



Boxborough, MA



Energy Reduction Plan Spring 2024

Crystal Hamlin

(207) 671-0904

Crystal.hamlin@energysource.com

www.energysource.com



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Dear Alec Wade,

Energy Source is pleased to present you with this energy reduction plan. We trust you will find this to be a cost-effective means to reduce your energy costs and improve the overall comfort throughout your facilities. In addition, these recommended projects will minimize equipment related disruptions and maintenance costs until the newly installed equipment nears its end of life – typically several years.

In the attached analysis, you will find a detailed report recommending energy conservation measures (EMC's) for the following facilities:

- Boxborough Police Station
- Boxborough Fire Station
- Albert J. Sargent Memorial Library
- Blanchard Elementary School
- Boxborough DPW (New)
- Boxborough Town Hall

Energy Source will secure incentives from the utility companies wherever applicable. The utility incentives reflected in this proposal are estimated and are subject to change until projects are reviewed by the utility company. Pricing in this report is budgetary and will need to be finalized prior to moving forward with contracts/construction.

I hope you find this proposal informative. If you have any questions, please do not hesitate to contact me.

Sincerely,
Crystal Hamlin
Energy Source



Disclaimer

This report is not for widespread use and is the property of Energy Source.

All savings estimates and rebates must be considered estimated until reviewed and approved by the utility companies designated within this report.

Pre-existing conditions beyond energy conservation measures that are above and beyond these scopes will need to be submitted and approved as additional money may be incurred.

For any questions regarding this report, please contact Crystal Hamlin. Any additional use of this report is prohibited unless permission is given in writing from Energy Source, Inc.



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Executive Summary

Energy Source recently conducted energy surveys of Boxborough's town buildings. The goal was to identify energy efficiency projects which would reduce the town's total MMBTU consumption by 20%. The baseline energy consumption was provided to Energy Source by the town in the excel file ESCO Report- Building Level Usage (MMBTU)- FINAL. Based on this data, the town consumed 7,202 MMBTU's for FY2023.

Below is a summary of the recommended measures. The expected energy savings were determined based on current operating hours of equipment surveyed. Poorly performing equipment will reduce the effectiveness of employing these ECMs, and the cost to repair or replace that equipment is not covered in this estimate.



Boxborough Police Station

Existing Conditions

The Boxborough Police Station is a pitched-roof structure with offices on the 1st floor and jail cells/booking/storage rooms on the basement level. The building is heated by (3) standard-efficiency gas-fired furnaces. Each of these furnaces is tied to a condensing unit outside that provides cooling in the warmer months. Above the drop ceiling on the 1st floor, there is fiberglass batting providing some level of insulation. However, fiberglass is an air permeable material that is ineffective at controlling air leakage. The lighting in the police station has been upgraded to LED lighting.

Recommendations

There are two main recommendations at the police station. The first is to properly weatherize the building to reduce the heating & cooling loads. This would be done by installing an air barrier and then blowing 8” of cellulose insulation on top of that. In addition, an attic hatch would be installed for access. The other recommendation is the installation of air source heat pumps. Each of the existing furnaces could be replaced with a heat pump air handler unit and each of the existing condensing units would be replaced with a cold climate heat pump condenser. These heat pumps would handle the full heating & cooling loads of the building. Cost impacts should be considered as the heating fuel would be switching from natural gas to electric. Although the heat pumps are much more efficient, the cost of electricity is higher than that of natural gas.

Project Costs

Facility	Measure	Estimated Project Cost	Estimated Rebate	Net Cost
Police Department	Air Source Heat Pumps	\$90,024	\$26,250	\$63,774
	Weatherization	\$55,484	\$8,233	\$47,251

Energy Impacts

Facility	Measure	Estimated Electric Savings (kWh)	Estimated Gas Savings (Therms)	Total MMBTU Savings	Total MMBTU Savings
Police Department	Air Source Heat Pumps	-8,157	1,417	114	142
	Weatherization	1,376	234	28	



Boxborough Fire Station

Existing Conditions

The Boxborough Fire Station is a brick building with two main sections. The first is a 2-story pitched roof section which houses the offices and living areas. The other section is a single-story flat roof area consisting mainly of the apparatus bays. The pitched-roof section of the building is predominantly heated by a new 285 MBH Lochinvar condensing boiler that feeds baseboard radiators in the spaces. The boiler has an efficiency rating of ~93% and has a 10:1 turndown ratio. There is also a multi-zone Mitsubishi 3-ton air source heat pump that appears to have heating capability, but this system appears to be used mainly for cooling purposes. The apparatus bays have Modine unit heaters with hot water coils that are fed by the Lochinvar boiler. Cooling for the living areas is achieved by the above-mentioned air source heat pump (1st floor) and a window A/C unit in the lounge room on the 2nd floor. In the building envelope, there are some gaps, particularly around doors, that allow unwanted infiltration/exfiltration.

