Table of Contents

2. Project Description

The building, originally built in 1960, is a 8,192 square foot wood/masonry framed two story building. It rests on a concrete foundation at the backfilled section and on masonry wall resting on a concrete footing at the exposed section. The facade of the building is a combination of mostly block and block with brick veneer at the front of the building. The roof a flat EPDM roof resting on wood plank decking supported by wood cord trusses.

The front entrance of the building faces a North-North- West direction, for the purpose of this report the front of the building will be considered North. The floor plan includes an apparatus bay, radio room and utility rooms on the ground level, and a meeting room, kitchen, office space, toilet facilities and storage space on the upper level.

The building presently serves as the fire department for the town.

3. Executive Summary

3.1 Introduction:

This report details the recommendations and findings of the audit report conducted for the Berwick Fire Department located at 10 School Street in Berwick, Maine. The site visits were conducted on July 20 & 28, 2011. At the time John Monaghan met with Chief Plant and Lt. Tibbits.

This assessment recommends sixteen (16) Energy Conservation Measures (ECMs) addressing the electric and heating fuel usage, increasing comfort and cost savings. Details of the findings and recommendations are contained in the assessment.

The priorities are to apply air sealing, insulate the walls, insulate the underside of the roof deck and band joist, improve the lighting, weather strip the overhead doors, install programmable thermostats, install a timer on the domestic hot water system and replace the paddle fans with Thermal Equalizers.

The original design and construction of the building envelope and structure were poor and they have not improved with time. The building is in need of attention and consideration should be given to replacing the building based on a long term cost benefit assessment taking into account operating costs, repairs, equipment replacement and the functionality of the building.

3.2 Identified Energy Conservation Measures:

1. **Building Envelope Improvements**
    a. Provide general air sealing throughout the building
    b. Apply 2" of closed cell spray foam insulation at the band joist of the roof /wall
    c. Apply 3" of closed cell spray foam insulation to the underside of the roof deck
    d. Insulate the outer face of the exterior wall to an R-12.5, including a vapor barrier and drainage plane. See Building Envelope section for options.
    e. Replace weather stripping at the overhead doors

2. **Energy Efficient Lighting**
    a. Retrofit 1x8' 2 lamp T12 fixtures in Service bay to 1x8' 4 lamp T8 28 w fixtures
    b. Re-ballast & re-lamp the existing T12 fixtures to T8's
    c. Install occupancy sensors
    d. Replace incandescent bulbs with CFL's or LED's
    e. Replace the HPS exterior fixtures with LED's

3. **Heating System**
    a. Replace existing thermostats with programmable thermostats
    b. Develop a boiler replacement plan

4. **Domestic Hot water**
    a. Insulate the water lines in the mechanical room
    b. Install a seven day timer

5. **Ventilation**
    a. Install 4 Airius Thermal Equalizers in the apparatus bay

6. **Miscellaneous**
    a. Install Vending Misers on the two vending Machines

The table below lists the Recommended Energy Conservation Measures (ECM's), the savings in dollars and energy, the cost of the improvement, CO_2 savings, simple payback and the savings on investment ratio. Simple pay back is the cost of the improvement divided by the projected annual savings and it tells you how many years it will take to recoup your investment. Savings to Investment Ratio (SIR) is the projected annual savings times the useful life of the improvement, divided by the cost of the improvement, which it tells you how many times the investment will pay for itself over the life of the investment. The SIR should be

greater than 1 and the higher the number than 1 the better the investment. The table does not include the maintenance savings or the improvement in thermal comfort for the ECM's.

Berwick Fire Department Proposed Energy Conservation Measures

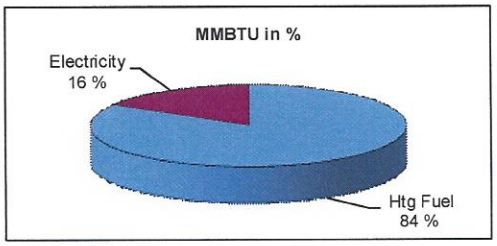
Energy Conservation Measure	Annual Cost Savings in Dollars	Annual Electric Savings in kWh	Annual Heating Fuel Savings in MMBtu	Annual CO2 Emissions Savings in tons	Cost of Work	Simple Payback in Years	Savings to Investment Ratio
Bldg Envelope							
Air seal	$ 845		29.31	2	$ 1,800	2.1	14.08
2" Foam insulation@band joist	$ 423		15.56	1	$ 845	2.0	12.51
3" Foam insulation@ Roof Deck	$ 850		29.4	2	$ 10,940	12.9	1.94
Insulate exterior walls	$ 2,029		70.35	5	$ 22,460	11.1	2.26
Subtotal	**$ 4,147**	0	145	5.44	**$ 36,045**	8.7	3.02
Lighting							
Annex							
Retrofit Aparatus bay 8' T12 fixtures to 4'T8's & ad sensors *1	$197	1,379		0.7	$1,431	7.3	1.79
Reduce lamp watts, relamp balast T12 's toT 8's reduce fixtures, add controls & switches	$406	5,589		2.9	$1,425	3.5	3.70
Exterior							
Relace HPS fixtures with LED	$671	5589		2.9	$3,115	4.6	2.80
Lighting Subtotal	**$406**	**5,589**		6	**$1,425**	3.5	3.70
Heating System							
Relace thermotats with programable	346		15.38	1	900	2.6	3.84
Replace Oill Boiler witt Propane Condensing Boiler *2	382		17	1	3,000	7.9	1.91
Subtotal	$728	-	32	2	$3,900	5.4	2.33
Domestic Hot Water							
Add Seven Day Timer	258	2,152		1.1	$325	1.3	7.94
Ventilation							
Install 4 Airius Equalizers	$ 907		39.1	1	$4,800	5.3	3.97
Misc. Items							
Energy Miser for Vending Machines	$ 387	2,580		0.6	$340	0.9	11.38
ECM Totals	$ 6,575	8,169	216	15	$ 46,510	7.1	5.39

