are actually exempt from this criterion, including heavy duty vehicles weighing over 8,500 pounds, fire engines, ambulances, police cruisers, passenger vans, and cargo vans. However, the passenger van, police cruiser, and cargo van exemptions are subject to change as fuel-efficient alternatives become commercially available (Department of Energy Resources, 2012).

Criterion 5 – Building Stretch Codes:

Criterion 5, as stated in the Green Communities Act, says "a municipality must require all new residential construction over 3,000 square feet and all new commercial and industrial real estate construction to minimize, to the extent feasible, the life cycle cost of the facility by utilizing energy efficiency, water conservation and other renewable or alternative energy technologies" (Department of Energy Resources, 2012). This criterion was implemented for energy efficiency in private construction, both residential and commercial. For a municipality to meet this requirement it must pass an appendix to its building code that sufficiently meets the standard in the Green Communities Act. The most common way for a city or town to do this is to adopt the Board of Building Regulations and Standards Stretch Code (780 CMR 115.AA). This Stretch Code is an appendix to the Massachusetts State Building Code that gives a more energy efficient alternative to municipalities. This Stretch Code provides standards that builders must adhere to, with the basic idea of reducing energy use of a structure by 20 percent compared to an average structure under the original building codes. Massachusetts updates its building code every three years to coincide with the updated international building code. When this update occurs the stretch code is updated by the International Energy Conservation Code to meet new requirements more like the building code to be used in the next cycle. While the standards of the Stretch Code are tighter than current state building codes, the means are more flexible. Each aspect of new construction is not required to meet a certain standard; rather the overall energy reduction is the only standard.

This gives builders the freedom to accomplish energy reductions in any way they see fit (Department of Energy Resources, 2011).

The Benefits of Becoming a Green Community:

Becoming a Green Community brings with it both environmental and economic benefits. Environmental benefits are pretty straight forward. A reduction in energy is better for the environment. By reducing energy consumption by 20 percent, acquiring fuel efficient vehicles, or adopting more energy efficient building codes, a municipality decreases the amount of resources used, thus helping out the environment. The Green Communities Act itself looks to bring environmental benefits equal to taking 876,000 cars off the road, or by recycling 1.65 million tons of waste instead of putting it in a landfill (Henriquez, Silva, & Szafarowicz, 2012).

Just as reducing resource consumption helps the environment, it also helps out towns economically. The best part about becoming a Green Community is that each municipality receives money to implement solutions that can ultimately help it save money. When the state designates a town as a Green Community, it also attaches an initial amount of grant money that can be used to implement the green solutions proposed in the energy reduction plan. This amount is calculated by a formula that starts with a base grant of $125,000 and increases based on income per capita, population, and energy production up to $1 million (Department of Energy Resources, 2011). In 2011, Massachusetts spent $3.8 million in grant money on the Green Communities program (Department of Energy Resources, 2012). Examples of towns which have received funding include Auburn with $165,550, Belchertown with $160,917 and Greenfield with $202,066. A specific example of how a town has used its Green Communities grant money is in Truro where they outfitted four out of eight of their police cruisers with IdleRight Fuel Management Systems. These systems allow police cruisers to be parked and have their engines off, but still have their lights on. This is especially useful on construction site detail. Truro used approximately $2,000 of its $141,200 to outfit the four vehicles, and is expected to save 1,768 gallons of fuel annually, or $7,072.

Past Progress:

With over 100 designated Green Communities, there is plenty of information on the successful plans and actions taken to gain Green Community status. An IQP project was completed in March of 2012 for the Town of Charlton, Massachusetts to help complete its application for Green Community status. Although Charlton has not officially completed the necessary requirements, the steps taken by the project team provided us with a valuable starting point to begin our work with Holden. Holden has unique circumstances in that it has a municipal light department instead of an investor owned utility company that provides power to the town. To date only one other town operated by a municipal light department has become a Green Community, which is Holyoke. This is not a major concern as the steps are very much the same as other towns. Another valuable resource is the energy reduction plans of many towns of similar size to Holden. All the ideas implemented by other towns give Holden many options to reduce its own energy, including insulating town buildings like in Scituate, replacing lights with high efficiency LEDs such as in Easthampton, or switching HVAC units with more efficient models like in Easton (Department of Energy Resources, 2012). Although many towns have adopted the Stretch Code appendix, it has proved difficult in some communities. Presentations that were given to towns that eventually adopted the Stretch Code are available online at the Department of Energy Resources website. All these past projects and plans are a big help in making Holden's application easier.

Methodology:

The initial objective in moving forward with this project was to gauge the interest of leading Town of Holden officials in becoming a Green Community, if they saw it a foreseeable goal. As a group, an interview was conducted with the Holden Municipal Light Department Director, Jim Robinson, the Acting Town Manager, Jacquelyn Kelly, the Department of Public Works Director, John Woodsmall, and the Director of Town Growth Management and Building Inspector, Dennis Lipka. Based on this first interview, these members of town government were interested in the Green Communities Act, however, each holds many responsibilities that occupy their time and limit their ability to find time to pursue the goal of Holden becoming a Green Community. They suggested that as an IQP group, we create a "road map" or plan that would outline the paths to pursue.

As of Right Siting:

In regards to the five criteria, Holden has already met the "as-of-right" siting for renewable energy or alternative energy generation. Jim Robinson informed the group during the meeting that a plan to construct a private solar photovoltaic farm was considered. In the decision to have such an energy generating facility, the area where it would be built would meet the "as-of-right" zoning criteria. Unfortunately, the plan to actually construct the solar photovoltaic farm will not move forward. Mr. Robinson said that the solar plant could not be built without an upgrade to the lightly loaded system circuits.

To meet the first Criterion, Holden would need to submit a letter that includes the zoning bylaws, with important zoning definitions, the zone selected as of right, yield calculations, and any documentation supporting the existence of available vacant space for the facilities.

Expedited Permitting:

Holden also meets the expedited permitting process criterion under the Green Communities Act. Under the Town's bylaws, Chapter 7.4 Rules and Regulations for Zoning Board, "If an application is granted by the Board (zoning), all permits necessary for the prosecution of the work shall be obtained and construction shall be commenced within one year from the date of grant thereof." By submitting a letter to the Department of Energy Resources that includes the zoning area for the "as-of-right" siting and information regarding the time frame for

permits, Holden can meet the first two criteria of the Green Communities Act.

Energy Reduction Plan:

To successfully draft an Energy Reduction Plan, we gathered energy usage data in all departments from the Town of Holden. This included street and traffic lighting, drinking water, wastewater treatment, pumping stations, municipal buildings and vehicles, and open spaces municipality owned (Department of Energy Resources, 2012). Energy usage software is a useful tool in recording this data. To acquire the water and sewer usage in Holden, we counted the number of treatment plants and pumping stations in the town. To calculate the usage of municipal buildings we acquired a list of non-exempt buildings in Holden, such as the Gale Free Library and Town Hall. From this point, we used software to calculate their combined MMBtu usage. For vehicles, we similarly acquired a list of municipally owned vehicles, and calculated the MMBtu usage by looking at each vehicle model separately.

All of this information must be detailed and "…provided on an MMBtu (Million British Thermal Units) basis" (Department of Energy Resources, 2012). The energy usage recorded must also keep track of the fuel type expended: electricity, natural gas, fuel oil, propane, gasoline, or diesel. Holden must also choose a baseline year, which can be up to two years before the application year. For five years following the application year, the Town of Holden must submit statistics about its energy use. At the end of these five years, Holden must have reduced its energy by 20 percent, or at least be able to show that it did everything reasonably possible to reduce energy consumption, in order to qualify as a Green Community.

Energy Efficient Vehicles:

In order to pass the fourth criterion, a municipality must create an inventory of its fleet of vehicles, and adopt a policy calling for the buying of fuel efficient vehicles. We worked with the Town to come up with an inventory of exempt and non-exempt vehicles. This included police cruisers, fire trucks, administrative vehicles etc. Once we had this inventory we could determine which vehicles are exempt, and which vehicles already meet the fuel efficiency standards. The latest standards are from March of 2012 and are:

2 wheel drive car: 29 MPG

4 wheel drive car: 24 MPG

2 wheel drive small pick-up truck: 21 MPG

4 wheel drive small pick-up truck: 19 MPG

2 wheel drive standard pick-up truck: 17 MPG

4 wheel drive standard pick-up truck: 16 MPG

2 wheel drive sport utility vehicle: 21 MPG

4 wheel drive sport utility vehicle: 18 MPG

Hybrid or electric vehicles in these vehicle classes will meet these criteria, and standards are based on the combined city and highway standards from the EPA (United States Environmental Protection Agency, 2013).

Stretch Energy Code:

The Stretch Energy Code is an appendix to Massachusetts State Building Code which towns can adopt as a more energy efficient alternative. It is based on requiring all new residential and commercial buildings to reduce energy usage by 20 percent. The exact standards vary based on square footage and building type. A town can adopt the code at a town meeting with a majority vote.

Commercial construction has many exceptions to the code including buildings of 5,000 square feet or less, "specialty buildings" of 40,000 square feet or less, and renovations. Specialty buildings are buildings such as supermarkets, warehouses, laboratories and other high energy use facilities. All construction under the code must meet the 20 percent energy reduction using known energy performance models.

Home Energy Rating System

In residential construction, a Home Energy Rating System (HERS) is used which rates homes on energy efficiency. The system uses ratings compiled by a specialized HERS rater. Energy models are made based on structure insulation, HVAC efficiency, lighting, and structure sealing. These models give a building a score- with a lower score being a more efficient building. To comply with the Stretch Energy Code, a home less than 3,000 square feet needs a score of 65 or below while a home of 3,000 square feet or more needs only a score of 70 or lower. Additions will be held to the same requirements for all new construction to the building.

Renovations are the exception requiring a rating of 80 for homes less than 2,000 square feet and 85 for homes of 2,000 square feet and larger.

Passing the Stretch Code

Information sessions can be held at town meetings to inform the people of Holden to the benefits of building under the Stretch Code. The obvious and primary benefit is long term energy savings which equates to financial savings. In addition, rebates are offered for builders under the ENERGY STAR incentive and HERS reimbursement. Presenting this information to builders and contractors in the Town of Holden will substantially help in passing the Stretch Code.

Results & Recommendations

Criterion 1

Holden met Criterion 1 of the Green Communities Act when it proposed the site for the solar photovoltaic installation. To qualify as a Green Community, the Town's bylaws must permit a qualifying facility "as-of-right." The "as-of-right" zoning allows a landowner or developer to build a qualifying facility without the need of a discretionary permit. Such qualifying facilities include renewable energy or alternative energy generating facilities, manufacturing facilities, or research and development facilities. The land available for one of these facilities must be at least 50,000 square feet and the construction is possible.

Town of Holden Bylaw Chapter 7.1 and Massachusetts General Laws Chapter 40a establish the zoning districts in the Town and the qualified uses for each zoning district. Holden provides for Industrial Districts, Commercial Districts, and Residential Districts. Except as provided in the Zoning Enabling Act or in this bylaw, no building, structure, or land shall be used except for the purposes permitted in the district. However, Chapter 40a exempts solar photovoltaic installation from local zoning restrictions. Under Chapter 40a:

> *No zoning ordinance or by-law shall prohibit or unreasonably regulate the installation of solar energy systems or the building of structures that facilitate the collection of solar energy, except where necessary to protect the public health, safety or welfare.*

With regards to the zone selected for the now scrapped solar photovoltaic farm, this zone would qualify "as-of-right." According to the Town Building Inspector, Dennis Lipka, Holden has no restrictions on the zoning for renewable or alternative generation facilities. There is no zoning bylaw prohibiting such facilities. The area has shown the potential possibility for one of the qualifying facilities, solar photovoltaic, for renewable energy or alternative energy generation, and a special permit is not needed. The zone specified for the allowed use of renewable energy generation. The area also provided a realistic and practical opportunity for solar energy.

To comply with this criterion, Holden will need to obtain a letter confirming that the Town of Holden allows for renewable energy or alternative energy generation facilities on the designated site. In addition, the letter needs to provide yield calculations for a generating facility and account for the height, floor area ratio, setback, parking, and other limits on building size, and any documentation regarding available sites. The letter must include documentation that the construction of a facility of at least 50,000 square feet is possible.

Criterion 2

With regards to the Town of Holden permitting procedures for building permits, planning and zoning permits, and conservation permits, all the applications have a statutory review period and/or advertising deadlines which affect the timeline for permitting. Planning and Zoning Permits are regulated by the State Zoning Act, Chapter 40a, and Holden's Town Bylaw Chapter 7.4 Rules and Regulations for Zoning Board. Applications must be heard within 65 days, but the advertising of a public hearing requires two legal notices in a newspaper of general distribution. Depending on the times for the committees, most public hearings take 30 to 45 days to schedule. The Town must issue and record the decision of the Zoning Board with the Town Clerk within seven days. After the recording by the Town Clerk, there is a 20 day appeal period. Once the decision is filed, “all permits necessary for the prosecution of the work shall be obtained and construction shall be commenced within one year from the date of grant thereof,” in accordance with Chapter 7.4.

Conservation is similar to planning but the time lines and abutter notifications are different. If the construction of an “as-of-right” facility affects protected water resources under the Wetlands Act, an application and permit is also required under Holden's Conservation Commission Wetlands Bylaw. Once an application is submitted, the Conservation Commission commences a public hearing upon receiving the application. “If the Commission, after a public hearing, determined that the activities which are subject to the permit application or the land and water uses which will results there from are likely to have a significant individual or cumulative effect upon the resource area values protected by this bylaw, the Commission within 21 days of the closing of the hearing, shall issue or deny a permit for the activities requested” (Town of Holden, 2011).

In the end, from the time an application is filed with the Town Clerk to the certification of the decision and its recording, usually 60 to 70 have elapsed. Controversial projects may have multiple public hearings,

requests for more information, or the town professional staff may require independent third party review. The established permitting procedures under these two Town bylaws and reliance upon them can be used to meet the one year requirement for the "as-of-right" facilities in pursuing the Green Communities designation. To fully meet the Criterion, Holden must submit a letter to the Department of Energy Resources to confirm that the Town's rules and regulations do not preclude the issuance of an expedited permitting decision within one year. The letter must outline the approval procedures and timing of the decision from the bylaws.

Criterion 3

Energy Reduction Recommendations:

The Energy Reduction Plan and data gathering requirement needed to fulfill Criterion 3 of the Green Communities Act, as outlined before, require the most effort on the part of the IQP group as well as the Town officials. The first necessity was to compile a list of municipally owned vehicles and buildings along with a summary of their natural gas, fuel oil, electricity, and gasoline usages. Through various and numerous email exchanges between the IQP group, Ms. Isabel McCauley, the Senior Civil Engineer at the Department of Public Works, and Jim Robinson, the General Manager of the Holden Municipal Light Department, the group was able to obtain the necessary information on building and vehicle energy consumption for the past five fiscal years starting in 2008. From this raw data, the largest consumers of electricity, gasoline, and heating oil were identified. These buildings include: Holden Public Safety Building, the Holden Senior Center, the Department of Public Works at various locations, the Gale Free Library, the Holden Municipal Light Department, the Holden Pool, the Town Hall, and the Starbard Building.

It is important to note that the Holden Public Safety Building is a state of the art facility that is just over two years old. The facility is equipped with a ground source, open loop, geothermal system for heating and cooling, high efficiency air handling units, and high efficiency lighting and appliances. This building is already energy efficient and will not be looked upon by the group to attempt to reduce its energy consumption. To address possible areas for energy reduction, the group met with Isabel McCauley and Dennis Griffin from the Department of Public Works, and Denise Morano from the Recreation Department to get a better assessment of the buildings of high energy usage. The buildings that will be targeted for improved efficiency measures are the

Gale Free Library, the Department of Public Works, the Town Hall, the Starbard Building, and the locations under the control of the Recreation Department.

The Town of Holden has undergone an Energy Audit for various buildings, including the Department of Public Works, Gale Free Library, the Starbard Building, and the Town Hall in 2006. Reports of these audits were provided to the group, which identified the inefficiencies in each building and possible corrective measures to be undertaken. While this data may seem dated, the value of the information provided is relevant to compare with data of the past five fiscal years to determine if corrective measures were taken.

Town Hall:

Current Status

The Town Hall is a historic building, built in 1836, that was refurbished from an old town meeting hall to offices and an auditorium area upstairs. The ground floor contains office spaces for the Department of Public Works officials, the Town Clerk, and the Director of Town Growth Management. The upstairs is an auditorium that operates as a meeting place for selectmen meetings and other board and committee meetings. This area is used approximately twice a week. Overall, the building operates an average forty hours per week, with additional meetings held throughout the week in the upstairs auditorium area.

In the 2006 Energy Audit Report, the main issues that needed to be addressed were the lighting system and the heating system. From this report the annual electrical use for the Town Hall was 138.90 MMBtu. Using MassEnergyInsight software, the electricity over the past five fiscal years for which the group has data averaged about 115.04 MMBtu. It is evident that corrective measures concerning the lights and electricity were addressed since the 2006 report.

TOWN HALL	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	AVERAGE
Electric Usage MMBtu	126.16	118.34	109.52	111.1	110.08	115.04
Oil Usage MMBtu	426.72	675.67	637.7	636.16	673.78	610

Table 1

Annual Energy Costs and Usage								
Source	Annual Use	Annual Cost	Average Cost	$ per ft²	% of Cost	Energy in MMBtu	MBtu/ft²	% of Energy
Electricity	40,698kWh	$6,200	$0.1523	$1.45	58%%	139	32	24%%
Oil #2	3,163gal	$4,577	$1.4470	$1.07	42%%	439	102	76%%
Total:		$10,777	--	$2.51	100%	578	135	100%

Floor space used in analysis: 4,290 ft²

Table 2

From an investigative walk through of the building, it was noted that the office equipment, such as computers, fax machines, copiers, and refrigerators were all fairly up to date. It was also noted that some of the energy corrective measures that were mentioned in the 2006 Energy Audit Report were being implemented, but not all of them. What was still left undone was to insulate the heating pipes, update the boiler system, and to further convert to more energy efficient lighting. The lighting system still has some incandescent lights within it, but fluorescent lighting is also being utilized, which is an energy saving measure. The issue still left open from the report was the heating. The Town Hall has a problematic, outdated heating control. There is only one thermostat for the entire downstairs offices, with old iron floor radiators used to graduate heat. There is currently one Peerless Steam Boiler that was manufactured in 1995 with an 80 percent efficiency rating. As the group walked through the offices, it was clearly evident that there existed a gradient of temperature differences within each office. When we did this walk through on March 21st, one employee had her window opened because the room was too hot.

Actions

With regards to energy saving measures to reach the 20 percent reduction required for the Energy Reduction Criterion, corrective actions still need to be put into place in the Town Hall. Measures to further be taken include replacing the lights that are still incandescent and upgrading them to fluorescent or even LED lights, installing more effective lighting schemes, and changing lighting schedules. Newer lighting systems can provide the same lighting with less electricity and reduce energy costs.

One important improvement for the efficiency of the Town Hall would be with regard to the heating system. The current oil boiler should be upgraded. It was mentioned, by Dennis Griffin of the Department of Public Works, that the Town is looking to convert to gas, which is possible because a gas line runs along Main St. The reason to replace the boiler would be to convert to gas and to create zone control heating in the building and have more control over the set point temperatures. Each office temperature level can be regulated and implementation of programmable thermostats would also be beneficial. Along with improved HVAC equipment, the hot water or steam heat piping should be insulated. Un-insulated piping causes unnecessary heat loss and reduces the efficiency of the system.

Cost Benefit

Simply switching from incandescent to compact fluorescent can produce an energy savings of seventy five percent. Newer lighting systems can provide the same intensity of light while using less electricity. Replacing the rest of the incandescent lights with compact fluorescent bulbs will provide the same quality, lumen output, but at a reduced lighting cost. According to Energy Star rated lights, "you can save about $6 per bulb or about $14 a fixture annually on your energy bill. The new light bulb standards only require bulbs to be 25% more efficient that leaves a lot of savings on the table" (ENERGY STAR).

	Quantity	Annual Total					Life Cycle Total				% Electricity Savings with ENERGY STAR	Total additional purchase price	Simple payback period for additional initial cost (years)	Assumed equipment lifetime (years)
		Electricity cost savings	Electricity savings (kWh)	Electricity cost	Electricity consumption (kWh)	Emissions reduction (pounds of CO2)	Electricity cost savings	Electricity savings (kWh)	Avoided cost for replacement bulbs & labor	Net cost savings				
CFL														
Bulb 1 (9 W CFL replacing 40 W)	1	$13	91	$4	26	139	$34	248	$3	$34	78%	$2.80	0.2	2.7
Bulb 2 (13 W CFL replacing 40 W)	1	$20	137	$6	38	211	$52	376	$3	$52	78%	$2.80	0.1	2.7

Table 3

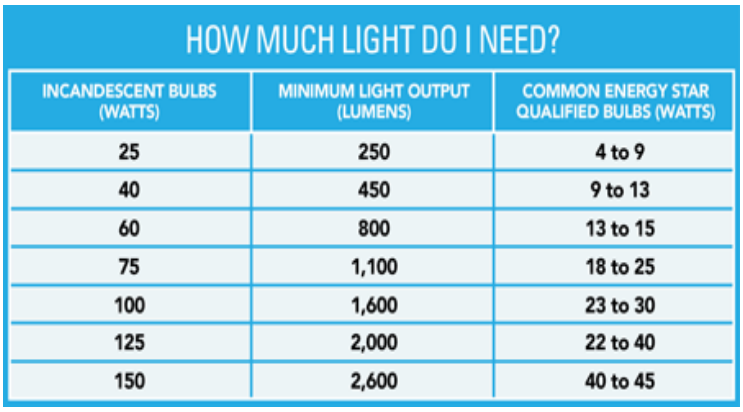

Figure 2

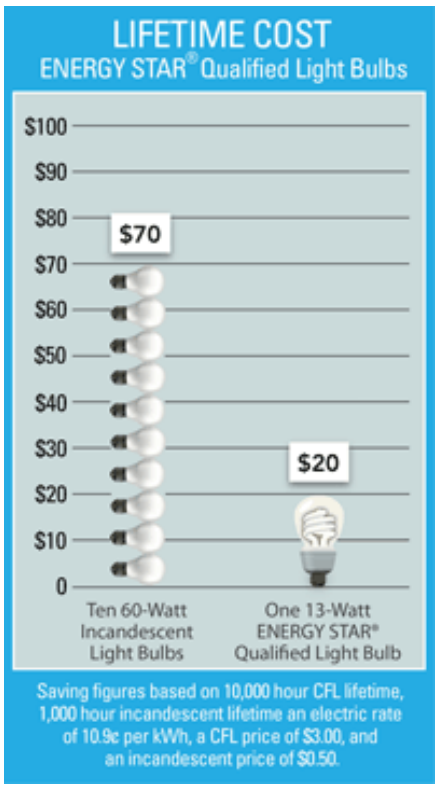

Figure 3

Based on the information gathered about electric usage and oil consumption, the energy savings that would have a significant impact on the Town Hall would be the conversion of the incandescent lights to compact fluorescent lighting fixtures and an upgrade to a natural gas boiler. It was noted that the electric consumption has decreased when compared to the 2006 Energy Audit Reports, but incandescent lights were still in place. A switch from a 40 Watt incandescent to a 9 Watt compact fluorescent would save annually 91 kWh, or 0.31 MMBtu of energy. A switch from a 60 Watt incandescent to a 13 Watt compact fluorescent yields an energy savings of 137 kWh, or 0.47 MMBtu of energy. The number of lights needed to still be converted was not counted. These numbers provide an estimate for the amount of energy savings if a single light bulb was changed.

With regards to a new boiler, the conversion to a high efficiency natural gas system could provide annual savings of fifty percent on heating bills due to the lower natural gas prices compared to oil. Over the past five fiscal years, the Town Hall consumed on average 4326.3 gallons of oil for heating purposes. Based off a four year average of $3.26 per gallon, this amounts to an estimated $14,100 dollars per year in oil costs. However, a conversion to natural gas will provide economic savings, as shown in the following statistics. According to data from NSTAR, with the cost of new equipment, materials, and labor, a new steam heat boiler would cost $7500. The conversion to a natural gas boiler would pay for itself in just over one year.

Number of gallons of oil used in the last 12 months:	4,326.30
Average price per gallon of oil:	$3.26
• Annual cost of oil:	$14,103.74
Equivalent therms of natural gas:	6,013.56
Current price of therm of natural gas:	$1.114
• Estimated annual cost of natural gas:	$6,699.10
• **Estimated annual savings using natural gas:**	**$7,404.64**

Table 4

Starbard Building:

Current Status

The Starbard Building is a municipal building built in 1797, located next to the Town Hall on Main Street. The building is used for administrative town functions and includes the Town Manager's office. The building was built originally as a residential house, then turned into a club before becoming what it is now. The building operates from 8:00AM to 4:00PM on weekdays, and occasionally individual offices will be operated overtime.

According to the 2006 Energy Audit that was conducted on the building, the main sources of energy savings were updating the lighting to new efficient fluorescent lights, replacing the HVAC system, and installing programmable thermostats in the facility. At the time, the facility was using 1,262 gallons of oil and 55,200 kWh's of electricity. This amounted to a cost of about $10,804.

Annual Energy Costs and Usage

Source	Annual Use	Annual Cost	Average Cost	$ per ft²	% of Cost	Energy in MMBtu	MBtu/ft²	% of Energy
Electricity	55,200kWh	$8,683	$0.1573	$2.83	80%%	188	61	52%%
Oil #2	1,262gal	$2,121	$1.6803	$0.69	20%%	175	57	48%%
Total:		$10,804	--	$3.52	100%	363	118	100%

Floor space used in analysis: 3,070 ft²

Table 5

Since then, the Starbard Building has seen upgrading in most of the lighting to efficient fluorescent lights. Lights tend to be replaced as needed, meaning that they usually are only updated when the old lights burn out. The heating system currently uses an oil fire steam system, using a nine year old boiler. The building still lacks any kind of zone heating, and is generally heated between 68 and 72 degrees Fahrenheit. There are plans to convert the building to gas in the near future. The building also now has air conditioning units for the building. There are two AC units outside and 2-3 window mounted AC units. The building also houses an IT room upstairs which has its own central air conditioning and a back-up window mounted unit in case of failure. People also bring in their own space heaters and portable fans to work. Some of the windows were replaced about 10 years ago, however because of historical reasons they were not replaced with the most efficient

windows. This is the same reason why there is a lack of sufficient insulation in the walls of the building. There cannot be any exterior changes to the building, and any internal solution would require a lot of relocation and hassle for employees. According to our data received from Holden, in 2012 the Starbard Building consumed 1,152 gallons of oil and 59,840 kWh's of electricity.

STARBARD BUILDING	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	AVERAGE
Electric Usage MMBtu	201.5	189.22	193.04	195.5	204.23	196.7
Oil Usage MMBtu	290.7	237.59	207.48	253.56	162.43	230.35

Table 6

Actions

The first recommendation is to go forward with the plan to install natural gas heating into the building. During this transition, installing some kind of zone heating and programmable thermostat system would be extremely beneficial for the building. Having thermostats that will automatically lower the heat during hours of non-operation can go a long way to lowering heating costs. This could also reduce the use of personal heaters or fans. With the addition of natural gas and zone heating, it should also be noted that the pipe insulation for the heating system should be finished as well, as not all the pipes are insulated.

A second recommendation is to look into replacing incandescent and fluorescent lighting with LED lights. LEDs are becoming cheaper to buy, are more efficient and last much longer than fluorescent lights. This cuts down on energy and replacement costs, while providing excellent lighting. These changes should be done proactively instead of reactively as well. Another addition that could help save energy is introducing motion sensors for certain areas of the building.

A third recommendation regards the IT room on the third floor. The key to that room is maintaining a cool temperature for the servers and other equipment in there. A simple act of keeping the shades closed when the room is not in use can help naturally keep that room cooler. Open window shades allow radiation heat from the sun to warm the room, kind of like a green house. By closing shades the load on the AC units can be reduced.

Cost Benefit

One of the biggest benefits for the Starbard Building will be converting from oil to a natural gas heating system. The table below illustrates the cost savings per year after switching from oil to natural gas.

