SUMMARY REPORT

Energy Audit Program

Town of Shutebury

Massachusetts

Massachusetts Department of Energy Resources

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Prepared by

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1. EXECUTIVE SUMMARY

An energy audit was performed on several buildings in the Town of Shutesbury as part of the Energy Audit Program (EAP) sponsored by the Massachusetts Department of Energy Resources (DOER).

The Town of Shutesbury submitted a total of 5 buildings for the EAP. Using utility data and building size, and in some cases previous audits, all of the buildings were reviewed for their energy intensity to determine the audit requirements. Based on this screening process all five buildings were audited. Comprehensive audits with feasibility analysis covering energy conservation and clean technology assessment were performed on the Town Hall and the Elementary School. These detailed audit reports are stand alone documents and are not contained within this summary report. Inspection audits to identify conservation measures were performed on the DPW Garage, the Library and the Fire Station; the findings are presented in Section 7, 8, and 9, respectively, of this report.

From all the audits a range of energy conservation measures were recommended, such as upgrades to: lighting, heating, control systems, appliances, and the building envelope. Several low/no cost conservation practices were also recommended within the details of each site report. Renewable energy, energy procurement, and demand response were reviewed as well.

The energy conservation measures are summarized in Table A, below, listed by site then by ECM category (each summary line reflects a summary of one or more measures). The total estimated capital cost of the ECMs is just over $64,500 with an average simple payback of 5.5 years. The estimated annual fuel savings total is approximately 3800 gallons of oil. Electricity savings are estimated at just under 19,000 kWh per year. At FY07 energy prices, the result is a forecasted savings of over $10,000: a 17% reduction in energy costs. These measures are estimated to reduce the carbon footprint caused by energy consumption of the buildings by 10%.

With regard to renewable energy measures, there is potential for wind development at the Town Hall or at a nearby property to the north. There is no potential for hydroelectricity at any of the sites. The Elementary School has an existing solar photovoltaics system; the DPW garage was identified as a potential solar photovoltaics site to host up to a 9 kW system. The school has future potential for a biomass boiler installation if pellet fuel prices moderate relative to oil prices.

The biomass project has the potential to eliminate over 50% of the municipal fuel oil consumption. The 100 kW wind turbine would produce over 1/3 of the electrical usage for all municipal buildings; an alternative site with a 250 kW turbine is estimated to produce 100% of the electrical needs for all municipal buildings.

Table A – Energy Conservation Summary

	Town of Shutesbury			Annual Energy Savings					Annual Cost Savings			Simple Payback ECM Cost/ Savings (years)
				Electrical		Fuels		Energy	Electrical	Fuels	Total	
	ECM#	Description	ECM Cost	kWh	kW	Oil Gal.	LPG Gal	Total MMBTU	$	$	$	
Elementary School	CSs	Control System	$9,150	0	0.0	951	0	131.9	$ -	$ 2,282	$ 2,282	4.0
	BEs	Building Envelope	$15,006	0	0.0	430	0	59.6	$ -	$ 1,032	$ 1,032	14.5
	OSs	Occupancy Sensors	$1,427	1,369	0.0	0	0	4.7	$ 130	$ -	$ 130	11.0
	MCs	Motor Controls	$19,447	8,600	0.0	869	0	149.8	$ 817	$ 2,085	$ 2,902	6.7
Town Hall	CSs	Control System	$1,626	0	0.0	171	0	23.8	$ -	$ 411	$ 411	4.0
	BEs	Building Envelope	$9,668	0	0.0	410	0	56.8	$ -	$ 983	$ 983	9.8
	EHs	Electric Heaters	$881	1306	1.5	0	0	4.5	$ 176	$ -	$ 176	5.0
DPW Garage		Conservation Items	$2,492	3,377	0.0	670	0	104.5	$ 574	$ 1,608	$ 2,182	1.1
Library		Conservation Items	$1,175	1,178	0.0	0	35	7.2	$ 200	$ 81	$ 281	4.2
Fire Station		Conservation Items	$3,683	2,933	0.0	333	0	56.2	$ 499	$ 799	$ 1,298	2.8
		TOTAL	$64,555	18,764	2	3833	35	599	$ 2,396	$ 9,281	$ 11,677	5.5

Town Building Energy Usage	297,592		22,924	350	4,227	$ 28,839	$ 40,944	$ 69,783
Savings Reduction (%)	6%		17%	10%	14%	8%	23%	17%

	Annual Emmisions Reduction (tons CO2)				
	Electrical	Fuels			
	kWh	Oil Gal.	LPG Gal	Total	
Town Emmisions	190	257	4,484	4,930	
Emmisions Reduction	12	43	448	503	10% Reduction

