

## Town of Warwick Energy Reduction Plan

### I. PURPOSE AND ACKNOWLEDGEMENTS

#### A. Letters from Both General Government Verifying Adoption of the ERP

**General Government**

See Warwick CR3 municipal government approval letter.pdf

**The Warwick Elementary School** is part of the Pioneer Valley Regional School District and will not be included in this Energy Reduction Plan.

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

Guardian Energy

Jack Cadwell – Warwick Buildings & Energy Committee

Larry Delaney – Warwick Highway Superintendent

Dan Dibble – Warwick Buildings & Energy Committee

Ron Gates - Warwick Fire Chief

Janice Kurkoski - Warwick Buildings & Energy Committee, Chair

Stephen Kurkoski – Warwick Buildings & Energy Committee

David Shoemaker - Warwick Police Chief

David Young – Warwick Town Coordinator

### II. EXECUTIVE SUMMARY

#### A. Narrative Summary of the Town

The Town of Warwick was established on land given to descendants of soldiers from Roxbury MA who served in the French and Indian War. The hilly land was originally settled in the 1740's and received a charter in 1763 when it grew enough to support a settled minister. The original agricultural economy of Warwick had expanded by the mid-nineteenth century to include saw mills, pail, stave and axe factories, blacksmith shops, failed glass factory and tanneries. Although Warwick is still a small rural town, its population grew by more than 20% between 1980 and 1990, which was one of the highest growth rates in the county. Part of that growth was due to expansion of a minimum security prison which is now closed. Today Warwick has 780 residents and about 300 households. The town is zoned residential and agricultural. The town recently became a "right to farm" community and even more recently elected to become a "Green Community". Warwick has no state highways and a population density of 20 people per square mile. Half of the land is state-owned forest or parkland. The town is located in North central Massachusetts, bordered by Royalston on the east; Orange to the south; Erving and Northfield on the southwest and west; and Winchester and Richmond, New Hampshire, on the north. Warwick is 18 miles east of Greenfield, 50 miles north of Springfield, 80 miles northwest of Boston, and 190 miles from New York City.

In 2008, Warwick became an Energy Star Partner with the US EPA Energy Star Partners program, and signed an MOU For Promoting and Implementing the Pioneer Valley Clean Energy Plan. Warwick also set up and runs it's own broadband service, providing high-speed internet to many local households and even others in nearby communities.

**B. Summary of Municipal Energy Uses**

- ☒ *Total Number of Municipal Buildings* – The Town of Warwick has seven actively used municipal buildings. Five of the buildings are heated with oil, the Police Station is heated with resistance baseboards, and the Transfer Station cabin is electrically as well. The Town Hall is equipped with two heating systems – an oil steam boiler for the offices and an oil furnace for the main hall and dining/kitchen area. It also has a commercial kitchen that uses electricity for cooking and water heating.
- ☒ *Total Number of Vehicles* – Warwick owns 16 vehicles, all of which are in the exempt category. 11 are diesel and 5 are gasoline. The Fire Dept. operates 2 gasoline and 4 diesel trucks, ranging in age from 1957 – 1991. The Highway Dept. operates 7 diesel trucks and heavy equipment in the 1987-2012 range. The Police Dept. operates 2 gasoline 4WD SUVs and 1 recent sedan.
- ☒ *Total Number of Street Lights and Traffic Lights* – There are nine street lights, mostly in the town center, owned by National Grid. These will not be included in this ERP. There are two blinking lights at the school entrance, owned by the town and included in this plan. There are two pole mounted security lights, one at the Highway Dept. and one at the Police/Fire Stations. These accounts are listed under the Highway and Fire Station buildings in MEI.
- ☒ *Water and Sewer* – There are no public water or sewer facilities in town. All water supplies are wells and waste water is treated in individual septic systems.

