

# ENERGY REDUCTION ACTION PLAN

*for*

**The Town of Swampscott  
Municipal and School Buildings and Facilities**

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In Support of an Application to Achieve Designation  
In the Commonwealth of Massachusetts  
As a

**Green Community**

Under

Chapter 169 of the Acts of 2008

**AN ACT RELATIVE TO GREEN COMMUNITIES**

May 6, 2010



**TOWN OF SWAMPSCOTT**  
22 Monument Ave., Swampscott, MA 01907

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**Attachment B – Swampscott Wastewater Pumping Station, Efficiency and Economics Study**

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## **Executive Summary**

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The Town of Swampscott will reduce the amount of energy consumed by 20% from a baseline set at July 2008 – June 2009 at all of its municipal and school facilities by creating, implementing, and following this Energy Reduction Action Plan in the next five years. The objective of this plan is to guide the fiscally and environmentally responsible usage of energy while maintaining a level of services within the Town that residents have come to expect.

Key elements of the plan include:

- Execution of an Energy Services Contract (ESCO) with Johnson Controls, Inc. (JCI) utilizing the results of the Investment Grade Energy Audit completed in February, 2010 of all municipal and school buildings in Swampscott
- Construction of an Energy Efficiency Improvement project at the Town's wastewater pumping station, in collaboration with National Grid
- Continued efforts to evaluate, design, and implement renewable energy installations in Town.
- Accurate measurements and analysis of energy use including an annual review of trends and costs.
- Continuing operation of the Swampscott Renewable Energy Committee to keep residents involved.
- Applying energy efficient and sustainable building practices to the extent feasible in all major facility construction/renovation projects.

The energy baseline and reduction plan was developed with contributions from the following parties:

The Swampscott Renewable Energy Committee; Tara Gallagher (Chair), Dorothy Allen, Neal Duffy, Milton Fistel, Victoria Masone, Sydney Pierce, Wayne Spritz, and Brian Watson.

Terence Dansdill, former Swampscott Renewable Energy Committee member

Andrew W. Maylor, Town Administrator

Edward Cronin, Business Manager, Swampscott Public School District

Johnson Controls, Inc.

Woodard & Curran, Inc.

## **Letters Verifying Adoption of the Energy Reduction Action Plan**

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\*\* INSERT TOWN LETTER HERE \*\*

\*\* INSERT SCHOOL LETTER HERE \*\*

## **I. Introduction**

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The Town of Swampscott is a seaside community of 14,600 residents located 15 miles northeast of Boston along the coastline of the Atlantic Ocean. The Town consists of 3 square miles, and is considered densely populated. Residents are served by three elementary schools, one Middle School and one High School. Municipal facilities include a Police Station, Fire Station, Department of Public Works (DPW) Garage, Wastewater Pumping Station, Town Hall, Public Library, and assorted recreational facilities. The Swampscott Senior Center is incorporated into the High School facility. Fuels consumed at the various facilities include electricity, natural gas, and fuel oil. The vehicle fleet for the Town includes 45 DPW vehicles, 15 Police vehicles, 7 Fire vehicles, 2 Council on Aging vehicles and 7 School vehicles. The entire fleet runs on either unleaded or diesel fuel.

The primary goals of the Town through this Energy Reduction Action Plan (Plan) is to achieve designation as a Green Community, and to help pursue greater energy efficiency, reduced energy costs and reduce greenhouse gas emissions.

The Swampscott Renewable Energy Committee (REC) has been tracking energy use at all school and municipal facilities since 2005. The energy use baseline for this Plan was determined with the help of Johnson Controls, Inc. (JCI), an Energy Service Company (ESCO) with whom the Town has contracted to design, construct and monitor energy efficiency measures Town-wide. The Assistant Engineer for the Town has since been trained on the MassEnergyInsight software, and intends to transition the existing utility data into that software for use in tracking energy reduction progress.

Goals and Strategies to be used in carrying out this Plan include close review of the Measurement and Verification Annual Report produced by JCI by the Town and by DOER, independent monitoring of energy use by the Town using MassEnergyInsight, and periodic updates to the School District and the Swampscott Board of Selectmen on our status, progress made to-date, and short-term goals.



## II. Results of Energy use Baseline Inventory

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### 1. Inventory Tool Used

The Swampscott Renewable Energy Committee (REC) has been tracking energy use at all school and municipal facilities since 2005 using direct downloads from the utility companies and Microsoft Excel® (MSEExcel). The Assistant Engineer for the Town has since been trained in use of the MassEnergyInsight software and intends to transition all of the existing data into that tool for use into the future. Fuel use for the vehicle fleet is tracked in an independent fuel-dispensing software program in place at the fueling station at the DPW garage. This data must be manually entered into MassEnergyInsight. Street and traffic lighting is also tracked in MSEExcel from direct downloads from the utilities. All of the utility data compiled by the Town was delivered to Johnson Controls, Inc. (JCI) at the inception of the ESCo project, and was used by JCI to establish our energy baseline. The period between **July 2008 - June 2009** was selected as our energy baseline since that data set was most complete and most representative of existing conditions with regard to building use.

### 2. Existing Municipal Energy Use

*Municipal and School Buildings:* Our baseline energy use was determined by JCI for ten school and town facilities listed below in Table 1.

**Table 1 : Facilities Included in Baseline Determination and Energy Audit**

<b>Swampscott Town Buildings</b>			
<b>Building</b>	<b>Address</b>	<b>Square Footage</b>	<b>Year Built</b>
Clarke School and Portables	100 Middlesex Ave.	28,912 1,500 (ports.)	1952
Stanley School	Whitman Road	38,400	1929
Hadley School	Redington Street	58,000	1911
Middle School	207 Forest Ave.	179,747	c. 1956
High School	200 Essex St.	197,000	2007
DPW Garage	200 Paradise Road	15,260	1950
Fire Station	76 Burrill St.	10,144	1960
Little League Complex including Concession Stand	207 Rear Forest Avenue	N/A	2008
Library	59 Burrill St.	18,500	1916, 1955, 1997
Town Hall	22 Monument Ave.	20,655	1950, 2008
Streetlights	Various	N/A	N/A

The Police Station was not considered because the Town is in the process of designing a new station and getting funds appropriated for construction. The Renewable Energy Committee attended a number of meetings with the architect and the Police Station Building Design Committee to ensure the new building is as energy efficient as practical. The Pumping Station was not considered by the ESCo because the Town is in the process of an energy efficiency upgrade at the station in collaboration with National Grid.

