Town of Carver, Massachusetts
Energy Reduction Plan

Prepared by the Southeastern Regional Planning and Economic Development District (SRPEDD) with support from the Town of Carver

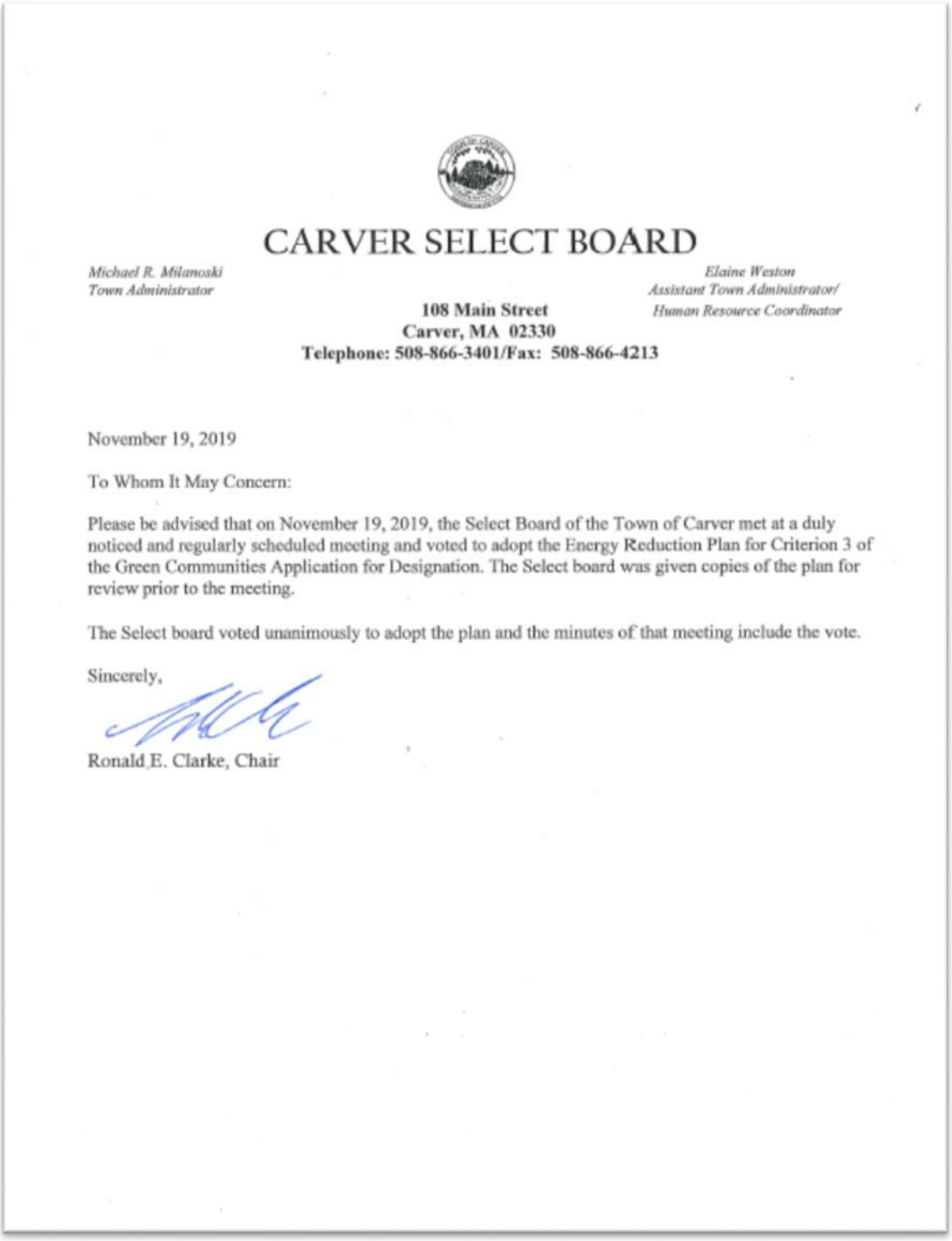
In Fulfillment of the
Massachusetts Green Communities Grant Program
Criterion #3

November 2019

Table of Contents

I. Purpose and Acknowledgements

A. Letter from the General Government Verifying Adoption of the Energy Reduction Plan



CARVER SELECT BOARD

Michael R. Milanoski
Town Administrator

Elaine Weston
Assistant Town Administrator/
Human Resource Coordinator

108 Main Street
Carver, MA 02330
Telephone: 508-866-3401/Fax: 508-866-4213

November 19, 2019

To Whom It May Concern:

Please be advised that on November 19, 2019, the Select Board of the Town of Carver met at a duly noticed and regularly scheduled meeting and voted to adopt the Energy Reduction Plan for Criterion 3 of the Green Communities Application for Designation. The Select board was given copies of the plan for review prior to the meeting.

The Select board voted unanimously to adopt the plan and the minutes of that meeting include the vote.

Sincerely,

Ronald E. Clarke, Chair

B. Letter from the School District Verifying Adoption/Approval of the Energy Reduction Plan

Scott E. Knief
Superintendent of Schools
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Carver Public Schools

3 Carver Square Boulevard
Carver, Massachusetts 02330-1200

November 21, 2019

To Whom It May Concern:

Please be advised that the town/city/regional school district adopts the Energy Reduction Plan as part of the city/town's Green Communities Application for Designation.

Sincerely,

Scott E. Knief
School Superintendent

C. List of Contributors

The collaborative efforts of Carver Town Administrator Michael Milanoski, Assistant Town Administrator/Human Resources Coordinator Elaine Weston, Operations and Maintenance Director David Siedentopf, Operations and Maintenance Assistant Director John Woods, Select Board Chairman Ronald E. Clarke, and Carver Public Schools Superintendent Scott Knief, as well as MA Department of Energy Resources Green Community Regional Coordinator Lisa Sullivan were all vital in the production this Plan.

Much of the information in this Plan was derived from energy audits performed by RISE Engineering, led by Frank Davey. Additional technical assistance was provided by the Southeastern Regional Planning and Economic Development District (SRPEDD), the author of this Plan.

II. Executive Summary

A. Narrative Summary of the Town

The Town of Carver is located in southeastern Massachusetts in southern Plymouth County. It is located 40 miles southeast of Boston and 39 miles east of Providence, Rhode Island. The town has an approximate land area of 39.7 square miles and is bordered by Plympton and Kingston on the north; Plymouth on the east; Wareham on the south; and Middleborough on the west. According to the 2010 U.S. Census, Carver had a population of 11,509 having experienced a 3.1% increase in population since 2000.

Carver was originally a part of Plympton, but was incorporated as its own community in 1790, with the primary reason being that many of the residents lived too far away to attend church in Plympton. In its earliest years, Carver was an agricultural community, but by the early 1730s the town became known for the iron ore that could be dug from its swampland and bogs and used to make cooking tools. As the market for iron ore declined in the latter part of the 19th century, Carver identified cranberry farming as a new use for the bogs in town. The agriculture industry flourished with the production of cranberries and by the 1940s, Carver produced more cranberries than any town in the world. While the town is no longer the world's largest producer of cranberries, the cranberry industry is still an important part of the town.

Today, Carver is an attractive suburban commuter community, due to its scenic rural environment and accessibility to the larger southeastern Massachusetts region via the east-west Route 44, the north-south Route 58, and Interstate 495, which is located just south of town.

B. Summary of Municipal Energy Uses

- Total Number of Municipal Buildings: 16
- Total Number of Municipal Vehicles: 103
- Total Number of Street Lights: 573
- Total Number of Traffic Lights: 11
- Water & Sewer: 3 drinking water pumping stations

Table 1: Municipal Energy Use Summary

	Number	Ownership
Buildings	**16**	
Oil Heat	3	Municipality
Natural Gas Heat	9	Municipality
Propane Heat	4	Municipality
Biomass Heat	0	
Electricity	0	
Vehicles	**103**	
Non-Exempt	4	Municipality
Exempt	99	Municipality
Street Lights	573	Municipality
Traffic Lights	11	Municipality
Water & Sewer	**3**	
Drinking Water Treatment Plant	0	
Drinking Water Pumping Station	3	
Wastewater Treatment Plant	0	
Wastewater Pumping Station	0	

C. Summary of Energy Use Baseline and Plans for Reductions

This Energy Reduction Plan commits Carver to reduce energy use in municipal facilities by at least 20% compared to Fiscal Year 2019 over five years. In the baseline year, the town used 42,435 MMBTUs of energy, which means the town must reduce usage by at least 8,487 MMBTUs over the following five-year period.

Figure 1: Municipal Energy Use Baseline Dashboard from MEI (FY2019)

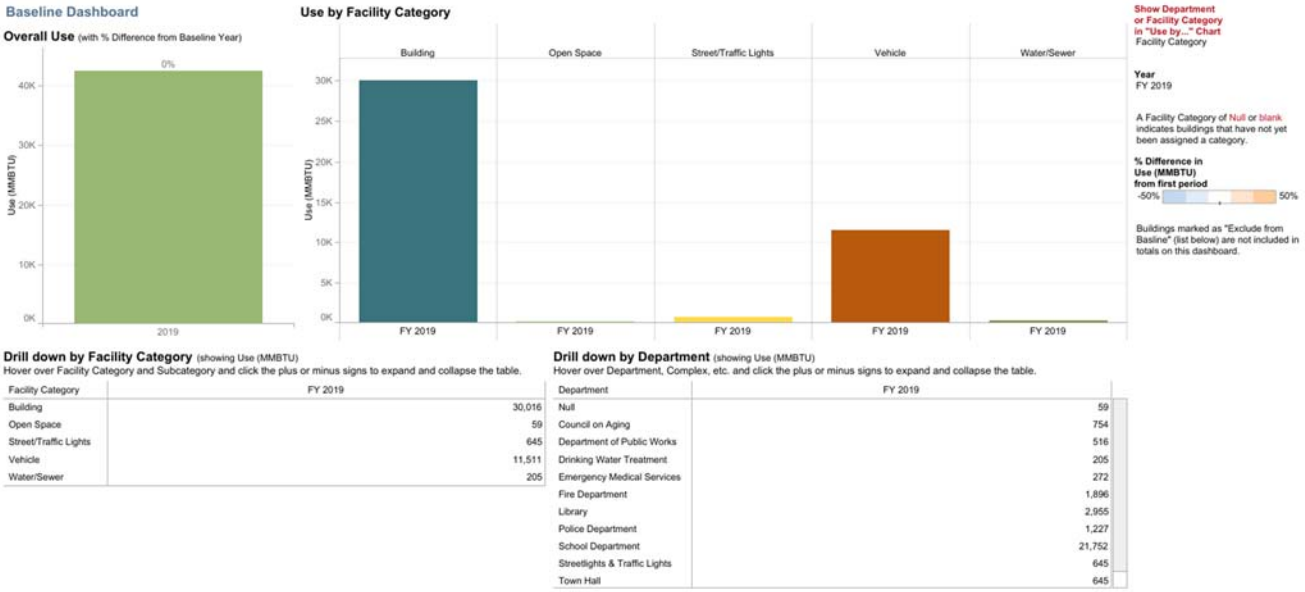


Table 2: Summary of Municipal Energy Use and Reductions

Facility Category	MMBTU Used in Baseline Year	% of Total MMBtu Baseline Energy Consumption	Projected Planned MMBtu Savings	Savings as % of Total MMBtu Baseline Energy Consumption
Buildings	30,016	70.7%	6,385	15.0%
Vehicles	11,511	27.1%	0	0.0%
Street/Traffic Lights	645	1.5%	0	0.0%
Open Space	58	0.1%	0	0.0%
Water & Sewer	205	0.5%	0	0.0%
Total	**42,435**	**100%**	**6,385**	**15.0%**

III. Energy Use Baseline Inventory

A. Identification of the Inventory Tool Used: The Town of Carver used the Department of Energy Resources (DOER) MassEnergyInsight (MEI) web-based energy inventory and analysis tool.

B. Identification of the Baseline Year: Fiscal Year (FY) 2019 will serve as the baseline year. FY2019 ran from July 1, 2018 to June 30, 2019. This will give the Town until June 30, 2024 (FY2020 - FY2024) to reach its 20% energy reduction goal.