**Table 1: Summary of Municipal Energy Users**

	<b>Number</b>	<b>Ownership</b>
<b>Buildings</b>		
Oil Heat	5	Muni
Electric Heat	2	Muni
<b>Vehicles</b>		
Non-Exempt	0	
Exempt	16	Muni
<b>Street Lights</b>	9	Utility (excluded)
<b>Pole Mounted Security Lights – Hwy Barn and Police/Fire Station</b>	2	Utility (included under their respective buildings)
<b>Traffic Lights (blinking school lights only)</b>	2	Muni
<b>Open Space (2 Broadband stations, cemetery)</b>	3 elec. accounts	Muni
<b>Water and Sewer</b>	0	

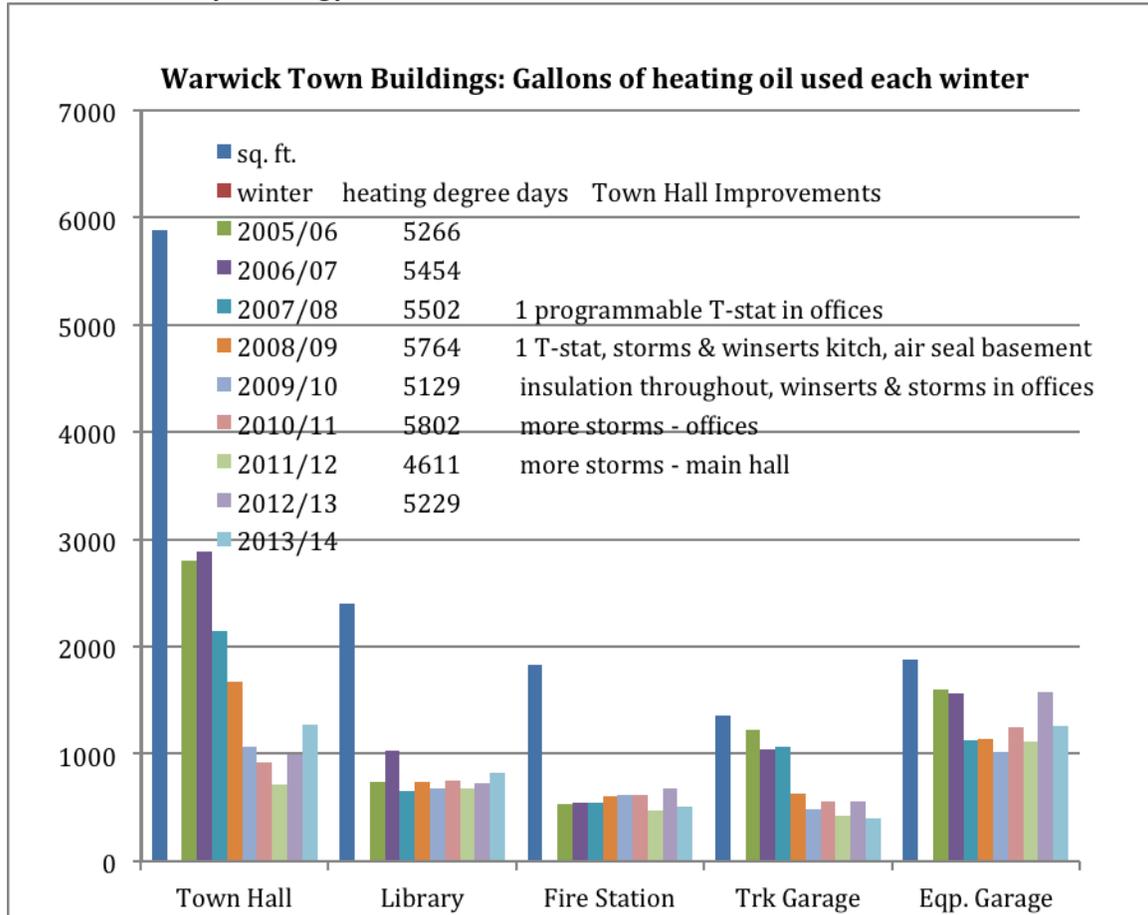
**C. Summary of Energy Use Baseline and Plans for Reductions –**