The baseline for these facilities was established using the protocol presented in **Attachment A, Energy Baseline Development**. The energy baseline for the period between July 2008 to June 2009 is presented in Table 2, which includes the wastewater Pumping Station, whose baseline was calculated by the Town.

**Table 2 : Municipal and School Buildings, Energy Baseline for July 2008 – June 2009**

Facility	Electric MMBTU	Natural Gas MMBTU	Total MMBTU
Clarke School	200	3,220	3,420
Stanley School	280	2,824	3,104
Middle School	2,199	9,563	11,762
High School	6,107	8,598	14,705
Hadley School	349	5,443	5,792
DPW Garage	83	819	903
Pumping Station	1,296	0	1,296
Police Station	188	0	188
Fire Station	251	689	940
Little League Complex	831	2,269	3,101
Library	321	679	1,000
Town Hall	573	1,530	2,104

*Vehicles:* The entire Town fleet fuels at a single fueling station located at the Department of Public Works garage. As such the fuel usage is easily tracked. Fuel use for the baseline period between July 2008 and June 2009 was as follows;

Vehicles	Unleaded gallons	Diesel gallons	Total MMBTU
Entire Town Fleet	35,184	6,003	4,788

*Street and Traffic Lighting:* The Town owns approximately one half of the streetlights in Town. The other half are owned by National Grid. As such, our control is limited to the lights that we own. JCI included our Town-Owned streetlights and traffic lights in their energy audit, and determined the energy baseline to be:

Facility	Electric MMBTU	Natural Gas MMBTU	Total MMBTU
Street & Traffic Lights	2,390	0	2,390

In 2006 the Town replaced all of its incandescent traffic lights (209 total) with LED technology. The total cost was \$29,590 of which \$13,090 was received by the utility in the form of a rebate, yielding a net cost to the Town of \$16,500. The average life of an LED bulb is seven years while the average life of an incandescent bulb is one year. Also, a 12-inch LED signal uses 25 watts compared to 150-watts for an incandescent bulb in a comparable application. As a result of the 2006 conversion on our traffic lights, there is no work anticipated on the traffic lights in the near future.

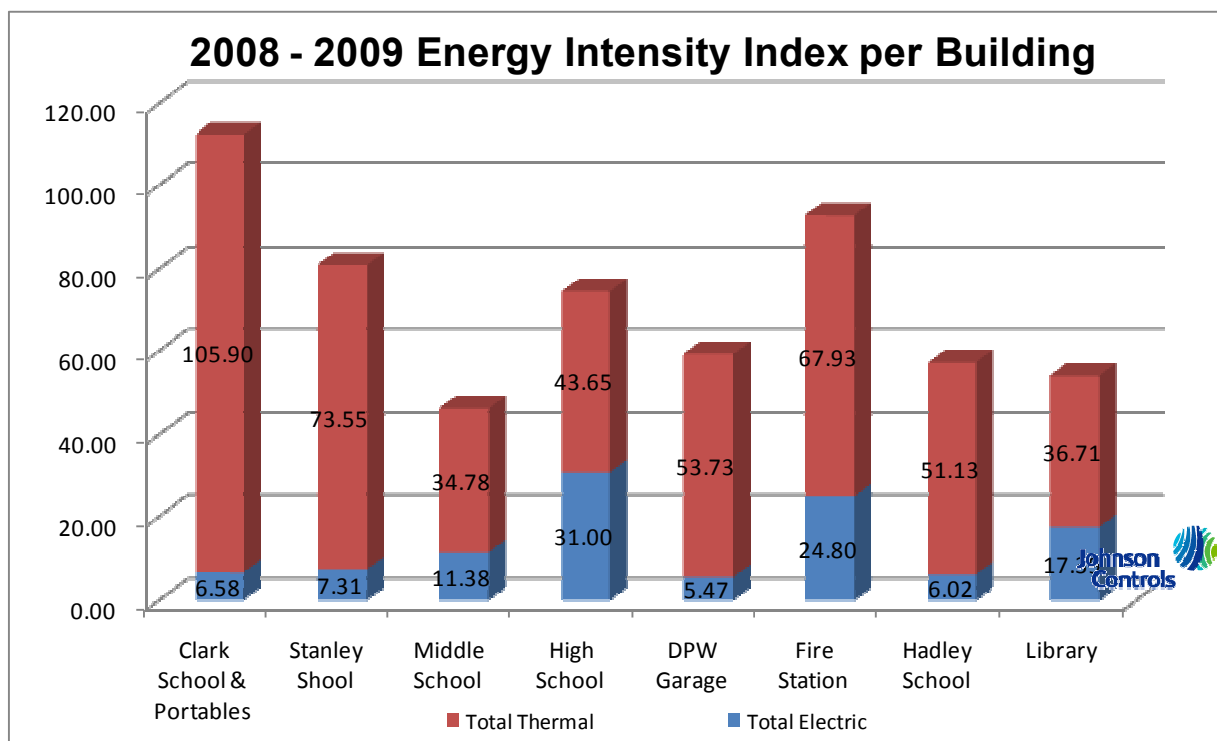
### 3. Existing Efficiency Measures Implemented in the Last 2 Years

The Town of Swampscott has implemented a number of energy efficiency measures within the School District in the last two years. Most notably, all of the windows were replaced at the Clarke Elementary School with EnergyStar® rated windows. Approximately one-third of the roof on the Middle School was replaced and the insulation increased from 2" foam insulation to 5" foam insulation. One-half of the windows in the Middle School have also been replaced, with the rest to follow in FY11 and FY12. On the municipal side, the historic Town Hall building underwent a \$3M renovation in 2008 which included conversion of oil to natural gas heat, and installation of a climate management system whereby the building climate can be scheduled to accommodate weekends, evenings, and holidays. Exterior lighting around the Town Hall operates on new timers.

### 4. Areas of Least Efficiency / Greatest Waste

As part of the energy audit, JCI prepared a chart of Energy Intensity Index for each building to determine where the most opportunity exists for energy efficiency improvements. A summary of the most notable results are below in Figure 1.