C. Municipal Energy Consumption for the Baseline Year (FY2019): In the baseline year, the town used 42,435 MMBTUs of energy. Tables 3A and 3B presents energy use for each municipal facility in native fuel units and MMBTUs.

- Buildings: Carver's 16 buildings used 30,016 MMBTUs, approximately 70.7% of Carver's total municipal energy use. The buildings with the largest energy use were Carver Middle High School (13,287 MMBTUs) and Carver Elementary School (7,679 MMBTUs), as shown in Figure 2.

- Street/Traffic Lights: There are 573 streetlights and 11 traffic lights in Carver. These lights consumed 645 MMBTUs, or 1.5% of the Town's energy use.

- Vehicles: Carver's 103 municipal vehicles used 27.1% of the baseline total, or 11,511 MMBTUs.

- Open Space: Carver's open space facilities consumed 58 MMBTUs, or 0.1% of the town's energy use.

- Water & Sewer: Carver's three drinking water pumping stations consumed 205 MMBTUs or 0.5% of the town's energy.

Table 3A: Municipal Energy Consumption for Baseline Year FY2019 (Native Fuel Units)

ERP Guidance Table 3a - Municipal Energy Consumption for 2019 (Native Fuel Units)

		2019					
		Electric (kWh)	Gas (therms)	Oil (gallons)	Gasoline (gallons)	Diesel (gallons)	Propane (gallons)
Building	Fire Station #1	180,800	4,175	231		231	
	Police Station	149,280	7,172				
	Emergency Medical Services		1,911	584			
	Town Hall	160,320	975				
	Council on Aging	36,535		4,094			663
	Library	181,640	23,350				
	High/Middle Schools	1,189,472	92,284				
	Carver Square Admin Offices	24,155	2,499				
	School Bus Transport Garage	38,583					3,541
	Fire Station #2	24,661	1,851				
	Fire Station #3	21,960					4,523
	Pond St Salt Shed	2,461					
	DPW Operations & Maint..	36,364					4,214
	Radio Repeater Site/Cell Tower	10,685					62
	Carver Elementary School	585,752	56,802				
	Total	**2,642,668**	**191,019**	**4,909**		**231**	**13,003**
Open Space	Playing Field Lights & Irrigatio..	17,296					
	Total	**17,296**					
Street/Traffic Lights	Streetlights	185,612					
	Traffic Signals	3,316					
	Total	**188,928**					
Vehicle	Vehicles				59,829	29,442	
	Total				**59,829**	**29,442**	
Water/Sewer	North Carver Water District W..						88
	Meadowbrook Way Municipal ..	20,445					0
	North Carver Water District W..	10,388					
	Cranberry Village Water Pump	26,831					
	172 Plymouth Street	40					
	Total	**57,704**					**88**
Grand Total		**2,906,596**	**191,019**	**4,909**	**59,829**	**29,673**	**13,091**

Table 3B: Municipal Energy Consumption for Baseline Year FY2019 (MMBTU)

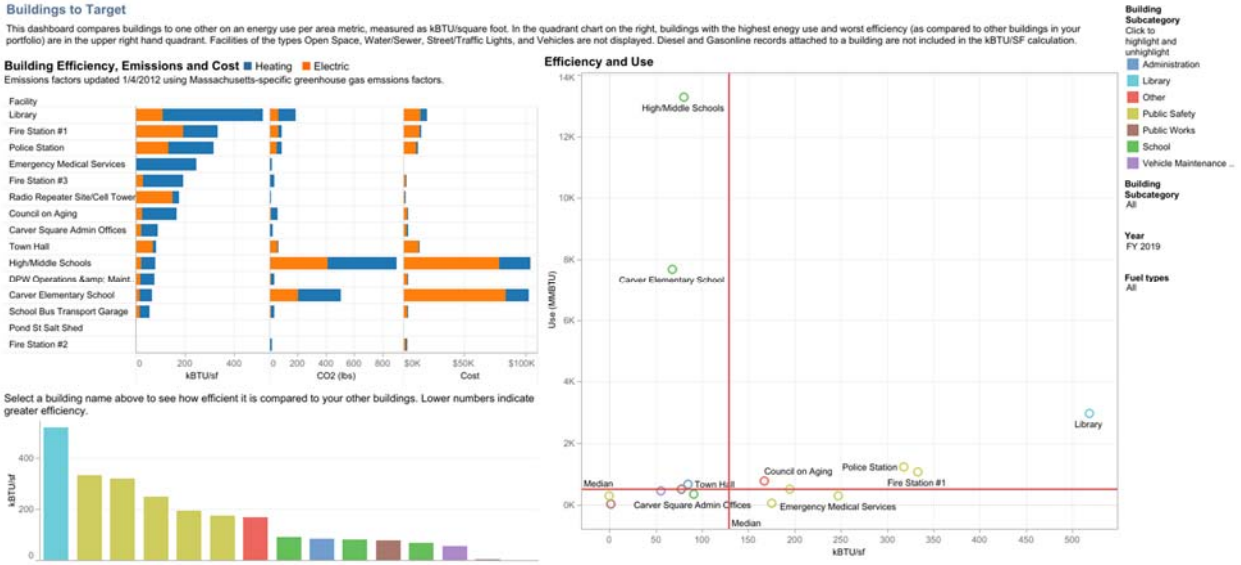
ERP Guidance Table 3b - Municipal Energy Consumption for 2019 (MMBTU)

Please make sure that any data submitted to DOER contains complete Data!

		2019						
		Diesel	Electric	Gas	Gasoline	Oil	Propane	Total
Building	Fire Station #1	32	617	418		32		**1,099**
	Police Station		509	717				**1,227**
	Emergency Medical Services			191		81		**272**
	Town Hall		547	98				**645**
	Council on Aging		125			569	60	**754**
	Library		620	2,335				**2,955**
	High/Middle Schools		4,058	9,228				**13,287**
	Carver Square Admin Offices		82	250				**332**
	School Bus Transport Garage		132				322	**454**
	Fire Station #2		84	185				**269**
	Fire Station #3		75				412	**487**
	Pond St Salt Shed		8					**8**
	DPW Operations & Maint..		124				383	**508**
	Radio Repeater Site/Cell Tower		36				6	**42**
	Carver Elementary School		1,999	5,680				**7,679**
	Total	**32**	**9,017**	**19,102**		**682**	**1,183**	**30,016**
Open Space	Playing Field Lights & Irrigatio..		59					**59**
	Total		**59**					**59**
Street/Traffic Lights	Streetlights		633					**633**
	Traffic Signals		11					**11**
	Total		**645**					**645**
Vehicle	Vehicles	4,092			7,419			**11,511**
	Total	**4,092**			**7,419**			**11,511**
Water/Sewer	North Carver Water District W..						8	**8**
	Meadowbrook Way Municipal ..		70				0	**70**
	North Carver Water District W..		35					**35**
	Cranberry Village Water Pump		92					**92**
	172 Plymouth Street		0					**0**
	Total		**197**				**8**	**205**
Grand Total		**4,125**	**9,917**	**19,102**	**7,419**	**682**	**1,191**	**42,436**

Figure 2: MEIs Buildings to Target Dashboard

In Figure 2 below, the points further to the right have a higher energy use per square foot (i.e. less energy efficient), while the points higher up use more total energy. Carver Middle High School, for example, uses the most energy of any building in Carver.



IV. Energy Reduction Plan

A. Narrative Summary

As shown below, the town has identified energy savings measures to reduce usage from FY2019 by 6,385 MMBTUs or 15.0%. It is important to note that the schedule below can be modified to accommodate the changing goals and priorities of the community and that projects outside the scope of this Energy Reduction Plan may be eligible for grant funding as long as they are in a building that is listed in this Plan.

1. Overview of Plan Goals Years 1-3:

- **Town Hall**

  LED Lighting: Replace the existing inefficient lighting high efficiency LED bulbs. This will result in up to a 90% increase in efficiency.

  Weatherization: Install weather-stripping and appropriate sweeps to 5 exterior doors.

  Condensing Boiler & Indirect DHWH: Currently, there is one (1) standard efficiency hydronic boiler that services the heating load of the entire building. It is recommended that a high efficiency condensing boiler and an indirect fired domestic hot water storage tank be installed.

  EC Motors with VFDs on HHW & CW Circulation Pumps: The two (2) existing heating hot water and chilled water circulator pumps and domestic hot water circulation pump have no drives. It is recommended that the existing motors be replaced with new electronically commutated motors and install VFDs on the circulator pumps to vary the energy consumed based on demand.

  Programmable Thermostat: Replace the manual thermostat with a programmable thermostat, which will allow for the implementation of space heating temperature setback strategies.

- **Operations & Maintenance Garage**

  LED Lighting: Replace the existing inefficient lighting high efficiency LED bulbs. This will result in up to a 90% increase in efficiency.

  Weatherization: The following weatherization measures are recommended:
  - Install weather-stripping and appropriate sweeps to 5 entry doors.
  - Remove the ineffective rubber seals and install Brush weatherstripping to the 8 overhead doors.
  - Install 2” (r-13) rigid insulation to the un-insulated “C” channels around the 8 overhead doors.
  - Install 2” (r-13) rigid insulation over the translucent, corrugated panels on the right side of the garage to reduce heat loss.

  Condensing Units Heaters: Replace the four (4) standard efficiency natural gas fired unit heaters with high efficiency condensing unit heaters.

  Condensing Furnace: Replace the one (1) standard efficiency natural gas fired furnace with a high efficiency condensing furnace to achieve increased efficiency.

- **Fire Station #3**
  LED Lighting: Replace the existing inefficient lighting high efficiency LED bulbs. This will result in up to a 90% increase in efficiency.

  Weatherization: It is recommended that the following weatherization measures be completed:
  - Seal 3,963 sf of attic and 430 sf of knee-wall chases, plumbing and wiring penetrations, access openings and other leakage points to reduce heat loss via thermal by-pass and air infiltration/exfiltration.
  - Create an effective pressure barrier below the existing R-30 fiberglass insulation that is installed in the front and rear attic framing above the suspended ceiling tiles using a rigid fiberglass board.
  - Furnish and install of 1" rigid (r-5) insulation to 430 SF of existing R-13 fiberglass in the front and rear common walls.
  - Seal exposed ducts in the attic to reduce heat loss via thermal by-pass and air infiltration/exfiltration.
  - Furnish and install of R-8 FSK fiberglass insulation to 628 SF of un-insulated ducts in the attic. Also, replacement of up to 24 lf of 8" un-insulated flexible duct with R-8 insulated Flex-duct.
  - Furnish and install material to create an insulated cover behind/above the 4 knee-wall and attic access hatches.
  - Install new weather-stripping and appropriate sweeps to 4 single entry doors.

- **Fire Station #2**
  LED Lighting: Replace the existing inefficient lighting high efficiency LED bulbs. This will result in up to a 90% increase in efficiency.

  Weatherization: The following weatherization measures are recommended:
  - Seal 2,800 sf of chases, plumbing and wiring penetrations, access openings and other leakage points in the open attic and 120 sf of vertical common wall to reduce heat loss via thermal by-pass and air infiltration/exfiltration. Also seal the 1st to 2nd floor transition, 28 lf, above the suspended ceiling tiles.
  - Create an insulated cover over the existing whole house fan that is currently not in use.
  - Furnish and install R-5 rigid fiberglass insulation to 120 SF of existing R-13 fiberglass batt in the vertical common wall.
  - Furnish and install R-24 Class 1 Cellulose insulation to 2,800 SF of existing R-19 (nominal) insulation. (existing insulation R-value will be reduced to R-14 after air sealing).
  - Weather-strip and insulate (R-26) the existing attic access hatch.
  - Insulate 12 lf of ¾" Copper DHW pipes with open cell foam pipe insulation

  Condensing Furnace: Replace the two (2) standard efficiency natural gas fired furnaces with two (2) high efficiency condensing furnaces to achieve increased efficiency.

- **Fire Station #1**
  EC Motor with VFDs on DHW Circulation Pumps: Replace the existing motor with a high efficiency electrically commutated (EC) motor that allows for similar control and energy savings. Replace the existing domestic hot water circulation pump motor with a new electronically commutated motor.