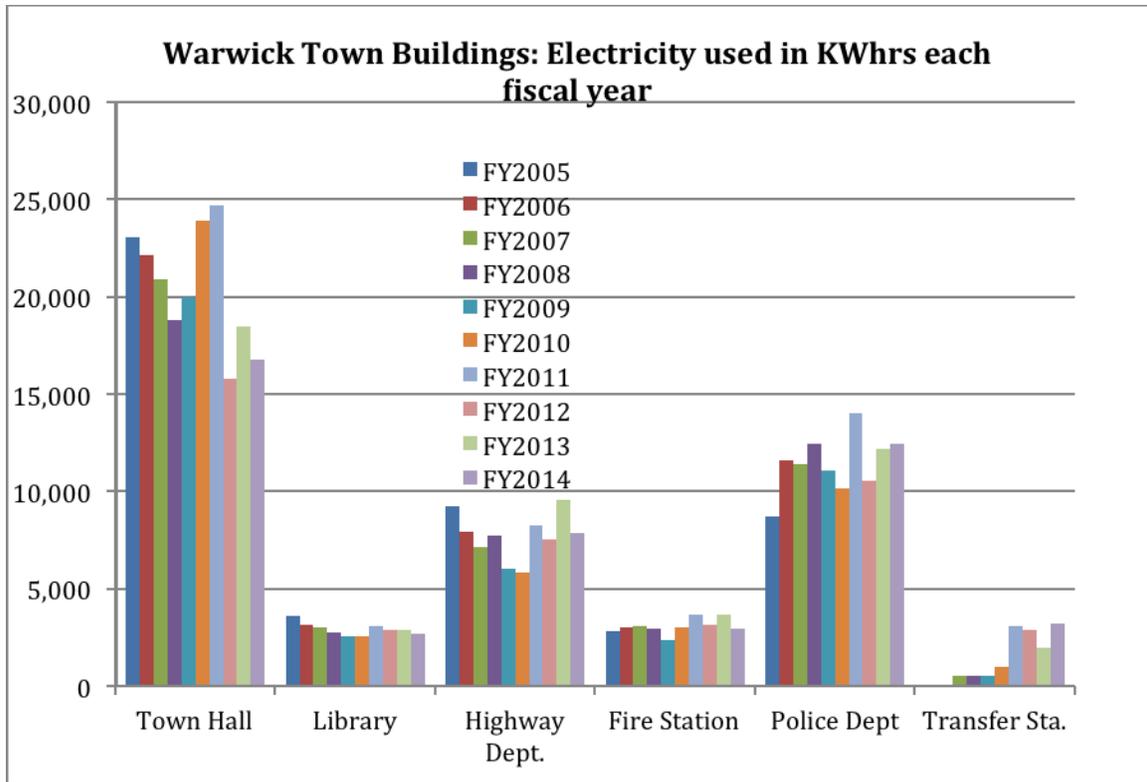
Since it’s inception in 2006, the Buildings and Energy Committee has followed in the tradition of the “little town that could”. Initial members were professional trades persons and not grant writers, so it was easier to pick the low-hanging fruit instead of applying for grants to do it. By leveraging National Grid incentives for lighting upgrades and implementing low-cost energy conservation measures, often using volunteer labor to do it, we were able to make significant reductions in energy use while building community support for these measures at the same time (see Town Building charts below). After already realizing these savings, we can see that it will be a bit harder to reach an additional 20% reduction, though not impossible. Our strategy is to

weatherize buildings first to the extent practical, then assess heating system change-outs. Having proven our worth, we enjoy the continued support of our select board, finance committee, town coordinator, and most community members. That said, it will be an additional challenge to reduce vehicle fuel consumption as our Highway vehicles use 86% of the total fuel used in town, and this will vary widely each year with storms and other weather events.

BASELINE YEARFY2013	MMBtu Used in Baseline Year	% of Total MMBtu Baseline Energy Consumption	Projected Planned MMBtu Savings	Savings as % of Total MMBtu Baseline Energy Consumption
Buildings	798.1	38.6%	499	24.1%
Vehicles	1261.7	61.1%	33	1.6%
Traffic Lights	.4	Negligible	0	0
Open Space <sup>1</sup>	6.4	.3%	0	0

Table 2: Summary of Energy Use Baseline





### III. ENERGY USE BASELINE INVENTORY

- A. Identification of the Inventory Tool Used** - The Town of Warwick used the Department of Energy Resources MassEnergyInsight (MEI) web-based energy use analysis tool for this report, and has used MEI since it's inception. Prior to that, energy was tracked using the EPA's Portfolio Manager.
- B. Identification of the Baseline Year** – Our baseline year is FY2013. The five year time for the 20% reduction goal is FY2014 – FY2018
- C. Municipal Energy Consumption for the Baseline Year (FY 2013)** – *See Table 3 and 4 in Appendix (Warwick CR3 FY13 Energy Use Baseline and Energy Conservation Measures 10 14)*

During the baseline year, the total energy use in municipal buildings and vehicles was 2066.6 MMBtus. The majority (61%) went towards fueling municipal vehicles, with diesel representing 90% of the vehicle MMBtus, and gasoline the other 10%. The Highway Department vehicles used 97% of the diesel fuel, and 86% of the total vehicle fuel used. Buildings were the next largest category of energy consumers accounting for 39% of municipal energy use. Open space is .3% of the total and consists of the cemetery, broadband cell tower, and broadband Wheeler Pond station. The two Blinking traffic lights were negligible.