**Figure 1 : Energy Intensity Index**



The highest energy index represents the facility with the most opportunity for energy efficiency improvements. Although all of the buildings and facilities were examined closely during the energy

audit, Clarke School, Stanley School, the High School and the Fire Station were especially considered due to their relatively high energy intensity indices.

#### **5. Areas That Can Most Easily Be Addressed**

The priority improvements identified in the energy audit were those that can most easily be addressed and yield the most benefit. These improvements are referred to as “low-hanging fruit” and are primarily focused on lighting. These improvements will be addressed through the ESCo project.

### **III. Summary of Energy Audit**

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The Town & Schools of Swampscott have an objective of creating a comprehensive approach to energy efficiency for the Town & Schools. Johnson Controls, Inc. (hereinafter "JCI") was selected by the Town & Schools of Swampscott (hereinafter "Town & Schools") to conduct a detailed energy audit for five (5) School building and five (5) Town buildings. The goals of this study are to identify and quantify opportunities to improve the energy efficiency of the Town & Schools, improve the reliability of mechanical and electrical systems and to maintain or increase occupant comfort and well-being. This report provides the results of the Detailed Energy Audit conducted by JCI during mid-November, 2009–mid-January, 2010.

JCI wishes to thank Victoria Masone and Garrett Baker and the Town & Schools's staff for their invaluable assistance and generous time spent with the JCI team during this study effort. Their experience has provided valuable insight to the systems and operating parameters that has helped to formulate JCI's recommendations.

This report provides detailed findings including descriptions, savings, costs and specifications for the recommendations. JCI has also included a financing scenario which will assist The Town & Schools to implement the recommendations utilizing funds available to the Town & Schools that JCI has identified.

The following tasks were performed by JCI during the detailed energy audit:

- Collected utility data and create a one year historical baseline of usage and costs for electricity, natural gas and fuel.
- Analyzed facility drawings for design intent and equipment information.
- Interviewed Town & Schools staff to identify issues and opportunities at buildings.
- Conducted onsite engineering survey including combustion efficiency of boilers and data logging of facility conditions and equipment, including light levels, temperatures, and carbon dioxide levels.
- Performed a retro-commissioning study of the existing HVAC equipment at the Clarke, Hadley Middle and Stanley Schools to determine functionality and identify opportunities for improvement.
- Generated a list of recommendations with scope of work and specifications.
- Determined actual costs and guarantee savings for this facility and created a cash flow using available funding.

## Financial Summary

<b>Project Cost</b>	<b>\$3,506,289</b>
<b>First Year Maintenance and Repair Savings</b>	<b>\$14,306</b>
<b>First Year Guaranteed Energy Savings</b>	<b>\$259,024</b>

## Findings

FIM MATRIX											
FIM #	Description of Measure	Middle School	Swampscott High School	Clarke School	Hadley School	Stanley School	Town Hall	Library	DPW	Fire Station	Little League Fields
FIM 1	Lighting - Fixture Retrofit	✓	✓	✓	✓	✓	✓		✓	✓	✓
FIM 2	Lighting - Fixture Controls	✓	✓	✓	✓	✓	✓	✓		✓	✓
FIM 3	Building Envelope - Weatherization	✓	✓	✓	✓	✓	✓	✓	✓	✓	
FIM 4	Energy Management System Upgrades	✓	✓	✓	✓	✓		✓			
FIM 6	Steam Distribution System - Steam Traps Replacement			✓	✓	✓					
FIM 7	Heating System Upgrade - Boiler / Burner Replacement			✓							
FIM 8	Heating System Upgrade - Boiler Controllers			✓		✓	✓			✓	
FIM 11	Building Envelope Improvements- Roof/Wall/Attic Insulation			✓						✓	
FIM 16	Kitchen Hood - VFD on Exhaust Fan		✓								
FIM 18	Water Conservation	✓		✓	✓	✓		✓		✓	
FIM 19	Vending Machine Controllers	✓	✓								
FIM 23	Street Lights										
FIM 26	Cogeneration		✓								
FIM 27	Refrigeration Upgrades	✓	✓								
FIM 28	Recommissioning	✓		✓	✓	✓					

**Legend:**

✓ Measure(s) Selected

The major findings of this study are as follows:

- There are many opportunities to reduce energy and operating costs within the own buildings. By implementing the recommendations outlined in this study, the Town & Schools could reduce energy costs by 27% based on the adjusted one year utility data established as the baseline period.
- The buildings boiler(s) and domestic hot water systems in general are in very fair condition, in many cases brand new. The boilers at the Clarke School are almost fifty (50) years old and well past their life cycle, however they are still quite functional. The boilers at the Hadley School are in disrepair but the configuration is such that they are still efficient.
- The HVAC systems are also in fair condition but opportunities exist for operational and energy efficiency improvements.
- Light levels were measured and found to be within the acceptable range in classrooms and hallways. Much of the existing lighting has already been upgraded to T8 lamps and electronic ballasts.
- The building envelope is in fair condition with the exception of the single pane windows at the DPW and some windows at the Library. Opportunity exists for improvement in those locations.
- There is opportunity to upgrade to the Metasys building automation system at the High School to an updated version of Metasys Extended Architecture. It is currently not compatible with newer revisions of the product.
- The plumbing fixtures in the Clarke, Hadley and Stanley Schools can be replaced with lower consumption fixtures.
- The High School is situated such that renewable photovoltaic energy systems may be installed on the roof.

#### IV. Summary of Fossil Fuel Reduction Measures

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##### 1. Overview of Short- and Long- Term Goals

The Town of Swampscott intends to take a three-pronged approach to reduce our fossil fuel consumption in the short-term.

The cornerstone of our efforts resides in the Energy Services Contract we are prepared to execute with Johnson Controls, Inc. Phase I of the project will be initiated in the summer of this year, and the entire project, to be completed within the next five years in a phased approach, will result in a reduction of 16.6% from our energy baseline in accordance with Table 3.