Variable Frequency Drives on HHW Circulator Pumps: Install variable frequency drives (VFDs) on the two (2) existing heating hot water circulator pumps. The power supplied to the pump is varied by the VFD to match the demand, which prevents excess consumption caused by direct on-line operation.

- **School Administration**

  LED Lighting: Replace the existing inefficient lighting high efficiency LED bulbs. This will result in up to a 90% increase in efficiency.

  Weatherization: The following weatherization measures are recommended:
  - Seal 1,003 sf of open attic and 2150 sf of floored attic chases, plumbing and wiring penetrations, access openings and other leakage points to reduce heat loss via thermal by-pass and air infiltration/exfiltration. This includes sealing the front 2 overhangs from inside by removing the suspended ceiling tiles.
  - Seal ducts in the attic to reduce heat loss via thermal by-pass and air infiltration/exfiltration.
  - Furnish and install an insulated and weather-stripped Thera-dome cover to the existing pull-down attic stairs.
  - Install new weather-stripping and appropriate sweeps to 3 single entry doors.
  - Insulate 8 lf of ¾" Copper DHW pipes with open cell foam pipe insulation.

  Programmable Thermostats: Replace the two (2) manual thermostats with two (2) programmable thermostat, which will allow for the implementation of space heating temperature setback strategies.

  Condensing Furnace: Replace the two (2) standard efficiency natural gas fired furnaces with two (2) high efficiency condensing furnaces to achieve increased efficiency.

- **Council on Aging**

  LED Lighting: Replace the existing inefficient lighting high efficiency LED bulbs. This will result in up to a 90% increase in efficiency.

  Weatherization: The following weatherization measures are recommended:

  Upper Attic, Original Section
  - Seal 684 sf of attic chases, plumbing and wiring penetrations, access openings and other leakage points to reduce heat loss via thermal by-pass and air infiltration/exfiltration.
  - Furnish and install R-19 Class 1 Cellulose insulation to 532 SF of un-insulated slopes. Cavities are to be filled to capacity from the main attic.
  - Furnish and install R-24 Class 1 Cellulose insulation to 684 SF of existing R19 (nominal) insulation. (existing insulation R-value will be reduced to R-14 after air sealing).
  - Furnish and install a new plywood attic access hatch cover to replace the existing cover that is too thin. The new hatch cover will be weather-stripped and insulated with rigid insulation board (R-26).
  - Furnish and install R-30 Class 1 Cellulose insulation to 70 SF of un-insulated porch overhang areas. Cavities are to be filled to capacity from 2 closets in the front by drilling into the floor and installing cellulose. The 2" holes will be plugged with wood plugs.

  Lower Rear, Behind Original Section

- Seal 1,212 sf of attic and 260 sf of crawlspace chases, plumbing and wiring penetrations, access openings and other leakage points to reduce heat loss via thermal by-pass and air infiltration/exfiltration.
- Furnish and install R-13 fiberglass and 1" rigid (r-5) insulation to 111 SF of uninsulated common wall in the rear attic.
- Furnish and install R-38 Class 1 Cellulose insulation to 852 SF of un-insulated attic flat.
- Furnish and install R-13 Class 1 Cellulose insulation to 360 SF of existing R-30 fiberglass insulation.
- Weather-strip and insulate (R-26) one existing attic access hatch in hall closet. Create a temporary ceiling access in the closet of the left room.

Right Section, Cafeteria/Nutrition Center

- There is currently no pressure barrier below the existing R-19 blown fiberglass insulation that is installed in the right attic framing above the suspended ceiling tiles. To create an effective pressure barrier, the existing insulation must be removed and a rigid fiberglass board is installed and sealed in place using one-part foam. The original insulation is then re-installed on the new pressure barrier.
- Seal 1,500 sf of basement chases, plumbing and wiring penetrations, access openings and other leakage points to reduce heat loss via thermal by-pass and air infiltration/exfiltration.
- Furnish and install R-24 Class 1 Cellulose insulation to 450 SF of existing R19 (nominal) insulation. (existing insulation R-value will be reduced to R-14 after air sealing).
- Install a removable, weather-stripped, pull-down stair cover (therma-dome) over the existing pull-down stairs.
- Furnish and install R-30 fiberglass insulation to 450 SF of uninsulated 2 x 10 joists in the basement ceiling.
- Furnish and install R-13 rigid insulation board to 450 SF of uninsulated basement ceiling between the random spaced timber joists.

Other Measures

- Seal exposed ducts in the basement to reduce heat loss via thermal by-pass and air infiltration/exfiltration. High quality mastics and other materials will be used to seal sources of air leakage. Some ducts have existing deteriorated insulation. This will be removed to allow sealing and new insulation to be installed.
- Install new weather-stripping and appropriate sweeps to 7 single entry doors.
- Furnish and install 46 white, aluminum, storm windows to the wood openings to replace the existing deteriorated storm windows. The new storm windows will be caulked for a weather tight seal.

EC Motors with VFDs on HHW & CW Circulation Pumps: Replace the existing motors with new electronically commutated (EC) motors and install VFDs on the heating hot water and chilled water circulator pumps to vary the energy consumed based on demand.

Pipe Insulation: Insulate 92 lf of existing exposed heating pipes using ASJ covered fiberglass insulation with 30 PVC fitting covers. Insulate 33 lf of DHW pipes with open cell foam pipe insulation.

Duct Insulation: Furnish and install R-8 FSK fiberglass insulation to 250 SF of un-insulated ducts in the attic.

Programmable Thermostats: Replace the six (6) manual thermostats with six (6) programmable thermostat, which will allow for the implementation of space heating temperature setback strategies.

2. Overview of Plan Goals Years 4-5:

- **Library**

  LED Lighting: Replace the existing inefficient lighting high efficiency LED bulbs. This will result in up to a 90% increase in efficiency.

  Weatherization: The following weatherization measures are recommended:
  - An area in a small room to the right of the building, as viewed from Meadowbrook Way, has had issues with air infiltration. Some pipes have frozen in the past. The following is recommended: Create, up to, 3 temporary accesses through the drywall to access the wall cavity. The original drywall will be re-installed, tape and joint compound applied, and left with a relatively smooth finish. Any sanding, additional coats of compound or painting are not included; Install rigid insulation board at the top of the wall where the roof slope meets the wall, and under the existing ventilation chutes. The rigid insulation will be sealed in place using one-part foam; Install 1" rigid insulation board to the exterior wall to create an air barrier.
  - Furnish and install R-38 fiberglass batt insulation to, up to, 50 SF of un-insulated slopes.
  - Furnish and install R-13 fiberglass to 80 SF of un-insulated exterior wall.
  - Insulate 12 lf of 4" exposed heating pipes using ASJ covered fiberglass insulation with 8 tee's and 2 end caps.
  - Install new weather-stripping and appropriate sweeps to 6 single entry doors.

  Condensing Boiler: Replace the two (2) standard efficiency hydronic boilers with two (2) high efficiency condensing boilers to achieve increased efficiency.

  Condensing Water Heater: Replace the standard efficiency gas fired storage type water heater with a high efficiency water heater to achieve high thermal efficiencies.

  EC Motors with VFD on DHHW & CW Circulation Pumps: Replace the existing motors with new electronically commutated (EC) motors and install VFDs on the heating hot water and chilled water circulator pumps to vary the energy consumed based on demand.

  Variable Frequency Drives on Circulator Pumps: Install variable frequency drives (VFDs) on the two (2) existing circulator pumps. The power supplied to the pump is varied by the VFD to match the demand, which prevents excess consumption caused by direct on-line operation.

  Retrocommissioning: Retrocommissioning provides an understanding of how closely a building comes to operating as intended. It helps to identify improper equipment performance, what

equipment or systems need to be replaced, opportunities for saving energy and money, and strategies for improving performance of the various building systems.[1]

- **School Bus Garage**
  LED Lighting: Replace the existing inefficient lighting high efficiency LED bulbs. This will result in up to a 90% increase in efficiency.

  Weatherization: The following weatherization measures are recommended:
  - Install weather-stripping and appropriate sweeps to 5 entry doors.
  - Remove the ineffective rubber seals and install Brush weather-stripping to the 5 overhead doors.

  Condensing Unit Heaters: Replace the six (6) standard efficiency natural gas fired unit heaters with high efficiency condensing unit heaters.

- **Middle/High School**
  LED Lighting: Replace the existing inefficient lighting high efficiency LED bulbs. This will result in up to a 90% increase in efficiency. LED lighting upgrades are recommended in the following areas: 2nd Floor Classrooms; 2nd Floor Common Areas; Library, Gym & Cafeterias; High School and Middle School Locker Room Areas; 1st Floor Classrooms; 1st Floor Common Areas; and Exterior Lights.

  Weatherization: The following weatherization measures are recommended:
  Middle/High School Building
  - There are gaps causing air leakage at the wall to roof connection around the perimeter of the school in some sections.
    - Seal the 2 “nominal gaps where the roof deck connects with the perimeter wall. LF=1,200.
    - Add 1” rigid fiberglass to 300 sf of area in the offices where the drywall was left short exposing fiberglass and the exterior walls.
    - Block and seal the 2’ cavity at the middle school and high school main entrances that is exposed to the exterior canopy using rigid insulation board (R-13). 70 sf
  - There are 11 exterior doors that would benefit from new/ replacement weather-stripping.
    - Replace the damaged sweeps on 7 single steel doors.
    - Replace the astragal pile weather-stripping and install new sweeps on 2 double aluminum doors.
    - Replace the damaged/non-effective weather-stripping with a brush seal on 2 overhead doors.

  Maintenance Building
  - There are gaps causing air leakage at the wall to roof connection around the perimeter of the building.
    - Seal the 2 “nominal gaps where the roof deck connects with the perimeter wall. LF=136

[1] https://www.energystar.gov/sites/default/files/buildings/tools/EPA_BUM_CH5_RetroComm.pdf

- There is 1 exterior entry door and 1 overhead door that would benefit from new/ replacement weather-stripping.
  - Install weather-stripping and add sweep to 1 single steel door.
  - Replace the damaged/ non-effective weather-stripping with a brush seal on 1 overhead door.

Energy Management System: A central energy management system saves energy by allowing for the implementation of control strategies like unoccupied temperature setback, optimal start-stop, direct digital control, etc. It is suggested that the fan-coil units in the classrooms and the boiler be controlled by the proposed EMS.

Walk-In Refrigeration Controls: Installing an electronic controller and electrically commutated motors on the evaporator fans allow for more comprehensive control of the system. The new system will maintain stable temperatures and save energy by controlling the compressors, evaporator fan speed, and defrost heater.

Kitchen Hood Controls and VFD: Install controls to the kitchen hood and install variable frequency drives (VFD) on the existing two (2) 3HP exhaust fans to reduce the time the exhaust fan is running at full load.

EC Motors with VFDs on HHW & CW Circulation Pumps: Replace the existing motors with new electronically commutated (EC) motors and install VFDs on the heating hot water and chilled water circulator pumps to vary the energy consumed based on demand.

Demand Control Ventilation: Demand control ventilation controls the quantity of outside air to an air handling system based on detected CO2 levels. The installed systems monitor the CO2 in the spaces or return air and reduce the outside air use when possible to save energy while meeting indoor air quality standards.

Retrocommissioning: Retrocommissioning provides an understanding of how closely a building comes to operating as intended. It helps to identify improper equipment performance, what equipment or systems need to be replaced, opportunities for saving energy and money, and strategies for improving performance of the various building systems.[2]

- **EMS Building**

LED Lighting: Replace the existing inefficient lighting high efficiency LED bulbs. This will result in up to a 90% increase in efficiency.

Weatherization: The following weatherization measures are recommended:

- Seal 2,117 sf of chases, plumbing and wiring penetrations, access openings and other leakage points in the open and floored attic and common wall areas to reduce heat loss via thermal by-pass and air infiltration/exfiltration.
- Furnish and install R-14 Class 1 Cellulose insulation to 192 SF of existing R-14 (nominal) insulation. Cavities are to be filled to capacity.
- Furnish and install R-5 rigid insulation board to 217 SF of existing R-13 fiberglass insulation.