Table B – Clean Technology Summary

Clean Energy Projects		Annual Energy Savings					Annual Cost Savings			
		Electrical		Fuels		Energy	Electrical	Fuels	Total	
Description	Cost	kWh	Pellets (tons)	Oil Gal.	LPG Gal	Total MMBTU	$	$	$	
Biomass System (Pellets)	$122,500	0	(97.0)	12,834	0	0.0	$ -	$ 30,802	$ 30,802	10.6 yr equity payback
DPW Garage Photovoltaics*	$21,300	10,000	0.0	0	0	34.1	$ 1,700	$ -	$ 1,700	12.5 yr simple payback
100 kW Wind Turbine**	$550,000	127,045	0.0	0	0	433.7	$ 16,516	$ -	$ 16,516	13 yr to positive cashflow

* net cost after MTC rebate and use of Clean Energy Choice Fund, total project cost estimated at 80,000

** payback assumes MTC rebate and 2.5% bond for project

2. INTRODUCTION

Through the Energy Audit Program (EAP) offered by the Commonwealth of Massachusetts, Department of Energy Resources (DOER), technical assistance is provided for all buildings owned and operated by cities, towns, regional school districts and wastewater districts to identify capital improvements to reduce energy costs. The technical assistance provided by DOER includes an initial benchmarking of buildings and structures included in the application. Based on the results of the benchmarking, a detailed energy audit may be performed as well as a variety of feasibility studies to evaluate the potential to incorporate renewable energy sources. This comprehensive assistance provides communities with the knowledge needed to reduce energy consumption and associated financial resources.

The purpose of the audit report is to provide the program participant with a list of energy conservation projects, their costs and estimated energy savings. This information may be used to support a future application to DOER's Energy Conservation Improvement Program (ECIP), support performance contracting or justify a municipal bond funded improvement program. ECIP is a state funded grant program that provides funds for energy conserving capital improvements.

The approach taken in the EAP includes a thorough walk-through of the building(s) and associated systems and equipment, including both process systems and building systems. The major areas covered in the audit include the building envelope, process systems, electrical systems, HVAC systems, lighting systems and operational and maintenance procedures. A major element of the audit also included an initial interview and ongoing consultation with operational and maintenance personnel, as well as building occupants. This approach is critical to the quality of the audit process, since the input of building personnel is invaluable to the effort to obtain accurate information required for the audit.

CET's energy auditor Bill Lafley and Precision Decisions' licensed professional engineer Chris Vreeland perform the onsite audits, develop the recommendations and write the audit reports. EAP participants provided site-specific information in advance of the audits as well as observations during the site walkthrough.

The recommendations within a report are based on one year of submitted usage data, a site review and preliminary evaluation. The energy savings and energy production figures are projected estimates based on conceptual project upgrades, information gathered at the site, and from the historical utility information provided. The actual savings may vary from these estimates due to a variety of factors. The figures used for the cost of recommended upgrades are "opinions of probable cost" and are intended to be used for feasibility purposes only. The recommended measures should proceed to detailed design and further re-evaluation followed by competitive bidding per the Massachusetts Procurement Guidelines. The resulting responses to the bid should be used for budget approval purposes. For more information see: *Office of the Inspector General, Municipal, County, District, and Local Authority Procurement of Supplies, Services, and Real Property, Publication No. CR-1520-170-200-09/06-IGO.*

3. ENERGY PROCUREMENT

Municipalities can derive large savings by employing a few energy procurement strategies:

1) Electricity: Municipalities should consider getting their electricity supply from a licensed electricity supplier to take advantage of potentially lower pricing.

A list of licensed suppliers can be found at the Dept. of Public Utilities Commission website:
http://db.state.ma.us/dpu/qorders/frmElectricitySuppliers.asp

2) Real-time Pricing: The savings from a variable priced offering can be great because the customer assumes the risk of price fluctuations. It is important for customers to understand the risk and potential savings of a real-time index product as compared to a fixed price contract by looking carefully at electricity usage during peak price periods and comparing those trends to the elements of the variable priced offerings. In the event that customer usage tends to be during off-peak periods, large savings can be derived. Suppliers should be asked if they have a real-time rate and be requested to give an estimate for what a customer would have paid in the last year; the calculation is based on the customer's specific usage data, the supplier's charge (in $/kWh) for such a product, and other charges that may apply.

The Town of Shutesbury could consider real time pricing, although this will likely be of limited to no benefit since most of its usage is at higher demand periods. Much of the usage is at the school and town hall, and coincides with higher real time pricing.