**Table 3 : Energy Baseline Reduction Yielded by ESCo Project**

	<b>ELECTRIC MMBTU</b>	<b>NATURAL GAS MMBTU</b>	<b>TOTAL MMBTU</b>
EXISTING MMBTU	16,713	42,740	59,454
POST MMBTU	12,650	36,907	49,558
		% Reduction	16.6%

The Town is also in the process of designing an energy efficiency improvement project at the main wastewater pumping station, located at 531 Humphrey Street. The pumping station receives all of the wastewater in town and conveys it to the Lynn Municipal Wastewater Treatment Facility via a 24-inch force main. The station contains three 250-hp centrifugal pumps with VFDs, and two grinders in the headworks building. The station was converted from a primary treatment plant to a pumping station in 1992, and therefore the age of the equipment is approximately 18 years old. In July 2009 Woodard & Curran, Inc. was hired by National Grid to prepare an Efficiency and Economics Study on the proposed improvements to determine our eligibility for a utility rebate. The project was subsequently approved by National Grid in December 2009 and will go to construction in the summer of 2010. The Study is included in this document as Attachment B, which shows a projected savings of 55,450 KWH per year or 174 MMBtu per year which will bring us up to a 17% reduction.

Long-term goals for reducing energy consumption in the Town of Swampscott include subsequent phases of the ESCo project, execution of the School District Master Plan which will include consolidation of schools, and continued outreach and education by the Renewable Energy Committee to residents, students, employees, and visitors to the Town.

##### 2. Getting to 20%

*Prioritized list of strategies to reduce fossil fuel usage:* The Town's first priority in reducing energy usage is execution of the ESCo Contract with Johnson Controls, Inc. The project was approved by Town Meeting on May 3, 2010 and the contract is under negotiations as of this date. The project is expected to go to construction in the summer of 2010. Construction of the energy efficiency improvements at the Pumping Station is expected to occur parallel to the ESCo Contract. Sale of the vacant Town buildings is expected to occur within calendar year 2010.

*Tools, Resources and Financial Incentives:* Many of the Energy Conservation Measures (ECMs) proposed within the ESCo Contract are eligible for utility rebates. Pursuing these rebates, estimated to be close to \$73,000 for Phase I, is within JCI's scope of work. The energy efficiency project at the Pumping Station has already been evaluated by National Grid, and is eligible for a \$24,000 rebate from the utility.



*Program Management Plan for Implementation, Monitoring and Oversight:* Implementation of this Plan will be overseen primarily by the Town Administrator and the School Business Manager. Monitoring and oversight will be done by the Department of Public Works and the School Facilities Manager with assistance from the Renewable Energy Committee. As part of the ESCo Contract, JCI will be required to submit an annual report on our actual energy savings, in accordance with the M&V Guidelines: Measurement and Verification for Federal Energy Projects Version 3.0, developed for the U.S. Department of Energy. This report will be independently reviewed by the Massachusetts Department of Energy Resources (DOER), and representatives from the Town in order to measure the success of the ESCo's efforts. Energy tracking using MassEnergyInsight will occur concurrently, through the Swampscott Department of Public Works and the Renewable Energy Committee.

## **V. Fossil Fuel Energy Reduction Measures**

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### **1. Short-term energy reduction goals – getting to 20% reduction in 5 years**

*Municipal Buildings (including schools):* The majority of the short-term energy reduction goals are detailed in the Investment Grade Energy Audit prepared by Johnson Controls, Inc. (JCI). This section presents a summary of the projects to be implemented through the ESCo project, while the full audit document is available for review upon request due to file size. Projected savings and capital and operating costs associated with each of these energy conservation measures are included as Attachment C to this Plan. Phase I of these improvements are scheduled to occur in Summer of 2010 with the remaining phases to occur in FY12 and FY13. The full scope of the ESCo project will yield a 16.6% energy savings from our established baseline annually.

### **Lighting – Fixture Retrofit and Fixture Controls**

Retrofit existing T8 lamp fixtures with Super T8 lamps without compromising light quality, replace HID fixtures with high output fluorescent and install occupancy sensors to ensure that lights are on only when required.

JCI performed a detailed survey of the interior spaces at all the Town & Schools buildings to find opportunities to capture energy savings, improve lighting quality and reduce maintenance costs. As a result of the survey and analysis, JCI has developed a high efficiency lighting upgrade project that will provide the Town & Schools with new energy efficient lighting fixtures, lighting sensors and day-light controls resulting in guaranteed annual energy savings and a reduction in electrical demand.

### **Building Envelope Improvements – Weatherization**

Install caulking, weather-stripping and seal roof-wall joints to prevent infiltration and improve insulating properties and reduce infiltration.

JCI conducted a detailed visual inspection of all the buildings to verify suspected air leakage locations. There are a number of building envelope defects and deficiencies that are contributing to higher than necessary air infiltration or ex-filtration. The defects also accelerate the deterioration of building components and increase maintenance costs. The building envelope treatments to be implemented will increase the overall energy performance of the building. Beyond the energy saving opportunities, the measures will also improve the air quality by limiting ingress of contaminants from outside and moisture migration throughout the structures.

### **Building Controls Upgrades / Re-commissioning**

Install a web-enabled Building Management System to update occupancy schedule and temperature set points. In addition, JCI will re-commission existing pneumatic building controls and equipment to enable more efficient operation through the application of building temperature setbacks and enhanced building control.

The High School has a Johnson Controls Metasys DDC system. The other four (4) school building's original temperature control systems are pneumatic. The control panel controls the day/night operation of each pneumatic zone and boiler operation using mechanical time clocks. The pneumatic control systems that are installed in the buildings are intended to automatically operate with day/night schedules. Manual

operation does occur on some equipment including boilers. No school has trending capability to troubleshoot problem areas or overheating issues, which was made clear with interviews with school staff. This mode of control is not reliable for achieving energy savings. This measure proposes the installation of improved building controls to provide reliable temperature control with enhanced monitoring and trending capabilities.

### **Demand Control Ventilation**

The Middle School is served by air-handling units that operate with a fixed outside air damper. By installing a CO2 sensor to determine occupancy levels, the outside air damper can be modulated to meet only the requirements of the actual level of occupancy.

The Outside Air (OA) Control uses data from CO2 sensors to adjust outside air dampers and the air handling units so that they maintain indoor air quality (specifically, CO2 levels) per ASHRAE Standard 62.1-2004. The primary advantage of installing OA controls is that they help ensure the quality of the air in the indoor environment, promoting a healthy work or living environment. In addition, by controlling system components (such as damper actuators) so that they bring into a facility only the amount of outside air required to meet ASHRAE standards, we can lower the amount of energy used and help reduce energy costs.