Number of gallons of oil used in the last 12 months:	1,152.00
Average price per gallon of oil:	$3.26
Annual cost of oil:	$3,755.52
Equivalent therms of natural gas:	1,601.28
Current price of therm of natural gas:	$1.114
Estimated annual cost of natural gas:	$1,783.83
Estimated annual savings using natural gas:	**$1,971.69**

Table 7

In terms of actual "energy" reduction, switching from oil to natural gas will lower the building's energy usage by approximately 15 MMBtu. The oil account would change from using 175.04 MMBtu to a natural gas account of 160.13 MMBtu. According to the 2006 Energy Audit Report, installing programmable thermostats would cut about 7.76 percent of electric usage and 47.62 percent of oil usage. Applying this same percentage reduction to a natural gas system, only 76.257 MMBtu of natural gas is used per year, and 173.77 MMBtu in electricity is used per year. So far this is a 31.12 percent reduction in energy usage.

The next step would be to go through the building and see where switching bulbs to either fluorescent or LED lights makes sense. While the majority of the building was using fluorescent lights, exploring LED options could be beneficial energy wise. A 40 Watt incandescent is about equal to an 8-9 Watt LED. It also makes sense cost wise as LED lights last up to 3 times longer than compact fluorescents. As stated earlier, a switch to 9 Watt incandescent saves 0.31 MMBtu annually. Switching 5-6 incandescent lights could save 1.86 MMBtu.

In summary, converting from oil to natural gas, inserting programmable thermostats, and switching out what remaining lights need to be switched out would result in the building using 248.257 MMBtu per year, which is about a 32 percent reduction in energy use.

Department of Public Works Garage:

Current Status

The Department of Public Works garage is located at 87 Adams Road in Holden. It was originally designed to be a temporary structure over 50 years ago but has been refurbished with slight modifications to become a permanent home for the maintenance and repair of public works vehicles. It is operated year round seven days a week during normal business hours unless under emergency weather conditions.

From the 2006 Energy Audit Report, the building used 216 MMBtu of electricity and 1,580 MMBtu of heating oil. The recommendations in the report show an estimated savings of 49 MMBtu of electricity and 611.67 MMBtu of oil which would mean the totals now should equal roughly 167 MMBtu of electricity and 971 MMBtu of heating oil. According to the data gathered for the past five years of usage, the DPW garage has averaged a higher total of electricity than in 2006 of 236 MMBtu which could be due to many factors such as increased use of the facility. The heating oil average over the past five years has gone down to 1,345 MMBtu per year from the 2006 study which shows the more efficient burner and heating system that was installed reduced the overall usage.

DPW	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	AVERAGE
Electric Usage MMBtu	231.06	230.4	236.94	277.27	260.88	247.31
Oil Usage MMBtu	NA	1548.6	1329.63	1233.26	238.15	1087.41

Table 8

Note: 1 2012 Data Incomplete

Annual Energy Costs and Usage								
Source	Annual Use	Annual Cost	Average Cost	$ per ft²	% of Cost	Energy in MMBtu	MBtu/ft²	% of Energy
Electricity	63,360kWh	$10,235	$0.1615	$0.80	38%%	216	17	12%%
Oil #2	11,394gal	$16,524	$1.4502	$1.29	62%%	1,580	123	88%%
Total:		$26,759	--	$2.08	100%	1,797	140	100%

Floor space used in analysis: 12,840 ft²

Table 9

Actions

Recommendations from the 2006 Energy Audit Report were partially carried out with more efficient fluorescent lighting installed in most of the fixtures and an upgrade to the heating system. Further actions recommended in the 2006 Audit could be taken, such as upgraded controls on the heating boiler which could save 94 MMBtu per year, electronic ballasts on all fluorescent fixtures which could save 32 MMBtu per year, and the switch from oil to natural gas will quickly show savings as natural gas is much more efficient in the forced air heating used in the garage.

Cost Benefit

Upgrading the controls on the HVAC system in the garage is estimated to cost only $375 and would save up to $1,360 per year. Additionally, insulating the heating and HVAC distribution pipes is estimated to cost $2,670 and would save about $570 per year. Insulating the entire structure could provide the largest amount of savings, but would require more time and cost more to fully install all necessary features. ENERGY STAR estimates that upgrading insulation in a facility such as the DPW Garage would save up to 25 percent of the energy used, and since the garage is operating with almost no insulation, the savings could reach twice as high. (ENERGY STAR)

Gale Free Library:

Current Status

The Gale Free Library is a municipal building located by the Town Hall on Highland Street. The library was built in 1888, and a newer, more energy efficient section was added in 1989. The old section of the building is historic and cannot be altered. The building is used to hold books, read, study, and host children's classes. It is open from 9:30-5:30 on Monday, Wednesday, and Friday. In addition, it is open from 9:30-8:00 on Tuesday and Thursday, and 9:00-4:00 Saturday. Most of the building operates on the first floor, but there is a children's section upstairs and additional storage downstairs.

From a walkthrough of the building, it was observed that the structure is relatively efficient in comparison to other Holden municipal buildings. The heating system is up to date and the boiler is five years old. The temperature in the library was comfortable, not too hot or cold in any particular room. It seemed to be between 68 and 72 degrees Fahrenheit. This means there is likely well regulated zone-heating in the library. The PCs, monitors, copy machines, and fax machines should be turned off each night. The lighting was updated during renovations, but was not particularly efficient or practical. The lights in the Gale Free Library are not efficient, elevated to the point of being hard to replace, and highly diffused. The bathroom lights appeared to be on switches where they might benefit from sensors instead. Predictably, gas usage in the library spikes during the winter and is the primary use of energy in the building by a wide margin. In 2012, the annual electrical usage in the building was 160,080kWh and 5,480 gallons of oil were consumed.

LIBRARY	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	AVERAGE
Electric Usage MMBtu	699.94	605.33	509.49	553.73	546.35	582.97
Oil Usage MMBtu	NA	NA	713.3	737.3	672.1	707.57

Table 10

Actions

The main recommendation to reduce energy usage in the library is to change the lighting on the main floor in particular. The lights hang far too high with no easy way to reach them costing the town money every time they need to be changed. This problem could be fixed with a pulley system. In addition, the lights are very bright and not particularly efficient, yet there are many of them on at once being diffused, and light is let out above. In addition, bathroom lights could be switched to sensors, and the foyer and parking lot lights could be turned off at night. Machines (computers, faxes, monitors, etc.) should be turned off at night as well.

The library is mostly up to date in terms of everything but lighting. Lights in the Gale Free Library could be upgraded to LEDs which, in addition to being more efficient than fluorescent or incandescent bulbs, last longer. An LED can pay for itself over an incandescent bulb in just three years due to the increased longevity and efficiency. This longer lasting bulb would also save the money spent by the Town of Holden each time one of the high-hanging bulbs must be replaced in a complicated fashion. Another option to reduce cost would be to modify the wires holding the lights into pulleys, saving time as well.

Recreation Department:

Current Status

The Recreation Department Building is an old two story house that has been converted into use by the Recreation Department. The building supports the head of the Recreation Department and an administrative assistant. The functional part of the building is housed on the first floor, with the second floor being used for storage. The building also occasionally hosts functions or programs for kids. The building operates from about 6:45AM to 6:00PM during the week.

When investigating the site, it was noted that while the structure may not be most efficiently put together, those who work there do their best to make it as efficient as possible. The lights downstairs which get the most use have been converted to fluorescent lights. The upstairs lighting however uses about five incandescent light bulbs throughout the halls and bedroom or "storage" rooms. These lights are rarely used, and any room on the first floor not being used had the lights off. The outside lighting includes motion sensor incandescent lights used for security.

The boiler and heating system is extremely old and delicate. The thermostat temperature upstairs was set at 60 degrees Fahrenheit and the downstairs heat is only turned on when someone is there to about 70 degrees Fahrenheit. There is a window mounted air conditioning unit which is used during the summer months. The building envelope is extremely old as well. The windows are old and very drafty. Masking tape is used around the edges to dry and seal up the windows. There is also a lack of sufficient insulation through the building. This is especially noticeable upstairs where you can feel a draft throughout the rooms.

Actions

The first recommendation proposed should be for the Town of Holden to consider what its long term plans for housing the Recreation Department are. If it is intended to keep the Recreation Department in that building, then many extensive fixes should be made to it. Other options to consider are moving the Recreation Department to a different building that is already in use by Holden such as the Senior Center, the new middle school, or the old Police Station.

If the Town intends to keep the recreation building, one of the first corrective measures to employ is to fix up the building structure. Putting in insulation and replacing windows will help regulate building temperature with less energy used. The next step would be to replace the boiler and to install programmable thermostats. Lastly, the Town could look into replacing the lights with LEDs or fluorescents for the upstairs lights. These steps would likely conserve at least 20 percent of the energy currently used.

Street Lights

Currently one of the largest uses for electricity by the Town of Holden is street lighting. The town uses about 820,000 kWh in a given year for street lighting, across approximately 1,600 street lights. The majority of these street lights are high pressure sodium bulbs. According to the DOER website and a statement from the City of Boston, LED streetlights can reduce energy consumption between 25 and 60 percent when compared with traditional mercury or sodium based lamps (Department of Energy Resources, 2012) (City of Boston, 2012). With the way current LED technology is growing, most sources indicate 50-60 percent savings most likely (Banham, 2012). They also have a longer lifespan of around 10-15 years and require less maintenance. In fact, the DOER estimates that another 25 percent in maintenance costs can be saved by switching to LED street lights.

The cost of switching to LED lights varies based on complexity, design choice, and size of orders. While the DOER estimates these costs between $300 and $750 per light, research shows that these installation costs are often closer to $300, and could fall below this into the $200 range. If the Town completely replaced its streetlights for $300 per light, the initial installation costs will be about $480,000. If the Town reduced street light energy consumption by 50 percent from this replacement, its new usage would be 410,000 kWh. At $0.14 per kWh, this would save the Town about $57,400 yearly. An additional $3,500 in maintenance costs could likely be saved as well due to the extended life of LED lights. This puts the total payback period at around eight years, and energy reduction of approximately 410,000 kWh or 1,399.33 MMBtu.

Criterion 4

For the "purchase only fuel efficient vehicles" criterion of the Green Communities Act, Holden must simply comply with the fuel-efficiency standards outlined under the Green Communities page on the DOER website. Many vehicles are exempt from this criterion, in particular heavy-duty vehicles that weigh over 8,500 pounds. In addition, police cruisers, passenger vans, and cargo vans are exempt until fuel-efficient alternatives become available. The standards as of 2013 are lenient, with the highest requirement being 29 miles per gallon for 2-wheel drive cars. To achieve this criterion, the Town of Holden must submit letters from their government, public school district, and (if they choose to participate) regional school district, promising to abide by these standards. In addition, an inventory of both exempt and non-exempt vehicles must be developed and maintained. Holden must review the fuel efficient vehicle policy annually and ensure that it reflects the DOER's most recently published MPG minimums.

One vehicle in Holden's fleet is a 2000 Ford Ranger used by the Light Department. One possible replacement to this vehicle that would meet the requirements under this criterion could be 2011 Ford Ranger. A side by side comparison of these two vehicles shows the newer 2011 Ford Ranger, with the same specifications, would consume $200 less in gasoline costs per year.

Criterion 5

To meet the Green Communities standard of the building code, the Town must submit to a vote a new energy efficient building code meeting all the requirements of the Stretch Energy Code. In Holden, a vote for this change would have to be held at a town meeting and would most likely require lobbying on behalf of the Town. As many as 122 other towns in Massachusetts have already passed the Stretch Energy Code by holding information sessions and making the public aware of the great benefits that comes with both residential and commercial buildings built under this code. As soon as the Town passes a code meeting all the requirements such as the Stretch Code, criterion 5 will be accomplished.

Conclusion:

The Green Communities Act provides many towns and cities the ability to reduce their carbon footprint by lowering their energy use and promoting new energy efficient methods. This Act gives communities achieving the status of "Green Community" grants and funding to apply some of the energy saving plans to town facilities. In order to achieve this status, towns must meet five criteria which are designed to help the community move forward in reducing energy in the future. These criteria are as follows:

- "As-of-Right" Siting
- Expedited Permitting Process
- Energy Reduction Plan
- Fuel Efficient Town Vehicles
- Stretch Energy Building Code

For this project, the Town of Holden was chosen to work on attaining Green Communities status. As a group, we delegated the different criteria to individuals in order to achieve a better understanding of the complexities of each criterion and research was done to better understand the requirements necessary to meet them. Work was then done to give Holden a solid foundation to move forward with meeting the criteria and achieving Green Community status.

Criterion 1, "As-of-Right" Siting, requires that a town zone areas specifically for the use of renewable energy generation, research and development, and manufacture. This can be accomplished by a letter from town officials confirming that such zones exist and are ready for use in the renewable energy industry. Through our research the Town of Holden was found to meet the zoning requirements for renewable energy sites and recommendations were made that a letter could be drafted confirming this fact.

Expedited Permitting in Criterion 2 says that building permits needed for all new construction included in Criterion 1 must be executed on a strict timeline that allows the construction to move forward. This means that any renewable energy facility can be opened as quickly as possible to help the community in energy

efficiency. Like Criterion 1, expedited permitting can be confirmed with an official letter from town officials stating that the process already in place or a newly approved process will expedite permits for facilities meeting the requirements of Criterion 1. Our group found Holden's permitting process to meet this requirement with help from the surveyor's office.

The reduction of the town's overall use of energy by official facilities is the most difficult criteria to accomplish as it requires the town reduce its total energy consumption by 20 percent over a period of five years. To satisfy the criterion the town must complete a plan that shows how this energy reduction will be accomplished. We assembled data given by the Town to establish a base year and set up the data gathering required to make an energy reduction plan by persons working on this project in the future. Visits to Town facilities and audits by our own group members were taken as a preliminary look at possible energy saving areas.

Criterion 4 is labeled as Fuel Efficient Vehicles which states that a town must make an effort to purchase only fuel efficient vehicles where commercially available to standards set by the Environmental Protection Agency. The purchase of these vehicles can be when a new or replacement vehicle is needed and not on any specific timeline. For Holden to pass this requirement a letter from town officials saying that this can be met, and the Town will in fact make the effort, is all that is needed. Our group has made this recommendation to the Town and officials will be taking it under advisement.

The Stretch Energy Code is an appendix to the current building code in Massachusetts which holds commercial and residential new construction to standards of better energy efficiency and building envelopes. For a town to meet this requirement, the Stretch Energy Code or a similar code must be passed by the town during a town meeting. In researching past communities who have passed the Stretch Code, our group has found that some towns experienced difficulties in that townspeople were resistant to the change. Recommendations were made to hold information sessions that would educate the public on the financial benefits as well as the environmental impact.

When all five criteria are met, Holden will become a Green Community and will receive grants helping the Town's energy reduction plans as well as updating the vehicles used by town officials and workers. The best uses of the grant money, from our observations and recommendations, would be updating the street lighting to LEDs, insulating the Department of Public Works garage, and implementing natural gas boilers to both the Town Hall and Starbard Building. A switch to LED street lights would be the most beneficial, as street lighting is one of the largest electrical accounts. This change could save 50 to 60 percent in energy use. The Department of Public Works garage is one of the most outdated buildings, and would be the biggest beneficiary of an improved building envelope. The amount of grant money received would not be useful in the constructing of a new Department of Public Works garage. In place of Town funds, the grant money could be used to switch out the old boilers in the Town Hall and Starbard Building and update the heating system with the use of programmable thermostats and zone heating. Our recommendations for the use of the grant money could significantly decrease the energy usage in the Town, without withdrawing from the Town budget.

So far 110 towns have reached Green Community status, and Holden can become the next one with written letters confirming it meets the first, second and fourth criteria, an energy reduction plan for the next five years, as well as adoption of the Stretch Energy Code. When these are complete Holden will be on its way to becoming a sustainable community.

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- Jacquie Kelly
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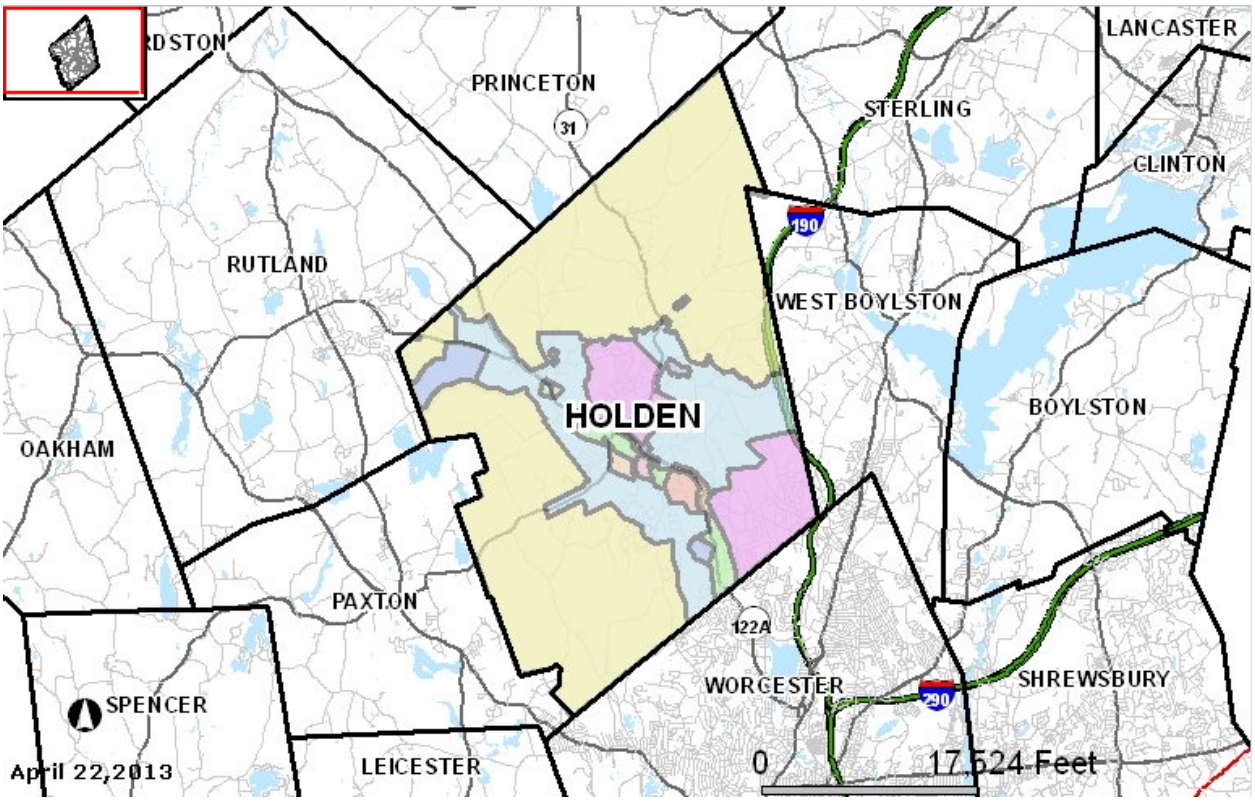
Appendix A:



Appendix A-1: Zoning Map of Holden 1

March 9, 2012

GREEN COMMUNITIES DESIGNATION & GRANT PROGRAM

Criterion 1

As-of-Right Siting via Generation, R&D, or Manufacturing

Overview Guidance

The Green Communities Act requires compliance with five criteria to qualify as a green community (*see Section 22 of the Green Communities Act, codified at M.G.L. ch. 25A § 10(c)*). This document assists communities in understanding and meeting the alternatives for complying with criterion one (#1). This document also provides links to other important documents to aid municipalities in meeting this criterion.

CRITERION 1: AS-OF-RIGHT SITING – RENEWABLE ENERGY / ALTERNATIVE ENERGY

A municipality must provide zoning in designated locations for the as-of-right siting for one of the following:

1. renewable or alternative energy generating facilities,
   OR
2. renewable or alternative energy research and development (R&D) facilities,
   OR
3. renewable or alternative energy manufacturing facilities

- "As-of-Right Siting" provides for the allowed use without unreasonable regulation. More specifically, as-of-right siting means that development may proceed without the need for a special permit, variance, amendment, or other discretionary approval. As-of-right development may be subject to non-discretionary site plan review to determine conformance with local zoning bylaws as well as state and federal law. As-of-right development projects that are consistent with zoning bylaws and with state and federal law cannot be prohibited.

- An applicant can meet this requirement by providing as-of-right siting for any one of the three types of facilities listed above.

- If a community has as-of-right siting in place for R&D and/or manufacturing facilities in general, this can meet this requirement. The community must demonstrate that the zoning bylaw applies to renewable and alternative energy R&D or manufacturing. More detailed guidance is available in our document: "Guidance for As-Of-Right Siting via R&D / Manufacturing" available on our website.

- Communities can select the specific locations for the as-of-right siting, for example, where these facilities are to be located. These locations must be feasible and practical. For example, locations for wind are required to have adequate wind resources (6m/s at 70 meters), biomass Combined Heat and Power (CHP) locations are required to have a sufficient thermal load, and large-scale ground-mounted PV must have adequate space.

- If providing as-of-right siting for a renewable or alternative energy generation facility, the community must select technology that is practically available and provides a realistic opportunity for generation. It is expected that a community will appropriately utilize its available renewable resources, and this will be taken into consideration in the review of an application meeting this requirement.

- As-of-right zoning bylaws can apply appropriate standards that protect public health and safety and provide for non-discretionary site plan review. Reasonable environmental performance standards per the developed bylaw may be incorporated into the Site Plan Review (SPR) process (e.g. height, setback, etc…), but cannot be so stringent as to make the use infeasible. The key is that SPR must be truly non-discretionary: if the standards and zoning requirements are met, the project can be built. This is distinct from the Special Permit (SP), in that the SP may be denied if the Planning Board or other permit granting authority is not satisfied with the project.

- An applicant can meet this requirement with as-of-right siting for renewable or alternative energy generation with any ***one*** of the following project requirements:

  - **On-shore Wind** – a turbine of a minimum 600 kW in size or above
  - **Off-shore Wind** – a turbine of a minimum 2.5 MW or above
  - **Solar Photovoltaic** – a single ground-mounted system of a minimum of 250 kW or above
  - **Biomass CHP** – a minimum of 5MW in a stand-alone building
  - **Ocean, wave or tidal** – no minimum threshold

NOTE: When grant awards are made to those applicants who have been designated as a Green Community, dependent upon the funds available, a bonus amount ***may*** be provided to those who have met the as-of-right siting requirement through renewable and alternative energy generation.

- Alternatively, If providing as-of-right siting for R&D or Manufacturing facilities, a municipality's zoning must specify as an allowed use construction of one of the following facilities:

  - **Research and Development Facilities** are those used primarily for research, development and/or testing of innovative information, concepts, methods, processes, materials, or products. This can include the design, development, and testing of biological, chemical, electrical, magnetic, mechanical, and/or optical components in advance of product manufacturing. The accessory development, fabrication, and light manufacturing of prototypes, or specialized machinery and devices integral to research or testing may be associated with these uses.

  - **Manufacturing Facilities** are those used primarily for heavy or light industry or the manufacture or assembly of a product including processing, blending, fabrication, assembly, treatment and packaging.

- Additionally, in order to qualify, the as-of-right zoning for R&D or manufacturing must clearly allow renewable or alternative energy activities defined as follows. The expectation is that the municipality will allow for all of the technology areas listed below. Given adequate justification, the Division may permit exclusion of a particular technology.

  Renewable Energy:
  - Solar – photovoltaic (PV) and thermal
  - Wind
  - Biomass power conversion or thermal technologies, including R&D related to, or the manufacture of, wood pellets
  - Ultra low emissions high efficiency wood pellet boilers and furnaces
  - Low Impact Hydro – electric and kinetic
  - Ocean thermal, wave or tidal
  - Geothermal
  - Landfill Gas
  - Fuels Cells that use Renewable Energy
  - Advanced biofuels

Alternative Energy:

- Combined Heat and Power
- Electric and hydrogen powered vehicles and associated technologies including advanced batteries and recharging stations

Documentation Required to Meet Criterion 1

The following documentation **must** be provided as evidence that the municipality has met this criterion.

- Brief description of the qualifying section of the bylaw or ordinance that identifies designated locations
- Color copy of the zoning map that shows area zoned
- Applicable sections of the zoning bylaw or ordinance
- Important zoning definitions
- Relevant section of the use table and any key that will help DOER interpret the use table
- Any related local regulations applicable to facilities sited under the bylaw/ordinance—such as site plan review regulations—so that DOER can confirm that the related local regulations are non-discretionary; and
- For *RE/AE R&D and/or Manufacturing Facilities only* yield calculations, either in the text of the letter provided by municipal legal counsel or attached.
- For *RE/AE R&D and/or Manufacturing Facilities only*, if meeting the criterion through *existing* bylaws or ordinances, applicants must provide a letter from municipal legal counsel certifying that the existing zoning complies with the RE/AE Facilities criterion. In terms of specific contents, the letter must cite and summarize the pertinent section of the zoning ordinance/bylaw.

Link to Criterion 1 Guidance web page, which contains this document and:

- Guidance for Meeting Criteria 1 via Renewable/Alternative Energy R&D and/or Manufacturing Facilities
- Model As-of-Right Bylaw for Large-Scale Photovoltaic Installations
- Model As-of-Right Bylaw for Use of Wind Facilities
- Green Communities that Adopted As of Right Siting Through Renewable Energy Generation

Updated 04-08-11

GREEN COMMUNITIES DESIGNATION & GRANT PROGRAM

Criteria 1

Guidance for Meeting Criteria 1 via Renewable/Alternative Energy R&D and/or Manufacturing Facilities

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Guidance - Complying with the Green Communities Act through the as-of-right siting of renewable or alternative energy research and development or manufacturing facilities

This Guidance was prepared by the Department of Energy Resources (DOER) to assist cities and towns in enacting zoning that satisfies a requirement of the Green Communities Program by facilitating development of renewable or alternative energy research and development facilities or renewable or alternative energy manufacturing facilities.

The Green Communities Act requires compliance with five criteria to qualify as a green community (*see Section 22 of the Green Communities Act, codified at M.G.L. ch. 25A § 10(c)*). This document assists communities in understanding and meeting the underlined alternatives for complying with criterion one (#1):

> *To qualify as a green community, a municipality or other local governmental body shall: . . . (2) provide for the as-of-right siting of renewable or alternative energy generating facilities, renewable or alternative energy research and development facilities, or renewable or alternative energy manufacturing facilities in designated locations . . .*

As stated, municipalities or local government bodies seeking to qualify as green communities may satisfy the as-of-right criterion one (#1) by providing for as-of-right siting of renewable or alternative energy research and development (R&D) facilities or as-of-right siting for renewable or alternative energy manufacturing facilities. This document provides communities with guidance on the standards against which their zoning will be evaluated, and how to document compliance with these standards.

It is important to recognize that municipalities may permit uses that satisfy criterion one (#1) under a variety of names and in a multitude of different types of districts. For example, industrial, light industrial, commercial, and mixed-use districts often allow R&D and manufacturing facilities. Key questions in regard to qualification as a green community are whether:

1. Development is permitted as **of right**;
2. Construction of a qualifying "renewable or alternative energy" R&D or manufacturing facility is **allowed** in the zoning district; AND
3. If additional development is **feasible** in the zoning district.

Question #1: Does the bylaw or ordinance permit development as-of-right?

First, to qualify as a green community under this provision, a bylaw/ordinance must permit a qualifying facility as-of-right. This type of zoning, otherwise commonly known as "by right," allows a landowner/developer to build the pertinent facility without the need for a special permit or any other type of discretionary permit. DOER will utilize the following definition when evaluating zoning for compliance:

> **As-of-Right Siting:** As-of-Right siting shall mean that development may proceed without the need for a special permit, variance, amendment, waiver, or other discretionary approval. As-of-right development

may be subject to non-discretionary site plan review to determine conformance with local zoning bylaws as well as state and federal law. As-of-right development projects that are consistent with zoning bylaws and with state and federal law cannot be prohibited.

Question #2: Does the bylaw or ordinance clearly allow the construction of facilities that will engage in "renewable or alternative energy" R&D or manufacturing?

To qualify a municipality's zoning must specify as an allowed use construction of one of the following facilities:

Research and Development Facilities are those used primarily for research, development and/or testing of innovative information, concepts, methods, processes, materials, or products. This can include the design, development, and testing of biological, chemical, electrical, magnetic, mechanical, and/or optical components in advance of product manufacturing. The accessory development, fabrication, and light manufacturing of prototypes, or specialized machinery and devices integral to research or testing may be associated with these uses.