[2] https://www.energystar.gov/sites/default/files/buildings/tools/EPA_BUM_CH5_RetroComm.pdf

- Furnish and install R-24 Class 1 Cellulose insulation to 1,708 SF of existing R-14 (nominal) insulation.
- Install a removable, weather-stripped, pull-down stair cover (therma-dome) over the existing pull-down stairs.
- Remove the ineffective rubber seals and install Brush weather-stripping to the 2 overhead doors.

- **Building Operator Certification**
  The Town intends to have a staff person attend the Building Operator Certification (BOC) Program. Energy-savings evaluations show that an individual Certified Building Operator (CBO) can reduce energy use by more than one (1) percent of a building's building electricity demand.[3] By certifying operators in building systems efficiency, the town will realize savings in energy use and related costs, improvements in comfort and safety, and may continue to experience these benefits for up to five (5) years following certification (based on program estimates).[4]

[3] Energy Savings for the Building Operator Certification (BOC®) Program. http://www.theboc.info/wp-content/uploads/2017/02/BOC-EnergySavings-FAQ-2.0-web.pdf
[4] 8 Building Operator Certification Program. https://www.theboc.info/certifications/

B. Path to 20% Energy Use Reduction by the end of Fiscal Year 2024

1. Program Management Plan for Implementation, Monitoring, and Oversight

The Town Administrator's Office will be responsible both for oversight of the Energy Reduction Plan and for the implementation of energy conservation measures within the Town. The Town Administrator's Office will also be responsible for the annual reporting requirements to maintain designation and eligibility for annual competitive grant funding.

2. Summary of Energy Audit(s) or Other Sources for Projected Energy Savings

Table 4 details energy conservation measures that reduce overall energy consumption by 6,385 MMBTUs or 15.0% over the next five years. The full Energy Audit performed by RISE Engineering is included as an attachment in Appendix A. In addition to implementing the energy conservation measures identified in Table 4, the town can further reduce their municipal energy use by adopting the following practices:

- Maintain appropriate air pressure in vehicle tires, which can decrease a vehicle's fuel consumption by as much as 4%.
- Use synthetic oil in all vehicles, which can reduce fuel consumption by 2% as well as decrease the number of annual oil changes and associated labor costs.
- Implement a town-wide "no idling" policy for municipal vehicles, which can reduce vehicle fuel consumption by 10%.
- Optimize building operations through better controls and retrocommissioning.

Criterion 3 Step 4: Complete Table 4 - ECMs

Click here to view a sample version of this table

Table 4
Energy Conservation Measures Data

ECMs			Status		Energy Data						Financial Data					Reference Data	
Building/Site Name	Energy Conservation Measure Name	ECM Type (select one from drop-down)	Status (select one from drop-down)	Status Date (Completed with month/year or planned month/year)	Projected Annual Electricity Savings (kWh)	Projected Annual Natural Gas Savings (therms)	Projected Annual Oil Savings (gallons)	Projected Annual Propane Savings (gallons)	Projected Annual Gasoline Savings (gallons)	Projected Annual Diesel Savings (gallons)	Projected Annual Cost Savings ($)	Total Installed Cost ($)	Green Community Grant ($)	Utility Incentives ($)	Net Cost ($)	Funding Source(s) for Net Costs	Source for Projected Savings
Town Hall	LED Lighting Upgrades & Controls	Interior Lighting	Planned	Years 1-3	69,466	0	0	0	0	0	$16,206	$99,654		$17,367	$82,288		RISE Engineering Audit
Town Hall	Insulation & Weatherstripping	Weatherization	Planned	Years 1-3	0	83	0	0	0	0	$108	$892		$0	$892		RISE Engineering Audit
Town Hall	Condensing Boilers & Indirect DHWH	Hot Water	Planned	Years 1-3	0	388	0	0	0	0	$504	$19,000		$1,000	$18,000		RISE Engineering Audit
Town Hall	New EC Motors w/VFDs on HHW and DHW Cic Pumps	Pump/Motor/Drive	Planned	Years 1-3	303	250	0	0	0	0	$396	$5,300		$500	$4,800		RISE Engineering Audit
Town Hall	Programmable Thermostats	Building Control	Planned	Years 1-3	0	23	0	0	0	0	$30	$200		$25	$175		RISE Engineering Audit
Department of Public Works	LED Lighting Upgrades & Controls	Interior Lighting	Planned	Years 1-3	24,111	0	0	0	0	0	$6,286	$35,152		$6,028	$29,124		RISE Engineering Audit
Department of Public Works	Insulation & Weatherstripping	Weatherization	Planned	Years 1-3	0	0	0	135	0	0	$160	$17,376		$0	$17,376		RISE Engineering Audit
Department of Public Works	Condensing Unit Heaters	HVAC	Planned	Years 1-3	0	0	0	473	0	0	$560	$42,500		$0	$42,500		RISE Engineering Audit
Department of Public Works	Condensing Furnace	HVAC	Planned	Years 1-3	0	0	0	119	0	0	$141	$9,000		$0	$9,000		RISE Engineering Audit
Fire Station #3	LED Lighting Upgrades & Controls	Interior Lighting	Planned	Years 1-3	11,011	0	0	0	0	0	$3,083	$19,518		$2,753	$16,765		RISE Engineering Audit
Fire Station #3	Insulation & Weatherstripping	Weatherization	Planned	Years 1-3	0	0	360	0	0	0	$651	$17,038		$0	$17,038		RISE Engineering Audit
Fire Station #2	LED Lighting Upgrades & Controls	Interior Lighting	Planned	Years 1-3	8,334	0	0	0	0	0	$1,544	$9,859		$2,084	$7,776		RISE Engineering Audit
Fire Station #2	Insulation & Weatherstripping	Weatherization	Planned	Years 1-3	0	291	0	0	0	0	$378	$12,461		$0	$12,461		RISE Engineering Audit
Fire Station #2	Condensing Furnaces	HVAC	Planned	Years 1-3	0	306	0	0	0	0	$398	$21,000		$600	$20,400		RISE Engineering Audit
Fire Station #1	New EC Motor w/ VFDs on DHW Circ Pump	Pump/Motor/Drive	Planned	Years 1-3	789	250	0	0	0	0	$471	$1,800		$500	$1,300		RISE Engineering Audit
Fire Station #1	VFDs on Existing HHW Circ Pumps	Pump/Motor/Drive	Planned	Years 1-3	11,659	0	0	0	0	0	$2,160	$7,000		$2,800	$4,200		RISE Engineering Audit
School Administration	LED Lighting Upgrades & Controls	Interior Lighting	Planned	Years 1-3	13,207	0	0	0	0	0	$3,038	$25,864		$3,302	$22,562		RISE Engineering Audit
School Administration	Insulation & Weatherstripping	Weatherization	Planned	Years 1-3	490	300	0	0	0	0	$503	$12,690		$0	$12,690		RISE Engineering Audit
School Administration	Programmable Thermostats	Building Control	Planned	Years 1-3	0	45	0	0	0	0	$59	$400		$50	$350		RISE Engineering Audit
School Administration	Condensing Furnaces	HVAC	Planned	Years 1-3	0	360	0	0	0	0	$468	$24,000		$600	$23,400		RISE Engineering Audit
Council on Aging	LED Lighting Upgrades & Controls	Interior Lighting	Planned	Years 1-3	4,756	0	0	0	0	0	$1,297	$10,873		$1,189	$9,684		RISE Engineering Audit
Council on Aging	Insulation & Weatherstripping	Weatherization	Planned	Years 1-3	0	0	723	0	0	0	$1,306	$52,189		$0	$52,189		RISE Engineering Audit
Council on Aging	New EC Motors w/ VFDs on HHW Circ Pumps	Pump/Motor/Drive	Planned	Years 1-3	668	0	0	0	0	0	$182	$7,000		$0	$7,000		RISE Engineering Audit
Council on Aging	Pipe Insulation	Hot Water	Planned	Years 1-3	0	0	37	0	0	0	$68	$2,000		$0	$2,000		RISE Engineering Audit
Council on Aging	Duct Insulation	Weatherization	Planned	Years 1-3	0	0	468	0	0	0	$845	$8,500		$0	$8,500		RISE Engineering Audit
Council on Aging	Programmable Thermostats	Building Control	Planned	Years 1-3	0	0	97	0	0	0	$176	$1,200		$150	$1,050		RISE Engineering Audit
Public Library	LED Lighting Upgrades & Controls	Interior Lighting	Planned	Years 4-5	62,813	0	0	0	0	0	$14,874	$63,567		$15,703	$47,864		RISE Engineering Audit
Public Library	Insulation & Weatherstripping	Weatherization	Planned	Years 4-5	703	565	0	0	0	0	$901	$4,557		$0	$4,557		RISE Engineering Audit
Public Library	Condensing Boilers	HVAC	Planned	Years 4-5	0	4,784	0	0	0	0	$6,219	$125,000		$8,000	$117,000		RISE Engineering Audit
Public Library	Condensing DHWH	Hot Water	Planned	Years 4-5	0	373	0	0	0	0	$485	$45,000		$1,000	$44,000		RISE Engineering Audit
Public Library	New EC Motors w/ VFDs on DHW Circ Pump	Pump/Motor/Drive	Planned	Years 4-5	469	250	0	0	0	0	$436	$1,800		$500	$1,300		RISE Engineering Audit
Public Library	VFDs on Existing HHW Circ Pumps	Pump/Motor/Drive	Planned	Years 4-5	11,659	0	0	0	0	0	$2,761	$7,000		$2,800	$4,200		RISE Engineering Audit
Public Library	Retrocommissioning	Retrocommission	Planned	Years 4-5	13,623	1,751	0	0	0	0							www.energystar.gov
Maintenance Garage	LED Lighting Upgrades & Controls	Interior Lighting	Planned	Years 4-5	26,155	0	0	0	0	0	$6,819	$29,794		$6,539	$23,255		RISE Engineering Audit
Maintenance Garage	Weatherstripping	Weatherization	Planned	Years 4-5	0	0	0	95	0	0	$122	$5,475		$0	$5,475		RISE Engineering Audit
Maintenance Garage	Condensing Unit Heaters	HVAC	Planned	Years 4-5	0	0	0	622	0	0	$735	$63,750		$0	$63,750		RISE Engineering Audit
Middle/High School	LED Lighting Upgrades & Controls-2nd Floor Classrooms	Interior Lighting	Planned	Years 4-5	36,822	0	0	0	0	0	$5,612	$78,161		$9,206	$68,956		RISE Engineering Audit
Middle/High School	LED Lighting Upgrades & Controls-2nd Floor Common Areas	Interior Lighting	Planned	Years 4-5	24,642	0	0	0	0	0	$3,755	$44,502		$6,161	$38,342		RISE Engineering Audit
Middle/High School	LED Lighting Upgrades & Controls-Library, Gym & Cafeteria	Interior Lighting	Planned	Years 4-5	89,085	0	0	0	0	0	$13,577	$94,009		$22,271	$71,738		RISE Engineering Audit
Middle/High School	LED Lighting Upgrades & Controls-HS & MS Locker Room Areas	Interior Lighting	Planned	Years 4-5	14,632	0	0	0	0	0	$2,230	$46,509		$3,658	$42,851		RISE Engineering Audit
Middle/High School	LED Lighting Upgrades & Controls-1st Floor Classrooms	Interior Lighting	Planned	Years 4-5	48,181	0	0	0	0	0	$7,343	$99,570		$12,045	$87,525		RISE Engineering Audit
Middle/High School	LED Lighting Upgrades & Controls-1st Floor Common Areas	Interior Lighting	Planned	Years 4-5	52,836	0	0	0	0	0	$8,052	$99,625		$13,209	$86,416		RISE Engineering Audit
Middle/High School	LED Lighting Upgrades	Exterior Lighting	Planned	Years 4-5	98,084	0	0	0	0	0	$14,948	$42,885		$24,521	$18,364		RISE Engineering Audit
Middle/High School	Insulation & Weatherstripping	Weatherization	Planned	Years 4-5	0	4,383	0	0	0	0	$5,698	$60,831		$0	$60,831		RISE Engineering Audit
Middle/High School	Energy Management System	Building Control	Planned	Years 4-5	35,684	2,769	0	0	0	0	$9,038	$200,000		$0	$200,000		RISE Engineering Audit
Middle/High School	Walk-in Cooler Refrigeration Controls	Refrigeration	Planned	Years 4-5	1,890	0	0	0	0	0	$288	$2,000		$0	$2,000		RISE Engineering Audit
Middle/High School	Kitchen Hood Controls	HVAC	Planned	Years 4-5	22,150	0	0	0	0	0	$3,376	$15,000		$2,000	$13,000		RISE Engineering Audit
Middle/High School	New EC Motors w/VFDs on HHW and DHW Cic Pumps	Pump/Motor/Drive	Planned	Years 4-5	2,455	250	0	0	0	0	$700	$14,100		$500	$13,600		RISE Engineering Audit
Middle/High School	Demand Control Ventilation	HVAC	Planned	Years 4-5	0	6,000	0	0	0	0	$7,800	$44,000		$12,000	$32,000		RISE Engineering Audit
Middle/High School	Retrocommissioning	Retrocommission	Planned	Years 4-5	89,210	6,921	0	0	0	0							www.energystar.gov/
EMS Building	LED Lighting Upgrades & Controls	Interior Lighting	Planned	Years 4-5	10,271	0	0	0	0	0	$2,427	$16,559		$2,568	$13,991		RISE Engineering Audit
EMS Building	Weatherstripping	Weatherization	Planned	Years 4-5	0	225	0	0	0	0	$293	$10,646		$0	$10,646		RISE Engineering Audit
All Builidngs	Building Operator	Behav & Training	Planned	Years 4-5	26,297	1,912	49	0	0	0							www.theboc.info
				TOTAL Projected Savi	**812,455**	**32,479**	**1,734**	**1,444**	**0**	**0**	**159,507**	**1,676,806**	**0**	**181,629**	**1,495,181**		
		TOTAL MMBtu SAVINGS	**6,392**		**2772.09646**	**3247.9**	**241.026**	**131.404**	**0**	**0**							