### **Steam Distribution System- Steam Trap Replacement**

Johnson Controls will replace steam traps in schools that have extensive steam distribution systems. On average, a steam trap population can experience from 5-10% failure each year. Left unaddressed, steam traps that have failed open can leak significant quantities of steam with its attendant energy loss.

JCI conducted a detailed steam trap survey and also inspected some of the steam traps for failures. Trap failures that result in steam passing through the traps are a substantial financial loss that requires a steam trap program, which includes an audit and the necessary repairs.

### **Energy Efficient Boiler Replacement**

Install a high efficiency steam boiler at the Clarke Elementary School as the existing boiler is original and well beyond its useful life.

### **Heating System Upgrade – Burner Upgrade / Burner Controls**

Install boiler controllers that save boiler energy by increasing the cycle lengths and reducing pre and post-purge losses.

Typically, boiler burners are sized to accommodate the coldest days (5% of a yearly requirement). During these periods of maximum demand, the burner is constantly on and the boiler is operating at its maximum capacity. At all other times, the burner cycles on and off maintaining temperature or pressure in the boiler. It is during these periods of lesser demand, that the controller will learn the boiler make-up rate and efficiently manage the firing of the boiler. The load is directly related to the time it takes for water (or steam) in the boiler to drop from its high-limit temperature (or pressure) to its low-limit or “call” setting. When demand is high, these off-cycles are short and the on-cycles are longer. When demand is lower, off-cycles are longer and on-cycles are reduced.

## **Domestic Hot Water – Heat Recovery**

There are opportunities to capture heat that is unused from other process, such as cooling, and use it to pre-heat domestic hot water. The walk in cooler and freezer refrigeration system at the High School offers an opportunity to capture the heat that system rejects to the outside and use it to pre-heat the domestic water used at the High School.

## **Building Envelope Improvements – Roof / Wall Insulation**

Heat flows naturally from a warmer to a cooler space. In the winter, this heat flow moves directly from all heated living spaces to adjacent unheated attics, garages, and basements, or to the outdoors; or indirectly through interior ceilings, walls, and floors--wherever there is a difference in temperature. During the cooling season, heat flows from outdoors to the building interior. To maintain comfort, the heat lost in winter must be replaced by the heating system. Insulating ceilings, walls, and floors decreases this heat flow by providing an effective resistance to the flow of heat.

## **Building Envelope – Window Film**

The conditioned areas of the High School are fitted with a large amount of double pane windows that allow infrared radiation heat gains in the summer and heat loss in the winter. This building is used extensively during the summer and has air conditioning units that maintain cooling set points. This measure proposes the installation of window film on the interior side of the windows to prevent energy loss during the winter and also will reduce cooling requirements during the summer.

## **Kitchen Hood – VFD on Exhaust Fan**

The High School kitchen currently has an exhaust hood with a fan that runs at a constant speed throughout the day. The exhaust hood serves the ovens, ranges and fryers. The fan is being operated at a constant speed and controlled manually. The existing setup exhausts a constant volume of valuable conditioned air whether or not there is any cooking going on. There is a dedicated make up air (MUA) unit on the roof that supplies heated makeup air to the kitchen.

It is recommended that a Variable Frequency Drive (VFD) be installed on the exhaust fan and controlled by the heat of the exhaust.

## **Water Conservation**

Upgrade standard flow fixtures to low flow fixtures will significantly lower the operating costs of the facility through utility savings.

All of the buildings were surveyed for the application of this measure. Sink retrofits offer good energy saving opportunities because any of these fixtures can be retrofitted with new low flow aerators to reduce the amount of water consumed per minute. Reducing sink water usage saves not only saves water but also energy that would otherwise be used to make hot water.

## **Vendmisers**

The buildings throughout the Town are equipped with refrigerated beverage vending machines. This measure addresses the inefficient control system that is standard on all units. At present, all of these

units run 24 hours a day throughout the year with the refrigeration compressors running 33 percent of the time irrespective of the facility or the equipment being occupied.

Johnson Controls proposes to install Vending Miser controls on all vending machines. Utilizing a custom passive infrared sensor, the controller powers down a vending machine when the area surrounding it is unoccupied and automatically re-powers the vending machine when the area is reoccupied. The intelligent controller develops optimal start-stop based upon the building occupancy, and modifies the time-out period accordingly.

### **Solar Photovoltaic System**

JCI is currently developing a Power Purchase Agreement (PPA) for a solar PV system to be put on the High School. Further details will be provided in a separate document.

### **Streetlights**

Replace existing High Pressure Sodium (HPS) street lights with induction light fixtures. Induction technology uses less electricity, provide better quality light and last longer than 100,000 hours.

### **Facility Performance Indexing**

Facility Performance Indexing is a program that takes Metasys data and converts it into useful diagnostic information. This application would be most beneficial at the High School for optimizing operations considering the complexity of the systems there. FPI can also benefit operations at the other schools

### **Cogeneration**

The electricity and natural gas costs at the High School are favorable for Cogeneration. The High School is used enough to make use of the energy (electricity and heat) generated from the

### **Refrigeration Upgrades**

This FIM recommends refrigeration controllers on walk-in coolers and freezers and installing Electrically Commutated Motors (ECM) on evaporator fans. The controllers will reduce compressor and evaporator runtime by up to 10%. The ECM fans are 30% more efficient than the standard two pole motors. Energy savings will be realized by reducing the runtime of the compressors and evaporator fans and the reduction in kW load of the new fans.

### **Solar Thermal System – Evaluated but not included in scope at this time**

JCI evaluated the use of a solar thermal system to provide energy for a portion of the domestic hot water load at the High School, this project did not have an attractive payback.

**Pumping Station** – The Town is in the process of designing an energy efficiency improvement project at the main wastewater pumping station, located at 531 Humphrey Street. The pumping station receives all of the wastewater in town and conveys it to the Lynn Municipal Wastewater Treatment Facility via a 24-inch force main. The station contains three 250-hp centrifugal pumps with VFDs, and two grinders in the headworks building. The station was converted from a primary treatment plant to a pumping station in 1992, and therefore the age of the equipment is approximately 18 years old. In July 2009 Woodard & Curran, Inc. was hired by National Grid to prepare an Efficiency and Economics Study on the proposed

improvements to determine our eligibility for a utility rebate. The project was subsequently approved by National Grid in December 2009 and will go to construction in the summer of 2010. The project capital cost is expected to be \$200,000 and we are expecting to receive a \$24,000 rebate from the utility. The project will yield approximately \$7,200 in savings annually or an additional 0.4% reduction from our established baseline.