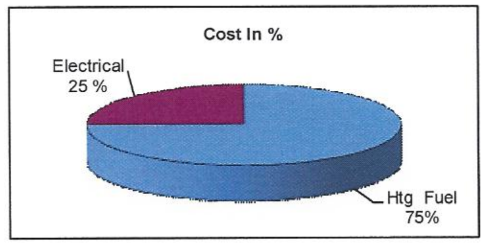
Note: A 5% to 10% contingency should be carried for the cost of work
***1 & 2 Includes the cost to make the enrgy eficient up grade**

4. Energy Usage

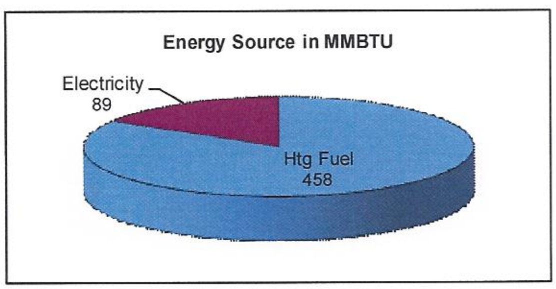
The energy usage of the building is from three sources: electricity for lighting, domestic hot water and power; #2 fuel oil and propane for heat and emergency power.

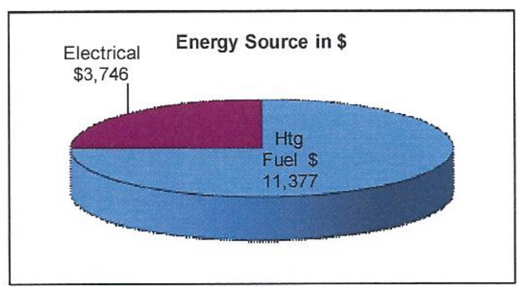
The first series of pie charts show the energy usage in percent for both BTU's, the common energy measurement unit and as the cost of energy.





The second series of pie charts shows the energy usage in millions of BTU's (MMBtu) and the cost in dollars.





As shown in the pie charts, heating fuel accounts for the greater portion of the energy usage in cost, 75% in dollars and is the greater in energy units, 84 % of the BTU's.

4.1 Historic Energy Consumption

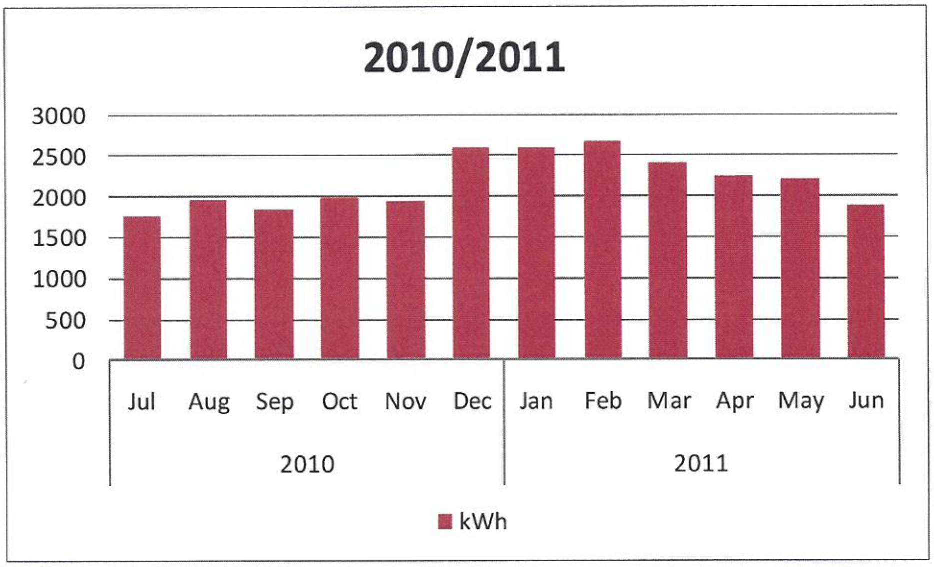
1. Electrical

Usage is shown in the table and graph below for July 2010 through June 2011. The baseline monthly consumption is about 1,800 kWh/month.

Electrical use per square foot is 3.16 kWh as compared to the New England average of 10.8 kWh or 29 % of the average for commercial buildings in New England.

However, there are still opportunities to improve the electrical usage.