Manufacturing Facilities are those used primarily for heavy or light industry or the manufacture or assembly of a product including processing, blending, fabrication, assembly, treatment and packaging

Additionally, in order to qualify, the as-of-right zoning for R&D or manufacturing must clearly allow renewable or alternative energy activities defined as follows. The expectation is that the municipality will allow for all of the technology areas listed below. Given adequate justification, the Division may permit exclusion of a particular technology:

Renewable Energy:

- Solar - photovoltaic (PV) and thermal
- Wind
- Biomass power conversion or thermal technologies, including R&D related to, or the manufacture of, wood pellets
- ultra low emissions high efficiency wood pellet boilers and furnaces
- Low Impact Hydro - electric and kinetic
- Ocean thermal, wave or tidal
- Geothermal
- Landfill Gas
- Fuels Cells that use Renewable Energy
- Advanced biofuels

Alternative Energy:

- Combined Heat and Power
- Electric and hydrogen powered vehicles and associated technologies including advanced batteries and recharging stations

Note: Municipalities seeking credit for zoning that authorizes R&D or manufacturing associated with other clean energy technologies or fuels should consult DOER.

Question #3: Does local zoning provide a realistic opportunity to locate renewable or alternative energy R&D or manufacturing facilities?

Finally, in order to satisfy criterion one (#1), an applicant must show one of the following:

1) that land is available for the construction of a facility or facilities of 50,000 square feet or larger in the aggregate; or
2) that there is enough available vacant space in existing buildings to provide for a facility or facilities of 50,000 square feet or larger in the aggregate, with a minimum of 5,000 square feet per unit; or
3) that a combination of available land for new construction and existing available vacant space in existing buildings can accommodate a facility or facilities of 50,000 square feet or larger in the aggregate.

Zoning districts with previously developed but vacant or underutilized structures or sites are preferred over those that would site clean energy facilities on land that is currently wooded, actively farmed, or otherwise undeveloped. Basic yield calculations accounting for height, floor area ratio, setback, parking, and other limits on building size will suffice as documentation that of available land for new construction purposes. For available vacant space, the individual units must be identified with addresses and the associated square footage, a single unit must be at least 5,000 sq feet, and an explanation of how it was determined the space is currently vacant must be provided.

Documentation: How to demonstrate that the municipality's zoning qualifies

Applicants must provide a letter from municipal counsel certifying that the above questions can be answered in the affirmative. In terms of specific contents:

The letter must cite and summarize the pertinent section of the zoning ordinance/bylaw;

- Applicants must include copies of:
  - The applicable section of their zoning bylaw/ordinance,
  - Important zoning definitions,
  - The relevant section of the use table and any key that will help DOER interpret the use table,
  - Any related local regulations applicable to facilities sited under the bylaw/ordinance—such as site plan review regulations—so that DOER can confirm that the related local regulations are non-discretionary; AND
- Yield calculations must be either included in the text of the letter or attached.
- Any documentation supporting the existence of available vacant space must be in the text of the letter or attached.

Sample Letter:

The town's light industrial district, section 4.3 of the zoning bylaw, allows the by-right construction of manufacturing facilities that meet the definitions provided. The text of this section, relevant portions of the town's site plan review regulations, and the table of uses are attached. Manufacturing of renewable/alternative energy products is clearly allowed, and in fact such a facility was permitted in 2007 and built last year. ABC Industries assembles solar panels from components produced on-site and in other locations around the globe. Finally, the light industrial district covers an area of 250+ acres near a highway interchange. Over 50% of the land in this district is vacant and developable. The district has no stated FAR limit, the impervious surface limit is 70%, buildings can be of up to 3 stories and only one parking space is required per 1000 square feet. Thus, as indicated in the attached calculation, plenty of space exists for 50,000 square feet of floor area to be built.

Examples of Qualifying Activities: By applying for certification as a green community under the R&D and manufacturing provision of criterion one (#1) legal counsel and local officials are certifying that landowners in the appropriate district are able to construct, as of right, facilities that can be used for renewable and alternative energy related manufacturing or R&D activities such as:

- Solar panel production
- Research and development intended to enhance geothermal systems
- Manufacture of turbines – wind or hydro
- Research related to advanced battery systems
- Manufacture of fuel cells
- Research to improve the efficiency of or reduce pollution from biomass power facilities
- Assembly of wave energy generating systems
- Manufacture of wood pellets
- Production of biofuels
- Assembly of Combined Heat and Power units

Model As-of-Right Zoning Bylaw: Allowing Use of Large-Scale Ground-Mounted Solar Photovoltaic Installations

Prepared by:
Department of Energy Resources
Massachusetts Executive Office of Environmental Affairs

March 2012

This Model Bylaw was prepared to assist cities and towns in establishing reasonable standards to facilitate development of large-scale ground-mounted solar photovoltaic installations. The bylaw was developed as a model and is not intended for adoption without specific review by municipal counsel.

1.0 Purpose

The purpose of this bylaw is to promote the creation of new large-scale ground-mounted solar photovoltaic installations by providing standards for the placement, design, construction, operation, monitoring, modification and removal of such installations that address public safety, minimize impacts on scenic, natural and historic resources and to provide adequate financial assurance for the eventual decommissioning of such installations.

The provisions set forth in this section shall apply to the construction, operation, and/or repair of large-scale ground-mounted solar photovoltaic installations.

1.1 Applicability

This section applies to large-scale ground-mounted solar photovoltaic installations proposed to be constructed after the effective date of this section. This section also pertains to physical modifications that materially alter the type, configuration, or size of these installations or related equipment.

Qualifying as a Green Community: In order to satisfy the Green Communities Act as-of-right zoning requirement a community's zoning must allow solar photovoltaic installations that utilize ground-mounted systems which individually have a rated name plate capacity of 250 kW (DC) or more.

Approximate size of installation: A solar photovoltaic array with a rated name plate capacity of 250 kW (DC) occupies approximately one acre of land.

Smaller installations (under 250 kW): The above requirement for qualification as a Green Community is not intended to discourage construction of solar photovoltaic installations that are smaller than 250 kW, but rather to ensure that in designated locations local regulatory barriers that may adversely affect large-scale ground-mounted projects are minimized.

Educational Note: Existing Massachusetts law largely exempts solar photovoltaic installations from local zoning restrictions. Massachusetts General Laws Chapter 40A, Section 3, provides, in relevant part, that:

> *No zoning ordinance or by-law shall prohibit or unreasonably regulate the installation of solar energy systems or the building of structures that facilitate the collection of solar energy, except where necessary to protect the public health, safety or welfare.*

In view of M.G.L. ch. 40A § 3, local zoning provisions specifically allowing for the as-of-right construction of smaller solar energy systems – such as those commonly installed on top of or on the lot of a home or business—are unnecessary. However, it is not clear whether M.G.L. ch. 40A § 3 applies to the construction of large scale ground-mounted systems. Therefore, to qualify as a green community, a municipality may adopt a solar photovoltaic bylaw for as-of-right siting of large scale ground-mounted systems in a designated location(s). An existing example of a large scale ground-mounted solar photovoltaic system is the Brockton Brightfields Project.

2.0 Definitions

As-of-Right Siting: As-of-Right Siting shall mean that development may proceed without the need for a special permit, variance, amendment, waiver, or other discretionary approval. As-of-right development may be subject to site plan review to determine conformance with local zoning ordinances or bylaws. Projects cannot be prohibited, but can be reasonably regulated by the inspector of buildings, building commissioner or local inspector, or if there is none in a town, the board of selectmen, or person or board designated by local ordinance or bylaw.

Building Inspector: The inspector of buildings, building commissioner, or local inspector, or person or board designated by local ordinance or bylaw charged with the enforcement of the zoning ordinance.

Building Permit: A construction permit issued by an authorized building inspector; the building permit evidences that the project is consistent with the state and federal building codes as well as local zoning bylaws, including those governing ground- mounted large-scale solar photovoltaic installations.

Designated Location: The location[s] designated by [the community's local legislative body], in accordance with Massachusetts General Laws Chapter 40A, section 5, where ground - mounted large scale solar photovoltaic installations may be sited as-of right. Said location[s] [is/are] shown on a Zoning Map [insert title of map] pursuant to Massachusetts General Laws Chapter 40A Section 4. This map is hereby made a part of this Zoning Bylaw and is on file in the Office of the [Town/City] Clerk.

Note: The term "designated location" refers to the location within a community where solar photovoltaic installations are permitted as-of-right. Establishment of a designated location for such installations is an integral part of the process of adopting an as-of-right solar photovoltaic bylaw.

***Legal Requirements:** The process of designating the location must comport with the requirements of Massachusetts General Laws Chapter 40A, Section 5, which sets out the requirements for adopting and amending zoning bylaws.*

***Methods of Designating a Location:** Communities may designate locations by reference to geographically specific districts. In the alternative, communities may create an overlay district consisting of all or portions of multiple preexisting zoning districts, where large scale solar photovoltaic power generation is permitted by right. Because solar photovoltaic power generation produces neither adverse noise impacts nor harmful emissions, use of land for the purpose of solar photovoltaic power generation should be compatible with most other types of land usage. However DOER strongly discourages designating locations that require significant tree cutting, because of the important water management, cooling and climate benefits trees have. DOER encourages designating locations in industrial and commercial districts, or on vacant, disturbed land.*

***Green Communities Program Requirements:** To qualify for designation as a Green Community, the designated location must provide a realistic and practical opportunity for development of a large scale solar photovoltaic power generation facility. In designating a location, it is important for the community implementing the as-of right zoning bylaw to consider the availability of sunlight and particular characteristics of the local community. It is not practical to site solar photovoltaic installations in areas that are surrounded by tall structures. The size of available lots is also a relevant consideration, though aggregation of contiguous parcels within a designated district in order to create a parcel of sufficient size to construct a qualifying facility will be considered. As previously mentioned, a solar photovoltaic array with a rated name plate capacity of 250 kW occupies approximately one acre of land.*

Large-Scale Ground-Mounted Solar Photovoltaic Installation: A solar photovoltaic system that is structurally mounted on the ground and is not roof-mounted, and has a minimum nameplate capacity of 250 kW DC.

On-Site Solar Photovoltaic Installation: A solar photovoltaic installation that is constructed at a location where other uses of the underlying property occur.

Rated Nameplate Capacity: The maximum rated output of electric power production of the Photovoltaic system in Direct Current (DC).

Site Plan Review: review by the Site Plan Review Authority to determine conformance with local zoning ordinances or bylaws.

Note: In some communities this is known as Site Plan Approval rather than Site Plan Review. Regardless of which term is used by a community, the following excerpt from Lowe's Home Centers, Inc. v. Town of Auburn Planning Board provides an excellent judicial explanation of the nature of site plan review as applied to as-of-right uses:

Site plan approval acts as a method for regulating as-of-right uses rather than prohibiting them as per Y.D. Dugout, Inc. v. Bd. Of Appeals of Canton, 357 Mass. 25, 31, 255 N.E.2d 732 (1970). When evaluating the Site Plan Applications, the Planning Board may not unconditionally deny the Site Plan Applications, but rather, it may impose reasonable conditions upon them. See Prudential, 23 Mass.App.Ct. at 281-82, 502 N.E.2d 137; Quincy, 39 Mass.App.Ct. at 21-22, 652 N.E.2d 901 ("[W]here the proposed use is one permitted by right the planning board may only apply substantive criteria ... i.e., it may impose reasonable terms and conditions on the proposed use, but it does not have the discretionary power to deny the use."). Thus, when a site plan application is submitted for an as-of-right use, a planning board is obligated to grant an approval with reasonable conditions unless, "despite best efforts, no form of reasonable conditions [can] be devised to satisfy the problem with the plan...." Prudential, 23 Mass.App.Ct. at 283n. 9, 502 N.E.2d 137; Castle Hill Apartments Ltd.P'ship v. Planning Bd. Of Holyoke, 65 Mass.App.Ct. 840, 845-45, 844 N.E.2d 1098 (2006).

Site Plan Review Authority: For purposes of this bylaw, Site Plan Review Authority refers to the body of local government designated as such by the municipality

Note: The Site Plan Review Authority can be the Board of Selectman, City Council, Board of Appeals, Planning Board or Zoning Administrator. However, the Planning Board is typically the best group to serve in this capacity as it is usually the most familiar with the municipality's zoning bylaws/ordinances as well as its Master Plan or other plans for future conservation/development.

Zoning Enforcement Authority: The person or board charged with enforcing the zoning ordinances or bylaws.

Note: By state statute, the Zoning Enforcement Authority may be the "inspector of buildings, building commissioner or local inspector, or if there are none, in a town, the board of selectmen, or person or board designated by local ordinance or by-law". M.G.L. ch. 40A § 7. In many communities, the building inspector is the person charged with enforcing both the state's building code and local zoning ordinances or bylaws.

3.0 General Requirements for all Large Scale Solar Power Generation Installations

The following requirements are common to all solar photovoltaic installations to be sited in designated locations.

3.1 Compliance with Laws, Ordinances and Regulations

The construction and operation of all large scale solar photovoltaic installations shall be consistent with all applicable local, state and federal requirements, including but not limited to all applicable safety, construction, electrical, and communications requirements. All buildings and fixtures forming part of a solar photovoltaic installation shall be constructed in accordance with the State Building Code.

3.2 Building Permit and Building Inspection

No large scale solar photovoltaic installation shall be constructed, installed or modified as provided in this section without first obtaining a building permit.

Note: Under the state building code, work must commence within six (6) months from the date a building permit is issued; however, a project proponent may request an extension of the permit and more than one extension may be granted.

3.3 Fees

The application for a building permit for a large scale solar photovoltaic installation must be accompanied by the fee required for a building permit.

3.4 Site Plan Review

Ground-mounted large scale solar photovoltaic installations with 250 kW or larger of rated nameplate capacity shall undergo site plan review by the Site Plan Review Authority prior to construction, installation or modification as provided in this section.

Purpose: The purpose of the site plan review is to determine that the use complies with all requirements set forth in this zoning bylaw and that the site design conforms to established standards regarding landscaping, access, and other zoning provisions.

Additional Considerations: As part of the implementation of an as-of-right large-scale ground-mounted solar photovoltaic bylaw, communities should consider amending their existing site plan review provisions in order to incorporate site plan review conditions that apply specifically to such installations.

3.4.1 General

All plans and maps shall be prepared, stamped and signed by a Professional Engineer licensed to practice in Massachusetts.

3.4.2 Required Documents

Pursuant to the site plan review process, the project proponent shall provide the following documents:

(a) A site plan showing:

i. Property lines and physical features, including roads, for the project site;
ii. Proposed changes to the landscape of the site, grading, vegetation clearing and planting, exterior lighting, screening vegetation or structures;

iii. Blueprints or drawings of the solar photovoltaic installation signed by a Professional Engineer licensed to practice in the Commonwealth of Massachusetts showing the proposed layout of the system and any potential shading from nearby structures
iv. One or three line electrical diagram detailing the solar photovoltaic installation, associated components, and electrical interconnection methods, with all National Electrical Code compliant disconnects and overcurrent devices;
v. Documentation of the major system components to be used, including the PV panels, mounting system, and inverter;
vi. Name, address, and contact information for proposed system installer;
vii. Name, address, phone number and signature of the project proponent, as well as all co-proponents or property owners, if any;
viii. The name, contact information and signature of any agents representing the project proponent; and

(b) Documentation of actual or prospective access and control of the project site (see also Section 3.5);
(c) An operation and maintenance plan (see also Section 3.6);
(d) Zoning district designation for the parcel(s) of land comprising the project site (submission of a copy of a zoning map with the parcel(s) identified is suitable for this purpose);
(e) Proof of liability insurance; and
(f) Description of financial surety that satisfies Section 3.12.3.
(g) A public outreach plan, including a project development timeline, which indicates how the project proponent will meet the required site plan review notification procedures and otherwise inform abutters and the community

The Site Plan Review Authority may waive documentary requirements as it deems appropriate.

Additional Consideration for Smaller Solar Photovoltaic Installations: The extensive site plan review documentation set forth in Section 3.4.2 of this model bylaw is not intended to apply to smaller solar photovoltaic installations. One of the key goals underpinning the Green Communities Program is the development of renewable and alternative energy generation. Communities should shape their bylaws to enable both large and small projects to proceed without undue delay.

3.5 Site Control

The project proponent shall submit documentation of actual or prospective access and control of the project site sufficient to allow for construction and operation of the proposed solar photovoltaic installation.

3.6 Operation & Maintenance Plan

The project proponent shall submit a plan for the operation and maintenance of the large-scale ground-mounted solar photovoltaic installation, which shall include measures for

maintaining safe access to the installation, storm water controls, as well as general procedures for operational maintenance of the installation.

3.7 Utility Notification

No large- scale ground –mounted solar photovoltaic installation shall be constructed until evidence has been given to the Site Plan Review Authority that the utility company that operates the electrical grid where the installation is to be located has been informed of the solar photovoltaic installation owner or operator's intent to install an interconnected customer-owned generator. Off-grid systems shall be exempt from this requirement.

3.8 Dimension and Density Requirements

3.8.1 Setbacks

For large - scale ground-mounted solar photovoltaic installations, front, side and rear setbacks shall be as follows:

(a) Front yard: The front yard depth shall be at least 10 feet; provided, however, that where the lot abuts a Conservation-Recreation or Residential district, the front yard shall not be less than 50 feet.

(b) Side yard. Each side yard shall have a depth at least 15 feet; provided, however, that where the lot abuts a Conservation-Recreation or Residential district, the side yard shall not be less than 50 feet.

(c) Rear yard. The rear yard depth shall be at least 25 feet; provided, however, that where the lot abuts a Conservation-Recreation or Residential district, the rear yard shall not be less than 50 feet.

Note: These setback distances are suggested values. Decreased setback distances may be appropriate. The municipality should evaluate what is appropriate for its designated location(s). Project developers may be encouraged to include screening vegetation along the borders of the site, to minimize the visual impact of the PV installation.

3.8.2 Appurtenant Structures

All appurtenant structures to large- scale ground-mounted solar photovoltaic installations shall be subject to reasonable regulations concerning the bulk and height of structures, lot area, setbacks, open space, parking and building coverage requirements. All such appurtenant structures, including but not limited to, equipment shelters, storage facilities, transformers, and substations, shall be architecturally compatible with each other. Whenever reasonable, structures should be shaded from view by vegetation and/or joined or clustered to avoid adverse visual impacts.

Note: Regulations governing appurtenant structures are typically contained in a town's zoning ordinance or bylaw.

3.9 Design Standards

3.9.1 Lighting

Lighting of solar photovoltaic installations shall be consistent with local, state and federal law. Lighting of other parts of the installation, such as appurtenant structures, shall be limited to that required for safety and operational purposes, and shall be reasonably shielded from abutting properties. Where feasible, lighting of the solar photovoltaic installation shall be directed downward and shall incorporate full cut-off fixtures to reduce light pollution.

3.9.2 Signage

Signs on large- scale ground-mounted solar photovoltaic installations shall comply with a municipality's sign bylaw. A sign consistent with a municipality's sign bylaw shall be required to identify the owner and provide a 24-hour emergency contact phone number.

Solar photovoltaic installations shall not be used for displaying any advertising except for reasonable identification of the manufacturer or operator of the solar photovoltaic installation.

3.9.3 Utility Connections

Reasonable efforts, as determined by the Site Plan Review Authority, shall be made to place all utility connections from the solar photovoltaic installation underground, depending on appropriate soil conditions, shape, and topography of the site and any requirements of the utility provider. Electrical transformers for utility interconnections may be above ground if required by the utility provider.

3.10 Safety and Environmental Standards

3.10.1 Emergency Services

The large scale solar photovoltaic installation owner or operator shall provide a copy of the project summary, electrical schematic, and site plan to the local fire chief. Upon request the owner or operator shall cooperate with local emergency services in developing an emergency response plan. All means of shutting down the solar photovoltaic installation shall be clearly marked. The owner or operator shall identify a responsible person for public inquiries throughout the life of the installation.

3.10.2 Land Clearing, Soil Erosion and Habitat Impacts

Clearing of natural vegetation shall be limited to what is necessary for the construction, operation and maintenance of the large – scale ground-mounted solar photovoltaic installation or otherwise prescribed by applicable laws, regulations, and bylaws.

3.11 Monitoring and Maintenance

3.11.1 Solar Photovoltaic Installation Conditions

The large - scale ground-mounted solar photovoltaic installation owner or operator shall maintain the facility in good condition. Maintenance shall include, but not be limited to, painting, structural repairs, and integrity of security measures. Site access

shall be maintained to a level acceptable to the local Fire Chief and Emergency Medical Services. The owner or operator shall be responsible for the cost of maintaining the solar photovoltaic installation and any access road(s), unless accepted as a public way.

3.11.2 Modifications
All material modifications to a solar photovoltaic installation made after issuance of the required building permit shall require approval by the Site Plan Review Authority.

3.12 Abandonment or Decommissioning

3.12.1 Removal Requirements
Any large- scale ground-mounted solar photovoltaic installation which has reached the end of its useful life or has been abandoned consistent with Section 3.12.2 of this bylaw shall be removed. The owner or operator shall physically remove the installation no more than 150 days after the date of discontinued operations. The owner or operator shall notify the Site Plan Review Authority by certified mail of the proposed date of discontinued operations and plans for removal. Decommissioning shall consist of:

(a) Physical removal of all large- scale ground-mounted solar photovoltaic installations, structures, equipment, security barriers and transmission lines from the site.
(b) Disposal of all solid and hazardous waste in accordance with local, state, and federal waste disposal regulations.
(c) Stabilization or re-vegetation of the site as necessary to minimize erosion. The Site Plan Review Authority may allow the owner or operator to leave landscaping or designated below-grade foundations in order to minimize erosion and disruption to vegetation.

3.12.2 Abandonment
Absent notice of a proposed date of decommissioning or written notice of extenuating circumstances, the solar photovoltaic installation shall be considered abandoned when it fails to operate for more than one year without the written consent of the Site Plan Review Authority. If the owner or operator of the large- scale ground-mounted solar photovoltaic installation fails to remove the installation in accordance with the requirements of this section within 150 days of abandonment or the proposed date of decommissioning, the town may enter the property and physically remove the installation.

3.12.3 Financial Surety
Proponents of large-scale ground-mounted solar photovoltaic projects shall provide a form of surety, either through escrow account, bond or otherwise, to cover the cost of removal in the event the town must remove the installation and remediate the landscape, in an amount and form determined to be reasonable by the Site Plan Review Authority, but in no event to exceed more than 125 percent of the cost of

removal and compliance with the additional requirements set forth herein, as determined by the project proponent. Such surety will not be required for municipally- or state-owned facilities. The project proponent shall submit a fully inclusive estimate of the costs associated with removal, prepared by a qualified engineer. The amount shall include a mechanism for calculating increased removal costs due to inflation.

Appendix B:

GREEN COMMUNITIES GRANT PROGRAM

GUIDANCE

Expedited Permitting

Criteria **2**

EXPEDITED PERMITTING OPTIONS

INTRODUCTION

Criteria Two of the Green Communities Program states that communities need to adopt an ***expedited application and permitting process*** under which as-of-right energy facilities (criterion #1) may be sited within the municipality and which shall not exceed 1 year from the date of initial application to the date of final approval.

Such an expedited application and permitting process applies only to the proposed facilities which are subject to the as-of-right siting provisions, and documentation that all permits necessary to site proposed facilities can be issued within the 1 year deadline is required.

Note: Municipalities can also meet this requirement by applying the expedited permitting process of MGL Chapter 43D to the as-of-right zoning district(s), which has a one hundred and eighty day (180) deadline requirement.

COMPLIANCE

Standard One Year Process

To meet this criterion municipalities need to have rules and regulations in place governing permit issuance such that all local permitting decisions - formal determinations, orders of conditions, licenses, certificates, authorizations, registrations, plan approvals, or other approvals or determinations with respect to the use, development or redevelopment of land, buildings, or structures required by any issuing authority – applicable to the siting and construction of clean energy facilities within the relevant zoning district(s) can be issued within 1 year of submission of a completed application.

In regard to documentation, municipalities will have already demonstrated that they have by-right zoning allowing clean energy facilities (criterion #1). Thus, communities need to show that other provisions of the zoning (e.g. site plan review), as well as other local regulations, allow permitting within one year. In order to document compliance with the Green Communities expedited permitting criterion (criterion #2) municipalities must provide DOER a letter from legal counsel affirming that nothing within the municipality's rules and regulations precludes issuance of a permitting decision within one year along with the language addressing approval procedures and associated timing from any applicable bylaws/ordinances or regulations.

Municipalities should also be aware that once designated a Green Community they will be required to report annually on their permitting of clean energy projects within as-of-right zoning districts. Communities not adhering to the 365 day permitting requirement will be at serious risk of losing their Green Community designation.

MGL c 43D Priority Development Sites

A municipality may also meet the Green Communities expedited permitting criterion by providing for as-of-right siting of renewable or alternative energy generation or manufacturing or research and development (R&D) facilities within a Priority Development site approved pursuant to Chapter 43D by the interagency Permitting Board. The municipality will be required to provide documentation that demonstrates that the designated as-of-right zoned area and the 43D Priority Development Site overlap. If meeting the criterion by allowing the by-right construction of either renewable or alternative energy (R&D) or manufacturing facilities, the municipality will be required to provide a letter from the municipality's legal counsel providing documentation that a Priority Development Site approved pursuant to Chapter 43D by the Interagency Permitting Board applies to enough land within the district zoned for the by-right siting of energy facilities to construct at least 50,000 square feet of (R&D) or manufacturing space in the aggregate. However, communities are encouraged to make the procedures expediting the permitting of renewable or alternative energy projects uniform throughout a zoning district in order to avoid confusion and facilitate siting and construction of renewable or alternative energy facilities.

Note: The materials developed to assist communities with issuance of permits within 180 days as required by Chapter 43D will also help communities looking to expedite permitting for the purpose of becoming a Green Community.

43D Website:
http://www.mass.gov/?pageID=ehedsubtopic&L=4&L0=Home&L1=Start%2c+Grow+%26+Relocate+Your+Business&L2=Licensing+%26+Permitting&L3=Chapter+43D+Expedited+Permitting&sid=Ehed

Appendix C:

GREEN COMMUNITIES DESIGNATION PROGRAM

Energy Use Baseline

Criteria 3

Energy Reduction Plan (ERP) Guidance and Outline

INTRODUCTION

Criterion Three for Green Communities Designation requires that a municipality (including both the general government and school district):

(1) Establish an energy use baseline. This inventory must include all divisions and departments including: all municipal buildings, school buildings, municipal and school vehicles, street and traffic lighting, drinking water and wastewater treatment plants, pumping stations and open spaces[1] owned by the municipality.

- Divisions and departments operating as Enterprise Funds under MGL Chapter 44, Section 53F ½ where such services are provided by a third party contractor or where the sole operating and budget authority resides with a board or commission) may be excluded from the Energy Reduction Plan. However, these operations are encouraged to become a part of and to adopt the Energy Reduction Plan. The exclusion does not apply to any other existing or future division or department operating as an Enterprise Fund for which the City has direct authority over its operation.

- If a municipality pays the energy bills for an asset that it does not own, it may elect to include that asset in its baseline if it would like to claim credit for any energy reductions for that asset. For example, towns frequently pay the energy bills for streetlights owned by their utility or for buildings owned by a historical society. Please explicitly state if you are electing to include an asset that the municipality does not own.

- The energy use baseline inventory should be provided on an MMBtu (Million British Thermal Units) basis. There are a number of acceptable tools for performing the inventory including:
    a. DOER's MassEnergyInsight (MEI) (www.massenergyinsight.net)
    b. Energy Star Portfolio Manager
    b. ICLEI software
    d. Other tools proposed by the municipality and deemed acceptable by DOER

- The baseline year should consist of the most recent year of complete data. For applications in the spring of 2012, this should be Fiscal Year 2011 (or Calendar Year 2011). However, to allow communities to take credit for energy efficiency measures completed in recent years, a municipality may provide a baseline that goes back as far as FY 2010 (or CY 2010), and provide a reduction plan that begins in FY 2011 (or CY 2011). Already completed measures should be documented as described in Section IV B 5.

- For applications consisting of more than one municipality, each municipality must complete the inventory. However, the comprehensive program to reduce the baseline by 20% can be applied across all communities.