*Vehicles (including schools):* The Town of Swampscott owns and maintains a fleet of 45 DPW vehicles, 15 Police vehicles, 7 Fire vehicles, 2 Council on Aging vehicles and 7 School vehicles. The entire fleet runs on either unleaded or diesel fuel. In May 2010 the Town and the School District voted on and approved a new Fuel Efficient Vehicle Purchasing Policy which dictates the required fuel efficiency of future passenger vehicle purchases in the Town. This is not expected to reduce energy use substantially since new passenger vehicles are not purchased very often in Town. In the past five years the Town purchased one new passenger vehicle for the Fire Department.

The Town adopted a Fuel Efficient Vehicle Purchasing Policy in May 2010 which will dictate the passenger vehicles purchased in the future. Of our entire fleet, there are 27 vehicles that this will affect should they need to be replaced. As mentioned previously, vehicles are not purchased very often in Town so this is not expected to contribute significantly to our energy reduction efforts.

*Street and traffic lighting:* Street lighting is the second largest source of electrical energy demand (20%) in the Town of Swampscott, second only to the new High School (40%). As such, street lighting was closely examined in the energy audit conducted by Johnson Controls, Inc. (JCI). Phase I of the ESCo Contract includes retrofitting of 103 130-watt streetlight fixtures with 40-watt fixtures, 293 295-watt fixtures with 150-watt fixtures, 10 460-watt streetlight fixtures with 200-watt fixtures, and 2 455-watt fixtures with 200-watt fixtures. This project will be installed in the Summer of 2010, resulting in nearly instantaneous energy savings. The installed cost of the project is \$68,675 and will be paid for out of future energy savings. The energy savings is expected to be \$32,144 annually, for a payback period of just over 2 years. Phase II of the ESCo project will include retrofitting of 1008 95-watt streetlight fixtures with 40-watt fixtures. This was eliminated from the Phase I project because the utility does not have in place a rate structure to incentivize installation of the lower watt fixtures. The Town of Swampscott along with JCI intends to work with the utility in upcoming years to resolve this issue and make the retrofit financially viable for the Town. These percent reductions are included in the overall reduction through ESCo of 16.6%.

*Municipally-Owned and -Operated Clean Renewable or Alternative Energy Installations:* The Town of Swampscott has been actively pursuing renewable energy since the inception of the Renewable Energy Committee in 2006. The three technologies being pursued are wind power, solar photo-voltaic, and geothermal heating.

In March 2008, The UMass Renewable Energy Research Lab (RERL) conducted a site walk and subsequent fatal-flaw analysis to evaluate three potential wind turbine sites identified by the Town and the Renewable Energy Committee. Their report, Wind Power in Swampscott: Siting Considerations for a Wind Turbine, March 18, 2008 is included as Attachment D to this Plan. RERL determined the Forest Avenue site to be the most viable, and so the Town retained a consultant and applied for a Feasibility Study grant through the Commonwealth Wind program in November 2009. The Town was denied during that grant round, and most recently applied for Block III of the Commonwealth Wind grant program in April 2010. The grant recipients have not yet been announced. Table 4 below summarizes the cost-benefit analysis of the two proposed alternatives for a wind turbine installation at the Forest Avenue site.

**Table 4 : Wind Project Technical Information**

<div>Proposed Wind Project System Size</div> <div><u>600 kW AC</u> (peak output) per manufacturers specifications</div>	<div>Annual Net Electricity Production Estimate (kWh) and Estimate of Behind the Meter Electricity Use:</div> <div><math display="block">\begin{array}{rcll} \text{kW} &amp; \times &amp; \text{CF} &amp; \times \text{ hrs/day} \times \text{ days/yr} = \text{ kWh/yr Produced} \\ 600 &amp; \times &amp; 0.30 &amp; \times 24 \times 365 = 1,566,288 \\ 1500 &amp; \times &amp; 0.32 &amp; \times 24 \times 365 = 4,231,080 \end{array}</math></div>																																										
<div>Estimated Installation Completion Date of Wind Energy Project:</div> <div>November, 2011</div>																																											
<div>Estimated Simple Payback of Wind Project without MassCEC Incentive (years):</div> <table><tr><th>Unit Rating kW</th><th>Total Cost Est.</th><th>Rate \$/kWh</th><th>CF</th><th>hrs/yr</th><th>Save \$/yr</th><th>Payback yrs</th></tr><tr><td>600</td><td>\$2M</td><td>\$0.13</td><td>0.30</td><td>8760</td><td>\$224,256</td><td>10</td></tr><tr><td>1500</td><td>\$4.1M</td><td>\$0.13</td><td>0.32</td><td>8760</td><td>\$605,371</td><td>8</td></tr></table>	Unit Rating kW	Total Cost Est.	Rate \$/kWh	CF	hrs/yr	Save \$/yr	Payback yrs	600	\$2M	\$0.13	0.30	8760	\$224,256	10	1500	\$4.1M	\$0.13	0.32	8760	\$605,371	8	<div>Estimated Simple Payback of Wind Project with MassCEC Incentive (years):</div> <table><tr><th>Unit Rating kW</th><th>Total Cost Est. w/ Max Grant</th><th>Rate \$/kWh</th><th>CF</th><th>hrs/yr</th><th>Save \$/yr</th><th>Payback yrs</th></tr><tr><td>600</td><td>\$1.7M</td><td>\$0.13</td><td>0.30</td><td>8760</td><td>\$224,256</td><td>9</td></tr><tr><td>1500</td><td>\$3.8M</td><td>\$0.13</td><td>0.32</td><td>8760</td><td>\$605,371</td><td>7</td></tr></table>	Unit Rating kW	Total Cost Est. w/ Max Grant	Rate \$/kWh	CF	hrs/yr	Save \$/yr	Payback yrs	600	\$1.7M	\$0.13	0.30	8760	\$224,256	9	1500	\$3.8M	\$0.13	0.32	8760	\$605,371	7
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If we are successful in obtaining grant funds for a Feasibility Study through Commonwealth Wind, the feasibility study yields favorable results, and we are successful in obtaining grant funds for Design and Construction through Commonwealth Wind, the turbine could be installed as early as November 2011. This project would offset 100% of the electrical energy use at the Middle School or 2,199 MMBtu or an additional 3.6% reduction from our baseline. This project is not guaranteed to be viable within the next five years due to uncertainties with grant funding, so it is not included in our short-term plan for energy reduction.

