

## Fire Station

### Energy Savings Analysis

In both the energy and financial analyses, “the whole is something besides the parts” Aristotle.

The ESM are described elsewhere in this report. The summary chart below indicates that an upfront investment of \$13,185 will result in an annual energy savings of 50.8 MMBTU, 367 gallons of oil, and 4.3 tons CO<sub>2</sub> emissions. Savings of completing all four ESM are 23% greater than the sum total of completing individual ESM. This is because making improvements to the thermal envelope—ie air sealing and increasing effective insulation—changes the dynamics of heat transfer in a cumulative fashion. To use clothing as an analogy—if you wear shorts outside on a cold day, you will be warmer if you put on long pants. You would also be warmer if you wore wool socks and shorts, or added a wool hat while wearing shorts. But in each scenario, you’d still be cold. But wear long pants, with wool socks and a wool hat, you’d be able to stay warm far longer than any other previous combination. In short: heat will find a way to move to cold—the more comprehensive or continuous the resistance, or, the more effective the thermal envelope, the slower the rate of heat loss. Please note that this is based on occupant behavior, such as thermostat setting, continuing as in prior years.

#	Envelope ESM	Cost of Measure	Saved Energy	CO <sub>2</sub> Tons Reduction	Gallons Oil Saved
1	Air Sealing Package <b>Tier II</b>	\$1,004	11.2	0.9	81
2	Stem Wall	\$1,497	3.3	0.3	24
3	Reinsulate Ceiling	\$8,308	17.9	1.5	129
4	Foundation Wall	\$2,376	6.6	0.6	47
	Sum of the Parts	\$13,185	38.9	3.3	281
<b>ALL</b>	<b>Sum of the Whole</b>	<b>\$13,185</b>	<b>50.8</b>	<b>4.3</b>	<b>367</b>

### Financial Analysis

Investing a total of \$13,185 in all recommended measures is predicted to save \$796 a year, with the price of oil at \$2.17 per gallon. If the price goes up, all other things remaining equal, so will annual savings. The ESM 1, at a cost of \$1,004, is predicted to save \$175 a year with a simple payback of 5.7 years and an annual return of 6.1% over the 25 year life of the measures. ESM 2-4 are presented as ‘Tier II’ because the simple payback is over 16 years, and yet—over 25 years, the return on investment (ROI) is nearly 2% at today’s energy prices. Importantly, the measures also reduce the design heating load to 61KBtu/hr from the present 107KBtu/hr—which means the cost to replace heating equipment will be lower, as will the options for heating technologies.

#	Envelope ESM	Cost of Measure	Annual \$ Savings	Simple Payback Yrs	Life of Measure	Investment Gain	ROI	Annual ROI
1	Air Sealing Package <b>Tier II</b>	\$1,004	\$175	5.7	25	\$3,371	335.8%	6.1%
2	Stem Wall	\$1,497	\$51	29.4	25	-\$222	-14.8%	-0.64%
3	Reinsulate Ceiling	\$8,308	\$281	29.6	25	-\$1,283	-15.4%	-0.67%
4	Foundation Wall	\$2,376	\$103	23.7	25	\$199	8.8%	0.32%
	Sum of the Parts	\$13,185	\$610		25	\$2,065	15.7%	58.0%
<b>ALL</b>	<b>Sum of the Whole</b>	<b>\$13,185</b>	<b>\$796</b>	<b>16.6</b>	<b>25</b>	<b>\$6,715</b>	<b>50.9%</b>	<b>1.66%</b>

## Community Center

### Summary of Cost / Savings Analysis

Two envelope improvement measures are recommended: an air sealing package and upgrading insulation levels in the attic floor, above the second floor ceiling. The total estimated cost for both measures is \$10,385 which, upon completion, is expect to save 286MMBtu a year from propane reductions of 235 gallons and electric reductions of 286 kWh. Over the 25 year life of measure, the energy savings will have reduced CO2 emissions by 39.4 tons. Specific measures for these two ESM are included in the following pages.