(2) Put in place a comprehensive program designed to reduce this baseline by 20% within the 5 year period following the Baseline Year. For example, applicants using a Calendar Year 2010 baseline must reduce their total energy use by 20% by the end of 2015. Please note that the 5 year time period begins the year following

[1] The "Open Space" category includes energy use by parking lots, parks, cemeteries and athletic fields.

the baseline year, not the year following designation as a Green Community. The 20% reduction is applied to the aggregate energy use (in MMBtus) in the baseline energy use inventory.

a. **Create an Energy Reduction Plan (ERP) to document both the baseline energy consumption and the comprehensive program to reduce total energy use by 20%.** An ERP is a document that requires thoughtful planning and participation by all municipal departments, including schools. It can be expected that this entire process will require a minimum of three months. A team of individuals and a designated lead responsible for conducting the baseline inventory and developing the ERP should be identified. The process will involve collecting data using one of the tools identified above, analyzing the data to understand where reductions can be achieved, setting goals and developing strategies based on data collection and analysis, and finally developing and writing the ERP.

   A well-prepared ERP will provide a realistic path for implementation. The benefits of ERP implementation include long-term savings in annual energy costs and reductions in a municipality's greenhouse gas emissions. It also presents an opportunity to perpetuate these benefits if a portion of the cost savings is re-invested in further energy efficiency. Finally, the ERP is an opportunity to engage the community in municipal energy reduction, both in its design and implementation and in publicizing its successes.

b. **Report annually on the ERP.** If at the end of 5 years a municipality has not reduced its energy consumption by 20%, it will be asked to provide justification for not fulfilling its ERP. If a municipality can demonstrate that it has done everything reasonably achievable to obtain the reductions, then no further action will be required. If the municipality does not effectively demonstrate why it has not reduced its consumption by 20%, then the municipality is at risk of losing its Green Community designation. A municipality will not lose its previously-awarded grant funding as a result of not meeting its 20% energy reduction goal.

INSTRUCTIONS FOR CREATING AN ENERGY REDUCTION PLAN

A comprehensive ERP consists of a number of key components which enables a municipality to establish energy reduction goals and develop a structure to meet those goals over a specific period of time. The outline below presents the format for the ERP and addresses its key components. *The information contained in the outline below is the* ***minimum*** *information that a municipality is expected to provide in its ERP.* Please use the sample tables provided, but note that it is important to also provide a brief supporting narrative.

This outline contains several embedded excel files that will only work for Microsoft Office 2007 (Tables 3 and 4). **IF YOU WISH TO USE AN EXCEL TABLE BUT HAVE AN OLDER VERSION OF MICROSOFT OFFICE, PLEASE USE THE EXCEL 97-2003 FILE PROVIDED SEPARATELY.**

To use the embedded Excel tables below, double-click in the table. Make your changes, save and click back into the main document**.** The table will automatically sum and format the data, but please verify.

ENERGY REDUCTION ACTION PLAN OUTLINE

I. PURPOSE AND ACKNOWLEDGEMENTS

Letters from Both General Government and School District Verifying Adoption of the ERP

- **General Government** – The general government must provide a letter from the Chief Executive Officer of the city or town stating that it has adopted the Energy Reduction Plan. The Chief Executive Officer is defined as the manager in any city having a manager and in any town having a city form of government, the Mayor in any other city, and the Board of Selectmen in any other town unless some other officer or body is designated to perform the functions of a Chief Executive Officer under the provisions of a local charter or laws having the force of a charter.

- **Public School Districts** - For a municipality to meet this requirement, its public school district must be included in the municipality's baseline. Furthermore, the public school district must provide a letter from the Superintendent for the Schools stating that is has adopted the Energy Reduction Plan.

- **Regional School Districts** – Regional School Districts are not required to be part of a municipality's Green Communities designation application. However, for regional school districts that wish to be part of a municipality's Green Communities designation (with approval by the municipality), the regional school district must establish an energy use baseline and assign the appropriate percentage of that baseline to the municipality (based on the funding assessment percentage that municipality contributes annually to the regional school district). The regional school district must also adopt the Energy Reduction Plan. A municipality may also include its local elementary school that is part of a RSD, but not include their portion of the middle and/or high schools. In this case, 100% of the elementary school's energy use would be included in the Energy Reduction Plan. See Appendix A for details.

B. List of Contributors that Participated in the Baseline and ERP Process

II. EXECUTIVE SUMMARY

A. ***Narrative Summary of the Town*** - including population and any special school accreditations, Energy Star© ratings, EPA Community Energy Challenge participant, ICLEI community, etc.

B. ***Summary of Municipal Energy Uses*** - use instructions below to create Table 1 (sample below). Reiterating the Table 1 contents in text is not required.

- *Total Number of Municipal Buildings* - including schools, and broken down by type of heating fuel (e.g. oil, propane, natural gas, etc.). For Regional School Districts wishing to be included in the municipality's Green Communities designation, please list the number of their buildings (by fuel type) and vehicles (by exempt category) as separate lines and list "RSD" in the ownership column.
- *Building Additions and New Construction* - Please identify any building additions or new construction planned for completion during the 5-year ERP period. Due to the unique nature of many building projects, a community MUST consult with DOER regarding building stock changes prior to submission of their Green Communities application. For general guidance, please see Building Stock Changes Guidance in Appendix B.
- *Total Number of Vehicles* - including schools, and broken down by number of exempt and non-exempt vehicles as defined by Green Communities Criteria 4.
- *Total Number of Street Lights and Traffic Lights* – please list the number of street and traffic lighting are owned by the municipality or by the utility in separate rows with a note in the ownership column. If owned by the utility, then these will not be included in the baseline and Energy Reduction Plan.
- *Water and Sewer* – note the number of drinking and wastewater treatment plants and pumping stations owned by the municipality.

Table 1: Summary of Municipal Energy Users (Sample Data)

	Number	Ownership
Buildings		

Oil Heat	5	Muni
Oil Heat	3	RSD
Natural Gas Heat	0	
Propane Heat	4	
Biomass Heat	0	
Other Heat Type	0	
Vehicles		
Non-Exempt	25	Muni
Exempt	20	Muni
Exempt	5	RSD
Street Lights	200	Utility
Traffic Lights	2	Muni
Water and Sewer		
Drinking Water Treatment Plant	1	
Wastewater Treatment Plant	0	(regional)
Pumping Stations	10	

C. ***Summary of Energy Use Baseline and Plans for Reductions*** – use sample Table 2 provided below

Table 2: Summary of Municipal Energy Use Baseline

BASELINE YEAR ____	**MMBtu Used in Baseline Year**	**% of Total MMBtu Baseline Energy Consumption**	**Projected Planned MMBtu Savings**	**Savings as % of Total MMBtu Baseline Energy Consumption**
Buildings				
Vehicles				
Street/Traffic Lights				
Water/Sewer/Pumping				
Open Space[2]				
Total		**100%**		**20%**

[2] A municipality can choose to attribute Open Space energy use to the other categories if desired. If open space is used as a category, please be sure to list exactly what is included as a footnote and that, if using MassEnergyInsight, it matches its Table 3.

III. ENERGY USE BASELINE INVENTORY

A.*Identification of the Inventory Tool Used* *(preferably MassEnergyInsight)*

B.*Identification of the Baseline Year*

C.*Municipal Energy Consumption for the Baseline Year* – p*lease use one of the following options*:

- Using the embedded excel Table 3 below (only works for Excel/Word 2007), provide one table with both native units (kWh, therms, etc.) and MMBtu

- Using the separately provided excel version of Table 3, provide one table with both native units (kWh, therms, etc.) and MMBtu

- Using MassEnergyInsight, provide tables reporting energy use in native units (kWh, therms, etc.) and MMBtu separately. Your MassEnergyInsight information MUST be complete, including uploaded oil, propane, gasoline, diesel and renewable fuels. Refer to MassEnergyInsight's Energy Reduction Plan Guidance Table 3 (Fuel Units) and Energy Reduction Plan Guidance Table 3 (MMBtu).

Provide an overall breakdown per individual building, water and sewer treatment plants, and open space facilities. An open space category may be used for any facility or location where the primary purpose of the facility is exposed space, for example parks, cemeteries and athletic fields. Vehicles, streetlights, traffic lights and distribution and water/sewer distribution and collection pumping can be provided in the aggregate. Please insert additional columns for any other fuels and be sure to list their consumption in the correct units.

Fuel use from all vehicles, including those characterized as exempt AND non-exempt under Criterion 4 must be included. Diesel and gasoline must be listed separately.

Renewable Energy is a fuel source and the amount of renewable energy generated by the Green Community should be included here. Please report the amount of renewable energy consumed by each building. For example, a solar PV system that supplies electricity only to the high school it is mounted on should be included under Renewable Energy - Electric for the high school. For larger systems serving more than one building, please contact DOER. For thermal Renewable Energy systems that do not have a flow meter to measure the actual amount of thermal energy generated, please report the projected thermal energy generation from the design study. See examples in italics below. Biomass and biofuels should be reported separately from other Renewable Energy types by reporting fuel consumption. Please do not include any Renewable Energy Certificates as these only displace the carbon emissions associated with energy generation, not the use of the energy.

Table 3: Municipal Energy Use Baseline *(Embedded Excel version, only works with Office 2007; a separate version is provided for Excel 97-03)*[3]

	Electricity		Natural Gas		#2 Distillate Fuel Oil		Propane		Gasoline		Diesel		Renewable Energy - Electric		Renewable Energy - Thermal [1]		Total MMBtu
	kWh	MMBtu	Therms	MMBtu	Gallons	MMBtu	Gallons	MMBtu	Gallons	MMBtu	Gallons	MMBtu	kWh	MMBtu	Gallons	MMBtu	
School		0		0		0		0		0		0		0			
Town Hall		0		0		0		0		0		0		0			
Police Station																	
Add Bldg																	
Add Bldg		0		0		0		0		0		0		0			
Subtotal for Buildings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Drinking/Wastewater Treatment Plant(s)		0		0		0		0		0		0		0			
Pumping in Aggregate		0		0		0		0		0		0		0			
Open Space [2]		0		0		0		0		0		0		0			
Vehicles in Aggregate		0		0		0		0		0		0		0			
Street and Traffic Lights in Aggregate		0		0		0		0		0		0		0			
Total Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[3] 1 To convert thermal renewable energy generation to MMBtu, please multiply by the conversion factor for the displaced energy source. For example, for solar thermal replacing oil, multiply the gallons of oil that were not consumed by 0.139 MMBtu/gallon.
2 A municipality can choose to attribute open space energy use to the other categories if desired. If open space is used as a category, please be sure to list exactly what is included as a footnote and that, if using MassEnergyInsight, it matches MassEnergyInsight Table 3.

IV. ENERGY REDUCTION PLAN

A. *Narrative Summary* –

1. *Overview of Goals for Years 1-3*
2. *Overview of Goals for Years 4-5*
3. *Identify Areas of Least Efficiency/Greatest Waste* – MassEnergyInsight's "Buildings to Target" view is helpful in identifying these areas

B. *Getting to a 20% Energy Use Reduction Within the 5 Year Period Following the Baseline Year* - NOTE: At a minimum, a municipality must be able to identify specific measures with projected reductions to obtain a 15% reduction with supporting audits and/or calculations for these measures. A general strategy in the narrative section for identifying and obtaining the remaining 5% is acceptable. This section should include energy reductions anticipated from all divisions and departments including: all municipal buildings, school buildings (excluding Regional School Districts), municipal and school vehicles, street and traffic lighting, drinking water and wastewater treatment plants, pumping stations and open spaces owned by the municipality.

1. *Program Management Plan for Implementation, Monitoring and Oversight* – Identify the personnel responsible both for oversight of the Energy Reduction Plan implementation and for implementation of energy conservation measures in specific departments or buildings, if applicable. Also identify personnel responsible for the Annual Reporting requirements.

2. *Summary of Energy Audit(s) or Other Sources for Projected Energy Savings* - Although an energy audit is not a requirement for an ERP, an audit can provide a better understanding of existing conditions and can identify opportunities for energy reduction. All sources for projected energy savings for individual measures must be identified in Table 4 and included as attached audits or calculations. If any energy audits were completed, including an Investment Grade Audit conducted as part of an energy savings performance contract, please provide a brief summary of the audit(s) and either provide as an attachment or cite as a resource.

3. *Energy Conservation Measures* – In Table 4[4], list completed and planned energy conservation measures, including vehicular efficiency measures. **References for each measure must be included in the table and these references must be included as appendices to the Energy Reduction Plan.** Please subtotal projected annual MMBtu savings for each category: buildings, vehicles, street and traffic lights, water and sewer, and open space, as well as a municipal total. Refer to the sample table below.

Table 4 will be also be used for future Green Communities reporting if you are designated, including applying for and final reporting on a Green Communities designation grant and for annual reports.

For each measure, provide[5]:

[4] Table 4 will be also be used for future Green Communities reporting if you are designated, including applying for and final reporting on a Green Communities designation grant and for annual reports.

[5] **Why Does DOER Want This Level of Detail?**

This information will be used by DOER to:

- Confirm that a municipality has a well thought-out and documented pathway to fulfill their commitment to reduce their energy consumption by 20% in five years.
- Ensure that all Green Communities have met a similar level of review stringency in order to be designated.

- its status/projected timeline
- the projected energy savings in native units (kWh, gallons, therms, etc.)
- the projected cost savings
- the total cost
- any utility incentives received
- any planned use of Green Communities grant funds, if designated
- for measures requiring additional funding, please list the funding source: capital budget, operating budget, debt and type, or other grants
- the source of the calculated energy and cost savings in the reference column. Audits and/or calculations must be included in the Appendices.

4. *If Creating an ERP Without an Audit* - municipalities can analyze the energy baseline data for the buildings which are least efficient to identify appropriate Energy Conservation Measures based upon knowledge of the building and its equipment. Projected energy savings may be obtained by requesting information from equipment manufacturers. For example, if a building has an older boiler with an efficiency factor of 50% and the proposed new boiler has an efficiency factor of 90%, energy savings from the boiler can be estimated by multiplying 40% times the annual fuel use of the boiler. These calculations must be included in the Appendices.

For estimates based upon the knowledge and expertise of energy professionals that are members of the community, please document all rationale and calculation in the Appendices. For example, if a lighting project were implemented in one school and saved 10% of electricity use, the 10% savings could be used as an energy savings estimate to another school for the same measure. This estimate cannot be applied to another building type such as a Town Hall or Police Station. Additionally, the year of the last lighting retrofit in both schools should be provided to confirm that there are similar efficiency opportunities. If sources other than an audit are used for projected energy savings, please provide a brief summary of those sources here and include complete assumptions and calculations in the Appendices.

PLEASE NOTE that the projected energy savings from a building in another municipality's Energy Reduction Plan cannot be used. In addition, the total projected energy savings in an audited municipal building cannot simply be applied to other municipal buildings. In order to be able to apply projected savings from one audited building to another unaudited building, the buildings must be similar in type and specific measures that are common to both must be identified with supporting details included to verify this type of estimation. Examples include last year of lighting retrofits, current boiler/furnace efficiencies and quotes for new boiler/efficiencies, R-values of insulation and calculations of potential savings. The building types and occupational profiles must be similar unless the measure is building-independent (such as vending machine energy controls).

5. *For Municipalities Taking Credit for Efficiency Measures Occurring Before Green Communities Designation Application* - (i.e. for towns with a baseline of FY2010 or CY2010). Actual reductions in energy usage may be applied to the 15% in identified energy savings. For example, a municipality with a baseline year of FY2010 saw an energy reduction of 4% in FY2011. They would then need to identify an additional 11% in documented energy efficiency measures in Table 4, as well as an additional 5% in general efficiency strategies in the narrative.

- Provide information to the legislature and general public on the total and average projected energy savings, projected energy cost savings, greenhouse gas reductions, total capital costs, simple payback time, and financial support from the electric and gas utilities for the Green Communities program as a whole.
- Confirm that energy use reduction is from energy efficiency projects and initiatives. Because reporting of a building's total energy usage reflects both efficiency and renewable energy projects, a municipality needs to demonstrate that it has implemented enough energy efficiency to account for 20% of the total energy reduction in year 5.
- Analyze the relative effectiveness of project measures (i.e., heating upgrades, VFDs on pump stations, LED streetlights, use of biodiesel) to provide informed recommendations to additional municipalities.

In order to claim credit for actual energy reductions, include in Table 4 all efficiency measures implemented during the period following the baseline year with estimated energy savings from each measure. Then demonstrate the actual energy reductions by providing a separate Table 3a for each year following the baseline year with the annual energy reductions for each building and for the municipality as a whole. (This is the same information that will eventually be asked of you in the Annual Reports if designated as a Green Community.)

6. *For Municipalities Using a Performance Contract (Energy Management Services)* – If an Investment Grade Audit (IGA) has been performed, a municipality may provide the IGA report in lieu of Table 4 for those measures and buildings/facilities. If ≥ 15 percent reduction from the baseline energy use has not been identified, additional measures should be listed using Table 4.

C. ***Summary of Long-Term Energy Reduction Goals – Beyond 5 years***

1. *Municipal Buildings (including schools)*
2. *Vehicles (including schools)*
3. *Street and Traffic Lighting*
4. *Perpetuating Energy Efficiency* – Has the town considered an energy conservation savings reinvestment plan (in which some of the energy savings are reinvested into a fund to finance future energy efficiency or renewable efficiency measures)? Or has it identified a mechanism for directing some of the energy cost savings from an annual operating budget to reinvesting in further energy efficiency?

(Embedded Excel version, only works with Office 2007; a separate version is provided for Excel 97-03)[6]

Table 4 Energy Conservation Measures Data															
Measure		**Status**	**Energy Data**						**Financial Data**					**Reference Data**	
Category/Building	**Energy Conservation Measure**	**Status (Completed with month/year or planned Qtr/year)**	**Projected Annual Electricity Savings (kWh)**	**Projected Annual Natural Gas Savings (therms)**	**Projected Annual Heating Oil Savings (gallons)**	**Projected Annual Propane Savings (gallons)**	**Projected Annual Gasoline Savings (gallons)**	**Projected Annual Diesel Savings (gallons)**	**Projected Annual Cost Savings ($)**	**Total Installed Cost ($)**	**Green Community Grant ($)**	**Utility Incentives ($)**	**Net Cost ($)**	**Funding Source(s) for Net Costs**	**Source for Projected Savings**
Elementary School	*Lighting Retrofit*	*Completed 2/2011*												*Town Capital Plan FY2011*	*http://www.energystar.gov/ia/business/downloads/BP_Checklist.pdf*
Town Hall	*Air Sealing*	*In progress*												*N/A*	*A-Z Energy Audit, 2008*
Town Hall	*NewBoiler*	*Planned Q1-Q2 2012*												*N/A*	*Boilers-to-Go Quote, 2009*
BUILDINGS SUBTOTAL			**0**	**0**	**0**		**0**		**$0**	**$0**	**$0**	**$0**	**$0**		
Traffic Lights	*LED Traffic lights*	*In progress*												*Town Operating Budget FY2011*	*LED Signals Today Quote, 2009*
STREET AND TRAFFIC LIGHTS SUBTOTAL			**0**	**0**	**0**		**0**		**$0**	**$0**	**$0**	**$0**	**$0**		
Drinking Water Treatment Plant	*2 Variable Speed Drives*	*Planned Q3-Q4 2012*												*Town Bond 2012*	*Energy Masters Technical Study, 2010*
WATER/SEWER/PUMPING SUBTOTAL			**0**	**0**	**0**		**0**		**$0**	**$0**	**$0**	**$0**	**$0**		
Vehicles	*Anti-idling retrofit for 2 police cruisers*	*In progress*												*Town Operating Budget FY2012*	*green.autoblog.com*
Vehicles	*Purchase of 2010 Hybrid Civic Hybrid to replace 2001 Toyota Camry (incremental cost)*	*Planned fall 2011*												*Town Capital Plan FY2011*	*www.fueleconomy.gov*
VEHICLES SUBTOTAL			**0**	**0**	**0**		**0**		**$0**	**$0**	**$0**	**$0**	**$0**		
TOTAL Projected Savings			**0**	**0**	**0**		**0**		**$0**	**$0**	**$0**	**$0**	**$0**		
TOTAL MMBtu SAVINGS		**0**	**0**	**0**	**0**	**0**	**0**	**0**							

[6] 1 To convert thermal renewable energy generation to MMBtu, please multiply by the conversion factor for the displaced energy source. For example, for solar thermal replacing oil, multiply the gallons of oil that were not consumed by 0.139 MMBtu/gallon.
2 A municipality can choose to attribute open space energy use to the other categories if desired. If open space is used as a category, please be sure to list exactly what is included as a footnote and that, if using MassEnergyInsight, it matches MassEnergyInsight Table 3.

V. ONSITE RENEWABLE ENERGY PROJECTS & RENEWABLE ENERGY

Please note any plans for onsite municipal renewable energy projects during the 5-year period. These projects should not be included towards 20% reduction. The purchase of Renewable Energy Certificates cannot be used towards the 20% reduction in any instance. If renewable energy projects are planned, in process or completed, please include them in Table 5.

(Embedded Excel version, only works with Office 2007; a separate version is provided for Excel 97-03)[7]

Measure		Status	Energy Data		Financial Data					Reference Data	
Location	Renewable Energy Project	Status (Completed with month/year or planned Qtr/year)	Projected Annual Electricity Generation (kWh)	Projected Thermal Generation/Displaced (therms)	Total Project Cost ($)	Projected Annual Cost Savings ($)	Green Community Grant ($)	MassCEC & Other Grants ($)	Net Town Costs ($)	Funding Source(s) for Net Town Costs	Source for Projected Generation and Savings
Renewable Energy		*N/A*	0	0	0	$0	$0	$0	$0	*N/A*	*N/A*
SAVINGS		0	0	0							

VI. LIST OF RESOURCES

Identify resources that the municipality used to create its ERP (websites, documents, tools). Please include contact information (websites, names and emails, etc.). Please note that this section cannot be used in place of the Reference "Source for Projected Savings" column in Table 4.

[7] 1 To convert thermal renewable energy generation to MMBtu, please multiply by the conversion factor for the displaced energy source. For example, for solar thermal replacing oil, multiply the gallons of oil that were not consumed by 0.139 MMBtu/gallon.
2 A municipality can choose to attribute open space energy use to the other categories if desired. If open space is used as a category, please be sure to list exactly what is included as a footnote and that, if using MassEnergyInsight, it matches MassEnergyInsight Table 3.

MMBtu Conversion Chart[8]

Fuel Energy Content of Common Fossil Fuels per DOE/EIA

BTU Content of Common Energy Units – (1 million Btu equals 1 MMBtu)

- 1 kilowatt hour of electricity = 0.003412 MMBtu
- 1 therm = 0.1 MMBtu
- 1 ccf (100 cubic foot) of natural gas = 0.1028 MMBtu (based on U.S. consumption, 2007)
- 1 gallon of heating oil = 0.139 MMBtu
- 1 gallon of propane = 0.091 MMBtu
- 1 cord of wood = 20 MMBtu
- 1 gallon of gasoline = 0.124 MMBtu (based on U.S. consumption, 2007)
- 1 gallon of E100 ethanol = 0.084 MMBtu
- 1 gallon of E85 ethanol = 0.095 MMBtu
- 1 gallon of diesel fuel = 0.139 MMBtu
- 1 gallon of B100 biodiesel = 0.129 MMBtu
- 1 gallon of B20 biodiesel = 0.136 MMBtu[9]
- 1 gallon of B10 biodiesel = 0.137 MMBtu[9]
- 1 gallon of B5 biodiesel = 0.138 MMBtu[9]
- 1 barrel of residual fuel oil = 6.287 MMBtu

FOR MORE INFORMATION

Website:

www.mass.gov/energy/greencommunities

[8] If a conversion factor for a fuel you use is not provided, please contact DOER.

[9] Calculated Values from those of diesel and B100 biodiesel

APPENDIX A – Guidance for Inclusion of Regional School Districts in Energy Reduction Plan

- For a regional school districts (RSD) to be included as part of a municipality's Green Communities designation, the RSD must be included in the energy use baseline for the municipality and must adopt the energy reduction plan. For the RSD to be included in the municipality's energy use baseline, it must determine its individual energy use baseline and assign the appropriate percentage of that baseline to the municipality. The appropriate percentage is the funding assessment percentage that municipality contributes annually to the RSD.

- The energy use data for the RSD should be apportioned and included in the Town's Energy Reduction Plan as described below. Upon request, both the Town and the RSD should be able to provide the RSD's data prior to apportionment (i.e. the RSD's total energy use).

- A municipality may include its local elementary school that is part of a RSD, but not include their portion of the middle and/or high schools. In this case, 100% of the elementary school's energy use would be included in the Energy Reduction Plan. The apportionment instructions below do not apply. The accounts from an elementary school belonging to a RSD may be assigned in MassEnergyInsight to an individual municipality if desired.

<u>Instructions to include RSD Energy Data in a Town's Energy Reduction Plan</u>

- Include a paragraph in **IIA *Narrative Summary of the Town*** including a description of the RSD and the portion of its funding (as a percentage) that the municipality contributes.

- Add a column to **Table 1** to indicate the TOTAL number of buildings, vehicles, streetlights, and traffic lights owned by the RSD, with appropriate subcategories. These numbers should NOT be apportioned to the Town based upon the funding assessment percentage. See sample below:

Table 1: Summary of Municipal and RSD Energy Users

	Municipal Number	Ownership
Buildings		
Oil Heat	5	Muni
Oil Heat	3	RSD
Propane Heat	4	Muni
Vehicles		
Non-Exempt	25	Muni
Exempt	20	Muni
Exempt	5	RSD
Street Lights	200	Utility
Traffic Lights	2	Muni

- Include the RSD in the energy usage and projected reduction totals in **Table 2 *Summary of Energy Use Baseline and Plants for Reductions***. To calculate the appropriate amount to be included in the usage,

multiply the total annual energy use of the RSD by the percentage of funding that the municipality contributes.

Example: Town Y's total annual energy use is 320,000. Town Y contributes 25% of the annual RSD funding. Its RSD's total annual energy use is 80,000 MMBtu. The portion of the RSD's energy use attributable to Town Y is 80,000 x 0.25 = 20,000 MMBtu. So Town Y's Total Energy Use, including its RSD portion, is 320,000 + 20,000 = 340,000 MMBtus.

- For **IIIC *Municipal Energy Consumption for the Baseline Year***, **Table 3**, please list the RSD as separate building(s) in their own rows and only include the portion attributable to the Town based upon their funding assessment percentage. For vehicles and street and traffic lights, include as separate rows. For the energy consumption of the RSD's buildings vehicles and lighting, only include the portion attributable to the Town based upon their funding assessment percentage.

<u>Instructions to use MassEnergyInsight for energy use data</u>

- Both the Town and the RSD must have authorized users, their accounts signed to specific buildings, and be actively entering oil, propane, and third-party purchased energy data.
- Calculations to assign energy use to the Town from the RSD cannot be performed in MassEnergyInsight, the data must be exported and independently manipulated. However, as described above, these are simple multiplication and addition functions that can easily be done using a calculator or Excel.
- The accounts from an elementary school belonging to a RSD may be assigned in MassEnergyInsight to an individual municipality if desired.
- This data can be found in MassEnergyInsight's ERP Guidance Tables 3A (Native Units) and 3B (MMBtu).
- The RSD should provide their energy use data from MEI to the Town for inclusion in the Green Communities Energy Reduction Plan.
- The Town should include the RSD data in Tables 1, 2, and 3 as described above.

APPENDIX B - Guidance for Building Stock Changes

For changes in building stock (including renovations, additions, new construction, demolition, replacement or acquisition) that occur after the baseline year AND after submission of this ERP (i.e. municipalities using FY2010 or CY2010 as their baseline year), **PLEASE CONSULT WITH DOER TO DETERMINE THE PROPER TREATMENT OF THEIR ENERGY USE IN THE BASELINE AND FUTURE ANNUAL REPORTS.** In general, the guidance provided in the table below will be followed. However, due to the unique nature of many building projects, a community MUST consult with DOER regarding building stock changes prior to submission of their Green Communities application. Please contact your Regional Coordinator to initiate this conversation.

Table: Building Stock Changes Summary Guidance

	Building Energy Use Included in Energy Consumption?	**How to Report?**
Retrofit/Renovation	Yes	Annual report
Addition	Yes, pro-rated by square footage	Annual report
New Construction	No	Separate monitoring
Removal/Demolition	No, subtract from baseline	Annual report
Replacement of an Existing Building	Yes	Annual report
Acquisition of an Existing Building	Only if desired	Separate monitoring or add to baseline in annual report

- **Retrofit/Renovations:** Retrofits and Renovations will be factored into the 20% reduction and do not alter the energy use baseline. This is not additional space and renovations should be done such that the space becomes more efficient.