## IV. ENERGY REDUCTION PLAN

### A. Narrative Summary

1. *Overview of Goals for years 1 – 3:* Warwick's strategy is to focus first on weatherizing all buildings by air-sealing and adding insulation where practical. Phase I will also include interior storms and internet connected set-back thermostats in most if not all buildings. We will then be able to right-size and upgrade heating systems in all town buildings using appropriate technologies. Savings can also be realized with lighting upgrades in some buildings, and occupancy sensors and de-stratification fans in the Town Hall, but the baseline table clearly indicates that heating oil reduction should be our main target. The plans are already in place to insulate the Highway Equipment Garage, going from R2 at best (bare concrete) to R23 SIP panels. The Police Station, though small, is ripe for an air-source heat pump to replace the elec. resistance heaters. Multi head heat pumps can also work well in the Town Hall.

The Warwick Buildings and Energy Committee will work to identify additional energy efficiency improvement projects, working closely with the finance committee, select board, department heads, and general population. One idea that has been well received is to use some of the initial GC grant monies to offset the co-pay that private homeowners need in order to participate in the MASS Save program. This could be done on a sliding scale using home values as a guideline.

After the much debated stretch code, there still appears to be many misconceptions. Warwick has an abundance of professional and self-taught contractors. Subsidized training sessions on sound building science could play a key role in bringing these contractors and up to speed on how to build or remodel buildings that will meet the new IECC2012 and the stretch code. To round out these trainings, Warwick is considering purchasing a Minneapolis Blower Door tester. Our neighboring Town of Wendell purchased a FLIR infrared camera with their GC money, and both towns have agreed to share this equipment. Trainings can include this equipment. These two items together offer valuable insights in targeting proper air sealing and checking the effectiveness of control measures already performed on town buildings.

Warwick's vehicle fuel to building energy ratio is much higher than most other places. As seen in the initial chart, buildings account for 38.6% of the total energy consumption (in MMBtu), while vehicles consume the majority at 61.1%. Warwick has 49.62 miles of roads, 33.85 of which are paved, and 15.77 are un-paved. Furthermore, 57.6% of the total Highway Dept. vehicle fuel use is attributed to winter storm events. In FY13 there were 45 such events, and in FY14 there were 54 events. Even with this 20% increase in winter storms, the Highway fuel use increased by only 1.2%, due primarily to a change in plowing techniques that cut the plowing time of the main roads in half. Energy Conservation Measures here will require even more creativity and cooperation on the part of the Public Works and Public Safety Departments (and Mother Nature). The Buildings & Energy Committee is consulting with the Highway, Police, and Fire Departments and considering the following measures: adopting an anti-Idling policy for Town-owned vehicles, using alternative road plowing and de-icing strategies so plows can go out less

often, contracting out snow plowing to more efficient vehicles, as well as other strategies that are now being put forth by the general public. Department Heads will be asked to monitor compliance and report to the Energy Committee and the Town Coordinator in order to make suggestions for changes, alternatives, or improvements. It is also of note here that the Police Dept. vehicle fuel budget was increased by 33% for FY15 due to an increase in personnel. This will result in an additional 35 MMBtu if the entire fuel budget were consumed.

2. *Overview of Goals for Years 4-5:* Once our building enclosures are in order, we can then fine tune other upgrades and complete unfinished projects from previous years. The Town will also examine the feasibility of biomass heating options in some Town buildings.