Berwick FD			
Electricity Usage-2010/2011			
		kWh	Cost (incl demand)
2010	Jul	1760	257
	Aug	1960	287
	Sep	1831	266
	Oct	1967	287
	Nov	1933	282
	Dec	2589	374
2011	Jan	2594	375
	Feb	2,671	386
	Mar	2,406	341
	Apr	2,246	314
	May	2,196	310
	Jun	1,885	257
	Total	26,038	$3,736
12 Mo	Avg	2,170	$311
Avg	$/kW		$0.143

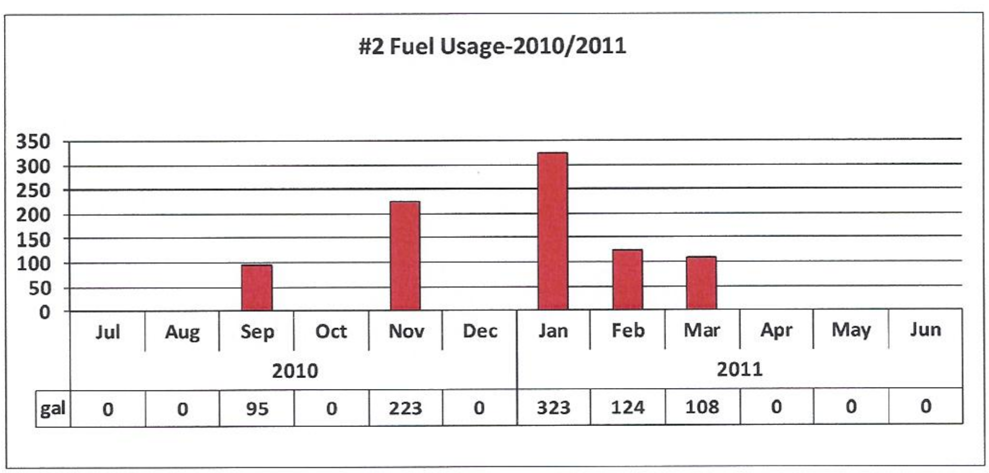

2010/2011
3000
2500
2000
1500
1000
500
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
2010
2011
kWh

2. Heating Fuel:

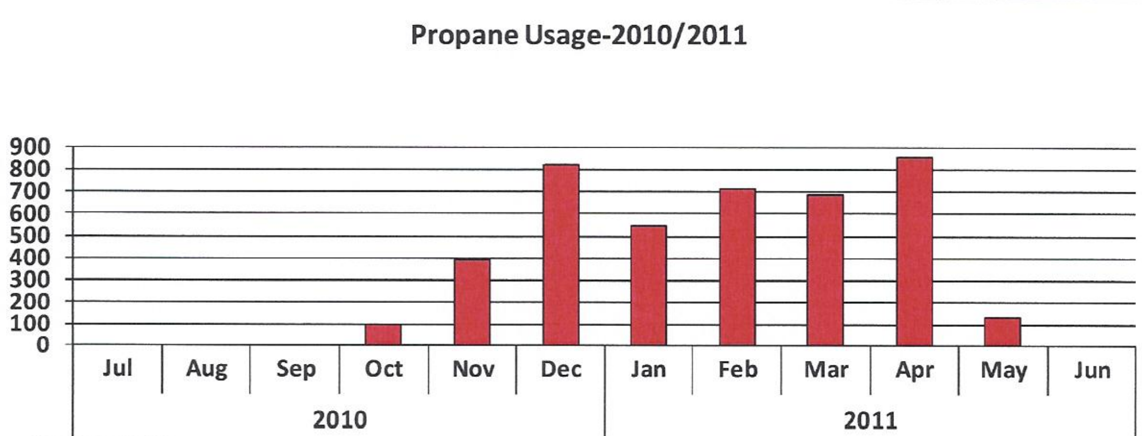
The heating fuel usage for July 2010 through June 2011 for #2 fuel oil and propane are shown below in the tables and graphs. The heating usage mostly coincides with the colder winter weather.

The equivalent fuel oil usage for both propane and #2 fuel oil on a square foot basis is .40 gals/SF as opposed to an average of .32 gals/SF and 55,961 BTU/SF as opposed to an average of 44,480 BTU/SF or 126 % of the average for commercial buildings in New England.

Berwick FD			
#2 Fuel Usage-2010/2011			
		gal	cost
2010	Jul	0	0
	Aug	0	0
	Sep	95	222
	Oct	0	0
	Nov	223	561
	Dec	0	0
2011	Jan	323	946
	Feb	124	377
	Mar	108	363
	Apr	0	0
	May	0	0
	Jun	0	0
	Total	873	$2,469
Month	Average	73	$206
$/gal	Average		$2.83



Berwick FD			
Propane Usage-2010/2011			
		gal	cost
2010	Jul	0	0
	Aug	0	0
	Sep	0	0
	Oct	100	212
	Nov	390	828
	Dec	821	1,859
2011	Jan	546	1,415
	Feb	718	2,073
	Mar	689	1,708
	Apr	856	635
	May	135	335
	Jun	0	0
	Total	4,255	$9,065
Month	Average	355	$755
$/gal	Average		$2.13



	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
gal	0	0	0	100	390	821	546	718	689	856	135	0

The predominate use of heating fuel is propane at 336.25 MMBTU's verse #2 fuel oil at 122.18 MMBTU's. (million BTU's)

5. Building Envelope

The building was built in 1960, and has seen little improvement other than cosmetic work such as painting. It is reported that the roof was replaced in mid to late 1990's. There have been structural and moisture issues with the building

Based on tests of similar buildings the ACH (Air Changes per Hour) it is estimated to have .7 to .8 ACH, having it fall into the semi- loose to loose category according to Manual N for Commercial Buildings published by the ACCA. For a similar tight building the ACH is .31 ACH and an average building is .49 ACH, placing the building higher than average. The goal is to have a tight building, but at a minimum in the average range of .50 ACH. The air infiltration indicates the building is a good candidate for air sealing.