3) Aggregation: It is recommended for municipal offices to aggregate as many electric and gas accounts as possible when going out to bid for energy procurement contracts. In some cases, municipalities have benefited even more by aggregating with bordering municipalities.

Most, but not all, of the buildings have been combined and bid to an alternative supplier for electric for a five year term. The DPW garage was inadvertently not included in this bid (or was included, but the account was never switched over from National Grid Basic Service. This site should be switched over to the less costly alternative supply, if possible; or included in the next bid which is due in the next two years.

The Town of Shutesbury participates in the FRGOC competitive bid for oil. This practice should be continued for as long as it provides for competitive pricing for the town.

4. DEMAND RESPONSE

The Town of Shutesbury does not appear to be a good candidate, at this time, for enrolling in the ISO New England Demand Response Program. This program pays customers for reducing their demand by at least 100 kW when called upon. The primary method of doing this is distributed generation, such as running an emergency generator.

Upon notification, a participating site would disconnect from the grid and operate off of their emergency generators. This typically would happen in the summer months during periods of high cooling demand (often 10AM – 8 PM).

The Town of Shutesbury has no sizable generators at any of their locations. The only site that has a sizable demand is the school with average demand of 62 kW and peak of 69 kW. At this time this is too small to participate in the program. In the future the limits for participation may be reduced. If the school installed a generator large enough to run the entire school (or the critical portions of the school needed for summer operation); then it could consider participating in this program. The school is considering an emergency generator in light of the recent winter ice storm. This project should consider both summer and winter operational needs when determining the emergency power circuits and system sizing. A cost benefit analysis can be run to determine if the added circuits and capacity to run summer operating scenarios will be justified by participation in a future demand response program.

The appropriate town representative should contact the Department of Energy Resources for further assistance on this opportunity.

5. FORWARD CAPACITY PAYMENTS

The ISO New England Forward Capacity Market (FCM) program pays customers for reducing their demand by at least 100 kW during performance hours. The Town of Shutesbury is not a viable candidate for enrollment since aggregated demand level does not even reach 100 kW. It is possible that in the future the program requirements will be reduced.

6. CLEAN ENERGY OPPORTUNITIES

An initial renewable energy assessment with regard to hydroelectric, solar photovoltaics (PV), solar hot water, wind, and biomass was performed for each of the detailed audit sites; see each audit report for a complete analysis of each recommendation and for a full description of the programs available in Massachusetts.

The conclusions from these assessments:

- The Town Hall has potential for a small wind installation. A 10 kW wind turbine was modeled; it had poor financials. A 100 kW wind turbine was modeled and had better financial returns; however, the property setbacks at the site may not allow a turbine of this size. Alternative sites north of the center of town should be considered for a wind turbine of 100-250 kW capacity, which would potentially produce enough electrical power for all five municipal buildings.

- The DPW Garage has potential for a 9 kW solar PV installation. This would produce enough electricity to offset all of the annual electrical usage at the Garage. This system is not large enough to be considered for third party solar development. The town has over $16,000 in its Clean Energy Choice Fund and is expected to reach approximately $20,000 by the end of the program. Combined with MTC funding this will pay for nearly 3/4 of the installation of this project. The remaining $21,300 investment is project to a 12.5 year payback.

- The Shutesbury Elementary School has the potential for a biomass boiler, but at this time it is not economical due to high biomass costs and relatively low oil costs.

- The Town Hall has potential for a wood pellet stove. This is recommended for future consideration once pellet prices moderate.

7. DPW GARAGE – INSPECTION AUDIT

The DPW Garage is located at 59 Leverett Road in Shutesbury, Massachusetts and was audited as part of the Department of Energy Resources Energy Audit Program. The building did not warrant a detailed audit with a feasibility study because there were limited opportunities for energy efficient measures at this site.

The DPW Garage was built in 1972 and is approximately 2240 square feet. It has a direct-fired oil heater. The building uses approximately 2200 gallons of oil per heating season and 13,000 kWh per year of electricity. The winter electrical usage is nearly triple the non-heating season usage. This is likely due to more active use of the building during plowing season and the use of block heaters for the trucks; but a portion is also due to the use of electric space heater(s). The following energy prices were used in this analysis to determine project economics: $2.40 per gallon - oil, $0.17 per kWh – electric.