3. *Identify Areas of Least Efficiency/Greatest Waste:* The Highway Equipment Garage has the highest heating load for its area. Even with keeping the building at barely comfortable temperatures, the ceiling-mounted oil-burning hot-air heater has a hard time keeping up with 18ft tall concrete walls and 10ft garage doors in sub-zero temperatures. This building needs help right away in the form of wall insulation, a set-back thermostat, and perhaps an infrared heater. Eliminating the utility-owned security light and replacing it with two wall-mounted lights will save 5.12MMBtu annually, not to mention pole and fixture rentals.

## **B. Getting to a 20% Energy Use Reduction Within the 5 Year Period Following the Baseline Year-**

1. *Program Management Plan for Implementation, Monitoring and Oversight* – The Town Coordinator and Select Board will be responsible for securing the funds and general oversight of the energy efficiency projects. The Town Coordinator and Buildings and Energy Committee will be responsible for maintaining energy use data in MEI as well as DOER Green Communities Annual Reporting requirements.

2. *Energy Conservation Measures* – A list of documented and itemized energy conservation measures is presented in Table 4 (see Warwick CR3 FY13 Energy Use Baseline and Energy Conservation Measures 10 14 in Appendix). This table contains information such as project status, projected annual energy savings, projected annual cost savings, total project cost, incentive and financing information, funding sources as well as a reference sources for information. Previous and current audits are also contained in the Appendix, the most important being the Guardian audit (Warwick CR3 ERP Guardian Energy 2014\_10\_14.pdf). ASHRAE level II audits may be needed before some of the heating equipment replacements. Here is an expanded explanation for ECMs in each building:

Town Hall: As our town hall is open to the community more and more (Yoga, Zumba, Circuit Training, Friday lunches, Senior meals, meetings, dances, music & art events, etc.), an internet connected set-back thermostat will enable multiple users of the building to fine tune on-off times for the heating systems. Multi-head air-source high efficiency ductless heat pumps will also enable employees to better manage their needs and heat or cool only certain offices and rooms at any given time. De-stratification fans for the main hall and entryway will help balance

the air temps in those rooms. Another proposal is to move from a 5-day work week to a 4-day work week for the Town coordinator. Air sealing, additional attic insulation, above-grade basement wall insulation, and additional band joist insulation will round out the initial efforts in this area. Interior storms will be added to the remaining windows that are without them. An LED lighting upgrade, occupancy sensors for the bathrooms, and de-stratification fans in the main hall are proposed. Control modifications to the hot air distribution system shall be investigated.

**Highway Equipment Garage:** The Town of Warwick is using a partially heated garage for storing and maintaining equipment including a road grader, front-end loader, back hoe, small dump truck, and other equipment. The space is also used to maintain and repair the equipment. The workers need a warm space in order to work on the machinery. The machinery needs to be kept warm and out of the weather. The garage was built in the late 1980's as part of a salt shed. The salt shed part has a separate access at the north end of the building and is not heated. The walls are 5" thick high-density concrete, estimated at less than R2. The roof is made of trusses, with a sheetrock ceiling 18' above the floor. The Highway Department added loose fill insulation to the attic in FY08, but more is needed. The garage is heated with an oil-fired space heater hung from the ceiling. There are several small windows on the west side, one entry door, and two large insulated garage doors that take up the entire south wall of the building. The Buildings and Energy Committee proposes that the Town insulate the west, north, and east walls with R23 6 1/16" OSB/EPS Foam Nail Base Panel insulation, which comes covered with Oriented Strand Board, and add a layer of cement board up to 8' for fire safety. The south wall would be insulated around the garage doors (see Appendix for Highway Equipment Garage plan drawings, as well as Highway Equipment Garage heat loss calculations by Peter Talmage P.E.). The work of removing and re-installing the electrical system is being coordinated and performed by Stephen Kurkoski, a licensed electrician, on a volunteer basis. An internet-connected set-back thermostat and appropriately sized infrared heater could then be installed to replace the ceiling hot air unit. A Lighting upgrade was done in FY09. Ceiling fans already exist.

**Highway Truck Garage:** This is a cement block building with three garage doors, a small office, bathroom, and a furnace room. Interior storms already exist on all windows. Additional air sealing for the walls and attic is planned. The furnace could be replaced in the future with a more efficient unit once the building enclosure is fixed. The 400W high-pressure sodium utility owned security light will be discontinued and replaced with two motion actuated building mounted 50w Maxlite LED Flood wall-packs (EFI catalog # 1300.607) Also see Appendix MA\_Commercial\_Table for cost savings calculations. An internet-connected set-back thermostat can be installed here.