The east, west and south of the original building walls are painted 6" masonry block and the north wall is exposed brick with CMU back up. The estimated R value of the east, west and south walls is R-1.5; the north wall is R-4.1, the overhead doors R-6.5 and the man doors R-2 to 4. The interior is painted masonry or dry wall.

The ceilings are suspended acoustical and open wood framing. The flat roof is wood framed truss covered with planking and an EPDM roof with 2" of polyisocyanurate insulation. The estimated R value of the roof space is R-16.

The current Energy Code specifies an R 20 at the roof and an R13 at the walls. These are minimum R values; better performing buildings have an R 20 at the walls and an R 40 at the roofs.

A visual inspection of the building shows numerous cracks and voids in the block walls and, around windows and doors. The tops of the block walls are open and the blocks are porous, creating a chimney affect within the walls and moisture issues.

Listed below are the recommendations to improve the building envelope. However, considering the poor quality of the building envelope, its structural problems, the moisture issues, the older lighting and heating systems, it may be more cost effective to replace the building in the long term.

Penetrations, cracks, gaps and voids at the walls and ceilings are recommended to be air sealed. The tops of the block walls should have closed cell spray foam applied to seal them. The next recommendation is to add 3" of closed cell spray foam insulation at the underside of the roof deck and 2" of closed cell spray foam insulation at the band joist at the roof and masonry wall intersection. The spray foam shall have a coating that meets the State Fire Marshalls requirements. This will increase the roof R value to an estimated R-34 and the band joist to R-20. It will not only improve the heat loss and gain due to conduction but will also reduce the air infiltration and moisture problems. This will reduce the heat loss through the roof by an estimated 50%.

There are two possible approaches to improving the walls R values: one is to add insulation to the interior face; the other is to add insulation to the exterior face of the wall. Adding insulation to the inside is easier, but presents a problem as it would move the dew point into the block wall causing moisture issues, most likely freezing and thawing within the wall. This can severely damage the wall.

The recommendation is to apply insulation to the exterior face of the exposed block walls. One approach is to clean and furr out the walls, apply 2" of closed cell spray foam or add a 2" layer of rigid insulation, install a fluid applied vapor barrier over the insulation leaving a space for a drainage plane and then apply cladding to the exterior face. The cladding could be a variety of materials, including vinyl siding, metal panels, wood, etc.

A second and preferred method, is to install a drained EIFIS system and the drained system is emphasized. Both approaches will require framing out at the windows, the roof facia and replacing flashing. No interior air or vapor barrier should be added to these walls, any cover should be permeable so the walls can breath and dry to the inside.

This would improve the R value of the walls to an estimated R-12.5 and reduce the heat loss through the walls by an estimated 70%.

No grout or reinforcing could be detected in the walls with the infrared camera or upon visual inspection. This was confirmed through information the town had obtained from the Structural Engineer. Considerable cracking and signs of movement were noted, and a lack of control or expansion joints were noted. These joints should be added based on the recommendation of the structural engineer. Both the new and existing joints should have backer road and caulking applied to both faces of the wall.

In addition, where the masonry wall rests on the concrete foundation there is no flashing, and a mortar fillet that attempts to shed water likely does not work effectively. Correcting this will be difficult because the concrete wall is so close to the outside finished grade, however installing a termination strip with flashing wherever possible as well as a perimeter drain at the rear of the building will help.

The weather stripping of the overhead doors is worn, allowing considerable air infiltration. It is recommended that the overhead doors have the weather stripping replaced with a commercial grade material by Gossen Corp Jambseal or equal. It is estimated the weather stripping will save about 1% of the heating fuel.

The purpose of including the following photos is to offer a visual representation of the present condition of the building envelope so the reader may have a better understanding of the situation and why the recommendations are being made.

Picture to left shows voids at the jamb and no flashing.

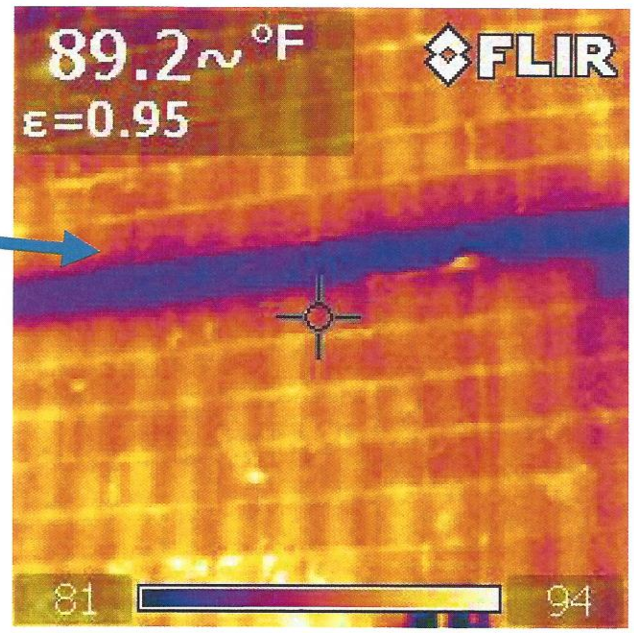
Picture below shows no sill flashing and signs of water intrusion