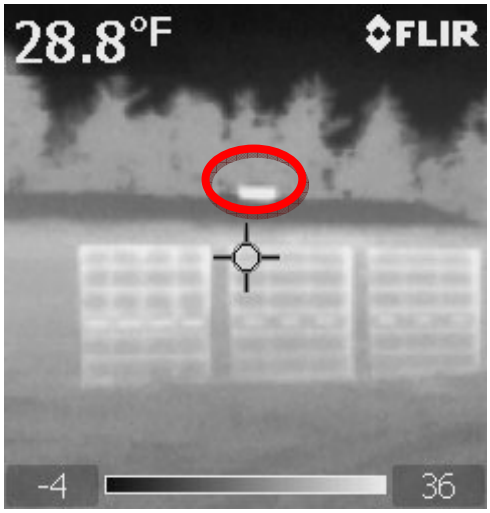
Based on the inspection, there are a few minor upgrades and recommendations for consideration at this time:

1. Occupancy sensors should be installed in the parking garage behind the main building and the new storage room. The sensors would turn the lights off when there is no activity in these spaces. If the lights are off an average of 3 hours/day the estimated energy savings is 612 kWh resulting in an annual savings of $104. The estimated cost of the measure is $227 yielding a simple payback of 2 years. *Note: Sensors would not work in the main garage area because of the destratification fans.*

2. The old refrigerator uses a total of 2400 kWh per year. It should be replaced with a 15 cubic foot Energy Star rated refrigerator that uses 363 kWh per year. The estimated energy savings is 2037 kWh per year resulting in an annual savings of $346. The estimated cost of the measure is $732 yielding a simple payback of 2.3 years.

3. An electric space heater is used at times in the office area. The heater should be replaced with an electric floor mat which uses only 100 – 120 watts. The mat should be plugged into an outlet occupancy sensor to turn the unit off when the desk is not being used. The estimated energy savings is 728 kWh/year resulting in an annual savings of $123. The estimated cost of measure is $149 yielding a simple payback of just over 1 year.

4. The electric block heaters in the trucks are used to keep the diesel engines warm so they will start in cold weather. Their use should be optimized so that they are only plugged in when the temperature demands it; also they should not be activated if there are no immediate plans for using the trucks (i.e. the block heaters may be left off over a weekend if this is no snow forecast).



5. A programmable thermostat should be installed and set to turn the furnace back to 40-45 degrees during unoccupied periods. The estimated energy savings is up to 500 gallons of oil per year resulting in an annual savings of $1,200. The estimated cost of the measure is $134 yielding a simple payback of 0.1 years.

6. The opening along the peak of the roof allows large amounts of heat to escape the building (see infrared photo at right – white "cupola" circled in red is very warm). The gap should be blocked and sealed, and an exhaust fan should be installed to provide ventilation when needed. The fan would have closing louvers and would be operated by a manual switch. The estimated cost of this measure is $650.

7. The two destratification fans should be replaced with larger commercial grade fans and operated at a higher speed in order to circulate the warm air down to the ground level more effectively. The estimated cost of this measure is $600.

Items 6 and 7 will each provide small improvements in heating efficiency; individually, these measures are too small to warrant comprehensive modeling for estimating project economics; however, it is reasonable to assume a combined reduction of 10% on oil usage a savings. When combined with the projected savings from Item 5, the oil usage at the garage is projected to be reduced by as much as 670 gallons per year or roughly 1/4 of the current usage. Items 1, 2 & 3 are estimated to reduce the annual electrical consumption by 26%.

The garage has enough unshaded roof area for a potential solar photovoltaics installation of up to 9 kW. A system this size is estimated to produce approximately 10 MWh per year which would nearly equal the estimated post-conservation electrical usage at the site. This project is estimated at $80,000 with a potential rebate of $38,700, or roughly half of the project cost. The town has over $16,000 in its Clean Energy Choice Funds and this is estimated to grow to $20,000 by the end of the program. The remaining $21,300 would need to be appropriated from the town; this would have a simple payback of approximately 12.5 years at an assumed average rate of $0.17 per kWh. A system of this size would be too small for third party solar (see detailed report for either the Town Hall or the Elementary School for a description of third party solar). *A structural evaluation would need to be performed to confirm the additional load capacity of the structure; this critical initial task precedes detailed design for a PV project.*

8. LIBRARY – INSPECTION AUDIT

The M. N. Spear Memorial Library is located at 10 Cooleyville Road, in Shutesbury and was audited as part of the Department of Energy Resources Energy Audit Program. The building did not warrant a detailed audit with a feasibility study because there were limited opportunities for energy efficient measures at this fairly small site.

The library was built in 1901 and is approximately 1000 square feet. It has a small propane direct-fired heater for the main library and electric heat in the bathroom. The building uses approximately 350 gallons of propane per heating season and 6200 kWh per year of electricity. The winter electrical usage is nearly double the non-heating season usage due to the use of electric heat. The following energy prices were used in this analysis to determine project economics: $2.30 per gallon - propane, $0.17 per kWh – electric.