Interior lighting consists mainly of linear fluorescent lighting. The offices and living areas have mostly T8 fluorescent lights with a few areas having older T12 fluorescent lights. The apparatus bays have high output T5 high bays. Exterior lighting consists mainly of jelly jar style fixtures with screw-in incandescents & compact fluorescents. There is also one quartz flood light.

Recommendations

It is recommended that the existing interior lighting is replaced or retrofitted with LED lighting technology. Onboard controls should be included where practical to take advantage of occupancy and daylight sensing. The exterior jelly jar and flood lights should be replaced with new LED fixtures. Regarding the building envelope, door weather-stripping should be installed on the regular doors as well as the overhead garage doors for the trucks. There is also a section of 84 linear feet that should be caulked. The door weather-stripping and caulking will reduce unwanted infiltration/exfiltration. Another recommendation is the installation of air source heat pumps for the 2nd floor living area & kitchen. The hydronic zone feeding this area can be isolated and shut off, allowing the heat pumps to fully heat and cool the space. The existing heat pump system on the 1st floor can also be utilized more for heating purposes, if desired. Lastly, it is recommended that the pipes in the boiler room are insulated so that more of the heat produced by the boiler reaches the intended spaces.



Project Costs

Facility	Measure	Estimated Project Cost	Estimated Rebate	Net Cost
Fire Department	Air Source Heat Pumps	\$36,137	\$7,500	\$28,637
	Weatherization	\$8,428	\$2,976	\$5,452
	Pipe Insulation	\$8,169	\$1,059	\$7,110
	LED Lighting	\$31,255	\$0	\$31,255

Energy Impacts

Facility	Measure	Estimated Electric Savings (kWh)	Estimated Gas Savings (Therms)	Total MMBTU Savings	Total MMBTU Savings
Fire Department	Air Source Heat Pumps	-409	354	34	176
	Weatherization	0	992	99	
	Pipe Insulation	0	353	35	
	LED Lighting	2,286	0	8	



Albert J. Sargent Memorial Library

Existing Conditions

The Albert J. Sargent Memorial Library is a 12,102 square foot, single-story facility that opened in 2005. There are two 606 MBH non-condensing boilers that have an efficiency of approximately 80%. These boilers provide heating water for fan powered terminal (FPT) reheat coils and radiation. There are also two rooftop units (RTUs) that provide pre-conditioned air to the terminal devices (RTUs were not accessible at time of audit). There is a building management system (BMS) that is original to the building that controls the HVAC equipment. Onsite staff indicated they are having some issues with the automation system. Being a newer building, the building envelope is in pretty good shape. The weaknesses identified onsite were gaps around doors and a gap along the roof-wall intersection totaling 240 linear feet.

The interior lighting at the library is predominantly fluorescent. The open areas predominantly have 2x2 recessed fixtures and pendant-mounted direct/indirect fixtures with T8 lamps & ballasts. The uplighting in the main open area has high output T5 fluorescent lighting. There are also some recessed downlights that have compact fluorescent lights. Battery backups are included in certain fixtures to provide emergency lighting in the event of a power outage. The exterior lighting is comprised mainly of metal halide pole lights (150W) as well as a handful of assorted building-mounted fixtures and a 100W metal halide flood light illuminating a sign by the street.

Recommendations

There are no recommendations at this time for the main HVAC equipment at this facility. As the existing equipment reaches end-of-life, the town should look at a possible decarbonization project to reduce its reliance on fossil fuels. Advancements in air to water heat pumps are being made and there could be more options to electrify this facility in the near future. In the meantime, an upgrade to the BMS is recommended to more effectively control the existing HVAC equipment. Energy-saving control strategies such as demand control ventilation, optimal start/stop, and scheduling (among others) should be included in the upgrade to reduce energy consumption and improve comfort for the occupants.

The library could benefit from an LED lighting retrofit, which would include new fixtures and/or retrofits for the interior spaces. Onboard occupancy/daylight controls should be included where practical. Battery backups will need to be factored into the LED lighting project to ensure that emergency lighting is accounted for. The exterior pole lights and floods should be replaced with new LED fixtures. The building-mounted fixtures could be a mix of retrofit or fixture replacement.



To reduce unwanted infiltration/exfiltration in the building envelope, it is recommended that door weather-stripping is installed on three doors and that air sealing is performed on 240' at the roof-wall intersection.