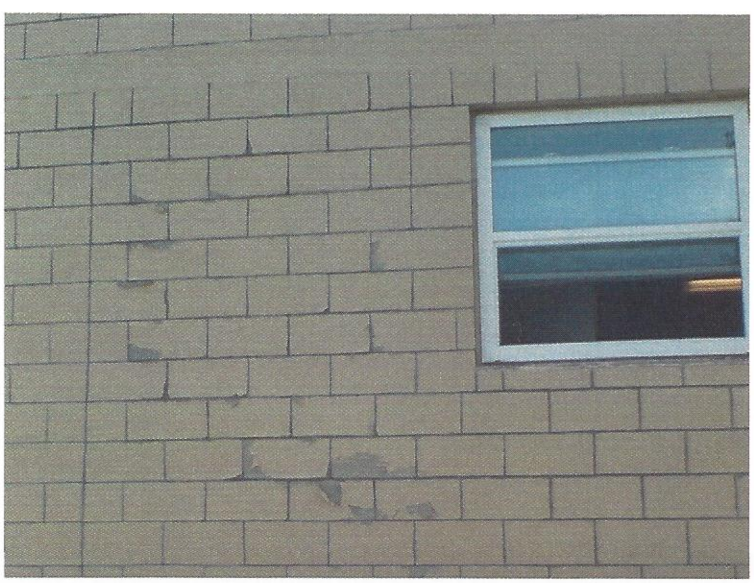
Picture below show voids at window frame allowing air and moisture to enter building and heat to escape

View of deck recommended to receive cell spray foam insulation. Tongue and groove deck is noted for air infiltration at joints. Spray insulation will correct this.

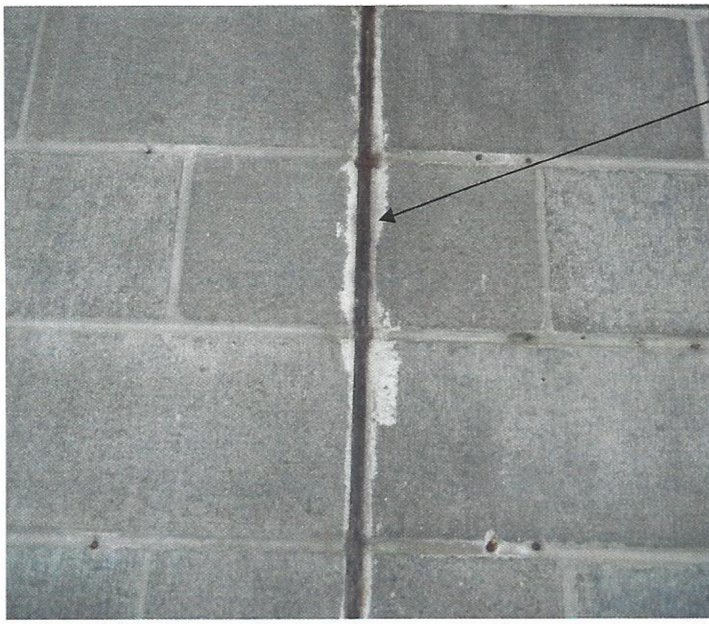
View of south wall, blue shows the floor line and joist. The blue represents a cooler surface that is recommended to receive closed cell spray foam.

Note if the wall had been grouted or reinforced it would have shown bluer because the core would be filled





View of wall showing paint lifting due to driving force of moisture to the outside of the building

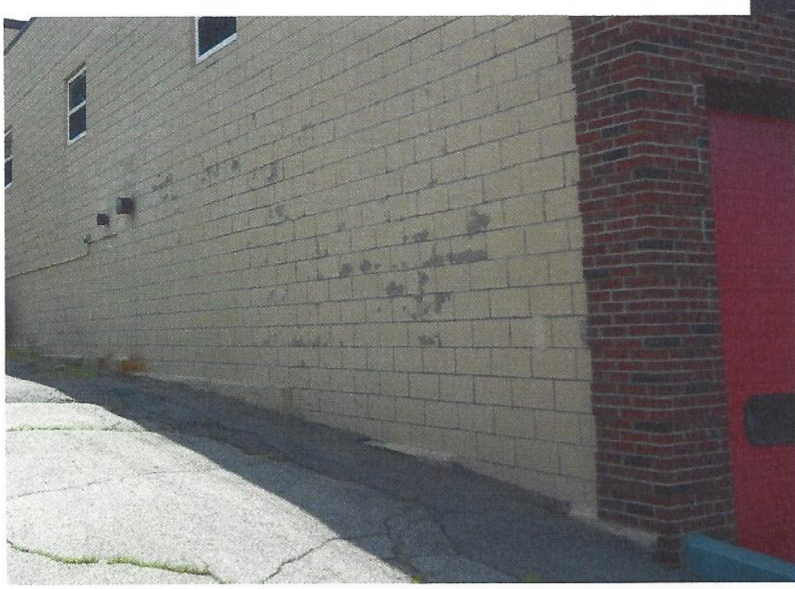


Interior view of expansion joint, a wood spacer was inserted, never removed for backer rod and caulking to be installed

View to right shows mortar fillet at top of concrete foundation trying to be used as flashing. Note how loose and cracked it is.