- **Additions:** The energy load for that building and its addition will be counted towards the 20% reduction target but will be pro-rated based on the building square footage. For example, if a 1000 sq foot building added 300 sq feet (an additional 30%), then 70% of the energy bills for the building would be accounted for in monitoring the community's progress towards meeting its 20% energy reduction target.

- **New Construction:** The additional energy load from these buildings will NOT be added into the energy use baseline and therefore the additional load will NOT be factored into the 20% reduction target. However, a municipality will be expected to monitor the performance of this building, using MassEnergyInsight or another tool, under its annual Green Communities reporting to verify that it is performing as designed and modeled. If it is not, a corrective action plan must be developed and implemented to correct the building's performance.

- **Removal/Demolition:** For buildings that are removed from the building stock, the energy use baseline will be adjusted to subtract that building and the 20% reduction target will be revised accordingly. This will occur if they are not replaced by a new building (see below).

- **Replacement of an Existing Building:** For buildings originally included in the baseline that go offline and are replaced by a new building, the energy use baseline will not change and the new building will be included in the 20% reduction target. If the new building is larger than the replaced building, then

the energy use will be apportioned according to the difference in their square footages. For example, , if a 1000 sq foot building was replaced with a 1500 sq feet (an additional 33%), then 67% of the energy bills for the building would be accounted for in monitoring the community's progress towards meeting its 20% energy reduction target.

- **Acquisition of an Existing Building:** For buildings that are acquired after the baseline year, that are old buildings and not new construction, and that are not replacing a building already included in the baseline, the additional load from these buildings will not be required to be included in the consumption profile and therefore the additional load will not be factored into the 20% reduction target. HOWEVER, one of the following two should occur:

    - At a minimum, as part of the Green Communities application Energy Reduction Plan (ERP), the municipality should address these buildings separately, noting what their baseline energy use was when they were acquired and what measures are planned for their improved energy performance.

    - As an alternative, if a municipality so chooses, they can add the load from these buildings into the energy use baseline when they were acquired and include them in the 20% reduction target. (A municipality may choose to do this because it may provide a better opportunity for them to achieve the 20% reduction target). If a municipality should choose to do this, they need to explain this in their ERP.

- **Petition to Modify Energy Use Baseline:** At any time, a municipality can petition DOER to consider modification of its baseline. For example, a municipality may replace an existing smaller school with a new school that is significantly larger, with a pool added, etc, and they may wish to adjust its baseline to take this added square footage and energy use data into consideration. DOER reserves the right to approve or deny any such petition.

- **For a municipality using FY2010 or CY2010 as the baseline year:** If building additions or acquisitions occurred after the baseline year BUT prior to submitting its application for Green Communities Designation, a separate monitoring plan must be included in the ERP to address their energy efficiency. These buildings will NOT be added into the consumption profile and therefore the additional load will not be factored into the 20% reduction target. HOWEVER, the municipality should note in the ERP how these buildings were constructed or retrofit to be as energy efficient as possible and the intended energy performance as designed. The ERP must include a separate monitoring program for these buildings to ensure that they are performing as designed and modeled and, if not, must include a plan for corrective actions.

Gasoline / Heating Fuel Usage (gallons unless specified otherwise)

Department/ Account	FY 2012	FY 2011	FY 2010	FY2009	FY2008
Gasoline					
Fire Dept.	2439.99	1931.8	2158.9	2489.4	2206.9
HPD	14752	15625.9	15878.4	18211.5	18456.5
An. Control	1020	809.9	966.7	940	792.4
Town Manager			446.9	1223.5	1267.6
Assessor		56.8	226.4	127.8	0
Adm	271.7	439.4	347.4	307.3	259.1
Eng	504.6	295.1	271	232.5	206.2
Vehicle Maint.	377.2	395.7	419.5	783.3	533.8
Highway	4046.1	3650.3	3852.5	3876.3	3104.3
B/G	3261.9	3453.5	3240.8	3092.6	3075.2
Sr. Bus #1&2	3361.5	3158	3516.1	3109.8	3202.1
Recreation	250	243.4	270.7	226.6	226.9
Water/Sew	5961.9	5631.7	6282.54	5467	5973.4
Light	3435.3	2952.8	3229.8	3353.8	2962.7
WRHS	1050.3	1272.6	838.7	734	646.3
Driver Ed	1458	1263.3	1873.3	2111.2	1308
School	13	39.7	39.8	38.5	38.9
WRHS Van	511.2	548.9	291.4	308.5	316.9
Total	**42,714.7**	**41,768.8**	**44,150.8**	**46,633.6**	**44,577.2**
Diesel					
Fire	2867.6	3707.1	2865.5	3022.3	3959.4
Ambulances	3833	3582.4	3227.7	0	0
Hwy	7556.6	5423.2	4970.5	6664.9	6314.5
Snow Rem	3536.9	6383.2	4409.7	6447.6	9867.7
Vehicale Maint	823	331.1	557.6	441	488.5
B/G	3721.1	3205.6	3255.9	2951	3278.1
Water/Sew	2608.8	4075.5	3512.9	2390.5	3318.4
Light	6692.6	5185.1	4882	3950.1	5355.4
School	0	0	305.6	0	0
WRHS Maint	591.5	493.1	388.4	365.4	358.8
W/S Oper Pump Stat.	1295	299	258	0	945
Highway Garage Fuel	26	183	90	66	190
Total	**33,552.1**	**32,868.3**	**28,723.8**	**26,298.8**	**34,075.8**

Gasoline / Heating Fuel Usage (gallons unless specified otherwise)

Department/ Account	FY 2012	FY 2011	FY 2010	FY2009	FY2008
Heating Fuel / Nstar					
Town Hall	4,778.6	4511.8	4522.7	4792	3026.4
Starbard Bld	1,152.0	1798.3	1471.5	1685	2061.7
Adams Road oil	1026	8746.5	9430	10983	0
Adams Road ccf	663				
Spring Street	322	2057.9	1299.8	2063	0
Recreation	1,166.9	1318.8	1196.9	957	977.3
Senior Center ccf	5,618	7229	5720	7269	4890
Trout Brook	559.2	717.3	883.6	464	546.9
Grove Cemetery oil		441.3	502.6	398	
Grove Cemetery ccf	336.4				

* Transferred Oil from Old Fire Station
* Town Hall
* Starbard

Holden KWH Usage

Category	Location	Fiscal Year 2008	2009	2010	2011	2012
DPW	DPW BUILDING ADAMS RD	3,220	3,426	3,423	3,398	3,318
DPW	MUNI GARAGE	64,480	64,080	66,000	77,840	73,120
DPW	OLD HPD	-	-	-	5,462	7,239
DPW - Sewer	VARIOUS LOCATIONS	438,383	347,135	372,203	656,573	640,382
DPW - Water	VARIOUS LOCATIONS	2,070,195	1,844,701	1,935,257	2,011,676	2,258,840
Library	GALE FREE LIBRARY	205,080	177,360	149,280	162,240	160,080
Light	OFFICE / GARAGE		208,400	191,440	190,800	158,880
Light	SUBSTATIONS AND OTHER		112,789	104,060	110,218	111,437
Public Safety	OLD FIRE DEPARTMENT	50,893	60,845	80,755	70,362	-
Public Safety	OLD POLICE DEPT	107,634	107,386	99,641	56,988	-
Public Safety	PUBLIC SAFETY BUILDING	-	-	-	427,515	584,762
Recreation	BANDSTAND	2,117	2,311	1,982	1,588	1,335
Recreation	EAGLE LAKE	740	490	631	476	365
Recreation	POOL	130,988	140,079	119,527	121,051	145,114
Recreation	RECREATION DEPT	3,721	4,140	4,421	4,754	4,387
Recreation	TENNIS COURTS	6,144	4,559	3,951	3,322	4,665
Recreation	TROUT BROOK	62	66	66	173	220
Senior Center	SENIOR CENTER	106,680	103,188	113,617	91,977	65,898
Starbard Bldg	STARBARD BUILDING	59,040	55,440	56,560	57,280	59,840
Town Hall	TOWN HALL	37,003	34,708	32,123	32,585	32,288
Natural Gas - Therms						
Light	OFFICE / GARAGE	4,359	2,698	2,785	2,506	2,198

Holden Public Library
1056-177-0016

	Month	Therms	Billed	
2012	Dec	1237	1158.91	
	Nov	677	558.55	
	Oct	35	36.49	
	Sep	229	152.56	
	Aug	0	15.55	
	Jul	63	68.26	
	May	231	163.07	
	Apr	531	499.77	
	Mar	821	764.21	
	Feb	1236	1180.27	
	Jan	1661	1727.11	
2011	Dec	901	952.15	
	Nov	544	522.25	
	Oct	126	106.94	
	Sep	8	21.19	
	Aug	0	15.38	
	Jul	3	17.56	
	Jun	242	221.33	61 Day Bill
	May	835	966.11	
	Mar	1209	1391.95	
	Feb	1839	2109.26	
	Jan	1666	1896.19	
2010	Dec	1284	1439.96	
	Nov	512	475.13	
	Oct	255	125.71	
	Sep	10	19.91	
	Aug	38	82.52	120 Day Bill
	Apr	616	674.42	
	Mar	822	894.86	
	Feb	1647	1777.69	
	Jan	1949	2094.3	

PSB 2010 Gas Usage		
Mth	Therms	# Billing Days
Dec	752	29

PSB 2011 Gas Usage		
Mth	Therms	# Billing Days
Jan	855	30
Feb	997	32
Mar	317	29
Apr	228	30
May	190	29
Jun	157	32
Jul	128	30
Aug	134	32
Sep	144	30
Oct	185	30
Nov	632	29
Dec	565	31

PSB 2012 Gas Usage		
Mth	Therms	# Billing Days
Jan	1103	34
Feb	514	30
Mar	244	29
Apr	287	32
May	267	28
Jun	169	31
Jul	125	29
Aug	140	32
Sep	144	30
Oct	163	29
Nov	307	32
Dec	129	30

CHAPTER 1 -- EXECUTIVE SUMMARY

INTRODUCTION

This report presents the findings of an energy management study conducted by Steven Gratan for:

Starbard Building
1204 Main Street
Holden, MA 01520

The energy management study, which was completed on January 31, 2006, included the following activities:

- Walk-through of the facility to identify major energy-using systems
- Collection of detailed equipment and process data
- Computer analysis of current facility energy consumption
- Enumeration of recommendations
- Determination of the cost and payback of each recommendation

The principal contact during the energy management study was Mr. Larry Galkowski.

There are four chapters in this report. Chapter 1, "Executive Summary", presents an overview of the study results, including a table summarizing the estimated cost and potential savings of each recommendation. Chapter 2, "Energy Management Recommendations", provides detailed information on each of the recommendations. This chapter includes a description of the technologies being recommended. Chapter 3, "Energy Profile", summarizes the current energy costs and the distribution of energy use within the facility. Marginal energy costs at your present rate are also discussed in chapter 3. Chapter 4, "Facility Equipment Inventory", is an overview of the data collected during the energy management study. This chapter includes summary information on all building systems covered by the study.

We hope that the report is helpful. If you have specific questions about the report, call your ENE representative.

ENERGY MANAGEMENT RECOMMENDATIONS

The energy survey on which this report is based showed that annual energy costs for the facility now total:

Electricity	$8,683
Oil #2	$2,121
Annual energy cost	$10,804

The on-site energy evaluation found opportunities to obtain the following savings:

Annual Energy Savings (total): $4,600 = 43% of total energy bill

Each recommendation presented in this report was analyzed as a stand-alone recommendation. The impacts provided are conservative estimates. Exact impacts will depend on other recommendations implemented and the specific conditions following implementation. Since some recommendations may overlap, the total savings given may not be realized.

We project that these savings will result from following the recommendations that are summarized below and discussed more fully in Chapter 2 of this report.

Replace incandescent with compact fluorescent lamps
Incandescent lighting is very inefficient and can be replaced by fluorescent lighting which will provide the same lumen output for one fourth to one third of the energy use.

Install more efficient exit signs
Several types of efficient exit signs are now available to replace existing fixtures which are typically illuminated by incandescent lamps.

Install T-8 lamps and electronic ballasts
Your current lighting can be replaced by more efficient fluorescent lighting which will provide the same lumen output with two thirds the electricity.

Clean A/C evaporator and condenser coils
Clean, well maintained cooling equipment which is regularly checked will operate more efficiently and economically.

HVAC system tune up
The heating and cooling equipment requires maintenance to operate at peak efficiency. Maintaining the HVAC equipment by keeping it clean and tuned will increase operating efficiency and save energy.

Replace with high efficiency HVAC equipment
A new, properly designed HVAC unit can achieve a significant efficiency improvement over the old unit, and can save a substantial percentage of current heating and cooling costs.

Change HVAC setpoint temperature
Recommendations have been made to adjust heating and or cooling temperature setpoints to reduce energy costs. Occupant comfort considerations have been included in the analysis of this measure.

Install Programmable thermostats
Programmable thermostats have been recommended to provide better control of temperature setpoints.

Install insulation under roof
Installation of additional ceiling insulation will reduce heating and cooling costs.

Reduce DHW temperature setpoint
Keeping the water temperature at a reduced but adequate setting will lower standby and distribution losses and save energy.

Insulate DHW distribution pipe
Adding the correct insulation to piping and repairing damaged insulation will enhance the system efficiency and reduce energy costs.

Refrigeration operational and maintenance measures
Refrigeration energy can be saved through implementation of several low cost operation and maintenance procedures.

Individual Recommendations
As well as the preceding standard recommendations, the evaluator has made other, facility-specific recommendations.

Energy management recommendation savings and costs are summarized in the following table. The 'costs' given below represent the estimated cost of installation. The 'payback' periods shown below are obtained by dividing the implementation costs by the annual dollar savings shown.

Summary of Energy Management Recommendations

Description	Annual Cost Savings	Cost	Simple Payback (years)	Annual Energy Savings
Lighting				
Replace incandescent with compact fluorescent lamps	$300	$383	1.3	1,361 kWh 0.5 kW
Install more efficient exit signs	$396	$578	1.5	1,717 kWh 0.2 kW
Install T-8 lamps and electronic ballasts	$315	$1,330	4.2	2,044 kWh 0.7 kW
Subtotal Lighting	$1,011	$2,291	2.3	
HVAC Equipment				
Clean A/C evaporator and condenser coils	$113	$115	1.0	736 kWh 0.4 kW
HVAC system tune up	$133	$345	2.6	862 kWh 0.4 kW
Replace with high efficiency HVAC equipment	$602	$10,400	17.3	3,907 kWh -2.0 kW
Subtotal HVAC Equipment	$848	$10,860	12.8	
HVAC Zones				
Change HVAC setpoint temperature	$85	$7	0.1	552 kWh
Install Programmable thermostats	$1,862	$600	0.3	4,286 kWh 0.3 kW 601 gal
Install insulation under roof	$352	$1,875	5.3	-342 kWh 0.1 kW 202 gal
Subtotal HVAC Zones	$2,299	$2,482	1.1	
Water Heating				
Reduce DHW temperature setpoint	$111	$7	0.1	724 kWh
Insulate DHW distribution pipe	$10	$36	3.8	62 kWh
Subtotal Water Heating	$121	$43	0.4	
Refrigerated Units				
Refrigeration operational and maintenance measures	$1	$2	1.5	8 kWh 0.0 kW
Other Recommendations				
Computers: Change operating hours to W-35 Hrs/Week	$321	$0	0.0	2,083 kWh
BUILDING TOTAL	$4,600	$15,677	3.4	16,000 kWh 4.7 kW 803 gal

CHAPTER 3 -- ENERGY PROFILE

This chapter profiles energy costs and usage for Starbard Building. It presents information that serves as a basis for quantifying and evaluating energy and cost-savings opportunities presented elsewhere in this report.

Cost of Energy

The per unit cost of energy is an important factor in any energy management study. In the table below, entitled "Annual Energy Costs and Usage", the average unit cost is given for each type of energy used in the facility. The "average" costs are different from the "marginal" unit costs given in the rate tables which follow. It is the "marginal" costs that have been used in this study to obtain accurate estimates of measure cost impacts. The savings calculations address impacts on energy consumption as well as peak demand where appropriate, so marginal costs have been given for both energy and demand.

Annual Energy Costs and Usage

Source	Annual Use	Annual Cost	Average Cost	$ per ft²	% of Cost	Energy in MMBtu	MBtu/ft²	% of Energy
Electricity	55,200kWh	$8,683	$0.1573	$2.83	80%%	188	61	52%%
Oil #2	1,262gal	$2,121	$1.6803	$0.69	20%%	175	57	48%%
Total:		$10,804	--	$3.52	100%	363	118	100%

Floor space used in analysis: 3,070 ft²

Energy Costs Per Unit

Electric Rate for Electric Service (Account 20082000):

$/kWh	$/kW
0.15400	--

Oil #2 Rate for Oil (Account 1204 Main Street):

$/gal
2.00000

Common Energy Conversion Factors

Electricity:	3,413 MBtu/kWh	Natural Gas:	100.0 MBtu/Therm
Fuel Oil:	138.7 MBtu/Gal	Propane:	92.0 MBtu/Gal
Coal:	27,000 MBtu/Ton		

A common measure of energy is the British Thermal Unit or Btu, defined as the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit (see the glossary in the appendix of this report), and its multiples, the MBtu and the MMBtu, i.e.

1 MBtu = 1,000 Btu and 1 MMBtu = 1,000,000 Btu = 1,000 MBtu

CHAPTER 1 -- EXECUTIVE SUMMARY

INTRODUCTION

This report presents the findings of an energy management study conducted by Steven Grattan for:

Holden Town Hall
1196 Main Street
Holden, MA 01520

The energy management study, which was completed on January 26, 2006, included the following activities:

- Walk-through of the facility to identify major energy-using systems
- Collection of detailed equipment and process data
- Computer analysis of current facility energy consumption
- Enumeration of recommendations
- Determination of the cost and payback of each recommendation

The principal contact during the energy management study was Mr. Larry Galkowski.

There are four chapters in this report. Chapter 1, "Executive Summary", presents an overview of the study results, including a table summarizing the estimated cost and potential savings of each recommendation. Chapter 2, "Energy Management Recommendations", provides detailed information on each of the recommendations. This chapter includes a description of the technologies being recommended. Chapter 3, "Energy Profile", summarizes the current energy costs and the distribution of energy use within the facility. Marginal energy costs at your present rate are also discussed in chapter 3. Chapter 4, "Facility Equipment Inventory", is an overview of the data collected during the energy management study. This chapter includes summary information on all building systems covered by the study.

We hope that the report is helpful. If you have specific questions about the report, call your ENE representative.

ENERGY MANAGEMENT RECOMMENDATIONS

The energy survey on which this report is based showed that annual energy costs for the facility now total:

Electricity	$6,200
Oil #2	$4,577
Annual energy cost	$10,777

The on-site energy evaluation found opportunities to obtain the following savings:

Annual Energy Savings (total): $3,651 = 34% of total energy bill

Each recommendation presented in this report was analyzed as a stand-alone recommendation. The impacts provided are conservative estimates. Exact impacts will depend on other recommendations implemented and the specific conditions following implementation. Since some recommendations may overlap, the total savings given may not be realized.

We project that these savings will result from following the recommendations that are summarized below and discussed more fully in Chapter 2 of this report.

Change lighting operating schedule

Energy costs can be reduced by the elimination of unnecessary lighting through better control.

Replace Incandescent with compact fluorescent lamps
Incandescent lighting is very inefficient and can be replaced by fluorescent lighting which will provide the same lumen output for one fourth to one third of the energy use.

Install Metal Halide lighting systems
The use of correct, more efficient lighting sources, as directed, will provide comparable quality and levels of illumination while reducing lighting cost.

Install more efficient exit signs
Several types of efficient exit signs are now available to replace existing fixtures which are typically illuminated by incandescent lamps.

Install more efficient lighting systems
The use of correct, more efficient lighting sources, as directed, will provide comparable quality and levels of illumination while reducing lighting cost.

Install T-8 lamps and electronic ballasts
Your current lighting can be replaced by more efficient fluorescent lighting which will provide the same lumen output with two thirds the electricity.

Insulate HVAC distribution pipe
Adding the correct insulation to piping and repairing damaged insulation will enhance the system efficiency and reduce energy costs.

Replace HVAC equipment
A new, properly designed HVAC unit can achieve a significant efficiency improvement over the old unit, and can save a substantial percentage of current heating and cooling costs.

Replace with high efficiency HVAC equipment
A new, properly designed HVAC unit can achieve a significant efficiency improvement over the old unit, and can save a substantial percentage of current heating and cooling costs.

Change HVAC setpoint temperature
Recommendations have been made to adjust heating and or cooling temperature setpoints to reduce energy costs. Occupant comfort considerations have been included in the analysis of this measure.

Insulate DHW distribution pipe
Adding the correct insulation to piping and repairing damaged insulation will enhance the system efficiency and reduce energy costs.

Refrigeration operational and maintenance measures
Refrigeration energy can be saved through implementation of several low cost operation and maintenance procedures.

Energy management recommendation savings and costs are summarized in the following table. The 'costs' given below represent the estimated cost of installation. The 'payback' periods shown below are obtained by dividing the implementation costs by the annual dollar savings shown.

Summary of Energy Management Recommendations

Description	Annual Cost Savings	Cost	Simple Payback (years)	Annual Energy Savings
Lighting				
Change lighting operating schedule	$165	$0	0.0	1,069 kWh 1.2 kW
Replace incandescent with compact fluorescent lamps	$354	$320	0.9	1,492 kWh 0.5 kW
Install Metal Halide lighting systems	$512	$472	0.9	2,712 kWh
Install more efficient exit signs	$453	$660	1.5	1,962 kWh 0.2 kW
Install more efficient lighting systems	$114	$249	2.2	627 kWh 0.3 kW
Install T-8 lamps and electronic ballasts	$506	$1,521	3.0	3,265 kWh 1.2 kW
Subtotal Lighting	$2,113	$3,222	1.5	
HVAC Equipment				
Insulate HVAC distribution pipe	$115	$222	1.9	58 gal
Replace HVAC equipment	$28	$175	6.2	184 kWh 0.1 kW
Replace with high efficiency HVAC equipment	$89	$600	6.8	575 kWh 0.9 kW
Subtotal HVAC Equipment	$232	$997	4.3	
HVAC Zones				
Change HVAC setpoint temperature	$1,286	$13	0.0	1,725 kWh 2.8 kW 510 gal
Water Heating				
Insulate DHW distribution pipe	$13	$135	10.6	82 kWh
Refrigerated Units				
Refrigeration operational and maintenance measures	$6	$9	1.5	38 kWh 0.0 kW
BUILDING TOTAL	$3,651	$4,377	1.2	13,752 kWh 7.2 kW 568 gal

CHAPTER 3 -- ENERGY PROFILE

This chapter profiles energy costs and usage for Holden Town Hall. It presents information that serves as a basis for quantifying and evaluating energy and cost-savings opportunities presented elsewhere in this report.

Cost of Energy

The per unit cost of energy is an important factor in any energy management study. In the table below, entitled "Annual Energy Costs and Usage", the average unit cost is given for each type of energy used in the facility. The 'average' costs are different from the 'marginal' unit costs given in the rate tables which follow. It is the "marginal" costs that have been used in this study to obtain accurate estimates of measure cost impacts. The savings calculations address impacts on energy consumption as well as peak demand where appropriate, so marginal costs have been given for both energy and demand.

Annual Energy Costs and Usage

Source	Annual Use	Annual Cost	Average Cost	$ per ft²	% of Cost	Energy in MMBtu	MBtu/ft²	% of Energy
Electricity	40,698kWh	$6,200	$0.1523	$1.45	58%%	139	32	24%%
Oil #2	3,163gal	$4,577	$1.4470	$1.07	42%%	439	102	76%%
Total:		$10,777	--	$2.5[illegible]	100%	578	135	100%

Floor space used in analysis: 4,290 ft²

Energy Costs Per Unit

Electric Rate for Electric Service (Account 20109000):

$/kWh	$/kW
0.15400	--

Oil #2 Rate for oil (Account 1196 Main Street):

$/gal
2.00000

Common Energy Conversion Factors

Electricity:	3.413 MBtu/kWh	Natural Gas:	100.0 MBtu/Therm
Fuel Oil:	138.7 MBtu/Gal	Propane:	92.0 MBtu/Gal
Coal:	27,000 MBtu/Ton		

A common measure of energy is the British Thermal Unit or Btu, defined as the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit (see the glossary in the appendix of this report), and its multiples, the MBtu and the MMBtu, i.e.

1 MBtu = 1,000 Btu and 1 MMBtu = 1,000,000 Btu = 1,000 MBtu

CHAPTER 1 – EXECUTIVE SUMMARY

INTRODUCTION

This report presents the findings of an energy management study conducted by Steven Grattan for:

Holden DPW Garage
87 Adams Road
Holden, MA 01520

The energy management study, which was completed on January 23, 2006, included the following activities:

- Walk-through of the facility to identify major energy-using systems
- Collection of detailed equipment and process data
- Computer analysis of current facility energy consumption
- Enumeration of recommendations
- Determination of the cost and payback of each recommendation

The principal contact during the energy management study was Mr. Larry Galkowski.

There are four chapters in this report. Chapter 1, "Executive Summary", presents an overview of the study results, including a table summarizing the estimated cost and potential savings of each recommendation. Chapter 2, "Energy Management Recommendations", provides detailed information on each of the recommendations. This chapter includes a description of the technologies being recommended. Chapter 3, "Energy Profile", summarizes the current energy costs and the distribution of energy use within the facility. Marginal energy costs at your present rate are also discussed in chapter 3. Chapter 4, "Facility Equipment Inventory", is an overview of the data collected during the energy management study. This chapter includes summary information on all building systems covered by the study.

We hope that the report is helpful. If you have specific questions about the report, call your ENE representative.

ENERGY MANAGEMENT RECOMMENDATIONS

The energy survey on which this report is based showed that annual energy costs for the facility now total:

Electricity	$10,235
Oil #2	$13,524
Annual energy cost	$23,759

The on-site energy evaluation found opportunities to obtain the following savings:

Annual Energy Savings (total): $11,065 41% of total energy bill

Each recommendation presented in this report was analyzed as a stand-alone recommendation. The impacts provided are conservative estimates. Exact impacts will depend on other recommendations implemented and the specific conditions following implementation. Since some recommendations may overlap, the total savings given may not be realized.

We project that these savings will result from following the recommendations that are summarized below and discussed more fully in Chapter 2 of this report.

Replace incandescent with compact fluorescent lamps
Incandescent lighting is very inefficient and can be replaced by fluorescent lighting which will provide the same lumen output for one fourth to one third of the energy use.

Install T-8 lamps and electronic ballasts
Your current lighting can be replaced by more efficient fluorescent lighting which will provide the same lumen output with two thirds the electricity.

Install Metal Halide lighting systems
The use of correct, more efficient lighting sources, as directed, will provide comparable quality and levels of illumination while reducing lighting cost.

Tune up burner
Maintaining the heating equipment by keeping it clean and tuned increases operating efficiency and thereby saves energy.

Install hot water reset controls on heating boiler
Automatically resetting hot water temperatures on the hydronic or hot water system according to outside temperatures will reduce standby and distribution losses.

Insulate HVAC distribution pipe
Adding the correct insulation to piping and repairing damaged insulation will enhance the system efficiency and reduce energy costs.

Replace with high efficiency HVAC equipment
A new, properly designed HVAC unit can achieve a significant efficiency improvement over the old unit, and can save a substantial percentage of current heating and cooling costs.

Clean A/C evaporator and condenser coils
Clean, well maintained cooling equipment which is regularly checked will operate more efficiently and economically.

Reduce DHW temperature setpoint
Keeping the water temperature at a reduced but adequate setting will lower standby and distribution losses and save energy.

Insulate DHW tank
Adding a layer of the appropriate tank insulation material will produce savings by reducing both standby losses and the energy necessary to maintain hot water temperatures.

Insulate DHW distribution pipe
Adding the correct insulation to piping and repairing damaged insulation will enhance the system efficiency and reduce energy costs.