The Town is also pursuing a Solar Photovoltaic (Solar PV) array at the new High School and a portion of the Middle School where the roof was recently replaced. The project will be financed through a third party, and the Town will purchase power at a rate below retail from the third party financier. While this method is not as financially attractive to the Town as purchasing and installing the PV array ourselves, the lack of capital funds makes it the only viable option to getting solar power in Swampscott. The proposed project is a 200 kW array on the High School, and a to-be-determined array at the Middle School. The installation cost is \$1.3M on the High School and the estimated production accounting for actual orientation and shading is 212,019 kWh. The Town applied for a grant through the Commonwealth Solar program in January 2010 and was consequently denied grant funding. We applied for Block II of the Commonwealth Solar funds in April 2010 and are waiting to hear the results of that application. Regardless of success in obtaining grant funds, the Town intends to move forward with installation of the project in Summer 2010. The High School array is anticipated to produce 220,850 KWH annually for a reduction in fossil fuel energy use of 754 MMBtu or an additional 1.2% reduction from our baseline.

Finally, the Town pursued installation of a geothermal heating system for the Swampscott Public Library. In December 2009 the Town applied for the Energy Efficiency and Conservation Block Grant through the Department of Energy Resources and was subsequently denied due to the payback period of the system without grant funds. The estimated cost of the project was \$185,000 and the grant amount was \$150,000. The system would have reduced our energy use at the Library by 6,642 kWh annually. It was scheduled

to also be installed in Summer 2010. The Town intends to continue pursuing this opportunity through grants or other financing mechanisms. Although this project would be an exciting renewable energy effort, it would yield a less than 1% reduction in our energy baseline due to the relatively small size of the library compared to our other facilities.

*Education and Outreach:* The Town intends to continue its education and outreach efforts through the Renewable Energy Committee to residents, students, businesses and employees in the Town. Initiatives completed to date are presented in **Attachment E, Chronology of the Renewable Energy Committee** and include an "Ask The Energy Miser" column in the Swampscott Reporter, outreach forums on LEED buildings and on Geothermal Energy, tours for local officials of "green" elementary schools in Salem and in Beverly, a "Battle of the Bulb" competition with the Town of Marblehead to encourage residents to take a pledge to change a light bulb to a CFL (this contest included many outreach events at schools and local events), meeting with and financial support of the High School Physics Club's investigation of renewable energy technologies, an information-packed website, outreach sessions on the Stretch Energy code, and many other initiatives. The Renewable Energy Committee intends to continue with these efforts to achieve the remaining 1.8% reduction required to get Swampscott to 20%.

*Total Projected Fossil Fuel Reduction:*

**Table 5 : Summary of Reductions Within Five Years**

<b>Energy Reduction Measure</b>	<b>Projected % Reduction Yielded</b>
Municipal Buildings Through ESCo	16.6%
Streetlights / Traffic Lights	Included in ESCo number
Wastewater Pumping Station	0.4%
Solar PV on High School	1.2%
Education and Outreach	1.8%
<b>TOTAL</b>	<b>20%</b>

## **2. Measurement and Verification Plan for Projected Reductions**

Measurement and Verification (M&V) will be conducted both by the ESCo and by the Town, independent of each other. The ESCo is required to produce an annual M&V report in accordance with M.G.L - Chapter 25A, Section 11i. The annual M&V report from the ESCo will be reviewed by both the Town and the Massachusetts Department of Energy Resources. M&V will be conducted in accordance with the U.S. Department of Energy's M&V Protocol.

The Town will continue to track energy data using the MassEnergyInsight software developed by DOER for Massachusetts cities and Towns. The Assistant Engineer has been trained in the software and will be in charge of compiling all of the data, creating tracking reports, and comparing actual vs. projected reductions proposed in this Plan.



### **3. Long-term energy reduction goals – Beyond 5 years**

The Town is committed to continuing its energy reduction efforts beyond the five-year term of this Plan. A new Police Station and a new DPW complex are the next two municipal buildings anticipated to be constructed beyond the five-year period. Since the Town has adopted the Stretch Energy Code, we are assured the buildings will be constructed in an energy-efficient manner with consideration given to life-cycle costs of the facility.

The Town of Swampscott adopted a Fuel Efficient Vehicle Purchasing Policy as part of our effort to become a Green Community. With this policy in place we can be assured that future vehicle purchases will be made with consideration of fuel efficiency.

At the conclusion of our ESCo Contract we will have extracted all of the available energy savings from our street lighting in Town, and our traffic lights have already been converted to LED technology. Unless new, more energy efficient street and traffic lighting technology is developed, we do not see any future work on our street or traffic lights.

The Town intends to direct its efforts to Renewable Energy installations in the period beyond five years, including wind power at the Middle School, geothermal heating at the Library, and additional solar PV arrays on Town buildings, pending the success of our initial High School and Middle School installations.

## **VI. Conclusion**

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The Town of Swampscott is excited about this effort to reduce fossil fuel use in Town and School facilities by 20% in the next five years. This Plan, coupled with the existing efforts of the Town's Renewable Energy Committee, will help Swampscott in its long-term financial and environmental planning efforts, and help reduce greenhouse gas emissions. The Renewable Energy Committee maintains an active page on the Town's website with updated progress on energy initiatives, which can be reviewed at:

[http://www.town.swampscott.ma.us/Public\\_Documents/SwampscottMA\\_BComm/energy1](http://www.town.swampscott.ma.us/Public_Documents/SwampscottMA_BComm/energy1)

## **Attachment E – Chronology of the Renewable Energy Committee**

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### **Chronology of the Swampscott Renewable Energy Committee**

(and other energy initiatives supported by the Swampscott DPW or School District)

*More information is available on the Renewable Energy Committee's website at [http://www.town.swampscott.ma.us/Public\\_Documents/SwampscottMA\\_BComm/energy1](http://www.town.swampscott.ma.us/Public_Documents/SwampscottMA_BComm/energy1).*

**May 14, 2010. Submitted Designation Form to become a Green Community.**

**May 12, 2010.** Fuel-Efficient Vehicle Policy Adopted by School Committee

**May 11, 2010.** Fuel-Efficient Vehicle Policy Adopted by Board of Selectmen

**May 4, 2010** Commonwealth Wind Feasibility Grant Submitted to CEC. This grant is for \$85,000.

**May 3, 2010 Town Meeting:** Four energy related articles passed; stretch energy code was adopted; bonding for a \$940,616 Energy Services Contract passed; and two zoning articles allowing "Renewable and Alternative Research and Development Facilities" in the town's Industrial Zone passed. These four articles support the town's efforts to become a Green Community.