This is not performing as flashing

Below the view shows the steps in the concrete foundation with no flashing creating a point for water to enter. Also, note some steps are below grade, but there is positive drainage away from the building



6. Lighting

The predominant lighting fixtures are linear fluorescents, a few are newer T8's and a number of older T12's. In addition, there are some incandescent and high pressure sodium fixtures mixed in. The primary measure is to retrofit or re-lamp and re-ballast the existing T12 fixtures with high performance T8's and replace existing 32 watt T8 lamps with lower voltage 28 watt lamps. Retrofitting the Apparatus Bay fixtures from 8' lamps to 2-4' lamps is recommended. Some of these measures only make sense from a cost perspective when lamps or ballasts burn out and are indicated in the payback table. In addition, the recommended control strategy is to add sensors in rooms and areas to turn off lights when not occupied. This can be a hidden cost when lights are left on in rooms that are not occupied for extended periods of time. Some additional switches are also recommended.

Where incandescents exist, it is recommended that they be replaced with CFL's and in some instances LED's, if they are on for extended periods of time. The recommendations are to replace exterior HPS lamps and man door fixtures with LED fixtures. LED replacement lamps and fixtures are becoming more cost effective, the price is being reduced by half every two to three years, they are the least expensive to operate, work well in cold weather, are dimmable, work with photo sensors and reduce replacement costs because of their long life.

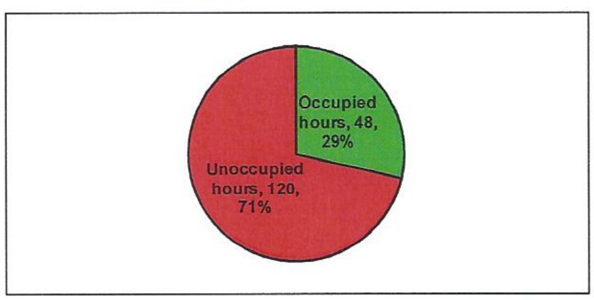
The tables below provide an approximate potential for energy savings opportunities to reduce electrical lighting consumption throughout the facility by upgrading a number of the lighting fixtures. These recommendations should result in better lighting control, more comfortable lighting and save lighting expense.

Summary Lighting Table

	Location	Fixture type	# of units	Watts per Unit	Max Total kW	Hrs/ Day	# of Days	Annual Operating Hours	Annual Total kWh	Annual kWh Cost	Potential Annual Savings	Annual kWh Saved
										$0.14		
Estimated Annual Lighting Usage and Cost									10,578	$1,513		
TOTAL Estimated Annual Lighting Savings											$802	5,610
						Estimated Carbon Dioxide (CO2) Savings Tons Per Year						4.4

Based on 168 hours in a week

Occupied hours	Unoccupied hours
48	120



Berwick Fire Department Lighting Table												
1	Location	Fixture type	# of units	Watts per Unit	Max Total kW	Hrs/ Day	# of Days	Annual Operating Hours	Annual Total kWh	Annual kWh Cost	Potential Annual Savings	kWh Saved
										$0.14		
Existing	App Bay	2L 1x8 T12	6	138	0.828	8	250	2000	1,656	$237		
Retrofit	Add 2 sensors	2L 2 1x4 T8-28w	6	99	0.594	7	220	1540	915	$131	$106	741
Existing		2L 1x8 T12	3	138	0.414	8	250	2000	828	$118		
Retrofit		2L 2 1x4 T8-28w	3	98	0.294	8	250	2000	588	$84	$34	240
Existing	Bot Stair	2L 1x4 T12	1	80	0.08	24	365	8760	701	$100		
Retrofit		2L 1x4 T8-28w	1	40	0.04	24	365	8760	350	$50	$50	350
Existing	Radio Room	4L 2x4 T12	1	144	0.144	8	250	2000	288	$41		
Retrofit		2L 1x4 T8-28w	1	40	0.04	8	250	2000	80	$11	$30	208
Existing		1L Inc	2	65	0.13	4	120	480	62	$9		
Retrofit		1L CFL	2	14	0.028	4	120	480	13	$2	$7	49
Existing	Boiler Rm	2L 1x8 T12	1	138	0.138	2	120	240	33	$5		
Retrofit	New Fixt	2L 1x4 T8-28w	1	40	0.04	2	120	240	10	$1	$3	24
Existing	Rest Rm	1L Inc	1	60	0.06	2	250	500	30	$4		
Retrofit		1L CFL	1	14	0.014	2	250	500	7	$1	$3	23
Existing	Lt Office	2L 1x4 T12	1	80	0.08	8	250	2000	160	$23		
Retrofit	Add sensor	2L 1x4 T8-28w	1	40	0.04	8	250	2000	80	$11	$11	80
Existing	Hall	2L 1x4 T8	3	53	0.159	8	250	2000	318	$45		
Retrofit		2L 1x4 T8-28w	3	40	0.12	8	250	2000	240	$34	$11	78
Existing	Womens Room	1L Inc	2	60	0.12	0.5	250	125	15	$2		
Retrofit		1L CFL	2	14	0.028	0.5	250	125	4	$1	$2	12
Existing	Mens Room	1L Inc	2	60	0.12	1	250	250	30	$4		
Retrofit		1L CFL	2	24	0.048	1	250	250	12	$2	$3	18
Existing	Chief	2L 1x4 T8	6	53	0.318	9	250	2250	716	$102		
Retrofit	Add switch (leave 6 fixtures)	2L 1x4 T8-28w	4	40	0.16	9	250	2250	360	$51	$51	356
Red indicates estimate									Annual Total kWh	Annual kWh Cost	Potential Annual Savings	kWh Saved
										$0.14		
Estimated Annual Lighting Usage and Cost									4,837	$ 692		
Table 1 Estimated Annual Lighting Savings											$311	2,178