Refrigeration operational and maintenance measures
Refrigeration energy can be saved through implementation of several low cost operation and maintenance procedures.

Individual Recommendations
As well as the preceding standard recommendations, the evaluator has made other, facility-specific recommendations.

Energy management recommendation savings and costs are summarized in the following table. The 'costs' given below represent the estimated cost of installation. The 'payback' periods shown below are obtained by dividing the implementation costs by the annual dollar savings shown.

Summary of Energy Management Recommendations

Description	Annual Cost Savings	Cost	Simple Payback (years)	Annual Energy Savings
Lighting				
Replace incandescent with compact fluorescent lamps	$143	$249	1.7	767 kWh 0.3 kW
Install T-8 lamps and electronic ballasts	$1,450	$6,277	4.3	9,413 kWh 3.9 kW
Install Metal Halide lighting systems	$31	$236	7.7	163 kWh
Install controls w/fixtures: 1 ceiling IR/sensor and 7 - 4-4' 32W T8 Lamp, Elect Ballast (1)	$216	$531	2.5	1,403 kWh 0.4 kW
Install controls w/fixtures: 1 ceiling US/sensor and 6 - 4-4' 32W T8 Lamp, Elect Ballast (1)	$178	$602	3.4	1,156 kWh 0.3 kW
Subtotal Lighting	$2,018	$7,889	3.9	
HVAC Equipment				
Tune up burner	$1,597	$198	0.1	796 gal
Install hot water reset controls on heating boiler	$1,359	$372	0.3	679 gal
Insulate HVAC distribution pipe	$566	$2,670	4.7	283 gal
Replace with high effiniency HVAC equipment	$5,365	$33,018	6.2	434 kWh 0.2 kW 2,648 gal
Clean A/C evaporator and condenser coils	$15	$115	7.7	97 kWh 0.1 kW
Subtotal HVAC Equipment	$8,901	$36,373	4.1	
Water Heating				
Reduce DHW temperature setpoint	$92	$7	0.1	598 kWh
Insulate DHW tank	$25	$41	1.6	161 kWh
Insulate DHW distribution pipe	$10	$90	8.7	67 kWh
Subtotal Water Heating	$127	$137	1.1	
Refrigerated Units				
Refrigeration operational and maintenance measures	$19	$45	2.4	126 kWh 0.0 kW
BUILDING TOTAL	$11,065	$44,445	4.0	14,384 kWh 5.1 kW 4,410 gal

CHAPTER 3 -- ENERGY PROFILE

This chapter profiles energy costs and usage for Holden DPW Garage. It presents information that serves as a basis for quantifying and evaluating energy and cost-savings opportunities presented elsewhere in this report.

Cost of Energy

The per unit cost of energy is an important factor in any energy management study. In the table below, entitled "Annual Energy Costs and Usage", the average unit cost is given for each type of energy used in the facility. The "average" costs are different from the "marginal" unit costs given in the rate tables which follow. It is the "marginal" costs that have been used in this study to obtain accurate estimates of measure cost impacts. The savings calculations address impacts on energy consumption as well as peak demand where appropriate, so marginal costs have been given for both energy and demand.

Annual Energy Costs and Usage

Source	Annual Use	Annual Cost	Average Cost	$ per ft²	% of Cost	Energy in MMBtu	MBtu/ft²	% of Energy
Electricity	63,360kWh	$10,235	$0.1615	$0.80	38%%	216	17	12%%
Oil #2	11,394gal	$16,524	$1.4502	$1.29	62%%	1,580	123	88%%
Total:		$26,759	--	$2.08	100%	1,797	140	100%

Floor space used in analysis: 12,840 ft²

Energy Costs Per Unit

Electric Rate for Electric Service (Account 20098000):

$/kWh	$/kW
0.15400	--

Oil #2 Rate for Oil (Account Adam Road DPW Garage):

$/gal
2.00000

Common Energy Conversion Factors

Electricity:	3.413 MBtu/kWh	Natural Gas:	100.0 MBtu/Therm
Fue Oil:	138.7 MBtu/Gal	Propane:	92.0 MBtu/Gal
Coal:	27.000 MBtu/Ton		

A common measure of energy is the British Thermal Unit or Btu, defined as the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit (see the glossary in the appendix of this report), and its multiples, the MBtu and the MMBtu, i.e.

1 MBtu = 1,000 Btu and 1 MMBtu = 1,000,000 Btu = 1,000 MBtu

Appendix D:

03/05/2012

GREEN COMMUNITIES GRANT PROGRAM

GUIDANCE

Fuel efficient Vehicles

Criteria **4**

DOER Massachusetts Department of Energy Resources

INTRODUCTION

Criteria Four of the Green Communities Program states that communities must purchase only fuel-efficient vehicles for municipal use whenever such vehicles are commercially available and practicable. The purpose behind this criterion is to reduce carbon dioxide emissions by municipal vehicles, which has a positive impact on the environment and saves the municipality money.

As background, the US Environmental Protection Agency's Green Vehicle Guide states that:

Vehicles with lower fuel economy create more carbon dioxide - the most prevalent greenhouse gas - than vehicles with higher fuel economy. Every gallon of gasoline your vehicle burns puts about 20 pounds of carbon dioxide into the atmosphere because air has weight and mass, and it takes a lot of it to burn a gallon of gasoline. One of the most important things you can do to reduce your contribution to global warming is to buy a vehicle with higher fuel economy. The difference between 25 miles per gallon and 20 miles per gallon can amount to the prevention of 10 tons of carbon dioxide over a vehicle's lifetime. Buying a more fuel efficient vehicle will also will help to reduce our nation's dependence on fossil fuels. And of course, you will save money by having to fuel up less often.

COMPLIANCE

To meet this criterion, municipalities need to adopt a written, Fuel Efficient Vehicle Policy (by local official or body with authority to enact policies) that requires their departments and divisions to purchase only fuel efficient vehicles (***See Appendix A, model policy***). Both general government and school districts are required to enact a fuel efficient vehicle policy for a municipality to meet this requirement, and letters documenting adoption must be provided, signed by the appropriate municipal authorities as noted below Letters from other municipal officials are not acceptable.

For the letters from the general government and school district:

- **General Government** – The general government must provide a letter from the Chief Executive Officer of the city or town stating that it has adopted the Fuel Efficient Vehicle Policy.

The Chief Executive Officer is defined as the manager in any city having a manager and in any town having a city form of government, the Mayor in any other city, and the Board of Selectmen in any other town unless some other officer or body is designated to perform the functions of a Chief Executive Officer under the provisions of a local charter or laws having the force of a charter.

- **Public School Districts** - For a municipality to meet this requirement, its public school district must provide a letter from the School Superintendent stating that is has adopted the Fuel Efficient Vehicle Policy. Please note that even if the school only has exempt vehicles, adoption of the Policy by the school must be provided in the event that the school does acquire non-exempt vehicles in the future.

- **Regional School Districts** – Regional School Districts are not required to be part of a municipality's Green Communities designation application. However, for regional school districts that wish to be part of a municipality's Green Communities designation (with approval by the municipality), the regional school district must also adopt the Fuel Efficient Vehicle Policy and provide a letter from the Superintendent stating that it has adopted the Policy.

Sample adoption letters are provided in Appendices B and C.

In addition, the municipality is required to develop and maintain a vehicle inventory for all vehicles, both exempt and non-exempt. A plan for replacing non-exempt vehicles with vehicles that meet the fuel efficiency ratings below must also be developed and maintained. This inventory of all vehicles and replacement plan for non-exempt vehicles must include school vehicles. The fuel efficiency ratings are set to ensure that at least 5 or more automatic transmission models of mass production are available for sale in Massachusetts (all from affordable brands; no luxury brands). Based on 2010 EPA data, vehicles are to have a combined city and highway MPG no less than the following:

- 2 wheel drive car: 29 MPG
- 4 wheel drive car: 24 MPG
- 2 wheel drive small pick-up truck: 21 MPG
- 4 wheel drive small pick-up truck: 19 MPG
- 2 wheel drive standard pick-up truck: 17 MPG
- 4 wheel drive standard pick-up truck: 16 MPG
- 2 wheel drive sport utility vehicle: 21 MPG
- 4 wheel drive sport utility vehicle: 18 MPG

Hybrid or electric vehicles in these vehicle classes will meet these criteria

To inform your purchasing decisions, information on makes and models of vehicles including fuel economy comparisons can be found at: http://www.fueleconomy.gov/

***NOTE:** The EPA maintains a database on vehicle fuel efficiency that is updated occasionally throughout the year, as new models are released. As increasing numbers of fuel efficient vehicle models are released the

minimum combined MPG requirements of the Green Communities Act will be revised upwards. Thus, cities and towns must check for updates prior to ordering new vehicles.

In order to encourage efficient driving practices municipalities should implement a monitoring system to record miles driven, fuel consumption, etc. for each vehicle in every department. A monitoring system will help facilitate the municipality's reduction in aggregate energy consumption. If a municipality provides fuel for fleet vehicles it should consider using one of the universal fleet cards available on the market today that provide a monitoring system for tracking fuel use.

VEHICLE RECYCLING

Recycling of vehicles is only allowed if the replacement vehicle meets the fuel efficient criteria listed above. Please be advised that a recycled Ford Crown Victoria does not meet the MPG rating and therefore would not meet fuel efficient vehicle requirements. When a town is ready to retire a Crown Victoria police vehicle, fleet disposal companies can provide an attractive option.

EXEMPTIONS

Vehicles that are exempt from municipal Efficient Fleet Policies include heavy-duty vehicles defined as having a manufacturer's gross vehicle weight rating (GVWR) of more than 8,500 pounds. Examples include fire engines, ambulances, and some public works vehicles. In addition, police cruisers, passenger vans, and cargo vans are exempt from this criterion. However, municipalities must commit to purchasing fuel efficient cruisers, passenger vans, and cargo vans when they become commercially available. Police and fire department administrative vehicles MUST meet fuel efficient requirements.

Emergency Response vehicles that are under 8,500 pounds and for which there are fuel efficient models available are NOT exempt.

ALTERNATIVE COMPLIANCE

If a municipality has a vehicle fleet composed of only exempt vehicles (e.g. heavy-duty vehicles and/or police cruisers), it must propose alternative means of reducing vehicle fuel consumption in order to comply with this criterion. This could include having in place policies and programs that reduce vehicle fuel consumption such as: carpooling incentives for municipal employees; preferred parking for employees with hybrid vehicles; bicycle racks at municipal buildings; incentives to encourage employees to bike to work; or a bicycle sharing program for employees to travel within the municipality. Alternative compliance can also be provided through the Installation of electric vehicle charging stations. Use of alternative fuels such as biodiesel blends from B-5 to B-20 for heavy duty fleets are also encouraged as part of an alternative compliance plan.

A municipality must note that should it acquire non-exempt vehicles in the future, it is committed to purchasing non-exempt vehicles that meet the most recent guidance for Criteria 4 published by the MA Department of Energy Resources' Green Communities Division

A vehicle inventory of exempt vehicles must be provided.

APPLICABILITY

All communities seeking Green Communities designation must adopt a fuel efficient vehicle policy that reflects the most recent MPG criteria published in this Guidance. If a municipality has adopted a policy that reflects old mpg criteria it must have done so within the 6 months immediately preceding issuance of revised Guidance in order to qualify for credit under this criterion when it is applying for designation. All designated Green Communities must review their Fuel Efficient Vehicle Policy on an annual basis and ensure that it reflects DOER's most recently published MPG minimums. The Annual Reporting required of Green Communities will include this information.

Future Financial Considerations

Contingency language regarding potential future budgetary constraints in Fuel Efficient Vehicle Policies will not be accepted. DOER recognizes that predicting and committing future budgets is difficult and will work with municipalities on a case-by-case basis should they encounter difficulty in complying with their Fuel Efficient Policy due to a budget issue in a particular budget-year.

FOR MORE INFORMATION

Website:

www.mass.gov/energy/greencommunities

For fleet questions, contact

Stephen Russell, stephen.russell@state.ma.us

03/05/2012

APPENDIX A

This model policy was prepared to assist cities and towns in developing a fuel efficient vehicle policy. This model policy is intended for illustration purposes, communities are free to utilize the format provided.

Municipality / School District **FUEL EFFICIENT VEHICLE POLICY**	
Effective Date	
Revisions	
Approval Date	
Effective Date	

DEFINITIONS

Combined city and highway MPG (EPA Combined fuel economy): Combined Fuel Economy means the fuel economy from driving a combination of 43% city and 57% highway miles and is calculated as follows:

=1/((0.43/City MPG)+(0.57/Ihighway MPG))

Drive System: The manner in which mechanical power is directly transmitted from the drive shaft to the wheels. The following codes are used in the drive field:

- AWD = All Wheel Drive: four-wheel drive automatically controlled by the vehicle powertrain system
- 4WD = 4-Wheel Drive: driver selectable four-wheel drive with 2-wheel drive option
- 2WD = 2-Wheel Drive

Heavy-duty vehicle: A vehicle with a manufacturer's gross vehicle weight rating (GVWR) of more than 8,500 pound

POLICY STATEMENT

In an effort to reduce the (city/town/school district/other local entity)'s fuel consumption and energy costs the (policy making body) hereby adopts a policy to purchase only fuel efficient vehicles to meet this goal.

PURPOSE

To establish a requirement that the (city/town/school district/other local entity) purchase only fuel efficient vehicles for municipal/school use whenever such vehicles are commercially available and practicable.

03/05/2012

APPLICABILITY

This policy applies to all divisions and departments of the (city/town/school district/other local entity)

GUIDELINES

All departments / divisions shall purchase only fuel-efficient vehicles for municipal use whenever such vehicles are commercially available and practicable.

The (city/town/school district/other local entity) will maintain an annual vehicle inventory for ALL vehicles and a plan for replacing any non-exempt vehicles with vehicles that meet, at a minimum, the fuel efficiency ratings contained in the most recent guidance for Criteria 4 published by the MA Department of Energy Resources' Green Communities Division.
This Green Communities' Guidance for Criteria 4 must be checked for updates prior to ordering replacement vehicles.

Exemptions

- Heavy-duty vehicles. Examples include fire-trucks, ambulances, and some public works trucks that meet the definition of Heavy-duty vehicle.

- Police cruisers, passenger vans and cargo vans are exempt from this criterion as fuel efficient models are not currently available. However, we commit to purchasing fuel efficient police cruisers, passenger vans and cargo vans when they become commercially available. Police and fire department administrative vehicles are NOT exempt and must meet fuel efficient requirements.

Inventory

The following information shall be included in a vehicle inventory list and said list shall be updated on an annual basis and provided to the Green Communities Division:

Model	Make	Model Year	Drive System: 2 WD, 4WD or AWD	Year/month Purchased	> 8500 pounds? (Y or N)	Exempt or non-exempt	MPG Rating	Vehicle Function

NOTE: Departments/Divisions may use EPA combined MPG estimates or actual combined MPG.

FUEL EFFICIENT VEHICLE REPLACEMENT PLAN

The (city/town/school district/other local entity) shall develop a plan to replace all non-exempt vehicles with fuel efficient vehicles as defined above. Said plan shall outline the process by which the (city/town/school district/other local entity) will replace vehicles, set goals for when the existing fleet will be replaced and review said plan on an annual basis. The Fuel Efficient Vehicle Replacement Plan will be provided as an attachment to this Policy.

QUESTIONS / ENFORCEMENT

_All other inquiries should be directed to the department/division responsible for fleet management and/or fleet procurement. This policy is enforced by the Chief Administrative Officer and/or their designee(s)

Appendix B
Sample town adoption letter

Letter must be on Town Letterhead

MA Department of Energy Resources
Green Communities Division
100 Cambridge Street – Suite 1040
Boston, MA 02114

{date of letter}

At a public Board of Selectmen meeting held on [DATE], the Board of Selectmen voted to adopt the attached Fuel Efficiency Vehicle Policy.

Thank you.

Signature and Typed Name of Chair

Appendix C
Sample School Adoption Letter

Letter must be on School letterhead

MA Department of Energy Resources
Green Communities Division
100 Cambridge Street – Suite 1040
Boston, MA 02114

{date of letter}

Please be advised that the Public Schools of [Town] hereby adopted the attached Fuel Efficiency Vehicle Policy.

Thank you.

Signature and Typed Name of Superintendent of Schools

FMVEH	DEPT	INS#	YEAR	MAKE	DESCRIPTION	VIN #	LICENSE #	DATE	DEALER	PRICE
HP-10	ANIMAL CONT	04	1998	FORD (T)	E150 VAN	1FTRE1465WHB76288	M18320	7/15/1998	NATICK AUTO SALES	
AC	ANIMAL CONT	32	2003	ford(t)	EXPEDITION U16	1FMPU16L43LA48125		9/11/2002		
BG-51	BLDG/GRDS	08	2008	CHALLENGER	FLAIL MOWER	T015001	M78419	10/10/2008	MILTON CAT	82,977
B/G -KU	BLDG/GRDS	nr	2010	KUBOTA	TRACTOR	30665	NOT REG	7/1/2010	AHEARN EQUIPMENT	11,153
BG- CEM	BLDG/GRDS		1997	KUBOTA	CEMETERY BACKHOE		NOT REG	7/1/1997	AHEARN EQUIPMENT	
BG-TR		03	1989	TRAIL FLITE (T)	TRAILER	41GT61226KB000019	M61115	6/24/1989	GOODALLS POWER EQUI	2,250
BG-30	BLDG/GRDS	06	2003	FORD 550T	4X4 PICKUP	1FDAF57F83EA49234	M65133	12/30/2002	MHQ MUNICIPAL VEHICL	48,753
DPS8	BLDG/GRDS	42	2009	FORD (T)	F150 4X4	1FTMF1FWXAKA16358	M47352	9/16/2009	MHQ MUNICIPAL VEHICL	19,980
B/G 56	BLDG/GRDS	07	2012	FORD (T)	F550 4x4	1FDUF5HT2CEC68689	M84464	11/29/2012	MINUTEMAN Truck	99,777
BG-KB	BLDG/GRDS	nr	1997	KUBOTA 2150	TRACTOR W/LOADER BUCKET	60277/13186/32686	NOT REG	12/17/1997	NORFOLK POWER EQUIP	16,169
BG-CH	BLDG/GRDS	72	1998	BRUSH BANDIT (T)	CHIPPER	013156	M60383	9/8/1998	CLEAVES CO., INC.	17,742
BG-38	BLDG/GRDS	05	1999	FORD F-350 (T)	FWD PICKUP	1FTSF31L8XEB92170	M60271	8/19/1998	NATICK AUTO SALES	28,000
BG-45	BLDG/GRDS	85	2002	FORD (T)	F350	1FTSX31L23A45369	M63319	1/24/2000	MHQ MUNICIPAL VEHICL	17,744
BG-LV	BLDG/GRDS	nr		HIWAY GRDS KEEPER	LEAF VACUUM	95041505	NOT REG	10/16/1996	J. C. MADIGAN	12,360
MG-MF	BLDG/GRDS	nr		SUNDRY	MISC. VEHICLE		NOT REG	1/1/1980		
MG-MP	BLDG/GRDS	nr		SUNDRY	PARKS MISC.	MISC	NOT REG	1/1/1980		
B/G 37	BLDG/GRDS		2007	FORD	CAB&CHASSIS 4X4	1FDAF57PX7EA84710	M80039	2/21/2007	MHQ MUNICIPAL VEHICL	54,889
B/G 53	BLDG/GRDS		2001	Jacob	Tractor	6235	M65041	11/14/2001	SAWTELLE BROS	42,800
BG-41	BLDG/GRDS		2006	FORD(T)	4X4 UTILITY	1FDWF31576EC00451	48733	4/6/2006	MHQ MUNICIPAL VEHICL	40,364
BG-42	BLDG/GRDS		2005	FORD	E250 VAN	1FTNE24L55HA16047	M71813	9/27/2004	MHQ MUNICIPAL VEHICLES	
BG-4330	BLDG/GRDS		2006	KUBOTA	TURF BUCKET TRACTOR		NR			
BG-ZD28	BLDG/GRDS		2005	KUBOTA	0 TURN MOWER		NR			
	BLDG/GRDS		2012	BELMONT	FLAT BED TRAILER	1B9D01821CL657722		8/20/2012	146 SUPPLY	6,000
CA-01	COA	08	2001	DODGE VAN 131	Senior Bus	2B6LB31Z01K555444	M76156	12/12/2001	WORC.REG. AUTHORITY	36,389
CA-02	COA		2006	FORD AEROLITE	VAN 604	1FDWE35LX7DA13093	WR1A0423	6/62007	WRTA	
CA-03	COA		2009	FORD E350	VAN 760	1FTDS34L49DA22879	M82465	9/10/2009	MHQ MUNICIPAL VEHICL	43,995
EL-UT	ELEC LIGHT	09	1973	UNKNOWN (T)	UTILITY TRAILER	1887	M19858	1/1/1973		1,310
	ELEC LIGHT	65	1983	STRATA-DYNE (T)	TRAILER	21031	M48978	7/8/1997	NESCO INC.	7,450
EL-52	ELEC LIGHT	58	1995	FORD (T) New Holland	BACKHOE	A432433	M15224	8/1/2008	Holden DPW	15,000
EL-21	ELEC LIGHT	11	2007	INTERNATIONAL (T)	CAB & CHASS-DBL BKT	1HTMKAAR97H533686	M80055	11/29/2007	MORSE MFG	104,018
EL-23	ELEC LIGHT	12	1990	CHEVROLET (T)	CAB & CHASS-SNGL BKT	1GBM7D165LV101409	M42792			
EL-29	ELEC LIGHT	13	2007	FORD (T) F150	4 X 4 PICKUP	1FTRW14W67FA48927	M79752	71/07	MHQ MUNICIPAL VEHICL	25,840
EL-31	ELEC LIGHT	14	2012	INTERNATIONAL (T)	AERIAL BUCKET TRUCK	1HTMKAAROCH597335	M17378	2/28/2012		67,984
EL-28	ELEC LIGHT		2003	FORD F250	4X4 PICKUP	1FTNX21L73EC55267	M48686	7/1/2003	MHQ MUNICIPAL VEHICL	
EL-27	ELEC LIGHT	17	1995	FORD (T)	DIGGER	1FDYF80E1SVA19962	M48933	8/30/1994	AMI	114,050
EL-24	ELEC LIGHT	18	1996	CHEVROLET (T)	PICKUP	1GCCS1446TK133462	M15236	3/5/1996	GEORGE LUDDY CHEV	11,200
EL-22	ELEC LIGHT	64	1997	INTERNATIONAL (T)	CAB & CHASS	1HTSDAAN2VH475464	M48969	1/27/1997	MID STATE INTL TRUCKS	40,631
EL-MS	ELEC LIGHT	73	1998	BANDIT (T)	CHIPPER	013486	M60786	8/26/1998	CLEAVES CO., INC.	22,500
EL-20	ELEC LIGHT	76	1999	FORD (T)	F350 DUMP	1FDWF37F6XED31792	M78118	5/12/1999	SUNNYSIDE FORD	19,300
EL-26	ELEC LIGHT	91	2000	FORD(T)	RANGER	1FTZR11V3YTB18664	M37378	10/6/2000	NATICK AUTO SALES	
	ELEC LIGHT	89	2000	TSE REEL(T)	TRAILER	1T9TS0926YS268077	M64752	5/25/2000	DC BATES EQUIPMENT	8,279
EL-25	ELEC LIGHT		2004	INTERNATIONAL (T)	CAB&CHASS	1HTMMAAR14H617345	M69458	10/22/2003	MID STATE INTL TRUCKS	125,000

EL-09	ELEC LIGHT		2010	FORD	ESCAPE	1FMCU5K31AKC89634	M83649	5/26/2010	MHQ MUNICIPAL VEHICLE	30,882
14-AF	FIRE	79	1928	AHRENS-FOX	ANTIQUE	816M145	FIRE 3585	1/1/1928	AHRENS-FOX	5,500
Car 1	FIRE		2011	CHEVROLET	TAHOE	1GNSK2E02BR363395		7/13/2011	LIBERTY CHEV	31,375
14-E1	FIRE	77	1977	MAXIM (T)	1500 GPM PUMPER	42006	FIRE 3581	8/26/1977	MAXIM INDUSTRIES	66,955
14-E3	FIRE		2005	HME AHRENS FOX	FIRE PUMPER	44KFT42855WZ20507	MF3584	10/1/2004	KANSAS STATE BANK	357,012
14-E6	FIRE	23	1984	FARRAR/DUPLEX (T)	HOSE REEL PUMPER	1D91D31D9E1008429	FIRE 3580	7/1/1985	FARRAR	136,968
14-R1	FIRE	24	1986	GMC	RESCUE TRUCK	1GDM7D1GV526622	FIRE 5874	7/16/1987	FARRAR	85,000
14-C4	FIRE		2002	CHEVROLET (T)	TAHOE	1GNEK13Z02J315174	FIRE 3576	9/3/2002	MIRAK CHEVROLET	39,139
14-A3	FIRE		2012	INTERNATIONAL	AMBULANCE	1HTMNAAM4CJ604890	MFA694	7/3/1905	CUSTOM WORKS	
14-F2	FIRE	26	1994	FORD (T)	PICKUP	2FTHF36H7RCA79446	FIRE 3582	7/25/1994	NATICK AUTO SALES	24,294
14-E2	FIRE	28	1996	KME RENAGE (T)	1500 GPM PUMPER	1K9AF428XTN058385	FIRE 7780	11/29/1995	KOVATCH MOBIL EQUIP	183,964
14-TOWER1	FIRE	19	1998	SUTPHEN (T)	TELESCOPIC AERIAL PLATFOR	1S9A3KLE6W1003073	MF3578	11/24/1998	SUTPHEN CORP	583,000
14-F1	FIRE	93	2001	FORD F450(T)	UTILITY	1FDXF47F61EA31574	MF7995	12/14/2000	NATICK AUTO SALES	43055
Car 3	FIRE		2008	FORD	EXPLORER	1FMEU73E28UA99639	MF8497	7/28/2008	MHQ MUNICIPAL VEHICLES	
14-A1	FIRE		2009	GMC	HORTON AMBULANCE	1GDE4V1929F403973	FIRE265A	7/1/2009		
14-A2	FIRE		2000	FORD	ROADRESC AMBULANCE	1FDXE45F8YHB35069	MF473A			
	FIRE				LIGHT TRAILER					
	FIRE				SIGN TRAILER					
	FIRE				FOAM TRAILER					
14-E4	FIRE		2009	SPART	PUMPER	4S7CV2D989C071766	MF9739	7/8/2010	ROSENBAUER/CENTRAL	419114
CERT			1993	CHEVROLET (T)	HICUBE VAN	2GCHG31JXP4123549	A173			FREE
PD-H15	POLICE		2011	FORD	EXPEDITION	1FMJUTG5XBEF48962	23G	9/12/2011	MHQ	34000
PD-MISC	POLICE	04	1998	FORD(T)	E150 VAN	1FTRE1465WHB76288		7/15/1998	NATIC AUTO	
PD-H4	POLICE	30	2005	FORD (T)	FOUR DOOR SEDAN	2fafp71w75x106700	298CZA	9/16/2005	AMI	
PD-H6	POLICE	57	2005	FORD (T)	CROWN VICTORIA - SEDAN	2FAFP71W35X120083	707HMB	10/21/2005	NATIC	
PD-H7	POLICE	34	2010	FORD(T)	CROWN VICTORIA - SEDAN	2FAHP71V59X115019	MP235J	7/1/2009	MHQ MUNICIPAL VEHICLE	
PD-H8	POLICE	66	2007	FORD (T)	SEDAN	2FAFP71WB7X129817	92EH56	7/1/2007	MHQ MUNICIPAL VEHICLE	
PD-H1	POLICE	82	2010	FORD (T)	CROWN VICTORIA - SEDAN	2FABP7BV5AX124103	HP9410	7/1/2010	Harr Motor Co	30,430
PD-H2	POLICE	88	2008	FORD (T)	FOUR DOOR SEDAN	2FAFP71V18X112169	MP7658	5/4/2003	NATICK FORD	
PD-H9	POLICE	83	2007	FORD	CROWN VICTORIA - SEDAN	2FAFP71W77X129825	815OLV	7/1/2007	MHQ MUNICIPAL VEHICLES	
PD-H14	POLICE		2010	FORD	CROWN VICTORIA - SEDAN	2FABP7BV2AX117870	MP812H	6/14/2010		32,215
PD-H5	POLICE	87	2009	FORD (T)	CROWN VICTORIA - SEDAN	2FAHP71V29X104575	MP7659	7/1/2009	MHQ MUNICIPAL VEHICLE	
PD-MS	POLICE	nr		MISC	MISCELLANEOUS	MISC	NOT REG	11/9/1987		
PD-H12	POLICE		2008	CHARGER		2B3KA43H68H247711	MP594H	7/1/2008	MHQ MUNICIPAL VEHICLES	
PD-H11	POLICE		2003	FORD	PICKUP F150	1FTRX18WB52803	MP571G	4/28/2003	MHQ	22,500
PD	POLICE	81	2010	FORD(T)	FUSION HYBRID		68ZB21	7/1/2009	MHQ	
DP-08	PUB WKS	44	2007	FORD 500		1FAFP27107G114636	M74698	7/21/2006	MHQ Municipal Vehicles	20,466
DP-MH	PUB WKS	nr	0	SUNDRY	HIGHWAY MISC.	MISCELLANEOUS	NOT REG	1/1/1980		
DP-HT	PUB WKS	35	1970	HOMEMADE	HOMEMADE TRAILER	NONE	M15226	1/1/1960		250
DP-46	PUB WKS	38	1979	MACK DUMP TRUCK (T)	4WD DUMP TRUCK	RM6854X1317	M49074	9/14/1978	WORCESTER MACK, INC	52,907
DP-15	PUB WKS	39	1985	MACK(T)	ALL-WHEEL DR	1M2S137C2FA001432	M48916	2/11/1985	MORSE MACK SALES INC	74,926
DP-35	PUB WKS	40	2002	INTERNATIONAL	DUMP	1HTWCAAR52J041292	M48951	4/11/2002	MID-STATE INTERN	145,633
E-4	PUB WKS		1984	GMC	SIERRA TANKER	1GTS7D4G1EV510712				20,466
DP-14	PUB WKS		2007	MACK (T)	DUMP TRUCK	1M2AT04CX7M001963	M81282	6/28/2007	BALLARD MACK	117,268