**Library:** An initial blower door test was performed in April indicating there is plenty of opportunity here to reduce energy use with air sealing techniques before mechanical ventilation is needed. Combined with additional insulation, 10 – 20% reductions are often realized in these types of buildings (see Appendix for library blower door test results and remediation calculations). A replacement for the oil furnace will be assessed after the enclosure upgrades are in place. Interior storms will be installed on the remaining 8 3' X 6' windows, as well as the

transoms and the picture window (see Appendix for Interior Storm Plans – Library Example, and R Value of two-layer Interior Storms, by Peter Talmage P.E.) A set-back thermostat already exists, but may be converted to wireless.

Police Station: Air sealing and added insulation throughout this modular building will provide the foundation for right-sizing a high efficiency ductless heat pump here to replace the elec. resistance baseboard heaters. An internet-connected set-back thermostat will be installed to enable a flexible heating schedule for emergencies and other unscheduled events. Interior storms are also needed, even though the windows are already dual pane.

Fire Station: This building is primarily used to house two fire trucks and host an occasional meeting upstairs. It is kept at a temperature to prevent freezing of the equipment. All but one of the windows are single pane, so two layer interior storms are a must here. The fire escape egress is un-insulated – this can be remedied easily with rigid sheet insulation and gasketing. The garage doors are not insulated either, but it remains to be seen if their replacement has a reasonable pay-back or not. The utility owned 250W pole mounted high-pressure sodium security light will be discontinued and replaced with a motion actuated building mounted 50w Maxlite LED Flood wall-packs (EFI catalog # 1300.607). An internet-connected set-back thermostat will be installed.

Transfer Station: Electric use has increased drastically in recent years. There are two compactors and a small, insulated attendant's cabin on site. Both compactors have fluid heaters. These units can be ground coupled with sheet insulation and spray foam to reduce the heat loads, and the temperature controls checked, as these do not appear to be set properly.

Vehicles: The Fire Dept. will assume control of the Police Tahoe and use it for medical calls instead of using a fire truck, this being the majority of Fire Dept. calls. This will save approx. 10.3MMBtu. The Police Dept. has recently acquired a 2008 Crown Victoria that will get 18 mpg. This will replace the Tahoe, which gets 13 mpg. Over the 5k estimated annual miles driven, this will save 107 gallons of gasoline, or 13.3MMBtu. (see resources - fueleconomy.gov pages). An anti-idling policy will be adopted wherever practical. The Highway Dept. will continue to use vehicle use saving strategies during storm events. A new front-end loader purchase is planned, and will comply with Tier 4 emissions regulations. This may not save fuel use, but it will certainly be cleaner to operate.

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

First a little history: In 2006, the Select board established an *ad hoc* Town Buildings Committee. The Select board voted on June 30, 2008, to make it an official town committee, named The Buildings and Energy Committee, with the following mission statement: “The purpose of the Warwick Buildings and Energy Committee is to assess town buildings and maintenance needs, research options for the select board and Warwick citizens to encourage efficient energy consumption and optimal maintenance of town properties, and encourage Warwick townspeople's own efforts in renewable energy production and carbon footprint reduction.” You

can see by the Warwick Buildings Energy Use charts listed previously in this document that this committee has already successfully implemented some of these goals. The Committee's motto has been "Conservation, Efficiency, and Renewable Energy", more or less in that order. But given the urgency of climate change, and the fiscal belt-tightening needed across all departments, we need to throw all strategies at the problem at the same time. Community building around this is part of this plan, and will continue as a priority long after 5 years.

1. *Municipal Buildings:* A move away from fossil fuels is not only in the Town's interest, but would make sense regionally, nationally, and world-wide. As new technologies emerge, especially in the realm of locally produced energy sources, Warwick will look beyond simply the cost of these, but consider the environmental cost of the whole life cycle of energy production and emissions when making decisions about energy sources and equipment purchases.

2. *Vehicles:* When purchasing new or used vehicles, emphasis will be placed on fuel efficiency. The Highway Department, which uses the bulk of vehicle fuel, as well as the Police and Fire Departments, will optimize the use of their vehicles without jeopardizing public safety.