2	Location	Fixture type	# of units	Watts per Unit	Max Total kW	Hrs/ Day	# of Days	Annual Operating Hours	Annual Total kWh	Annual kWh Cost	Potential Annual Savings	kWh Saved
										$0.14		
Existing	Meeting Room	4L 2x4 T8	19	130	2.47	4	200	800	1,976	$283		
Retrofit		4L 2x4 T8 28W	19	80	1.52	4	200	800	1,216	$174	$109	760
Existing	Kitchen	2L 1x4 T12	1	96	0.096	3	100	300	29	$4		
Retrofit		2L 1x4 T8-28w	1	40	0.04	3	100	300	12	$2	$2	17
Existing		1L 1x2 T12	4	96	0.384	4	100	400	154	$22		
Retrofit		2L 1x4 T8-28w	4	40	0.16	4	100	400	64	$9	$13	90
Existing		1L INC Spot	4	96	0.384	4	100	400	154	$22		
Retrofit		1L CFL Spot	4	53	0.212	4	100	400	85	$12	$10	69
Existing	Storage Rm 1	2L 1x8 T12	12	96	1.152	4	200	800	922	$132		
Retrofit	Add Sensor	2L 1x4 T8-28w	12	40	0.48	3	200	600	288	$41	$91	634
Existing	Lounge	3L 2x4 T8	8	85	0.68	2	200	400	272	$39		
Retrofit		3L 2x4 T8 28w	8	60	0.48	2	200	400	192	$27	$11	80
Existing	Storage Rm 1	2L 1x8 T12	1	96	0.096	2	50	100	10	$1		
Retrofit	Add Sensor	2L 1x4 T8-28w	1	40	0.04	2	50	100	4	$1	$1	6
	Exterior											
Existing	App O/H Dr light	1L HPS	1	300	0.3	12	365	4380	1,314	$188		
Retrofit	New Fixture	1L LED	1	33	0.033	12	365	4380	145	$21	$167	1,169
Existing	Man door lights	1L Inc	2	95	0.19	12	365	4380	832	$119		
Retrofit		1L LED	2	10	0.02	12	365	4380	88	$13	$106	745
Existing	Rear O/H Dr Light	1L Inc	1	130	0.13	12	365	4380	569	$81		
Retrofit		1L LED	1	20	0.02	12	365	4380	88	$13	$69	482
Red indicates estimate									Annual Total kWh	Annual kWh Cost	Potential Annual Savings	kWh Saved
										$0.14		
Estimated Annual Lighting Usage and Cost									6,231	$ 891		
Table 2 Estimated Annual Lighting Savings											$579	4,050

This table is for informational purposes only. Always consult your lighting professional before specifying a new technology for your facility.
The estimated annual savings are based on a general walk through of the building and the reported operating hours.
Detailed energy savings should be determined by your electrician, supplier or manufacturer before a purchase is completed.
Your electrician, supplier or manufacturer must confirm that the proposed lighting meets the Efficiency Maine prescriptive cash incentives.
You can find Efficiency Maine incentives at www.efficiencymaine.com/pdfs/Prescriptive-Cash-Incentives.pdf.

7. Mechanical Systems

The mechanical systems are comprised of the heating, controls, ventilation and domestic hot water systems.

7.1 Heating System & Controls

The heating system is a combination of forced hot air unit heaters, in the lower section of the building and fin tube baseboard in the upper section. The heat source in the lower section is two gas fired fan driven Reznor unit heaters. The larger is a 300,000 Btu input 2 stage unit rated at 80% efficiency and the other is a 130,000 Btu input two stage unit rated at 80% efficiency. The first stage operates at 50% of the rated capacity of the unit heater. These are suspended from the ceiling near the north wall with the larger unit facing toward the front of the station.

The boiler is a Weil McLean 248,000 Btu input firing at 2.0 gph. There were no current efficiency tests available, however when new the unit was rated at 80% efficiency and is likely in the 75 to 80% range. The burner has been replaced, but the boiler is 18 years old and approaching the end of its useful life, which is in the 20 to 25 year range. The seasonal efficiency is estimated to be in the 60 to 70% range based on industry studies.

Due to the open stair well and un-insulated floor, much of the heat from the lower section rises and actually heats the upper floor placing a greater demand on the unit heaters in the basement. This is confirmed by heat loss calculations for the two areas and the amount of fuel usage. The heat loss of the upper section is calculated to be twice that of the lower section but the fuel usage of the unit heaters is three times that of the boiler. Some of this difference is offset by the opening and closing of the overhead doors but only a portion.

Since the unit heaters are fairly new, staged and relatively efficient it is not recommended to make changes. Keeping them clean, tuned and throwing their exhaust downward will help them work more efficiently. In addition changing the present manual thermostats to programmable ones compatible to the two stage unit should improve efficiency in the 5% range. Improving how the heat is recalculated to the floor area will improve the effectiveness of the system and will be discussed under the ventilation system.