DP-16	PUB WKS		2007	MACK	MACK DUMP SANDER	1M2AT04C17M001964	M81280	6/28/2007	BALLARD MACK	107,268
DP-PA	PUB WKS	67	1990	LAYTON (T)	LAYTON SUPER PAVER	D10238K0	M58508	8/21/1990	FILES EQUIP CO INC	31,415
DP-33	PUB WKS	47	2008	ELGIN (T)	SWEEPER	NS0118S	M81246	9/27/2007	MHQ Municipal Vehicles	122,788
DP-RL	PUB WKS	48	1992	STOW ONE TON ROLLER	ONE TON ROLLER	159TF1323NB068017	M48752	5/1/1993	PARKER DANNER	6,975
DPW TANK	PUB WKS	69	1984	GMC(T)	SIERRA TANKER	1GTS7D4G1EV510712		7/16/1998	SURPLUS EQUIP	
DP-13	PUB WKS		2012	MACK	DUMP TRUCK	1M2AX04CXCM014033	M82743	4/12/2012	BALLARD MACK	211,913
DP-19	PUB WKS	49	2003	FORD (T)	DUMP TRUCK	1FDAF57F63EA49233	M48932	1/27/2003	MHQ Municipal Vehicles	48,253
DP-18	PUB WKS	52	1995	FORD (T)	4 X 4 DUMP	1FDLF47F6SEA59276	M49008	2/14/1996	AMI NATICK	39,021
DP-34	PUB WKS	53	2008	CAT	BACKHOE/LOADER	CAT0420ECKMW03072	M19755	7/1/2008	SOUTHWORTH MILTON	83,000
DP-AC	PUB WKS	51	1995	INGERSOLL-RAND (T)	AIR COMPRESSOR	257871VGF327	M51963	8/4/1995	INGERSOLL-RAND	9,662
DP-01	PUB WKS	54	1996	FORD (T)	CAB & CHASSIS	1FDKF38F7TEB39787	M44637	8/1/1996	NATICK AUTO SALES	34,284
DP-62	PUB WKS	55	2002	FORD F350	4 X 4 PICKUP	1FTSF31L72ED02747	M67586	7/12/2002	MHQ Municipal Vehicles	39,545
DP-17	PUB WKS	56	1996	VOLVO(T)	LOADER	L90CV62432	M48921	10/25/1996	WOODCO MACHINERY	98,708
DP-10	PUB WKS		2012	FORD	F350 4X4	1FTRF3B63CEA14510		10/26/2011	MHQ Municipal Vehicles	44,177
DP-12	PUB WKS	68	1998	MACK (T)	DUMP SANDER	1M2P263COWM025897	M60248	1/23/1998	BALLARD MACK	136,685
DP-43	PUB WKS	75	1999	MTV (T)	TRACTOR	MT5T1534	M60736	1/20/1999	C. N. WOOD	70,388
DP-44	PUB WKS	78	1999	MTV (T)	TRACTOR	MT5T1576	M48880	5/21/1999	C. N. WOOD	58,000
DP-47	PUB WKS	80	1999	ELGIN (T)	SWEEPER	S8745S	M58011	5/28/1999	C. N WOOD	95,276
DP-32	PUB WKS	90	2000	FORD (T)	EXPLORER	1FMZU72EOYZB68348	M62888	7/19/2000	MHQ Municipal Vehicles	29,827
DP-36	PUB WKS	92	2000	VOLVO	LOADER	L90DV642087	M65481	11/6/2000	WOODCO MACHINERY	161,000
DP-48	PUB WKS		2001	FORD (T)	F550 DUMP	1FDAF57F61EA61122	M65970	2/27/2001	NATICK AUTO SALES	60,729
DP-TR	PUB WKS		2002	CAM TRAILER	UTILITY	5JPBU20222P005999	M69224	8/29/2002	AHEARN EQUIPMENT	2,219
DP-55	PUB WKS		2003	VOLVO	EXCAVATOR	26301895	M71634	5/24/2004	WOODCO MACHINERY	149,325
DP-11	PUB WKS		2004	FORD	F550 DUMP	1FDAF57P34ED34420	M72761	8/2/2004	AMI	71,811
DP-49	PUB WKS		2004	CHEV TAHOE	TAHOE	1GNEK13104J230379	M71813	9/9/2004	MIRAK	37,187
DP57	PUB WKS		1995	FORD	RANGER	1FTCR11UPSTA17729	M20031	3/9/2007	LIGHT DEPT	
DP-6	PUB WKS		2010	FORD	F350 4X4	1FTWX3B58AEA23546	M82403	10/14/2009	MHQ Municipal Vehicles	41,999
DP-63	PUB WKS		2010	FREIGHTLINER/ VACTOR	SEWER VAC TRUCK	1FVAC3BSXADAR8483	M83042	11/25/2009	MHQ Municipal Vehicles	294,610
DP64	PUB WKS		1984	GMC	PUMPER TRUCK	1GTS7D4G1EV510712	M83666	8/3/2010	FIRE DEPT	0
DP65	PUB WKS		2010	MSV	MULTI SERV. VEHICLE	1M9AC1329AH849025		8/23/2010	DYAR SALES	98,360
RC52	RECREATION		2007	FORD 500	500	1FAFP27177G114620	M15212		MHQ	20,751
WS-MW	W & S	nr	0	SUNDRY	WATER MISC.	MISC.	NOT REG	1/1/1960		200
WS-MS	W & S	59	1987	SEWER JET (T)	SEWER JET	8700126	M38588	7/24/1987	AQUATECH, INC	15,965
WS-04	W & S		2006	4X4 UTILITY	PICKUP	1FDWF31556EC00450	M48733	4/6/2006	MHQ	44,359
WS-03	W & S		2012	FORD (T)	UTILITY F350PU	1FDRF3B62CEA14509		1/30/2012	AMI MUNICIPAL VEH.	47,433
WS-39	W & S	74	2012	JOHN DEERE	BACKHOE/LOADER	1T0310SKKCE230037	M61103	8/8/2012	SCHMIDT EQUIPMENT	89,025
WS-07	W & S	84	1999	FORD (T)	F-450 UTILITY	1FDAF57F4XEE72754	M15221	11/30/1999	NATICK AUTO SALES	51,104
WS-TR	W & S	71	1999	LOAD RITE (T)	TRAILER	5A4KY4L10X2000014	M60424	8/4/1998	N. E. MARINE IND. INC.	1,775
WS-05	W & S	94	2001	FORD (T)	UTILITY BODY F550	1FDAF57F81EA61123	M15225	2/15/2001	NATICK AUTO SALES	58,975
WS-02	W & S		2012	FORD (T)	F350	1FTRF3B64CEC70378	M66796	10/11/2012	WAYSIDE FORD	41,400
WS-50	W & S		2012	FORD (T)	F350	1FTRF3B66CEC70379	M87052	10/11/2012	WAYSIDE FORD	41,400
DP-80	PUB WKS	44	2002	FORD (T)	Explorer	1FMZU72E92ZA36468	M67400	7/12/2001	MHQ Municipal Vehicles	30,653

WS60	W & S	46	1994	FORD (T)	DUMP TRUCK	1FDYK82E8RVA33151	M71827	3/24/1994	NATICK AUTO SALES	79,248
			2010	GENERATOR	UTILITY TRAILER	1R9111026AA230349	M84190	10/7/2011		0
	W/S		2012	TRAILER	UTILITY TRAILER	5N6200F29C1036260	M87237	7/3/2012	ATLANTIC COAST TR.	9,772
UPDATED	8/20/2012									

Examples of Vehicles that meet the MPG Requirements of Criteria 4

(in order or price low-high)

Cars

2011 Chevrolet Aveo

2011 Chevrolet Aveo5

2013 Chevrolet Spark

2013 Smart fortwo

2013 Hyundai Accent

2014 Ford Fiesta

2013 Chevrolet Sonic

2013 Kia Rio

2013 Mazda MAZDA2

2013 Kia Rio5

2013 Toyota Yaris

2013 Fiat 500

2013 Scion xD

2013 Dodge Dart2013 Honda Fit

2014 Chevrolet Cruze

2013 Toyota Corolla

2013 Hyundai Veloster

2013 Hyundai Elantra Coupe

2013 Hyundai Elantra

2013 MINI Cooper

2013 Buick Encore

Trucks

2011 Ford Ranger

2011 GMC Canyon

2012 GMC Canyon

2012 Chevrolet Colorado

2013 Ram 1500

Sport Utility Vehicles

Wagons

2012 Hyundai Elantra Touring

2012 Dodge Caliber

2013 Nissan Cube

2013 Toyota Matrix

2013 Volkswagen Jetta SportWagen

2013 Subaru Outback

2013 Ford C-Max

2013 Toyota Prius V

2011 Volvo V50

SUVs

2014 Jeep Patriot

2013 Suzuki SX4 Crossover

2014 Jeep Compass

2011 Chevrolet HHR

2013 Kia Sportage

2013 Mitsubishi Outlander Sport

2013 Jeep Compass

2012 Nissan Juke

2012 Hyundai Tucson

2013 Nissan Juke

2013 Mazda CX-5

2014 Mazda CX-5

2012 Kia Sorento

2012 Ford Escape

Appendix E:

Revised 8/20/12

GREEN COMMUNITIES DESIGNATION

GUIDANCE

Criterion 5

Stretch Code Adoption Process for a Town

INTRODUCTION

A municipality must require all new residential construction over 3,000 square feet and all new commercial and industrial real estate construction to minimize, to the extent feasible, the life-cycle cost of the facility by utilizing energy efficiency, water conservation and other renewable or alternative energy technologies.

The recommended way for cities and towns to meet this requirement is by adopting the Board of Building Regulations and Standards (BBRS) Stretch Code (780 CMR 115.AA), an appendix to the MA State Building Code. Should a community choose to not adopt the Stretch Code and choose to use another standard, the community must provide evidence that this alternative standard minimizes the life cycle energy costs for all new construction and is enforceable by the community.

The purpose of this code is to provide a more energy efficient alternative to the base energy code for new and existing buildings. A municipality seeking to ensure that construction within its boundaries is designed and built above the energy efficiency requirements of 780 CMR may mandate adherence to this code. Municipalities interested in adopting 780 CMR 115.AA, the "Stretch Energy Code" are directed to do so in the manner prescribed by law. The code may also be rescinded by any municipality in the Commonwealth in the manner prescribed by law.

If adopted by a municipality, this code, rather than Chapter 13 or 34 of the *International Building Code 2009* with Massachusetts Amendments (780 CMR 13.00 or 34.00) or for Single- and Two-family dwellings at 780 CMR 51.00 as applicable, shall govern. This code shall regulate the design and construction of buildings to provide flexibility, and to permit the use of innovative approaches and techniques to achieve effective energy use.

PROCESS for ADOPTION

Towns are advised to seek adoption of the Stretch Code as a general bylaw through a vote of Town Meeting. Cities are advised to adopt the Stretch Code by general ordinance via City Council. **Please note, once the Stretch Code is adopted by a municipality, all future editions, amendments and modifications of the Stretch Code are automatically adopted unless the municipality rescinds adoption of the Stretch Code itself.** A community must adopt the Stretch Code "as is", without applying any amendments or conditions.

Revised 8/20/12

The following sample article, sample motion, and sample bylaw are provided as examples:

SAMPLE TOWN WARRANT ARTICLE:

To see if the Town will vote to enact Chapter ___ of the Town of _____General Bylaws, entitled "Stretch Energy Code" for the purpose of regulating the design and construction of buildings for the effective use of energy, pursuant to Appendix 115.AA of the Massachusetts Building Code, 780 CMR, the "Stretch Energy Code," including future editions, amendments or modifications thereto,

a copy of which is on file with the Town Clerk, or take any other action relative thereto.

SAMPLE TOWN MEETING MOTION:

I move that the Town will enact Chapter ___ of the Town of _____General Bylaws, entitled "Stretch Energy Code" for the purpose of regulating the design and construction of buildings for the effective use of energy, pursuant to Appendix 115.AA of the Massachusetts Building Code, 780 CMR, the "Stretch Energy Code," including future editions, amendments or modifications thereto

SAMPLE BYLAW:

Chapter ____

STRETCH ENERGY CODE

[Adopted 0-0-2012 ATM / STM by Art.]

§ ____-1 Definitions
§ ____-2 Purpose
§ ____-3 Applicability
§ ____-4 Stretch Code

§ ____-1 Definitions

International Energy Conservation Code (IECC) - The International Energy Conservation Code (IECC) is a building energy code created by the International Code Council. It is a model code adopted by many state and municipal governments in the United States for the establishment of minimum design and construction requirements for energy efficiency, and is updated on a three-year cycle. The baseline energy conservation requirements of the MA State Building Code are the IECC with Massachusetts amendments as approved by the Board of Building Regulations and Standards.

Stretch Energy Code - Codified by the Board of Building Regulations and Standards as 780 CMR Appendix 115.AA of the 8th edition Massachusetts building code, the Stretch Energy Code is an appendix to the Massachusetts building code, based on further amendments to the International Energy Conservation Code (IECC) to improve the energy efficiency of buildings built to this code.

Revised 8/20/12

§ ____-2 Purpose

The purpose of 780 CMR 115.AA is to provide a more energy efficient alternative to the base energy code applicable to the relevant sections of the building code for both new construction and existing buildings.

§ ____-3 Applicability

This code applies to residential and commercial buildings. Buildings not included in this scope shall comply with 780 CMR 13, 34, 51, as applicable.

§ ____-4 Stretch Code

The Stretch Code, as codified by the Board of Building Regulations and Standards as 780 CMR Appendix 115.AA, including any future editions, amendments or modifications, is herein incorporated by reference into the Town of _____ General Bylaws, Chapter ____ .

The Stretch Code is enforceable by the inspector of buildings or building commissioner.

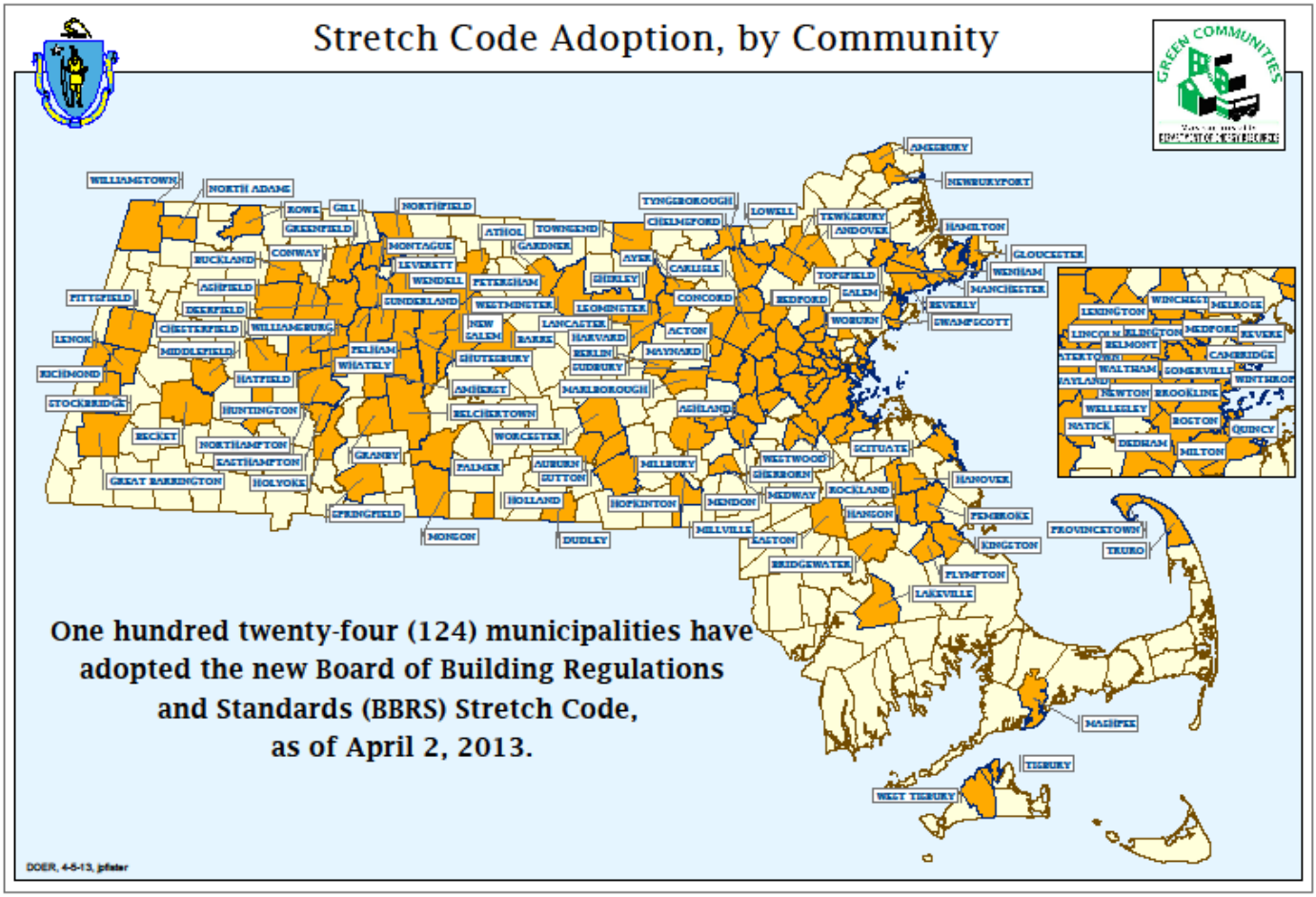
IMPORTANT LINKS
This document, as well as the following documents, is found on our web page for Criterion 5 guidance.

Residential Cash Flow Analysis
Home Loan Investment Bank Case Study
Fidelity Bank Corporate Office and Branch Case Study

Northeast HERS Alliance

Question and Answer for Stretch Energy Code Appendix 115.AA
780 CMR 115.AA Stretch Energy Code (pg 5-24)
Stretch Code Adoption by Community

Stretch Code Adoption, by Community



Community Adoption of the Stretch Energy Code;
"Appendix 115 AA" of the MA State Building Code (780 CMR)

Municipality	2010 Population	Status	Effective Date
Acton	21,924	Town Meeting adopted 4/6/10	1/1/2011
Amesbury	16,283	City Council adopted 1/8/13	1/1/2014
Amherst	37,819	Town Meeting adopted 5/23/11	1/1/2012
Andover	33,201	Town Meeting adopted 4/28/10	1/1/2011
Arlington	42,844	Town Meeting adopted 4/28/10	7/1/2011
Ashfield	1,737	Town Meeting adopted 9/29/11	7/1/2012
Ashland	16,593	Town Meeting adopted 5/1/12	1/1/2013
Athol	11,584	Town Meeting adopted 4/12/10	1/1/2011
Auburn	16,188	Town Meeting adopted 5/1/12	7/1/2013
Ayer	7,427	Town Meeting adopted 5/9/11	1/1/2012
Barre	5,398	Town Meeting adopted 6/20/11	1/1/2012
Becket	1,779	Town Meeting adopted 5/8/10	1/1/2011
Bedford	13,320	Town Meeting adopted 3/28/11	1/1/2012
Belchertown	14,649	Town Meeting adopted 5/10/10	1/1/2011
Belmont	24,729	Town Meeting adopted 5/11/11	1/1/2012
Berlin	2,866	Town Meeting adopted 5/3/11	1/1/2012
Beverly	39,502	City Council adopted 5/2/11	1/1/2012
Boston	617,594	City Council adopted 11/17/10	7/1/2011
Bridgewater	26,563	Town Meeting adopted 9/6/2011	7/1/2012
Brookline	58,732	Town Meeting adopted 5/25/10	1/1/2011
Buckland	1,902	Town Meeting adopted 5/4/11	1/1/2012
Cambridge	105,162	City Council adopted 12/21/09	7/1/2010
Carlisle	4,852	Town Meeting adopted 5/10/10	1/1/2011
Chelmsford	33,802	Town Meeting adopted 4/29/10	1/1/2011
Chesterfield	1,222	Town Meeting adopted 6/15/11	1/1/2012
Concord	17,668	Town Meeting adopted 4/29/10	1/1/2011
Conway	1,897	Town Meeting adopted 10/17/10	7/1/2012
Dedham	24,729	Town Meeting adopted 5/17/10	1/1/2011
Deerfield	5,125	Town Meeting adopted 4/25/11	1/1/2012
Dudley	11,390	Town Meeting adopted 11/7/2011	7/1/2012
Easthampton	16,053	City Council adopted 5/05/10	1/1/2011
Easton	23,112	Town Meeting adopted 5/17/10	1/1/2011
Gardner	20,228	City Council adopted 10/4/10	7/1/2011
Gill	1,500	Town Meeting adopted 06/21/10	1/1/2011
Gloucester	28,789	City Council adopted 8/3/10	7/1/2011
Granby	6,240	Town Meeting adopted 5/9/11	1/1/2012
Great Barrington	7,104	Town Meeting adopted 5/3/11	1/1/2012
Greenfield	17,456	City Council adopted 3/17/10	1/1/2011
Hamilton	7,764	Town Meeting adopted 5/8/10	1/1/2011
Hanover	13,879	Town Meeting adopted 5/3/10	1/1/2011
Hanson	10,209	Town Meeting adopted 10/3/10	7/1/2011
Harvard	6,520	Town Meeting adopted 11/9/10	1/1/2012
Hatfield	3,279	Town Meeting adopted 5/11/10	1/1/2011
Holland	2,481	Town Meeting adopted 4/19/11	1/1/2012
Holyoke	39,880	City Council adopted 4/15/10	1/1/2011
Hopkinton	14,925	Town Meeting adopted 5/4/10	1/1/2011
Huntington	2,180	Town Meeting adopted 5/9/12	1/1/2013
Kingston	12,629	Town Meeting adopted 4/5/10	1/1/2011
Lakeville	10,602	Town Meeting adopted 6/13/11	1/1/2012
Lancaster	8,055	Town Meeting adopted 5/3/10	1/1/2011
Lenox	5,025	Town Meeting adopted 5/6/10	1/1/2011
Leominster	40,759	City Council adopted 3/26/2012	7/1/2013
Leverett	1,851	Town Meeting adopted 4/24/10	1/1/2011
Lexington	31,394	Town Meeting adopted 3/31/10	1/1/2011
Lincoln	6,362	Town Meeting adopted 3/27/10	1/1/2011

Community Adoption of the Stretch Energy Code;
"Appendix 115 AA" of the MA State Building Code (780 CMR)

Municipality	2010 Population	Status	Effective Date
Lowell	106,519	City Council adopted 3/20/10	1/1/2011
Manchester	5,136	Town Meeting adopted 4/2/13	1/1/2014
Marlborough	38,499	City Council adopted 11/8/10	1/1/2012
Mashpee	14,006	Board of Selectment adopted 1/25/10	1/1/2011
Maynard	10,106	Town Meeting adopted 10/26/2011	7/1/2012
Medford	56,173	City Council adopted 5/4/10	1/1/2011
Medway	12,752	Town Meeting adopted 11/15/10	7/1/2011
Melrose	26,983	City Council adopted 5/10/10	1/1/2011
Mendon	5,839	Town Meeting adopted 6/6/2011	1/1/2012
Middlefield	521	Town Meeting adopted 5/7/11	1/1/2012
Millbury	13,261	Town Meeting adopted 6/7/11	1/1/2012
Millville	3,190	Town Meeting adopted 5/14/12	1/1/2013
Milton	27,003	Town Meeting adopted 9/20/10	7/1/2011
Monson	8,560	Town Meeting adopted 5/9/11	1/1/2012
Montague	8,437	Town Meeting adopted 4/1/10	1/1/2011
Natick	33,006	Town Meeting adopted 4/29/10	1/1/2011
New Salem	990	Town Meeting adopted 11/8/10	7/1/2011
Newburyport	17,416	City Council adopted 11/8/10	7/1/2011
Newton	85,146	Board of Aldermen adopted 11/9/09	7/1/2010
North Adams	13,708	City Council adopted 10/26/10	7/1/2011
Northampton	28,549	City Council adopted 4/15/10	1/1/2011
Northfield	3,032	Town Meeting adopted 5/7/12	7/1/2013
Palmer	12,140	Town Council adopted 5/10/10	1/1/2011
Pelham	1,321	Town Meeting adopted 5/5/12	1/1/2013
Pembroke	17,837	Town Meeting adopted 10/19/10	7/1/2011
Petersham	1,234	Town Meeting adopted 6/4/12	7/1/2013
Pittsfield	44,737	City Council adopted 4/14/10	7/1/2011
Plympton	56,468	Town Meeting adopted 5/16/12	1/1/2013
Provincetown	2,942	Town Meeting adopted 10/24/2011	7/1/2012
Quincy	92,271	City Council adopted 8/16/10	7/1/2011
Revere	51,755	City Council adopted 3/14/11	1/1/2012
Richmond	1,475	Town Meeting adopted 5/23/12	1/1/2013
Rockland	17,489	Town Meeting adopted 5/7/12	1/1/2013
Rowe	393	Town Meeting adopted 11/16/10	7/1/2011
Salem	41,340	City Council adopted 5/13/10	1/1/2011
Scituate	18,133	Town Meeting adopted 11/8/10	7/1/2011
Sherborn	4,119	Town Meeting adopted 4/28/11	1/1/2012
Shirley	7,211	Town Meeting adopted 11/7/11	7/1/2012
Shutesbury	1,771	Town Meeting adopted 10/26/10	7/1/2011
Somerville	75,754	Board of Aldermen adopted 6/9/11	1/1/2012
Springfield	153,060	City Council adopted 3/01/10	1/1/2011
Stockbridge	1,947	Town Meeting adopted 5/16/11	1/1/2012
Sudbury	17,659	Town Meeting adopted 4/6/10	1/1/2011
Sunderland	3,684	Town Meeting adopted 4/27/12	1/1/2013
Sutton	8,963	Town Meeting adopted 5/9/11	1/1/2012
Swampscott	13,787	Town Meeting adopted 5/3/10	1/1/2011
Tewksbury	28,961	Town Meeting adopted 5/4/11	1/1/2012
Tisbury	3,949	Town Meeting adopted 4/12/11	1/1/2012
Topsfield	6,085	Town Meeting adopted 5/3/11	1/1/2012
Townsend	8,926	Town Meeting adopted 11/15/11	7/1/2012
Truro	2,003	Town Meeting adopted 4/26/11	1/1/2012
Tyngsborough	11,292	Town Meeting adopted 3/02/10	1/1/2011
Waltham	60,632	City Council adopted 11/3/2011	7/1/2012
Watertown	31,915	Town council adopted 11/9/10	7/1/2011
Wayland	12,994	Town Meeting adopted 11/16/10	7/1/2011

Community Adoption of the Stretch Energy Code;
"Appendix 115 AA" of the MA State Building Code (780 CMR)

Municipality	2010 Population	Status	Effective Date
Wellesley	27,982	Town Meeting adopted 4/11/11	1/1/2012
Wendell	848	Town Meeting adopted 10/18/12	1/1/2014
Wenham	4,875	Town Meeting adopted 5/1/10	1/1/2011
West Tisbury	2,740	Town Meeting adopted 4/12/12	1/1/2013
Westminster	7,277	Town Meeting adopted 11/15/11	7/1/2012
Weston	11,261	Town Meeting adopted 5/9/11	1/1/2012
Westwood	14,618	Town Meeting adopted 5/7/12	1/1/2013
Whately	1,496	Town Meeting adopted 4/24/12	7/1/2013
Williamsburg	2,482	Town Meeting adopted 6/6/11	1/1/2012
Williamstown	7,754	Town Meeting adopted 5/18/10	1/1/2011
Winchester	21,374	Town Meeting adopted 11/18/10	7/1/2011
Winthrop	17,497	Town Council adopted 5/15/12	1/1/2013
Woburn	38,120	City Council adopted 3/15/11	1/1/2012
Worcester	181,045	City Council adopted May 4,10	7/1/2011
124	Adoption in One Hundred Twenty-Four MA Municipalities		
	48.5%	Percentage of State Population of 6,547,629	

Stretch Appendix to the Building Energy Code in Massachusetts

Question and Answer (Q&A) – February 2011

Commercial Building Questions

General Questions

1. What is the 'stretch' code?
The 'stretch code' is an optional appendix to the Massachusetts building energy code that allows cities and towns to choose a more energy-efficient option. This option increases the efficiency requirements in any municipality that adopts it, for all new residential and many new commercial buildings, as well as for those residential additions and renovations that would normally trigger building code requirements.