Energy Saving Measure	Cost of Measure	Life Of Measure	LP Gallons Saved Yearly	kWh Saved Yearly	Saved Energy MMBTU	Tons CO2 Reduction
# 1 Air Sealing Package	\$1,635	15	114	145	10.9	19.2
# 2 Ceiling Insulation	\$8,750	25				
Totals	\$10,385	25	235	286	22.4	39.4

In terms of dollar savings, that same \$10,385 investment is predicted to save \$366 a year, at today's energy prices. The investment gain in 25 years is \$1,435, yielding an annualize return on investment (ROI) of under 1%. Two noteworthy considerations: 1) the price of propane is currently very low and could be expected to rise again, especially as the true cost of burning fossil fuels begins to be included in pricing. 2) Both measures will reduce or eliminate damaging icicles and ice dams - and their associated maintenance costs—that occur. Severe icing was reduced several years ago with the addition of three foot metal edging. That reduced the symptom but did not address the root problem of heat loss which warms the underside of the roof sheathing.

Energy Saving Measure	Annual \$ Savings	Simple Payback Years	Investment Gain	ROI	Annual ROI	Tons CO2 Reduction
# 1 Rim Sealing	\$178	9.2	\$1,035	63.3%	3.3%	19.2
# 2 Ceiling Insulation						
Totals	\$366	24	\$1,435	4.6%	0.2%	39.4

### LED Lighting Conversion

This study included a lighting inventory and estimated breakdown of electric loads. It is estimated that over 46% of the building's annual consumption of 26,678 kWh is used for lighting. Converting to LED from the existing T8 fluorescent lamps is estimated to save the following annually:

2496.2 kWh  
 \$424.35 Dollars  
 8.5 MMBtu Energy  
 1.0 Tons CO2

It is a recommendation of this study to request a lighting audit from Eversource. This would be completed by a lighting contractor and include a cost proposal, which is outside the scope of this proposal.

## Highway Garage

### Summary of Cost Savings Analysis of Recommendations

The recommended envelope improvements include replace two overhead door seals (ESM 1\*), targeted air sealing and encapsulating steel beams with closed cell foam (ESM 2, Air Sealing Package) and insulating the above grade foundation wall (ESM 3). The total estimated cost of those three ESM is estimated at \$10,544. Based on the existing oil fired boiler, those improvements are predicted to have an annual savings of 90.9 MMBTU of energy and 7.7 tons CO2 emissions.

#	Energy Saving Measure	Cost of Measure	Annual \$ Savings	Simple Payback	Life Of Measure	Investment Gain	ROI	Annual ROI
1	Overhead Door Seals*	\$1,777	\$428	4.1	10	\$2,508	141.1%	9.2%
2	Air Sealing Package	\$2,596	\$301	8.6	25	\$4,929	189.9%	4.4%
3	Insulate AG FND	\$6,171	\$430	14.4	25	\$4,579	74.2%	2.3%
		\$10,544	\$1,159	9.1	20	\$12,016	114.0%	3.9%

Based on the two year average of \$2.09 per gallon of oil, implementing all measures would save \$1,159 per year which translates to a simple payback of 9.1 years. Since envelope measures have a minimum 20-25 year service life, the actual return on investment (ROI) is 3.9% per year and an investment gain of \$12,016. Again, this analysis does not factor a rise in any increases in the price of oil, which is currently at the lowest price in the last 15 years.

#	Energy Saving Measure	Cost of Measure	Saved Oil Gallons	Saved Energy MMBTU	Annual Tons CO2 Reduction
1	Overhead Door Seals*	\$1,777	205	28.4	2.4
2	Air Sealing Package	\$2,596	144	19.9	1.7
3	Insulate AG FND	\$6,171	206	28.5	2.4
		\$10,544	657	76.8	6.5

\*ESM #1: The door seals had already been replaced at the end of 2019. Energy savings were calculated based on the reduction of oil use in 2020 less the impact of 2020's milder winter temperatures.

**Lighting:** At the time of the site visit, there were 56 high bay T5 lamps working in 16 five tube fixtures, located at 16-20 feet high in the garage bays. The lights are on an estimated 1600 hours a year. According to the DPW Director, a lighting audit was completed recently and it was determined the fixtures would need to be replaced in order to convert to LED. Lighting is outside the scope of this Audit, and yet it may yet be a cost effective energy saving measure.

**Refrigerator:** The refrigerator in the office / lounge area is old and likely nearing the end of its service life. Replacing with a new Energy Star unit will reduce electric usage with an estimated 5 year simple payback. However it is also true that new refrigerators have far shorter warranty's than they used to and the compressors tend to fail more quickly. With only one or two manufacturers drawing from a wide range of parts factories, researching the reliability of a specific compressor before selecting a model is advised.