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

1. Municipal Buildings (including schools)

To better strategize for the long-term maintenance and management of municipal buildings, Carver will work with internal schools and town staff as well as outside consultants, when necessary, to assess and document the condition of major municipal buildings on an annual basis. In addition to exposing continuing opportunities for energy use reductions, this effort will provide the Town with a clear, long-term asset management strategy for the effective budgeting and maintenance of buildings.

2. Vehicles (including schools)

The Fuel-Efficient Vehicle policy will have become engrained within municipal purchasing practices after five years, and the Town will seek to explore even more efficient policies and tracking systems to enable more efficiency.

3. Perpetuating Energy Efficiency

Ongoing dialogue with Town and School staff can tap into the knowledge of the employees who use and maintain the buildings every day. It can empower building staff to develop a detailed repair and management schedule and collect data on problems and inefficiencies that may be missed by traditional third party audits. The use of a web-based application system like SeeClickFix creates additional real-time opportunities for efficiencies in operation and maintenance.

The Town of Carver will grow its capacity to retrofit and build more efficient facilities, purchase more efficient vehicles, and illuminate the Town through more efficient lighting throughout the 5-year period. These practices will become more engrained in the culture of the Town and will provide opportunities to instill the ethos into additional policies and programs for more dedicated long-term funding streams and strategies.

V: Appendix A: Building Energy Audits – RISE Engineering

(Please see attached report)

TOWN HALL

Prepared for the Town of Carver

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the Town Hall at 108 Main St, Carver, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Project Location and Contact Information

Town Hall
108 Main St.
Carver, MA 02330

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6181 SMurphy@RISEengineering.com
Sean Simpson	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6190 SSimpson@RISEengineering.com

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid and Eversource to help defer the cost of implementation.

The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighing	69,466	0	$ 11,809.22	$ 99,654.00	$ 17,367.00	7.0
2	Weatherization	0	83	$ 91.30	$ 892.00	$ -	9.8
3	Condensing Boilers & Indirect DHWH	0	388	$ 426.80	$ 19,000.00	$ 1,000.00	42.2
4	New EC Motors w/ VFDs on HHW and DHW Cic Pumps	303	250	$ 326.51	$ 5,300.00	$ 500.00	14.7
5	Programmable Thermostats	0	23	$ 25.30	$ 200.00	$ 25.00	6.9
	Totals	**69,769**	**744**	**$ 12,679.13**	**$ 125,046.00**	**$ 18,892.00**	**8.4**

Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: LED Lighting

Standard bulbs emit light in all directions, requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency. It is suggested to replace existing, inefficient lighting with high efficiency LED bulbs. Please see attached proposal for more information.

Summary of Savings and Economic Results for LED Lighing				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
69,466	$ 11,809.22	0	$ -	$ 11,809.22
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 99,654.00	$ 17,367.00	$ 82,287.00	8.4	7.0

ECM 2: Weatherization

A building that is poorly weatherized and leaky translates to a constant loss of energy and high energy bills. It is suggested to move forward with the weatherization measures listed in the attached proposal.

Summary of Savings and Economic Results for Weatherization				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	83	$ 91.30	$ 91.30
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 892.00	$ -	$ 892.00	9.8	9.8

ECM 3: Condensing Boiler & Indirect DHWH

High efficiency condensing boilers may include design improvements, sealed combustion, and the use of a second heat exchanger to condense flue gases in order to achieve increased efficiency. Currently, there is one (1) standard efficiency hydronic boilers that service the heating load of the entire building. Install a high efficiency condensing boiler and an indirect fired domestic hot water storage tank.

Summary of Savings and Economic Results for Condensing Boilers & Indirect DHWH				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	388	$ 426.80	$ 426.80
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 19,000.00	$ 1,000.00	$ 18,000.00	44.5	42.2

ECM 4: EC Motors with VFDs on HHW & CW Circulation Pumps

Variable frequency drives (VFDs) control the motor speed of pumps by varying the incoming frequency and voltage that power the motor. The power supplied to the pump is varied by the drive to match demand. This prevents excess consumption caused by direct on-line operation. The two (2) existing heating hot water and chilled water circulator pumps and domestic hot water circulation pump have no drives. Replace the existing motors with new electronically commutated motors and install VFDs on the circulator pumps to vary the energy consumed based on demand.

Summary of Savings and Economic Results for New EC Motors w/ VFDs on HHW and DHW Cic Pumps				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
303	$ 51.51	250	$ 275.00	$ 326.51
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 5,300.00	$ 500.00	$ 4,800.00	16.2	14.7

ECM 5: Programmable Thermostat

Installation of a 7-day programmable thermostat with the ability to adjust heating or air-conditioning operation times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation. Currently, there is one (1) non-programmable thermostats controlling the space heating set points. The facility has limited hours of operation. Replacing the manual thermostats with programmable thermostats with allow for the implementation of space heating temperature setback strategies.

Summary of Savings and Economic Results for Programmable Thermostats				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	23	$ 25.30	$ 25.30
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 200.00	$ 25.00	$ 175.00	7.9	6.9

Report Summary

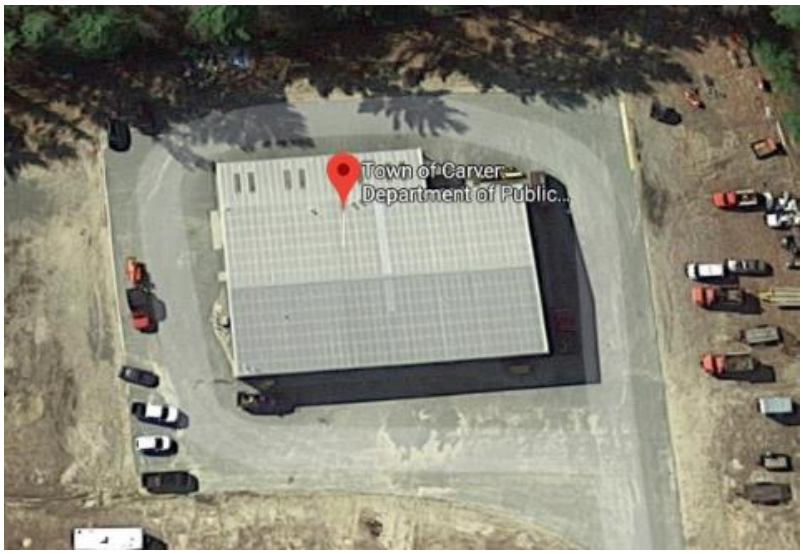
Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighing	69,466	0	$ 11,809.22	$ 99,654.00	$ 17,367.00	7.0
2	Weatherization	0	83	$ 91.30	$ 892.00	$ -	9.8
3	Condensing Boilers & Indirect DHWH	0	388	$ 426.80	$ 19,000.00	$ 1,000.00	42.2
4	New EC Motors w/ VFDs on HHW and DHW Cic Pumps	303	250	$ 326.51	$ 5,300.00	$ 500.00	14.7
5	Programmable Thermostats	0	23	$ 25.30	$ 200.00	$ 25.00	6.9
	Totals	**69,769**	**744**	**$ 12,679.13**	**$ 125,046.00**	**$ 18,892.00**	**8.4**

Next Steps

To pursue the recommendations outlined in this report, the customer should reach out to RISE Engineering. Once specific proposals are selected through this process, the customer can apply to the utility for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@RISEengineering.com.



OPERATIONS AND MAINTENANCE GARAGE

Prepared for the Town of Carver

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the Operations and Maintenance Garage at 51 Rear Pond St, Carver, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Project Location and Contact Information

Operations and Maintenance Garage
51 Rear Pond St.
Carver, MA 02330

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
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Sean Simpson	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6190 SSimpson@RISEengineering.com

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid and Eversource to help defer the cost of implementation.

The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighting	24,111	0	$ 4,098.87	$ 35,152.00	$ 6,028.00	7.1
2	Weatherization	0	123	$ 135.30	$ 17,376.00	$ -	128.4
3	Condensing Unit Heaters	0	430	$ 473.00	$ 42,500.00	$ -	89.9
4	Condensing Furnace	0	108	$ 118.80	$ 9,000.00	$ -	75.8
	Totals	**24,111**	**661**	**$ 4,825.97**	**$ 104,028.00**	**$ 6,028.00**	**20.3**

Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: LED Lighting

Standard bulbs emit light in all directions, requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency. It is suggested to replace existing, inefficient lighting with high efficiency LED bulbs. Please see attached proposal for more information.

Summary of Savings and Economic Results for LED Lighting				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
24,111	$ 4,098.87	0	$ -	$ 4,098.87
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 35,152.00	$ 6,028.00	$ 29,124.00	8.6	7.1

ECM 2: Weatherization

A building that is poorly weatherized and leaky translates to a constant loss of energy and high energy bills. It is suggested to move forward with the weatherization measures listed in the attached proposal.

Summary of Savings and Economic Results for Weatherization				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	123	$ 135.30	$ 135.30
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 17,376.00	$ -	$ 17,376.00	128.4	128.4

ECM 3: Condensing Unit Heaters

High efficiency condensing unit heaters utilize a second heat exchanger to make use of the waste heat that would normally be exhausted. There is currently four (4) standard efficiency natural gas fired unit heaters installed at the site. Replace the unit described above with new, high efficiency condensing unit heater.

Summary of Savings and Economic Results for Condensing Unit Heaters				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	430	$ 473.00	$ 473.00
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 42,500.00	$ -	$ 42,500.00	89.9	89.9

ECM 4: Condensing Furnace

High efficiency condensing furnaces may include design improvements, sealed combustion, and using a second heat exchanger to condense flue gases in order to achieve increased efficiency. Currently, there is one (1) standard efficiency natural gas fired furnace in the facility. Replace the furnace listed above with high efficiency condensing unit.