2. How is the stretch code different from the existing 'base' energy code?
The stretch code appendix offers a streamlined and cost effective route to achieving approximately 20% better energy efficiency in new residential and commercial buildings than is required by the base energy code. This is largely achieved by moving to a performance-based code, where developers are required to design buildings so as to reduce energy use by a given percentage below base code, rather than being required to install specific efficiency measures. Developers have flexibility to choose cost effective and appropriately designed solutions. New residential construction must use the performance-based approach, but residential renovations and most commercial buildings may instead opt to follow a 'prescriptive' route that specifies a set of minimum energy efficiency requirements for different building materials and systems. In the commercial case these add up to approximately a 20% improvement over the base code. Many of these changes have been endorsed by the federal Department of Energy and are likely to be incorporated into the commercial chapter of the next International Energy Conservation Code (IECC) in 2012.

3. Why did the Board of Building Regulations and Standards (BBRS) create this option?
There have been mounting calls for additional stringency in the building energy code, linked to the desire to reduce energy costs, cut dependence on imported fuels, and address concerns about climate change and national security.

Several towns and cities asked for the ability to adopt their own stronger energy code, and/or proposed legislative changes to allow municipalities to strengthen their building code and zoning options.

In response to this, the BBRS, along with the state's energy and environmental agencies, collaborated with regional and national code experts to develop one 'stretch' code that is consistent across the state, in order to meet demands for a stricter code without having multiple standards in different cities and towns.

4. What are some of the expected benefits to a municipality of a more stringent energy code?
The stretch code allows municipalities to take meaningful action on energy use and climate change; it will yield significant cost savings for local residents and businesses, and will increase design and construction firm competitiveness in the growing green building marketplace.

5. What is the anticipated cost of the stretch code?
Construction costs are estimated to rise approximately $3,000 for a typical single family home, and by 1% to 3% of total costs for commercial buildings. However, after energy cost savings on heating and electricity are included these higher performance standards save money. In addition, the state's electric and gas utilities provide financial incentives that further reduce the upfront costs of high performance buildings.

For example, a residential home purchased with a 30-year mortgage would typically result in net savings to the homeowner in the first year due to energy bill savings that are larger than the increase in mortgage payments from construction and financing costs. Case studies of commercial buildings utilizing the improvements on which the commercial code changes are based have shown paybacks of 1 to 2 years, when standard incentives from electric utilities are included on the benefits side.

6. Where can I find and read more about the stretch code appendix?
The stretch code appendix language is freely available on the Massachusetts BBRS website,[1] Along with a 2-page summary[2] of the code and other explanatory documents. In addition the stretch code appendix 780CMR 115.aa can be found with the rest of the Massachusetts energy code in the state bookstore. As the commercial stretch code in particular amends the base energy code, they are best read together. The base energy code is now the International Energy Conservation Code, 2009 edition (IECC 2009) currently available for free from the ICC website[3] due to a sponsorship by the Department of Energy, and also available for sale from other online book stores.

[1] Stretch code language:
http://www.mass.gov/Eeops/docs/dps/8th_edition/115_appendices.pdf
[2] Stretch code 2-page summary:
http://www.mass.gov/Eeops/docs/dps/inf/stretch_code_overview_jun05_09.pdf
[3] The IECC 2009 code book is available for free download or purchase from the ICC website at:
http://www.iccsafe.org/store/pages/doeregistration.aspx
http://www.iccsafe.org/e/prodshow.html?prodid=3800S09&stateInfo=fEadjxjbnWjcdbaj1729|5

Scope

7. What building types does the stretch code apply to?
The stretch code applies to both residential and commercial buildings:
a) Residential buildings from single family homes up to and including buildings 3 stories or less of any size. It applies to new construction, additions, and major renovations. Historic buildings are exempt from both the stretch code and the base code.
b) New commercial buildings over 5,000 square feet in size, including multi-family residential buildings over 3 stories., Supermarkets, laboratories, and warehouses are exempt if they are below 40,000 square feet. Other building types with unusual energy usage profiles can also apply for a waiver from the stretch code from the BBRS.

8. Does the stretch code apply to major renovation projects as well as new construction?
For commercial buildings: no, for residential buildings: yes. The stretch code has less stringent energy performance requirements for renovations than for new buildings. In addition, those doing additions and renovations have the option of using a simple 'prescriptive' path to code compliance. The prescriptive path specifies a set of minimum energy efficiency requirements for different building materials and systems, instead of requiring energy performance modeling and testing. This flexibility is available due to the greater design constraints involved in working with an existing building. Due to the wide variety in types and conditions of commercial buildings, at this time there are no widely-accepted standards for renovating such buildings, so only new commercial buildings are covered by the stretch code requirements.

9. Does the stretch code apply to minor additions to existing buildings?
Additions to existing buildings that are large enough to require code compliance are treated in the same way as new construction for commercial buildings, and in the same way as renovations in residential buildings. In both cases those doing additions can follow the performance approach to code compliance or a simplified prescriptive path. For residential additions, the prescriptive path is very similar to the base energy code but

also requires the use of a checklist to ensure quality installation of insulation and air sealing, use of Energy Star windows, doors and skylights as appropriate, and tighter duct sealing for new heating and cooling systems.

10. What happens to buildings not covered by the stretch code?
Building types that do not fall under the stretch code scope, such as small commercial buildings under 5,000 sq. ft., will follow the existing base energy code requirements, which changed in July, 2010 to the IECC 2009 code with minor Massachusetts amendments.

11. What categories do multi-family residential buildings fall into?
Residential multi-family buildings that are above 100,000 square feet and at least four stories tall have to follow the same performance path (20% better than the ASHRAE standard 90.1-2007) as other commercial buildings larger than 100,000 square feet. Residential buildings below 100,000 square feet and at least four stories tall are classified with commercial buildings between 5,000 and 100,000 square feet. Multi-family homes with one to three stories of any size fall under the residential stretch code standards. In the rare case of a multi-family building of three stories or less that is larger than 100,000 square feet, the developer may elect to be treated either as a residential or as a commercial building.

12. Does the stretch code apply to historic buildings?
Both the stretch code and the base energy code exempt historic buildings listed in state or national registers, or designated as a historic property under local or state designation law or survey, or with an opinion or certification that the property is eligible to be listed.

Standards

13. What standards are the stretch code appendix based on?
The residential stretch code is based on the pre-existing 'Energy Star for Homes'[4] program developed by the federal EPA and Department of Energy, and customized for Massachusetts. This Energy star program is in turn built upon the Home Energy Rating System (HERS) which is developed and administered by the national Residential Energy Services Network (RESNET).[5]

The Commercial stretch code for buildings from 5,000 square feet to 100,000 square feet is based on the International Energy Conservation Code (IECC 2009), which is now the base energy code for Massachusetts, with further improvements derived from the New Buildings Institute (NBI) Core Performance program for commercial buildings (recently revised and published as the Core energy code).[6] Above 100,000 square feet commercial buildings are required to show a percentage reduction below ASHRAE 90.1-2007 energy standards.[7] This performance approach is also an option for smaller commercial buildings.

14. What training and materials are available on these standards?
In addition to the websites referenced in the prior question, training on the IECC 2009 base energy code and an introduction to the stretch code appendix was offered to all municipal code officials (at no cost), as well as to interested building professionals (at a discounted cost), throughout 2010. Training on the stretch code and building best practices will be continuing through 2011 with more focus on reaching design and construction professionals. In addition, the Massachusetts Energy Star Homes program provides training covering HERS and other requirements of the residential stretch code, given the large overlap with the Energy Star Homes program. The major Massachusetts electric and gas utilities also offer occasional training on the New Buildings Institute (NBI) Core Performance program and their customized incentive programs for commercial buildings.

[4] The Massachusetts New Homes with Energy Star program website is: http://www.energystarhomes.com/

[5] The RESNET website is: http://www.natresnet.org/

[6] The Core energy code is available online at: http://www.newbuildings.org/codes.htm

[7] The ASHRAE 90.1-2007 standard is readable online in a Java enabled browser at: http://openpub.realread.com/rrserver/browser?title=/ASHRAE_1/ashrae_90_1_2007_IP_1280

Process

15. How would a town or city adopt the stretch energy code?
Towns and cities in Massachusetts may choose to remain on the base energy code or to adopt the stretch code as their mandatory energy code requirement. A city or town can adopt the stretch appendix by a vote of their appropriate elected officials: typically the town meeting in a town; or in a city the mayor and the city council or aldermen. Interested municipalities are encouraged to hold a public hearing to get input on and raise awareness about their intention to adopt the stretch code. As of January 1st 2011, 64 municipalities had adopted the stretch code.

16. How soon after a town or city adopts it would the stretch code take effect?
In order to provide consistency among communities, once adopted the stretch code can only go into effect on January 1st or July 1st, and there must be at least six months between adoption and when the stretch code becomes mandatory. For example: if Town A voted to adopt in November 2010, then on July 1st 2011 the stretch code would become mandatory. During the interim period the stretch code would be an option for builders to use.

Enforcement/Requirements

17. How is the stretch code implemented and enforced?
Implementation and enforcement of the code is similar to existing code, where the developer is responsible for submitting documentation of compliance to the building inspector for review, and the building inspector conducts a plan and site review.

18. What is the role of a building code official and a HERS rater for residential projects?
Residential buildings meeting the stretch code through a HERS rating and EPA thermal bypass or thermal enclosure checklist require independent certification by a HERS rater. The rater will produce a report detailing the energy systems in the building and will provide a HERS index score, together with proof of whether the home qualifies for any federal tax credits. Submission of the HERS report, together with a completed Energy Star Thermal checklist, are the steps required to demonstrate compliance with the energy portions of the code, and must be submitted to the local building inspector prior to receiving a certificate of occupancy. In this way the local inspector retains their oversight role but the additional energy requirements do not place a significant additional burden on their time.

19. What happens in 2012/13 when the base energy code changes?
Sometime in 2011 the next IECC base energy code (IECC 2012) will be published and the Green Communities Act requires that Massachusetts adopt it within one year i.e. in 2012. During that one year transition period the BBRS will consider adoption of an updated 2012 stretch code to maintain a gap between the base and the stretch energy requirements. Once a new stretch energy code is available the old stretch appendix will be rescinded by the BBRS. However, municipalities will remain stretch code or base code communities through the code change from 2009 to 2012 unless they elect to change their status. For example municipalities who have previously adopted the stretch code will automatically become stretch code 2012 municipalities, unless they choose to rescind their stretch code adoption

Residential Building Questions

R1. How do I meet the residential stretch code for new homes?
For new residential homes including multi-family homes of 3 stories or less, builders essentially follow the 2006 Energy Star for Homes program requirements in Massachusetts, and must show that each unit meets or is below a maximum HERS index score. For new homes greater than 3,000 ft^2 in size the maximum HERS score is 65 (similar but not identical to Energy Star tier 2), for smaller homes less than 3,000 ft^2 the maximum HERS score is 70. In addition the homes must be inspected using the Energy Star Thermal Bypass or Thermal Enclosure Checklist and as with the new base energy code likely require duct testing. These inspections ensure that the home is well air-sealed, while the HERS rating ensures that the home is designed to be well insulated with efficient heating, cooling and lighting – all measures that save energy and reduce utility bills.

R2. What is a HERS rating?
HERS stands for 'Home Energy Rating System,' and is a national standard that uses information on the design of the energy systems in a home to calculate, via computer modeling, the average energy needs of that home and give it a rating score. The HERS Index was developed by the non-profit Residential Energy Services Network (RESNET) for the mortgage industry, and is utilized by the Federal Internal Revenue Service (IRS) and the LEED for Homes program. On the HERS 2006 index scale smaller numbers are better, with 0 representing a net zero energy home, and 100 representing a home built to meet the national model energy code in 2006 (the IECC 2004 with 2005 amendments). A HERS rating of 65 means that the home uses about 35% less energy than the same size home built to the 2004/2005 IECC code requirements. The Residential Stretch code is based on the nationally successful 'Energy Star for Homes' program requirements, which utilize HERS ratings.

R3. Do I have to get a HERS rating?
New homes built under the stretch code must get a HERS rating. Renovations and additions to homes have the option of the HERS rating or a 'prescriptive' approach, whereby specific efficiency measures are required, but no computer modeling is done. The HERS performance-based approach provides an excellent way to ensure that homes are not only well designed but also well built. As part of the HERS rating the home will be tested for air leakage, and under both the base and the stretch code homes with heating and cooling ducts may also have those tested for leakage. Combined with the EPA thermal checklist the HERS rater, builder and building inspector can have confidence that the completed homes really are energy efficient.

R4. How do I meet the residential stretch code when making renovations to existing homes?
Existing homes being renovated or expanded have two choices when it comes to stretch code compliance. The performance option is based on a HERS rating, while the prescriptive option uses the base IECC 2009 energy code, but in addition requires quality assurance with either the Energy Star Thermal Bypass or the new Thermal Enclosure checklist and the use of Energy Star windows doors and skylights where replacements are made. If the prescriptive option is chosen, then you only need to meet code for the systems that are being replaced. This means that adding a new efficient boiler does not require changing the windows, and adding wall and attic insulation does not require modifying the basement – although it may often make sense to combine measures where that is cost-effective.

Choosing to follow the HERS rating approach used by new construction often makes sense when doing a whole house renovation. While using the same HERS approach as new homes, existing homes have an easier standard to meet. The maximum allowable HERS score is 80 for home renovations greater than 2,000 ft^2 and 85 for renovated homes less than 2,000 ft^2.

R5. If I'm doing a small remodeling project, like a kitchen or a bathroom renovation, will I have to meet the stretch energy code?
If a small renovation involved replacing a couple of windows and opening part of a wall cavity, then those new windows and wall cavity would have to be brought up to the stretch code, just as the plumbing in the kitchen or bathroom being remodeled would have to comply with the plumbing code. However, improving a kitchen or bathroom would not trigger required changes to the rest of the home such as attic insulation or a new heating system. Only the systems being modified have to be brought up to code. Despite not being required, your contractor, utility company and code official may suggest cost-effective changes (often with tax and rebate incentives to reduce your energy bills) that you may want to consider doing at the same time.

R6. How do I find a HERS rater?
HERS raters work with the residential builder/developer/design team, and should be included in the team from the outset. An updated list of HERS provider companies is available on the Energy Star Homes website. The Energy Star for Homes program staff can also help you to contact a HERS rater in your region.

R7. What training and certification do HERS raters undergo?
HERS raters are typically experienced building professionals, who in addition take a week- or

two week-long intensive training course in residential energy efficiency. After completing the training, learning how to use HERS rating software, and passing a test,[8] new raters must also complete at least 5 ratings with an experienced HERS rater before being able to independently award ratings. In addition to this initial training and certification, HERS raters must be affiliated with a company that is certified as a HERS provider, and is responsible for ongoing code education and quality assurance oversight of the HERS rater's work. The HERS providers also carry liability insurance and allow builders to request a review from a second HERS rater in the rare case of disputes.

R8. What testing equipment is required to meet the residential stretch code?
HERS ratings require testing of the air leakage rate of residential units. In addition, for homes that have forced air heating and central air conditioning systems that have ductwork running outside of the heated portion of a house, a duct leakage test is needed. These tests help calculate how much energy is needed to heat and cool a home, and help builders to identify possible problems before a home is completed, when there is still time to fix them cost-effectively.

R9. Are there enough HERS raters and testing equipment available, and what do they cost?
In 2008 over 15% of all new homes in Massachusetts were built through the Energy Star for Homes program, in 2009 that climbed to 34%, without any noticeable shortages. The majority of these homes used HERS raters and testing equipment to achieve a HERS rating. The growing interest in HERS ratings has led to more building professionals going through HERS training and certification and expanded sales of blower door and duct testing equipment. The Massachusetts Energy Star Homes website now lists several new HERS provider companies,[9] and many more builders as Energy Star Homes partners. There is already in place an active market for HERS raters and testing equipment, and we don't anticipate demand for HERS raters exceeding the supply.

Costs for HERS ratings currently range from around $600 to $1,500 per unit in Massachusetts, and they are also subsidized by the utility-sponsored Energy Star for Homes program. The price variation may reflect differing levels of technical assistance to the builder depending on their needs and preferences.

R10. How much more does it cost to build to the stretch code, and how does this compare to the energy savings?
For new construction additional first costs are estimated at around $3,000 for a 2,700 square foot single family home, including the cost of a HERS rater. This is reduced to about $1,700 after receipt of $1,300 in utility rebates, which translates into around $125 a year when rolled into a 30-year mortgage at 6% interest. But these investments reduce energy bills by about $500/year, resulting in net annual savings to the homeowner of about $400. For a larger 4,400 ft^2 home the additional costs are higher but so are the energy savings, resulting in a net annual savings of $1,100. This is an excellent value for the home buyer and a marketing opportunity for builders who are looking for another way to differentiate new homes from existing ones.

In the case of renovating a 3-unit urban triple-decker, the minimum additional construction costs for all three units combined relative to meeting the new base energy code is only around $1,400, while the annual energy savings are over $130 per year, yielding small but immediate net cash savings to the unit owners. Larger annual savings could be achieved by more aggressive energy efficiency improvements, but the stretch code requirements for renovations are modest.[10]

R11. What financial savings/rebates are there from building to the stretch code?
The stretch code is designed to allow builders to maximize use of the Energy Star Homes program

[8] More information on the HERS rater test is available here:
http://www.resnet.us/rater/tests/rater.htm

[9] http://www.energystar.gov/index.cfm?fuseaction=new_homes_partners.showStateResults&s_code=MA

[10] Separate documents are available that summarize the detailed cost-benefit analysis that has been undertaken to help set the appropriate level of energy efficiency for the stretch code. These calculations do not include substantial financial incentives available both from utilities in Massachusetts and through federal tax credits (see next question).

with its full range of training, support and financial incentives. A new home with a HERS rating of 65 or less currently qualifies for $1,250 from the Energy Star utility sponsors, and additional rebates are available for installing high efficiency heating and cooling equipment, appliances and lighting. The utility companies also provide $650 to partially or fully cover the cost of hiring a HERS rater to work with the builder.

For existing home renovations there are tax credits for the homeowner as well as the same utility incentives on efficient equipment, appliances, and windows. There are also major incentives available to add insulation and reduce air leakage in existing homes, through the MassSave program sponsored by the gas and electric utility companies.[11]

R12. How is the MA stretch code different from the existing Energy Star for Homes program?

The Energy Star for Homes program is a voluntary program for home builders. In Massachusetts it is currently administered by ICF International on behalf of the major electric utilities in the state, and has over two hundred builders enrolled.[12] The program accounted for 15% of all new homes in Massachusetts in 2008 and 34% in 2009. There are currently 3 tiers to the Energy Star program. The stretch code essentially makes the 2006-2010 Energy Star program requirements mandatory in any adopting municipality, and sets a specific minimum HERS index rating of 65 or 70 based on size for new homes, and less strict requirements for renovations.

R13. Do I have to use the Energy Star program?

The Energy Star Homes program is strongly recommended, but not required. It is also going through a transition from Energy Star v2.0 to Energy Star v2.5 and ultimately v3.0. Residential builders in stretch code communities will be required to get a HERS rating for new homes and the utility funded programs can help offset the cost of this rating. In the case of renovation or additions to existing buildings builders may instead utilize the prescriptive option – using only Energy Star qualified new windows, doors and skylights and carefully sealing ducts that are outside the heated space if installing new heating systems. In both cases builders must also complete the Energy Star Thermal Bypass or Thermal Enclosure Checklist. In order to simplify qualification for the rebates, training and technical assistance that are offered we recommend that builders participate in the Energy Star Homes program, but it is not mandatory.

R14. How does the building official in my town/city check whether I met the stretch energy code?

For several years, under both the 7th edition and the 8th edition base energy code in Massachusetts it has been possible to show code compliance by achieving a HERS rating and/or Energy Star Homes certification, and submitting a copy of the HERS report and Energy Star paperwork to the local building code official to demonstrate this. The stretch code expands the use of this existing code compliance option to all residential construction. Building code officials have been receiving free training on the new base energy code and the stretch code. An updated 2011 training[13] is also open and available to interested building professionals for a small fee to cover costs.

R15. How does the stretch code work with LEED for Homes?

LEED for Homes is a voluntary residential green building program that includes a significant energy efficiency component. The mandatory energy and atmosphere requirements of the LEED for Homes program are the minimum Energy Star Home requirements of a HERS 85 rating and a completed Thermal Checklist. Homes can then gain additional points for achieving a lower HERS score. Because LEED for Homes and the stretch code share the same HERS and Energy Star underpinnings they are fully compatible.

R16: When following the prescriptive path for residential additions or renovations can the builder or architect complete the thermal checklist?

[11] http://www.masssave.com/residential/

[12] http://www.energystar.gov/index.cfm?fuseaction=new_homes_partners.showAreaResults&s_code=MA&msa_id=all

[13] The MA building energy code training home page is at: http://www.cetonline.org/Events/events.php?id=124

Yes. They do have to sign to say that the relevant measures were checked in the field. A HERS rater is needed only if a HERS rating is needed or to go through the Energy Star Homes program (primarily for new construction and gut retrofits).

Commercial Building Questions

C1. What building types are covered by the commercial stretch code?
New buildings, and new additions to existing buildings covered by the commercial energy code, that are greater than 5,000 ft² in size are covered by the stretch code appendix. New commercial buildings smaller than 5,000 square feet, as well as renovation to existing commercial buildings are exempt from the stretch code and remain covered by the base energy code.

C2. What is required for large new commercial buildings above 100,000 square feet?
The designed energy use in large commercial buildings is required to be at least 20% below the use expected based on the energy modeling standards contained in ASHRAE 90.1 2007,[14] which is the latest version of the national model code for commercial buildings. This is determined by computer modeling of the building energy use, taking into account factors such as air sealing, insulation, efficiency of the cooling and heating systems, and lighting design. Builders have the flexibility to choose the set of energy efficiency features they prefer, as long as modeling shows that overall these features yield the required 20% reduction relative to the base ASHRAE 90.1-2007.

C3. What is required for new commercial buildings between 5,000 and 100,000 square feet?
Builders of such buildings have two choices. First, they can use the same modeling approach as buildings larger than 100,000 ft², and show that the expected energy use is at least 20% below the code requirements of ASHRAE 90.1 2007. Alternatively, they can choose a set of 'prescriptive' requirements for particular efficiency measures, based on the new base energy code for commercial buildings (IECC 2009 Ch.5), supplemented by enhancements taken from the Core Energy Code developed by the New Buildings Institute (NBI).[15] The Core Energy Code and its precursor the Core Performance Guide are nationally-recognized standards already in use by Massachusetts gas and electric utility companies as the basis for providing financial incentives to commercial building developers.

C4. What is required of small new commercial buildings, below 5,000 square feet?
Such buildings are exempt from the Stretch Code requirements.

C5. How are commercial renovations handled by the stretch code?
Commercial renovations are exempt from the Stretch Code requirements.

C6. How are new commercial buildings with special energy needs handled?
Supermarkets, laboratories, and warehouses above 40,000 ft² must meet the performance modeling requirements of the stretch code that apply to regular commercial buildings greater than 100,000 square feet. Because these buildings often have large and unusual energy loads developers are likely to model their energy usage as a standard design practice, so meeting the standard of 20% below ASHRAE 90.1-2007 via energy modeling should not require a new compliance approach.

Supermarkets, laboratories, and warehouses below 40,000 ft² are exempt from the stretch code requirements, but must still meet the base energy code. Other specialty buildings can apply to the Mass. BBRS for waivers based on evidence that they have unusual energy loads, and that they are not typically built using energy modeling.

C7. How do the benefits and costs from the commercial stretch code standards compare to the baseline code?
Case studies of specific buildings by Massachusetts utility companies National Grid and NSTAR

[14] Specifically: ASHRAE Standard 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings, Appendix G.

[15] For more information please see the New Buildings Institute press release available here: http://www.newbuildings.org/downloads/press/MAAdoptsStretchCode.pdf

show that the savings in reduced energy costs far exceed the greater initial construction costs. If the costs are included in a mortgage, then owners would see immediate cash-flow savings. Moreover, the utilities offer generous incentives that make the efficiency improvements even more profitable. For example, on one mid-sized office building in Leominster, Mass, the additional cost was $101,000, while the annual energy savings were $27,600, for a three year payback. But the utility energy efficiency program provided a rebate of $66,600, reducing the initial cost to $34,000. As a result, the energy savings pay for the extra costs in just over one year. More generally, we anticipate that any additional upfront costs incurred in construction should be recovered from energy savings with a payback after rebates of less than three years.

C8. How does the stretch code work with LEED buildings?

The commercial stretch code has two code compliance pathways. Both of these qualify for LEED new construction points, and require no additional work because of the stretch code. If pursuing the performance approach, then achieving the stretch code standard of 20% below ASHRAE 90.1-2007 uses the same baseline and modeling as the 2009 LEED program and qualifies for 5 out of 19 LEED energy and atmosphere points. Many LEED buildings will go significantly beyond these energy efficiency requirements, in order to obtain additional LEED points. Similarly, meeting the stretch code through the Core Performance-based prescriptive approach qualifies for LEED points.

C9. Does the stretch code require 3% renewable electricity or solar panels?

There is an option under the prescriptive path of the stretch code to meet one of the requirements of the code with onsite renewable electricity generation. However, this is not a requirement for all buildings, it is merely one of three options under the prescriptive approach, and builders may also choose to meet the commercial stretch code requirements using the 20% better than ASHRAE 90.1-2007 modeling approach. The three options which appear in section 507 of the prescriptive code option for buildings between 5,000 and 100,000 square feet are:

a) More efficient heating and cooling equipment – widely available and with utility rebates that offset much of the incremental cost.
b) More efficient lighting – also widely available and eligible for significant utility rebates.
c) Providing at least 3% of the onsite electric load from onsite renewable generation – which qualifies for both large federal tax incentives and significant state renewable energy incentives administered by the Department of Energy Resources[16] and the Massachusetts Clean Energy Center[17] (MA CEC).

[16] http://www.mass.gov/?pageID=eoeeaterminal&L=5&L0=Home&L1=Energy%2c+Utilities+%26+Clean+Technologies&L2=Renewable+Energy&L3=Solar&L4=RPS+Solar+Carve-Out&sid=Eoeea&b=terminalcontent&f=doer_renewables_solar_about-the-rps&csid=Eoeea

[17] http://www.masscec.com/index.cfm?pid=11159