3. *Street and Traffic Lights:* There are 9 utility owned street lights close to the town center. These are high-pressure sodium, with one at 70W and the remaining eight at 50W. A survey will be conducted to see if any of these can be eliminated, but given how few there are (many others were discontinued several years ago) and how low the consumption is, this was not a priority. The two blinking school lights may be addressed in the distant future.

4. *Perpetuating Energy Efficiency:* The Buildings and Energy Committee has discussed a plan to set up a revolving fund into which a portion of the savings resulting from these Energy Conservation Measures (ECMs) will be deposited to further implement energy savings projects in town. Authorization for this fund will be brought before the next annual Town Meeting in May of 2015.

## **V. ONSITE RENEWABLE ENERGY PROJECTS & RENEWABLE ENERGY**

At this time, the Town of Warwick does not have any plans for renewable energy generation on Town properties. However, after completion of the energy conservation measures described, we may consider adding 1kW to the existing 1kW PV system on the Town Hall roof. The Highway Truck Garage also has an appropriate south-facing slope, with room for maybe 15kW. The Police Station also has good solar exposure.

We will also investigate the feasibility of converting from oil to a biomass source for heating at several town buildings. Some of these renewable/alternative energy projects were suggested in the DOER energy audit conducted by Bowman Engineering in 2009 (see appendix).

## **LIST OF RESOURCES**

Jim Barry: Green Communities Regional Coordinator, Massachusetts Department of Energy Resources (DOER).

[Jim.Barry@state.ma.us](mailto:Jim.Barry@state.ma.us)

Green Communities Grant Program Information and Guidance: MA DOER, [www.mass.gov/energy/greencommunities](http://www.mass.gov/energy/greencommunities)

EFI Catalog – <http://host0158.csmhosting.com/Catalog/sheets/p93.pdf>

[http://www.fueleconomy.gov/feg/bymodel/1999\\_Chevrolet\\_Tahoe.shtml](http://www.fueleconomy.gov/feg/bymodel/1999_Chevrolet_Tahoe.shtml)

[http://www.fueleconomy.gov/feg/bymodel/2008\\_Ford\\_Crown\\_Victoria.shtml](http://www.fueleconomy.gov/feg/bymodel/2008_Ford_Crown_Victoria.shtml)

[https://www.nationalgridus.com/masselectric/non\\_html/MA\\_Commercial\\_Table.pdf](https://www.nationalgridus.com/masselectric/non_html/MA_Commercial_Table.pdf)

Idling Informational Presentation, *Idling Reduction Makes Sense*: U.S. Department of Energy (DOE) – Energy Efficiency & Renewable Energy,

[http://www1.eere.energy.gov/cleancities/pdfs/idle\\_reduction.pdf](http://www1.eere.energy.gov/cleancities/pdfs/idle_reduction.pdf)

<http://energy.gov/energysaver/articles/energy-efficient-window-treatments>

Peter Talmage: Northfield Energy Committee Member and Licensed Mechanical Engineer in the State of Maine with professional experience in building efficiency and renewable energy.

<http://www.dsireusa.org/incentives/index.cfm?re=0&ee=0&spv=0&st=0&srp=1&state=MA>

## **APPENDIX**

### **Warwick CR3 FY13 Energy Use Baseline and Energy Conservation Measures**

**Warwick CR3 ERP Guardian Energy 2014\_10\_14.pdf**

**R Value of two layer interior storms - Peter Talmage, P.E.**

**Interior Storm Plans – library example**

**Library blower door results and air sealing remediation calculations**

**Highway Equipment Garage Heat Loss Calculations, Peter Talmage, P.E. (2 files)**

**Highway Equipment Garage Plans.pdf**

**MA Commercial – National Grid Electric rates table**

**Town Hall PV production FY13.doc**

**Benchmarking\_Warwick\_01 (Bowman Engineering 2009)**

**Warwick Audit Report\_Final (Bowman Engineering – 2009)**

**Warwick Final PreliminaryReport 1-26-08 rkb (Siemen’s Audit. 2008)**

**MMBtu Conversion Chart<sup>1</sup>**

**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<sub>2</sub>

1 gallon of B10 biodiesel = 0.137 MMBtu<sub>9</sub>

1 gallon of B5 biodiesel = 0.138 MMBtu<sub>9</sub>

1 barrel of residual fuel oil = 6.287 MMBtu