**April 28, 2010** Public Information Session on Stretch Energy Code.

**April 28, 2010** Public Hearing on Proposed Zoning Bylaw Changes.

**April 12, 2010.** "Ask the Energy Miser" column in the Swampscott Reporter on the Green Communities Act, the stretch energy code and the rebates for homeowners interested in energy efficiency and solar energy.

**March, 2010.** DPW employee attended MassEnergy Insight training. Town plans to adopt this energy data tracking method.

**March 2, 2010** Joint Builders' Forum with Salem's Renewable Energy Task Force to discuss the stretch energy code.

**February, 2010** Commonwealth Solar Grant application submitted to CEC. This grant for \$162,000 would have supported solar panels on the High School. *Not funded.*

**February 11, 2010.** Joint Meeting with Salem Renewable Energy Task Force.

**February, 2010.** ESCO Investment Grade Audit Completed. Johnson Controls submitted an audit showing \$3.5 million in improvements. This scope was reduced to \$2.4 million due to limitations at the utility relating to the street lights. The scope was further reduced to \$940,616 by the School District and the Town Administrator.

**January, 2010.** National Grid awarded us \$24,000 to pursue energy efficiency at the pumping station.

**December, 2009** EECBG Grant for \$150,000 submitted. This was for a geothermal system at the Town Library. *Not funded.*

**November 17, 2009** Commonwealth Wind Feasibility Grant Submitted to CEC. \$85,000 - *Not funded.*

**Fall, 2009.** Coordinated with Police Station Building Committee to ensure energy-efficiency (LEED silver) is integrated into new police station.

**October, 2009.** Signed a Project Development Agreement with Johnson Controls, Inc. for an Investment Grade Audit on eleven Town and School Buildings.

**September 21, 2009.** “Ask the Energy Miser” column in the Swampscott Reporter promoting International Walk to School Day.

**September, 2009.** Voted to award remaining Clean Energy Choice program money (\$9559.89) to the High School Physics Club to support their innovative examination of renewable energy technologies. Clean Energy Choice program ended forcing us to commit the remaining money by the end of the month.

**September, 2009.** Awarded DOER joint planning grant (with the City of Salem) to receive assistance in becoming a Green Community.

**March, 2009.** Issued a Request for Qualifications for Energy Management Services in accordance with M.G.L. c.25A, Sec. 11i.

**November 13, 2008.** “Ask the Energy Miser” column in the Swampscott Reporter on the Green Communities Act.

**September 11, 2008.** “Ask the Energy Miser” column in the Swampscott Reporter on the visit to Carlton Elementary School in Salem that the Renewable Energy Committee sponsored for local officials.

**May 16, 2008.** “Ask the Energy Miser” column in the Swampscott Reporter on LEED buildings.

**April 2008.** Utility audit of new high school.

**March 5, 2008.** Site visit by UMASS Renewable Energy Research Laboratory to investigate potential wind energy sites in Swampscott. Report May 14, 2008. Updated October 8, 2008.

**March 2008.** Hosted community forum on Leadership in Environmental and Energy Design (LEED) standards. Program was presented by SEA Consultants.

**January 17, 2008.** “Ask the Energy Miser” column in the Swampscott Reporter on the High School lights being on all night. This column ushered in a new phase of lighting reduction at the High School.

**January 10, 2008.** “Ask the Energy Miser” column in the Swampscott Reporter on opportunities for businesses to improve energy efficiency.

**January 3, 2008.** “Ask the Energy Miser” column in the Swampscott Reporter on the town’s energy resolution, greenhouse gases, carbon offsets and the town’s efforts to win solar panels through the Clean Energy Choice program.

**June 2007.** Town installed a “Big Belly” solar-powered trash compacter at King’s Beach (subsequently moved to the playground at Clarke School). This was purchased partly with Clean Energy Choice funding.

**February 27, 2007.** “Ask the Energy Miser” column in the Swampscott Reporter on the Clean Energy Choice program.

**March 15, 2007.** “Ask the Energy Miser” column in the Swampscott Reporter on the Clean Energy Choice program and our efforts to win a free solar panel.

**March 2007.** KeySpan Audit of town buildings.

**November 8, 2007.** “Ask the Energy Miser” column in the Swampscott Reporter on “vampire” energy use.

**November 11, 2007.** “Ask the Energy Miser” column in the Swampscott Reporter on recycling computer equipment and other items.

**December 18, 2007.** Board of Selectmen pass an Energy Resolution to reduce the town’s Greenhouse Gas Emissions by 12% by 2014 and by 20% by 2020, measured from a 2005 benchmark.

**December 13, 2007.** “Ask the Energy Miser” column in the Swampscott Reporter on efforts to win free solar panels through the Clean Energy Choice program.

**Fall, 2006.** “Battle of the Bulb”. Swampscott and Marblehead participated in a competition to see which town could get more residents to take a pledge to switch to change a light bulb to an energy-efficient Compact Fluorescent Bulb (CFL). We exceeded our goal of obtaining 350 pledges with 581 pledges. Outreach was conducted at the schools, in the Swampscott Reporter and at various events around town. Marblehead won the contest with 961 pledges.

**October 2, 2006.** “Ask the Energy Miser” column in the Swampscott Reporter on the Light Bulb contest.

**September 7, 2006.** “Ask the Energy Miser” column in the Swampscott Reporter on reducing water use.

**August 2006.** Hosted well-attended community forum on geothermal energy at the Public Library.

**July 27, 2006.** “Ask the Energy Miser” column in the Swampscott Reporter on energy efficiency.

**June 15, 2006.** “Ask the Energy Miser” column in the Swampscott Reporter established. First column address ways to get better gas mileage from your car.

**February 2006.** National Grid audit of town buildings.

**2005.** Swampscott Board of Selectmen establishes Renewable Energy Committee.