Summary of Savings and Economic Results for Condensing Furnace					
Electricity Savings		Fuel Savings		Total Cost Savings	
kWh	$	Therms	$	$	
0	$ -	108	$ 118.80	$	118.80
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 9,000.00	$ -	$ 9,000.00	75.8	75.8	

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	**Measure Description**	**kWh**	**Therms**	**$**	**$**	**$**	**yrs.**
1	LED Lighting	24,111	0	$ 4,098.87	$ 35,152.00	$ 6,028.00	7.1
2	Weatherization	0	123	$ 135.30	$ 17,376.00	$ -	128.4
3	Condensing Unit Heaters	0	430	$ 473.00	$ 42,500.00	$ -	89.9
4	Condensing Furnace	0	108	$ 118.80	$ 9,000.00	$ -	75.8
	Totals	**24,111**	**661**	**$ 4,825.97**	**$ 104,028.00**	**$ 6,028.00**	**20.3**

Next Steps

To pursue the recommendations outlined in this report, the customer should reach out to RISE Engineering. Once specific proposals are selected through this process, the customer can apply to the utility for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@RISEengineering.com.

FIRE STATION #3

Prepared for the Town of Carver

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the Fire Station #3 at 120 South Main St, Carver, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Project Location and Contact Information

Fire Station #3
120 South Main St.
Carver, MA 02330

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6181 SMurphy@RISEengineering.com
Sean Simpson	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6190 SSimpson@RISEengineering.com

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid and Eversource to help defer the cost of implementation.

The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighting	11,011	0	$ 1,871.87	$ 19,518.00	$ 2,753.00	9.0
2	Weatherization	0	501	$ 551.10	$ 17,038.00	$ -	30.9
	Totals	**11,011**	**501**	**$ 2,422.97**	**$ 36,556.00**	**$ 2,753.00**	**14.0**

Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: LED Lighting

Standard bulbs emit light in all directions, requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency. It is suggested to replace existing, inefficient lighting with high efficiency LED bulbs. Please see attached proposal for more information.

Summary of Savings and Economic Results for LED Lighting				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
8,334	$ 1,416.78	0	$ -	$ 1,416.78
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 9,859.00	$ 2,084.00	$ 7,775.00	7.0	5.5

ECM 2: Weatherization

A building that is poorly weatherized and leaky translates to a constant loss of energy and high energy bills. It is suggested to move forward with the weatherization measures listed in the attached proposal.

Summary of Savings and Economic Results for Weatherization				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	291	$ 320.10	$ 320.10
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 12,461.00	$ -	$ 12,461.00	38.9	38.9

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	**Measure Description**	**kWh**	**Therms**	**$**	**$**	**$**	**yrs.**
1	LED Lighting	11,011	0	$ 1,871.87	$ 19,518.00	$ 2,753.00	9.0
2	Weatherization	0	501	$ 551.10	$ 17,038.00	$ -	30.9
	Totals	**11,011**	**501**	**$ 2,422.97**	**$ 36,556.00**	**$ 2,753.00**	**14.0**

Next Steps

To pursue the recommendations outlined in this report, the customer should reach out to RISE Engineering. Once specific proposals are selected through this process, the customer can apply to the utility for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@RISEengineering.com.

FIRE STATION #2

Prepared for the Town of Carver

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the Fire Station #2 at 1 Green St, Carver, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Project Location and Contact Information

Fire Station #2
1 Green St.
Carver, MA 02330

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6181 SMurphy@RISEengineering.com
Sean Simpson	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6190 SSimpson@RISEengineering.com

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid and Eversource to help defer the cost of implementation.

The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighting	8,334	0	$ 1,416.78	$ 9,859.00	$ 2,084.00	5.5
2	Weatherization	0	291	$ 320.10	$ 12,461.00	$ -	38.9
3	Condensing Furnaces	0	306	$ 336.60	$ 21,000.00	$ 600.00	60.6
	Totals	**8,334**	**597**	**$ 2,073.48**	**$ 43,320.00**	**$ 2,684.00**	**19.6**

Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: LED Lighting

Standard bulbs emit light in all directions, requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency. It is suggested to replace existing, inefficient lighting with high efficiency LED bulbs. Please see attached proposal for more information.

Summary of Savings and Economic Results for LED Lighting				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
8,334	$ 1,416.78	0	$ -	$ 1,416.78
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 9,859.00	$ 2,084.00	$ 7,775.00	7.0	5.5

ECM 2: Weatherization

A building that is poorly weatherized and leaky translates to a constant loss of energy and high energy bills. It is suggested to move forward with the weatherization measures listed in the attached proposal.

Summary of Savings and Economic Results for Weatherization				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	291	$ 320.10	$ 320.10
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 12,461.00	$ -	$ 12,461.00	38.9	38.9

ECM 3: Condensing Furnace

High efficiency condensing furnaces may include design improvements, sealed combustion, and using a second heat exchanger to condense flue gases in order to achieve increased efficiency. Currently, there are two (2) standard efficiency natural gas fired furnace in the facility. Replace the furnaces listed above with high efficiency condensing unit.

Summary of Savings and Economic Results for Condensing Furnaces				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	306	$ 336.60	$ 336.60
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 21,000.00	$ 600.00	$ 20,400.00	62.4	60.6

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	**Measure Description**	**kWh**	**Therms**	**$**	**$**	**$**	**yrs.**
1	LED Lighting	8,334	0	$ 1,416.78	$ 9,859.00	$ 2,084.00	5.5
2	Weatherization	0	291	$ 320.10	$ 12,461.00	$ -	38.9
3	Condensing Furnaces	0	306	$ 336.60	$ 21,000.00	$ 600.00	60.6
	Totals	**8,334**	**597**	**$ 2,073.48**	**$ 43,320.00**	**$ 2,684.00**	**19.6**

Next Steps

To pursue the recommendations outlined in this report, the customer should reach out to RISE Engineering. Once specific proposals are selected through this process, the customer can apply to the utility for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@RISEengineering.com.

FIRE STATION #1

Prepared for the Town of Carver

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the EMS Building at 110A Main St, Carver, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Project Location and Contact Information

Fire Station #1
110A Main St.
Carver, MA 02330

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6181 SMurphy@RISEengineering.com
Sean Simpson	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6190 SSimpson@RISEengineering.com

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid and Eversource to help defer the cost of implementation.

The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	New EC Motor w/ VFD on DHW Circ Pump	789	250	$ 409.13	$ 1,800.00	$ 500.00	3.2
2	VFDs on Existing HHW Circ Pumps	11,659	0	$ 1,982.03	$ 7,000.00	$ 2,800.00	2.1
	Totals	**12,448**	**250**	**$ 2,391.16**	**$ 8,800.00**	**$ 3,300.00**	**2.3**

Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: EC Motor with VFDs on DHW Circulation Pumps

Variable frequency drives (VFDs) control the motor speed of pumps by varying the incoming frequency and voltage that power the motor. The power supplied to the pump is varied by the drive to match demand. This prevents excess consumption caused by direct on-line operation. It is not cost effective to installed VFDs on motors smaller than 1 HP. Replacing the motor with a high efficiency electrically commutated motor allows for similar control and energy savings. Replace the existing domestic hot water circulation pump motor with a new electronically commutated motor.

Summary of Savings and Economic Results for New EC Motor w/ VFD on DHW Circ Pump				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
789	$ 134.13	250	$ 275.00	$ 409.13
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 1,800.00	$ 500.00	$ 1,300.00	4.4	3.2

ECM 2: Variable Frequency Drives on HHW Circulator Pumps

Variable frequency drives (VFDs) control the motor speed of pumps by varying the incoming frequency and voltage that power the motor. The power supplied to the pump is varied by the VFD to match the demand. This prevents excess consumption caused by direct on-line operation. The two (2) existing heating hot water circulator pumps have no drives. VFDs will be installed on the circulator pumps to vary the motor speed based on demand.

Summary of Savings and Economic Results for VFDs on Existing HHW Circ Pumps				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
11,659	$ 1,982.03	0	$ -	$ 1,982.03
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 7,000.00	$ 2,800.00	$ 4,200.00	3.5	2.1

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	New EC Motor w/ VFD on DHW Circ Pump	789	250	$ 409.13	$ 1,800.00	$ 500.00	3.2
2	VFDs on Existing HHW Circ Pumps	11,659	0	$ 1,982.03	$ 7,000.00	$ 2,800.00	2.1
	Totals	**12,448**	**250**	**$ 2,391.16**	**$ 8,800.00**	**$ 3,300.00**	**2.3**

Next Steps

To pursue the recommendations outlined in this report, the customer should reach out to RISE Engineering. Once specific proposals are selected through this process, the customer can apply to the utility for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@RISEengineering.com.

SCHOOL ADMINISTRATION

Prepared for the Town of Carver

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the School Administration at 3 Carver Square Blvd, Carver, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Project Location and Contact Information

School Administration
3 Carver Square Blvd.
Carver, MA 02330

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6181 SMurphy@RISEengineering.com
Sean Simpson	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6190 SSimpson@RISEengineering.com

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid and Eversource to help defer the cost of implementation.

The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighting	13,207	0	$ 2,245.19	$ 25,864.00	$ 3,302.00	10.0
2	Weatherization	490	300	$ 413.30	$ 12,690.00	$ -	30.7
3	Programmable Thermostats	0	45	$ 49.50	$ 400.00	$ 50.00	7.1
4	Condensing Furnaces	0	360	$ 396.00	$ 24,000.00	$ 600.00	59.1
	Totals	**13,697**	**705**	**$ 3,103.99**	**$ 62,954.00**	**$ 3,952.00**	**19.0**

Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: LED Lighting

Standard bulbs emit light in all directions, requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency. It is suggested to replace existing, inefficient lighting with high efficiency LED bulbs. Please see attached proposal for more information.

Summary of Savings and Economic Results for LED Lighting				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
13,207	$ 2,245.19	0	$ -	$ 2,245.19
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 25,864.00	$ 3,302.00	$ 22,562.00	11.5	10.0

ECM 2: Weatherization

A building that is poorly weatherized and leaky translates to a constant loss of energy and high energy bills. It is suggested to move forward with the weatherization measures listed in the attached proposal.

Summary of Savings and Economic Results for Weatherization				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
490	$ 83.30	300	$ 330.00	$ 413.30
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 12,690.00	$ -	$ 12,690.00	30.7	30.7

ECM 3: Programmable Thermostat

Installation of a 7-day programmable thermostat with the ability to adjust heating or air-conditioning operation times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation. Currently, there are two (2) non-programmable thermostats controlling the space heating set points. The facility has limited hours of operation. Replacing the manual thermostats with programmable thermostats with allow for the implementation of space heating temperature setback strategies.

Summary of Savings and Economic Results for Programmable Thermostats				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	45	$ 49.50	$ 49.50
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 400.00	$ 50.00	$ 350.00	8.1	7.1

ECM 4: Condensing Furnace

High efficiency condensing furnaces may include design improvements, sealed combustion, and using a second heat exchanger to condense flue gases in order to achieve increased efficiency. Currently, there is two (2) standard efficiency natural gas fired furnace in the facility. Replace the furnace listed above with high efficiency condensing unit.

Summary of Savings and Economic Results for Condensing Furnaces					
Electricity Savings		Fuel Savings		Total Cost Savings	
kWh	$	Therms	$	$	
0	$ -	360	$ 396.00	$ 396.00	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 24,000.00	$ 600.00	$ 23,400.00	60.6	59.1	

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	**Measure Description**	**kWh**	**Therms**	**$**	**$**	**$**	**yrs.**
1	LED Lighting	13,207	0	$ 2,245.19	$ 25,864.00	$ 3,302.00	10.0
2	Weatherization	490	300	$ 413.30	$ 12,690.00	$ -	30.7
3	Programmable Thermostats	0	45	$ 49.50	$ 400.00	$ 50.00	7.1
4	Condensing Furnaces	0	360	$ 396.00	$ 24,000.00	$ 600.00	59.1
	Totals	**13,697**	**705**	**$ 3,103.99**	**$ 62,954.00**	**$ 3,952.00**	**19.0**

Next Steps

To pursue the recommendations outlined in this report, the customer should reach out to RISE Engineering. Once specific proposals are selected through this process, the customer can apply to the utility for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@RISEengineering.com.

COUNCIL OF AGING

Prepared for the Town of Carver

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the Council of Aging located at 48 Lakeview St, Carver, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Project Location and Contact Information

Council of Aging
48 Lakeview St.
Groton, MA 01450

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6181 SMurphy@RISEengineering.com
Sean Simpson	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6190 SSimpson@RISEengineering.com

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid and Eversource to help defer the cost of implementation.