Based on the inspection, there are a few minor upgrades and recommendations for consideration at this time:

1. A 1500 watt electric space heater is used by the staff to keep warm while working at the circulation desk. This should be replaced with an electric floor mat which uses only 100 – 120 watts. The mat should be plugged into an outlet occupancy sensor to turn the unit off when the desk is not being used. The estimated energy savings is 728 kWh/year resulting in an annual savings of $123. The estimated cost of measure is $149 yielding a simple payback of just over 1 year.

2. The electric baseboard heater in the restroom should be controlled by a 7-day programmable thermostat. The heater could then be on when the library is open and set back when the library is closed. This would ensure that the restroom is heated only when the building is occupied and is not heated while the library is not open. The estimated energy savings is 450 kWh/year resulting in an annual savings of $76. The estimated cost of measure is $149 yielding a simple payback of 2 years.

3. The main library room has a programmable thermostat. At the time of the audit the time and day settings were incorrect and the thermostat was blocked by a display. The settings on the thermostats should be correctly programmed to match the hours of occupancy and checked at the beginning of each heating season. In order for the thermostat to accurately read the room temperature it requires good air circulation and should not be covered; therefore the display should be relocated.

4. The front door and attic hatch should be weather-stripped and the attic hatch should be insulated with at least 2" of foam board. The estimated cost of the materials for these measures is $20 and could be installed by a town maintenance employee.

5. The basement ceiling insulation is installed upside down and in several areas it is falling down (see photo). The side of the insulation with the kraft paper should be toward the warm side. This insulation could be reinstalled in a day or less by a town maintenance employee, or a contractor. Another more costly alternative would be to remove it and replace it with foil-faced double bubble wrap insulation.

Items 3, 4 and 5 will each provide small improvements in heating efficiency. The measures are too small to warrant comprehensive modeling for estimating project economics; however, it is reasonable to assume a combined reduction of at least 10% on propane usage; a savings of approximately $80 per year. Items 1 & 2 are estimated to reduce the annual electrical consumption by 19%.

9. FIRE STATION – INSPECTION AUDIT

The Fire Station is located at 42 Leverett Road, in Shutesbury, and was audited part of the Department of Energy Resources Energy Audit Program. The building did not warrant a detailed audit with a feasibility study because there were limited opportunities for energy efficient measures at this site.

The firehouse has an addition that was built in 1979 bringing the total building to approximately 4700 square feet. It has an oil-fired furnace. The building uses approximately 1500 gallons of oil per heating season and 12,400 kWh per year of electricity. The following energy prices were used in this analysis to determine project economics: $2.40 per gallon - oil, $0.17 per kWh – electric.

Based on the inspection, there are a few minor upgrades and recommendations for consideration at this time:

1. The fifteen - 2 lamp, T12, 4 foot fluorescent fixtures should be upgraded with T8 lamps and electronic ballasts. The estimated energy savings is 1404 kWh/year resulting in an annual savings of $240. The estimated cost of measure is $950 yielding a simple payback of 4 years.

2. Occupancy sensors should be installed in the office and main room to turn the lights off when there is no activity in these spaces. If the sensors turn the lights off an average of 3 hours per day the estimated energy savings is 221 kWh resulting in an annual savings of $38. The estimated cost of the measure is $227 yielding a simple payback of 6 years.

3. Two of the old refrigerators use a total of 1670 kWh per year. They could be combined and replaced with one 15 cubic foot Energy Star-Rated refrigerator that uses 363 kWh per year. The estimated energy savings is 1307 kWh per year resulting in an annual savings of $222. The estimated cost of the measure is $732 yielding a simple payback of 3.3 years.

4. A seven day programmable thermostat should be installed. The estimated energy savings is 96 gallons of oil per year resulting in an annual savings of $230. The estimated cost of the measure is $134 yielding a simple payback of 0.6 years.

5. The oil-fired furnace has a tested efficiency of 69.3%. The oil burner should be replaced and the rest of the furnace serviced. The estimated energy savings are 237 gallons of oil per year resulting in an annual savings of $569. The estimated cost of the measure is $1,600 yielding a simple payback of 2.8 years.

6. The attic access on the second floor is leaky and should be replaced with an insulation board (at least 2 inches thick) and weather stripped wood panel (plywood, OSB, etc) attached to the slope with screws. The estimated cost of the materials for this measure is $40.

These items combine for a reduction in usage of 23% for electricity and 22% for oil.