Project Costs

Facility	Measure	Estimated Project Cost	Estimated Rebate	Net Cost
Library	EMS Upgrades	\$55,714	\$4,124	\$51,590
	Weatherization	\$7,660	\$504	\$7,156
	LED Lighting	\$48,775	\$0	\$48,775

Energy Impacts

Facility	Measure	Estimated Electric Savings (kWh)	Estimated Gas Savings (Therms)	Total MMBTU Savings	Total MMBTU Savings
Library	EMS Upgrades	14,855	571	108	218
	Weatherization	50	168	17	
	LED Lighting	27,364	0	93	



Blanchard Elementary School

Existing Conditions

Blanchard Elementary is a regional school with utility bills paid by the Town of Boxborough. Lighting is primarily T8 fluorescent technology in recessed 2x4 troffers. The gymnasium lighting has been upgraded to Lusio LED high bays with occupancy sensors. The library area has also been retrofitted with LED tubes. Most of the 2x4 troffers have (3) 32W T8 lamps. Classrooms typically have nine 2x4 fixtures with (4) 32W T8 lamps with bi-level switching.

Two condensing natural gas fired Viessman boilers are in the basement with 3,500 MBH rating at 96% efficiency and with a 12:1 turndown. Hot water is sent from the boilers to unit ventilators located in the classrooms, floor-mounted radiators, and hot water coils in ceiling-mounted units. The hot water circulator pumps are Grundfos packaged VFD's. Domestic hot water is provided by the boilers with a separate zone. Three hot water tanks are roughly 250 gallons each. The domestic hot water circulator pumps have VFDs. The cooling for the building is provided by packaged rooftop units with DX cooling as well as ~15 window A/C units in classrooms. The building has been upgraded with DDC controls (Distech), which also monitors CO2 and occupancy for the classroom unit ventilators. The building shell is in good condition but there are some opportunities to reduce infiltration.

Recommendations

Energy Source recommends replacing existing fluorescent light fixtures with new LED light fixtures with integrated controls. New fixtures will allow for daylight harvesting, dimming, and a uniform light levels.

Existing rooftop units over the front office space should be replaced with (2) 15 Ton heat pump RTU's. Integral controls would be installed between the RTU's and the existing HW zone valves.

The 15 classrooms that currently have window AC units would be replaced with single zone heat pump systems to be the primary cooling system along with space heating. Integral controls would be installed between the heat pumps and the existing HW zone valves.

The building envelope would be tightened by air sealing sections of the roof-wall intersection and by installing door weather-stripping.



The primary heating system at the school is highly efficient and there are no recommendations at this time. At some point in the future there may be an opportunity to electrify as the existing equipment ages and technology improvements are made with air to water heat pump technology.

Project Costs

Facility	Measure	Estimated Project Cost	Estimated Rebate	Net Cost
Blanchard Elementary	Weatherization	\$24,834	\$7,842	\$16,992
	LED Lighting	\$266,018	\$0	\$266,018
	Heat Pumps in Classes with Window AC's	\$374,166	\$75,000	\$299,166
	Heat Pumps RTU's in Front Office & Café	\$292,617	\$75,000	\$217,617

Energy Impacts

Facility	Measure	Estimated Electric Savings (kWh)	Estimated Gas Savings (Therms)	Total MMBTU Savings
Blanchard Elementary	Weatherization	2,336	2,614	269
	LED Lighting	117,772	0	402
	Heat Pumps in Classes with Window AC's	-8,816	3,542	324
	Heat Pumps RTU's in Front Office & Café	-25,843	3,542	266



Boxborough DPW (New)

Existing Conditions

The new DPW building located at 873 Massachusetts Ave, Boxborough, MA 01719, was acquired within the last five years. The facility is open five days per week. Primary Electrical is a 150 kVA step down transformer with 120/208V secondary. Building is roughly 8,000 ft.². The old owner used the building as a mechanics garage with many lifts and existing panels having space available for Heat Pumps.

Exterior lighting and the front office lighting has been upgrade with full LED fixtures. T5 fluorescent recessed troffers are used in the open garage areas. The building has natural gas which goes to six air handlers. (4) Air handlers are in the drop ceiling of the garage bays with no cooling. (1) Air handler is in drop ceiling of garage dyno area with no cooling. (1) Air handler serves the front office area which has both DX cooling (5 Tons) and natural gas heating, 96% efficiency (York- YCJD60S41S2A) on a 60A breaker. Domestic hot water is done with a natural gas fired on-demand hot water heater with a maximum output of 120,000 BTUs. 96.1% eff. used for bathroom faucets only. Two 5 hp compressor's are located outside the building rear left-hand side. The compressors are belt driven on reciprocating compressors. Insulation is in good condition with minimal room for improvements.