The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighting	4,756	0	$ 808.52	$ 10,873.00	$ 1,189.00	12.0
2	Weatherization	0	1,004	$ 1,104.40	$ 52,189.00	$ -	47.3
3	New EC Motors w/ VFDs on HHW Circ Pumps	668	0	$ 113.56	$ 7,000.00	$ -	61.6
4	Pipe Insulation	0	52	$ 57.20	$ 2,000.00	$ -	35.0
5	Duct Insualation	0	650	$ 715.00	$ 8,500.00	$ -	11.9
6	Programmable Thermostats	0	135	$ 148.50	$ 1,200.00	$ 150.00	7.1
	Totals	**5,424**	**1,841**	**$ 2,947.18**	**$ 81,762.00**	**$ 1,339.00**	**27.3**

Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: LED Lighting

Standard bulbs emit light in all directions, requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency. It is suggested to replace existing, inefficient lighting with high efficiency LED bulbs. Please see attached proposal for more information.

Summary of Savings and Economic Results for LED Lighting				
Electricity Savings		**Fuel Savings**		**Total Cost Savings**
kWh	**$**	**Therms**	**$**	**$**
4,756	$ 808.52	0	$ -	$ 808.52
Cost	**Estimated Incentive**	**Net Customer Cost**	**Simple Payback, Years**	
			Before Incentive	**After Incentive**
$ 10,873.00	$ 1,189.00	$ 9,684.00	13.4	12.0

ECM 2: Weatherization

A building that is poorly weatherized and leaky translates to a constant loss of energy and high energy bills. It is suggested to move forward with the weatherization measures listed in the attached proposal.

Summary of Savings and Economic Results for Weatherization				
Electricity Savings		**Fuel Savings**		**Total Cost Savings**
kWh	**$**	**Therms**	**$**	**$**
0	$ -	1,004	$ 1,104.40	$ 1,104.40
Cost	**Estimated Incentive**	**Net Customer Cost**	**Simple Payback, Years**	
			Before Incentive	**After Incentive**
$ 52,189.00	$ -	$ 52,189.00	47.3	47.3

ECM 3: EC Motors with VFDs on HHW & CW Circulation Pumps

Variable frequency drives (VFDs) control the motor speed of pumps by varying the incoming frequency and voltage that power the motor. The power supplied to the pump is varied by the drive to match demand. This prevents excess consumption caused by direct on-line operation. The four (4) existing heating hot water and chilled water circulator pumps and domestic hot water circulation pump have no drives. Replace the existing motors with new electronically commutated motors and install VFDs on the circulator pumps to vary the energy consumed based on demand.

Summary of Savings and Economic Results for New EC Motors w/ VFDs on HHW Circ Pumps					
Electricity Savings		Fuel Savings		Total Cost Savings	
kWh	$	Therms	$	$	
668	$ 113.56	0	$ -	$ 113.56	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 7,000.00	$ -	$ 7,000.00	61.6	61.6	

ECM 4: Pipe Insulation

Insulation is recommended in heat distribution systems to reduce heat loss. It is recommended to install insulation on the bare heating piping to reduce the constant loss of energy. Please see the attached proposal for more information.

Summary of Savings and Economic Results for Pipe Insulation					
Electricity Savings		Fuel Savings		Total Cost Savings	
kWh	$	Therms	$	$	
0	$ -	52	$ 57.20	$ 57.20	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 2,000.00	$ -	$ 2,000.00	35.0	35.0	

ECM 5: Duct Insulation

Insulation is recommended in heat distribution systems to reduce heat loss. It is recommended to install insulation on the bare ductwork to reduce the constant loss of energy. Please see the attached proposal for more information.

Summary of Savings and Economic Results for Duct Insualation				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	650	$ 715.00	$ 715.00
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 8,500.00	$ -	$ 8,500.00	11.9	11.9

ECM 6: Programmable Thermostat

Installation of a 7-day programmable thermostat with the ability to adjust heating or air-conditioning operation times according to a pre-set schedule to meet occupancy needs and minimize redundant HVAC operation. Currently, there are six (6) non-programmable thermostats controlling the space heating set points. The facility has limited hours of operation. Replacing the manual thermostats with programmable thermostats with allow for the implementation of space heating temperature setback strategies.

Summary of Savings and Economic Results for Programmable Thermostats				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	135	$ 148.50	$ 148.50
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 1,200.00	$ 150.00	$ 1,050.00	8.1	7.1

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	**Measure Description**	**kWh**	**Therms**	**$**	**$**	**$**	**yrs.**
1	LED Lighting	4,756	0	$ 808.52	$ 10,873.00	$ 1,189.00	12.0
2	Weatherization	0	1,004	$ 1,104.40	$ 52,189.00	$ -	47.3
3	New EC Motors w/ VFDs on HHW Circ Pumps	668	0	$ 113.56	$ 7,000.00	$ -	61.6
4	Pipe Insulation	0	52	$ 57.20	$ 2,000.00	$ -	35.0
5	Duct Insualation	0	650	$ 715.00	$ 8,500.00	$ -	11.9
6	Programmable Thermostats	0	135	$ 148.50	$ 1,200.00	$ 150.00	7.1
	Totals	**5,424**	**1,841**	**$ 2,947.18**	**$ 81,762.00**	**$ 1,339.00**	**27.3**

Next Steps

To pursue the recommendations outlined in this report, the customer should reach out to RISE Engineering. Once specific proposals are selected through this process, the customer can apply to the utility for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@RISEengineering.com.

LIBRARY

Prepared for the Town of Carver

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the Library at 2 Meadowbrook Way, Carver, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Project Location and Contact Information

Library
2 Meadowbrook Way.
Carver, MA 02330

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6181 SMurphy@RISEengineering.com
Sean Simpson	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6190 SSimpson@RISEengineering.com

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid and Eversource to help defer the cost of implementation.

The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighting	62,813	0	$ 10,678.21	$ 63,567.00	$ 15,703.00	4.5
2	Weatherization	703	565	$ 741.01	$ 4,557.00	$ -	6.1
3	Condensing Boilers	0	4,784	$ 5,262.40	$ 125,000.00	$ 8,000.00	22.2
4	Condensing DHWH	0	373	$ 410.30	$ 45,000.00	$ 1,000.00	107.2
5	New EC Motors w/ VFDs on DHW Circ Pump	469	250	$ 354.73	$ 1,800.00	$ 500.00	3.7
6	VFDs on Existing HHW Circ Pumps	11,659	0	$ 1,982.03	$ 7,000.00	$ 2,800.00	2.1
	Totals	**75,644**	**5,972**	**$ 19,428.68**	**$ 246,924.00**	**$ 28,003.00**	**11.3**

Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: LED Lighting

Standard bulbs emit light in all directions, requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency. It is suggested to replace existing, inefficient lighting with high efficiency LED bulbs. Please see attached proposal for more information.

Summary of Savings and Economic Results for LED Lighting				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
62,813	$ 10,678.21	0	$ -	$ 10,678.21
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 63,567.00	$ 15,703.00	$ 47,864.00	6.0	4.5

ECM 2: Weatherization

A building that is poorly weatherized and leaky translates to a constant loss of energy and high energy bills. It is suggested to move forward with the weatherization measures listed in the attached proposal.

Summary of Savings and Economic Results for Weatherization				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
703	$ 119.51	565	$ 621.50	$ 741.01
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 4,557.00	$ -	$ 4,557.00	6.1	6.1

ECM 3: Condensing Boiler

High efficiency condensing boilers may include design improvements, sealed combustion, and the use of a second heat exchanger to condense flue gases in order to achieve increased efficiency. Currently, there are two (2) standard efficiency hydronic boilers that service the heating load of the entire building.

Summary of Savings and Economic Results for Condensing Boilers				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	4,784	$ 5,262.40	$ 5,262.40
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 125,000.00	$ 8,000.00	$ 117,000.00	23.8	22.2

ECM 4: Condensing Water Heater

High efficiency water heaters implement sealed combustion and a secondary heat exchanger to achieve high thermal efficiencies. Sealed combustion allows the water to be heated from the center, rather than from the bottom, reducing heat loss. The secondary heat exchanger is able to capture and utilize heat that would be otherwise lost from exhaust gases. There is currently a standard efficiency gas fired storage type water heater installed in the facility. Replace the water heater described above with a high efficiency water heater.

Summary of Savings and Economic Results for Condensing DHWH					
Electricity Savings		Fuel Savings		Total Cost Savings	
kWh	$	Therms	$	$	
0	$ -	373	$ 410.30	$ 410.30	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 45,000.00	$ 1,000.00	$ 44,000.00	109.7	107.2	

ECM 5: EC Motor with VFD on DHHW & CW Circulation Pumps

Variable frequency drives (VFDs) control the motor speed of pumps by varying the incoming frequency and voltage that power the motor. The power supplied to the pump is varied by the drive to match demand. This prevents excess consumption caused by direct on-line operation. The one (1) existing heating hot water and chilled water circulator pumps and domestic hot water circulation pump have no drive. Replace the existing motor with new electronically commutated motors and install VFDs on the circulator pumps to vary the energy consumed based on demand.

Summary of Savings and Economic Results for New EC Motors w/ VFDs on DHW Circ Pump					
Electricity Savings		Fuel Savings		Total Cost Savings	
kWh	$	Therms	$	$	
469	$ 79.73	250	$ 275.00	$ 354.73	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 1,800.00	$ 500.00	$ 1,300.00	5.1	3.7	

ECM 6: Variable Frequency Drives on Circulator Pumps

Variable frequency drives (VFDs) control the motor speed of pumps by varying the incoming frequency and voltage that power the motor. The power supplied to the pump is varied by the VFD to match the demand. This prevents excess consumption caused by direct on-line operation. The two (2) existing circulator pumps have no drives. VFDs will be installed on the circulator pumps to vary the motor speed based on demand.

Summary of Savings and Economic Results for VFDs on Existing HHW Circ Pumps					
Electricity Savings		Fuel Savings		Total Cost Savings	
kWh	$	Therms	$	$	
11,659	$ 1,982.03	0	$ -	$ 1,982.03	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 7,000.00	$ 2,800.00	$ 4,200.00	3.5	2.1	

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	**Measure Description**	**kWh**	**Therms**	**$**	**$**	**$**	**yrs.**
1	LED Lighting	62,813	0	$ 10,678.21	$ 63,567.00	$ 15,703.00	4.5
2	Weatherization	703	565	$ 741.01	$ 4,557.00	$ -	6.1
3	Condensing Boilers	0	4,784	$ 5,262.40	$ 125,000.00	$ 8,000.00	22.2
4	Condensing DHWH	0	373	$ 410.30	$ 45,000.00	$ 1,000.00	107.2
5	New EC Motors w/ VFDs on DHW Circ Pump	469	250	$ 354.73	$ 1,800.00	$ 500.00	3.7
6	VFDs on Existing HHW Circ Pumps	11,659	0	$ 1,982.03	$ 7,000.00	$ 2,800.00	2.1
	Totals	**75,644**	**5,972**	**$ 19,428.68**	**$ 246,924.00**	**$ 28,003.00**	**11.3**

Next Steps

To pursue the recommendations outlined in this report, the customer should reach out to RISE Engineering. Once specific proposals are selected through this process, the customer can apply to the utility for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@RISEengineering.com.

SCHOOL BUS GARAGE

Prepared for the Town of Carver

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the School Bus Garage at 51 Pond St, Carver, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Project Location and Contact Information

School Bus Garage
51 Pond St.
Carver, MA 02330

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6181 SMurphy@RISEengineering.com
Sean Simpson	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6190 SSimpson@RISEengineering.com

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid and Eversource to help defer the cost of implementation.

The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighting	26,155	0	$ 4,446.35	$ 29,794.00	$ 6,539.00	5.2
2	Weatherization	0	86	$ 94.60	$ 5,475.00	$ -	57.9
3	Condensing Unit Heaters	0	565	$ 621.50	$ 63,750.00	$ -	102.6
	Totals	**26,155**	**651**	**$ 5,162.45**	**$ 99,019.00**	**$ 6,539.00**	**17.9**

Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: LED Lighting

Standard bulbs emit light in all directions, requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency. It is suggested to replace existing, inefficient lighting with high efficiency LED bulbs. Please see attached proposal for more information.