Recommendations

Energy Source recommends replacing exiting fluorescent light fixtures with new LED light fixtures with integrated controls. New fixtures will allow for daylight harvesting, dimming, and uniform light levels.

A new 4-Ton air handler heat pump should be installed to repalce the existing natrual gas fired air handler that currently serves the front office area. Three new air source heat pumps should be installed in the garage area, two in the main garage, one in the old dyno room. Based on the buildings natural gas consumption, the open garage area currently has 100% redundancy which is the reason for only installing two in this space, rather than all four.

The building envelope would be tightened by installing door weather-stripping.



Project Costs

Facility	Measure	Estimated Project Cost	Estimated Rebate	Net Cost
DPW (New)	Weatherization	\$4,094	\$2,100	\$1,994
	LED Lighting	\$40,984	\$0	\$40,984
	Heat Pump Garage & Office	\$95,940	\$30,000	\$65,940

Energy Impacts

Facility	Measure	Estimated Electric Savings (kWh)	Estimated Gas Savings (Therms)	Total MMBTU Savings	Total MMBTU Savings
DPW (New)	Weatherization	0	587	59	130
	LED Lighting	5,734	0	20	
	Heat Pump Garage & Office	-5,605	708	52	



Boxborough Town Hall

Existing Conditions

The Townhall is a two-story building from 1901. The lighting is in poor condition and primarily consists of 4' T12 fluorescent bulbs. The building has four furnaces which are the primary heating system. The furnaces are condensing and are estimated to be 75,000 BTUs each. The furnace includes 5-Ton DX coils for cooling on a 50A breaker. One new Mitsubishi split unit was installed in the IT server room on the front right side of the building. A few areas contain electric resistive heaters including the front entry way and the front entry kitchen space (8' baseboard). Each electric heater is roughly 2kW. No mechanical fresh air is brought into the building.

Building attic space for the front section of the building could use additional insulation. Existing insulation is roughly 4 inches of cellulose. A 40' x 40' section can be relatively easily insulated with additional cellulose. Other two sections that are more difficult to insulate will cover roughly 40' x 25'. Access to the attic space is difficult and would require a lift for safely accessing the space, along with removing a window on the second floor.

To insulate the full attic, we would recommend first cleaning the attic space and removing all debris and materials that have been left in the space. Small areas around the building would benefit from air sealing properly such as mechanical spaces with combustion exhaust and intake pipes for natural gas HVAC equipment.

Recommendations

Energy Source recommends replacing existing fluorescent light fixtures with new LED light fixtures for a more consistent light level and color temperature.

The existing natural gas fired furnaces with DX cooling will be removed and replaced with four 4-Ton heat pump air handlers. A new single zone heat pump will be installed in the building's front café area which is currently heated with baseboard electric heaters. The existing heater will be abandoned in place.

Attic insulation will be upgraded with additional blow-in cellulose to reduce the building's heating and cooling loads.



Project Costs

Facility	Measure	Estimated Project Cost	Estimated Rebate	Net Cost
Town Hall	Weatherization	\$21,712	\$1,242	\$20,470
	LED Lighting	\$22,870	\$0	\$22,870
	Air Source Heat Pumps	\$130,958	\$41,875	\$89,083

Energy Impacts

Facility	Measure	Estimated Electric Savings (kWh)	Estimated Gas Savings (Therms)	Total MMBTU Savings	Total MMBTU Savings
Town Hall	Weatherization	538	414	43	153
	LED Lighting	10,279	0	35	
	Air Source Heat Pumps	-6,839	984	75	



Installation and Warranty Information

If you decide to proceed with this proposal, Energy Source will be responsible for the following tasks:

- Develop final equipment specifications and equipment layout
- Processing and filing application for utility incentives
- Material ordering and receiving
- Dismantling and removing existing systems from premises
- Construction
- Final walk-through with you

Installation

All installation staff will agree to submit to a CORI check before proceeding with project.

The removal and disposal of asbestos and toxic materials if present are the owner's responsibility and should be determined before proceeding with the project.

Warranty

Included with your project is a one-year warranty on all labor and materials provided by Energy Source. At the end of the first-year materials remain covered by standard warranties provided by their manufacturers. Warranty periods begin when the installation is completed. The owner has a one-month period following the completion of the installation to accept or reject work performed by Energy Source, after which time we will assume that the work has been accepted.

Due to the fluctuation in commodities this proposal is valid for a period of 30 days from the date shown at the top of this proposal, after which time we will be happy to provide an adjusted quote if necessary.