Summary of Savings and Economic Results for LED Lighting				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
26,155	$ 4,446.35	0	$ -	$ 4,446.35
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 29,794.00	$ 6,539.00	$ 23,255.00	6.7	5.2

ECM 2: Weatherization

A building that is poorly weatherized and leaky translates to a constant loss of energy and high energy bills. It is suggested to move forward with the weatherization measures listed in the attached proposal.

Summary of Savings and Economic Results for Weatherization				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	86	$ 94.60	$ 94.60
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 5,475.00	$ -	$ 5,475.00	57.9	57.9

ECM 3: Condensing Unit Heaters

High efficiency condensing unit heaters utilize a second heat exchanger to make use of the waste heat that would normally be exhausted. There is currently six (6) standard efficiency natural gas fired unit heater installed at the site. Replace the unit described above with new, high efficiency condensing unit heater.

Summary of Savings and Economic Results for Condensing Unit Heaters				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	565	$ 621.50	$ 621.50
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 63,750.00	$ -	$ 63,750.00	102.6	102.6

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	**Measure Description**	**kWh**	**Therms**	**$**	**$**	**$**	**yrs.**
1	LED Lighting	26,155	0	$ 4,446.35	$ 29,794.00	$ 6,539.00	5.2
2	Weatherization	0	86	$ 94.60	$ 5,475.00	$ -	57.9
3	Condensing Unit Heaters	0	565	$ 621.50	$ 63,750.00	$ -	102.6
	Totals	**26,155**	**651**	**$ 5,162.45**	**$ 99,019.00**	**$ 6,539.00**	**17.9**

Next Steps

To pursue the recommendations outlined in this report, the customer should reach out to RISE Engineering. Once specific proposals are selected through this process, the customer can apply to the utility for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@RISEengineering.com.

MIDDLE/HIGH SCHOOL

Prepared for the Town of Carver

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the Middle/High School at 60 South Meadow Rd, Carver, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Project Location and Contact Information

Middle/High School
60 South Meadow Rd.
Carver, MA 02330

RISE Engineering			
Frank Davey	Manager, Special Projects	RISE Engineering	(401) 301-0769 FDavey@RISEengineering.com
Shane Murphy	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6181 SMurphy@RISEengineering.com
Sean Simpson	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6190 SSimpson@RISEengineering.com

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid and Eversource to help defer the cost of implementation.

The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighting	364,282	0	$ 61,927.94	$ 505,261.00	$ 91,071.00	6.7
2	Weatherization	0	4,383	$ 4,821.30	$ 60,831.00	$ -	12.6
3	Energy Management System	35,684	2,769	$ 9,112.18	$ 200,000.00	$ -	21.9
4	Walk-in Cooler Refrigeration Controls	1,890	0	$ 321.30	$ 2,000.00	$ -	6.2
5	Kitchen Hood Controls	22,150	0	$ 3,765.50	$ 15,000.00	$ 2,000.00	3.5
6	New EC Motors w/ VFDs on HHW & DHW Circ Pumps	2,455	250	$ 692.35	$ 14,100.00	$ 500.00	19.6
7	Demand Control Ventillation	0	6,000	$ 6,600.00	$ 44,000.00	$ 12,000.00	4.8
	Totals	**426,461**	**13,402**	**$ 87,240.57**	**$ 841,192.00**	**$ 105,571.00**	**8.4**

Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: LED Lighting

Standard bulbs emit light in all directions, requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency. It is suggested to replace existing, inefficient lighting with high efficiency LED bulbs. Please see attached proposal for more information.

Summary of Savings and Economic Results for LED Lighting				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
364,282	$ 61,927.94	0	$ -	$ 61,927.94
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 505,261.00	$ 91,071.00	$ 414,190.00	8.2	6.7

ECM 2: Weatherization

A building that is poorly weatherized and leaky translates to a constant loss of energy and high energy bills. It is suggested to move forward with the weatherization measures listed in the attached proposal.

Summary of Savings and Economic Results for Weatherization				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	4,383	$ 4,821.30	$ 4,821.30
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 60,831.00	$ -	$ 60,831.00	12.6	12.6

ECM 3: Energy Management System (EMS)

A central energy management system saves energy by allowing for the implementation of control strategies like unoccupied temperature setback, optimal start-stop, direct digital control, etc. It is suggested that the fan-coil units in the classrooms and the boiler be controlled by the proposed EMS.

Summary of Savings and Economic Results for Energy Management System				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
35,684	$ 6,066.28	2,769	$ 3,045.90	$ 9,112.18
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 200,000.00	$ -	$ 200,000.00	21.9	21.9

ECM 4: Walk-In Refrigeration Controls

Most walk-in coolers and freezers have electromechanical thermostats that control only the compressors. Installing an electronic controller and electrically commutated motors on the evaporator fans allow for more comprehensive control of the system. The new system will maintain stable temperatures and save energy by controlling the compressors, evaporator fan speed, and defrost heater.

Summary of Savings and Economic Results for Walk-in Cooler Refrigeration Controls					
Electricity Savings		Fuel Savings		Total Cost Savings	
kWh	$	Therms	$	$	
1,890	$ 321.30	0	$ -	$ 321.30	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 2,000.00	$ -	$ 2,000.00	6.2	6.2	

ECM 5: Kitchen Hood Controls and VFD

Kitchen hood controls monitor cooking activity, measure effluence, and automatically adjust the exhaust fan speed accordingly. The kitchen has a hood with no controls. When the fans are on, they run at full load. Variable frequency drives (VFDs) control the motor speed by varying the incoming frequency and voltage that power the motor. The power supplied to the motor is varied by the drive to match demand. This prevents excess consumption caused by direct on-line operation. Install controls to the kitchen hood and install VFD on existing two (2) 3HP exhaust fans to reduce the time the exhaust fan is running at full load.

Summary of Savings and Economic Results for Kitchen Hood Controls					
Electricity Savings		Fuel Savings		Total Cost Savings	
kWh	$	Therms	$	$	
22,150	$ 3,765.50	0	$ -	$ 3,765.50	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 15,000.00	$ 2,000.00	$ 13,000.00	4.0	3.5	

ECM 6: EC Motors with VFDs on HHW & CW Circulation Pumps

Variable frequency drives (VFDs) control the motor speed of pumps by varying the incoming frequency and voltage that power the motor. The power supplied to the pump is varied by the drive to match demand. This prevents excess consumption caused by direct on-line operation. The two (2) existing heating hot water and chilled water circulator pumps and domestic hot water circulation pump have no drives. Replace the existing motors with new electronically commutated motors and install VFDs on the circulator pumps to vary the energy consumed based on demand.

Summary of Savings and Economic Results for New EC Motors w/ VFDs on HHW & DHW Circ Pumps					
Electricity Savings		Fuel Savings		Total Cost Savings	
kWh	$	Therms	$	$	
2,455	$ 417.35	250	$ 275.00	$ 692.35	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 14,100.00	$ 500.00	$ 13,600.00	20.4	19.6	

ECM 7: Demand Control Ventilation

Demand control ventilation controls the quantity of outside air to an air handling system based on detected CO_2 levels. The installed systems monitor the CO_2 in the spaces or return air and reduce the outside air use when possible to save energy while meeting indoor air quality standards.

Summary of Savings and Economic Results for Demand Control Ventillation					
Electricity Savings		Fuel Savings		Total Cost Savings	
kWh	$	Therms	$	$	
0	$ -	6,000	$ 6,600.00	$ 6,600.00	
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years		
			Before Incentive	After Incentive	
$ 44,000.00	$ 12,000.00	$ 32,000.00	6.7	4.8	

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighting	364,282	0	$ 61,927.94	$ 505,261.00	$ 91,071.00	6.7
2	Weatherization	0	4,383	$ 4,821.30	$ 60,831.00	$ -	12.6
3	Energy Management System	35,684	2,769	$ 9,112.18	$ 200,000.00	$ -	21.9
4	Walk-in Cooler Refrigeration Controls	1,890	0	$ 321.30	$ 2,000.00	$ -	6.2
5	Kitchen Hood Controls	22,150	0	$ 3,765.50	$ 15,000.00	$ 2,000.00	3.5
6	New EC Motors w/ VFDs on HHW & DHW Circ Pumps	2,455	250	$ 692.35	$ 14,100.00	$ 500.00	19.6
7	Demand Control Ventillation	0	6,000	$ 6,600.00	$ 44,000.00	$ 12,000.00	4.8
	Totals	**426,461**	**13,402**	**$ 87,240.57**	**$ 841,192.00**	**$ 105,571.00**	**8.4**

Next Steps

To pursue the recommendations outlined in this report, the customer should reach out to RISE Engineering. Once specific proposals are selected through this process, the customer can apply to the utility for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@RISEengineering.com.

EMS BUILDING

Prepared for the Town of Carver

Overview of Report

RISE Engineering conducted an energy efficiency assessment at the EMS Building at 110A Main St, Carver, Massachusetts. The purpose of the audit was to identify energy conservation opportunities.

By: RISE Engineering

Contents

Project Location and Contact Information

EMS Building
110A Main St.
Carver, MA 02330

RISE Engineering			
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			SMurphy@RISEengineering.com
Sean Simpson	Energy Engineer	RISE Engineering	(401) 784-3700 Ext 6190
			SSimpson@RISEengineering.com

Executive Summary

The purpose of this review is to summarize the existing points of energy use, highlight any issues with regard to elevated energy consumption, and determine cost-effective measures that can be implemented by the customer. These measures will decrease the site's energy consumption and provide a favorable payback to the customer over the years. Incentives may be available from National Grid and Eversource to help defer the cost of implementation.

The table below summarizes the energy conservation measures (ECMs), their energy savings, estimated costs, estimated incentives, and payback.

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighting	10,271	0	$ 1,746.07	$ 16,559.00	$ 2,568.00	8.0
2	Weatherization	0	225	$ 247.50	$ 10,646.00	$ -	43.0
	Totals	**10,271**	**225**	**$ 1,993.57**	**$ 27,205.00**	**$ 2,568.00**	**12.4**

Proposed / Installed Energy Conservation Measures (ECM)

ECM 1: LED Lighting

Standard bulbs emit light in all directions, requiring the use of reflection to direct the light. LED bulbs utilize all light being produced by emitting in one direction initially. This results in up to a 90% increase in efficiency. It is suggested to replace existing, inefficient lighting with high efficiency LED bulbs. Please see attached proposal for more information.

Summary of Savings and Economic Results for LED Lighting				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
10,271	$ 1,746.07	0	$ -	$ 1,746.07
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 16,559.00	$ 2,568.00	$ 13,991.00	9.5	8.0

ECM 2: Weatherization

A building that is poorly weatherized and leaky translates to a constant loss of energy and high energy bills. It is suggested to move forward with the weatherization measures listed in the attached proposal.

Summary of Savings and Economic Results for Weatherization				
Electricity Savings		Fuel Savings		Total Cost Savings
kWh	$	Therms	$	$
0	$ -	225	$ 247.50	$ 247.50
Cost	Estimated Incentive	Net Customer Cost	Simple Payback, Years	
			Before Incentive	After Incentive
$ 10,646.00	$ -	$ 10,646.00	43.0	43.0

Report Summary

Energy Action Plan

		Estimated Savings		Total Savings	Estimated Cost	Estimated Incentive	Simple Payback
ECM	Measure Description	kWh	Therms	$	$	$	yrs.
1	LED Lighting	10,271	0	$ 1,746.07	$ 16,559.00	$ 2,568.00	8.0
2	Weatherization	0	225	$ 247.50	$ 10,646.00	$ -	43.0
	Totals	**10,271**	**225**	**$ 1,993.57**	**$ 27,205.00**	**$ 2,568.00**	**12.4**

Next Steps

To pursue the recommendations outlined in this report, the customer should reach out to RISE Engineering. Once specific proposals are selected through this process, the customer can apply to the utility for financial incentives to help defray the cost of implementation.

If you have any questions with the material presented in this report please contact Frank Davey at FDavey@RISEengineering.com.