A replacement plan should be in place for the boiler since it could need major repairs or replacement in the near future. The most significant measure that could be under taken is to improve the building envelope which would allow the size of the boiler to be reduced by an estimated 30%. This would result in a lower first cost and long term operating costs. Installing a modulating propane fired condensing boiler would improve the seasonal efficiency by 20 to

25%. The fact that the town buys its propane at a competitive rate makes this choice feasible over oil. This will involve making sure the return water temperature will be low enough for the boiler to condense. In addition, changing the present manual thermostat to a programmable one should improve efficiency in the 5% range

Below is a table showing the dollar reduction in fuel costs based up on a percentage improvement in fuel use. This table only pertains to # 2 fuel burned in the boiler.

Estimated Fuel Oil Savings for Your Building Based on Cost Per Gallon						
Gallons of fuel oil used2010/2011	873					
Fuel oil cost per gallon	$3.00	$3.50	$4.00	$4.50	$4.50	$5.00
10 percent savings	$262	$306	$349	$393	$393	$437
15 percent savings	$393	$458	$524	$589	$589	$655
20 percent savings	$524	$611	$698	$786	$786	$873
25 percent savings	$655	$764	$873	$982	$982	$1,091
30 percent savings	$786	$917	$1,048	$1,179	$1,179	$1,310

7.2 Domestic Hot Water

Hot water is provided by a relatively new Rheem 40 gallon electric hot water tank. Hot water is supplied 24 hour per day 7 days per week even when the station is closed. Because the building has periodic high demands a small electric hot water tank with a seven day timer is not practical. However, installing a seven day programmable digital timer on the existing tank will save electricity and money.

In addition insulating the first 8 feet of hot water supply and cold water feed piping in the boiler room is recommended.

View of the 40 gallon electric hot water heater

The average estimated use of hot water is 29 gallons per day and the peak use is 6.5 gallons per hour. Below is a table showing the estimated hot water use for the building.

Estimated Hot Water Peak Demand and Yearly Use						
Fixture	Units	Gals per minute	mins / day	gals / day	days / year	Gal Year
Kitchen Sink	1	2	10	20	10	200
Commercial Clothes Washer	1	2	30	60	24	1440
Restroom Sink	3	0.5	15	22.5	250	5625
Utility Sink	1	1	10	10	10	100
Peak use in gallons per minute (all fixtures on simultaneously)						6.5
Estimated total gallons of hot water per year						7,365
Days per year hot water is used						250
Estimated gallons of hot water used per day						29
These are estimates based on the number of fixtures and estimated use.						
Actual domestic hot water usage should be calculated by the supplier who is proposing the equipment.						

Based on the usage and projected cost savings it is recommended a seven day timer be added

Electric Water Heater--add 7-day Timer												
	Location	Fixture type	# of units	Watts per unit	Max Total kW	Hrs/ Day	# of Days	Annual Operating Hours	Annual Total kWh	Annual kWh Cost @	Potential Annual Savings	Annual kWh Saved
										$0.14		
Existing	Kitchen	40 gallon electric hot water heater	1	4500	4.5	4	365	1460	6570	$920		
Retrofit		Add 7 day timer	1	4500	4.5	3	260	780	3510	$491	$428	3060
									Annual Total kWh	Annual kWh Cost	Potential Annual Savings	Annual kWh Saved
									6570	$920	$428	3,060
Estimated Carbon Dioxide (CO2) Savings Tons Per Year												2.4
Installing a timer will allow for the hot water heater to operate outside of normal business hours to help reduce electric demand.												
A 7- day timer turns the water on and off during the week. For a typical application with the normal water demand less than the tank's capacity, you can run the heater twice a day (early morning and late evening) for an hour outside of the business peak demand.												

to the hot water. The table below shows the estimated savings that can be realized.

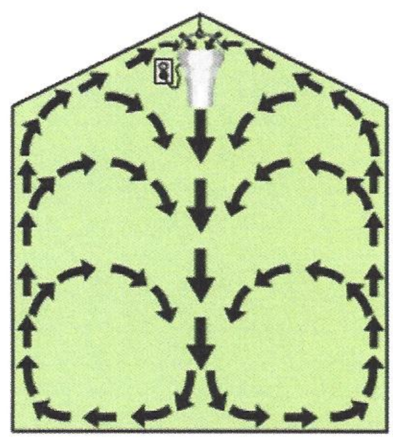
Based on the projected savings the payback for changing the domestic hot water system is about 1 year.

Estimated cost to Install a 7 day Timer			
Equipment/Labor	**Qty**	**cost each**	**Total**
7 day Timer	1	$175	$175
Installation Labor Electrician	2	$75	$150
Estimated installed capital cost			**$325**
Eff Maine Incentives	1	$0	**$0**
Cost to Implement (capital cost-incentives)			**$325**
*Projected Yearly Energy Savings			**$428**
Simple Payback in Years			**0.8**

7.3 Ventilation

Ventilation consists of a fume exhaust system in the apparatus bay which automatically engages when the overhead doors are opened. This appears to be operating properly for its intended use.

It is recommended that consideration be given to replacing the existing paddle fans with a "de-stratification" thermal equalizing fans in your facility. These fans use new air flow technology that collimates the air from the ceiling and transports it to the floor creating thermal equalization more efficiently than ceiling fans. They can provide comfort and reduce energy consumption in facilities with high ceilings.



Paddle ceiling fans mix the air, but in high bay areas they typically do not mix the air at the lower levels (where the people are) and the thermostats are located. The new turbo fans take up significantly less room than a ceiling fan and they are very effective at reducing dead zones, cold spots and hot spots within the room.

The turbo fans stabilize the temperature in the entire air column and reduce the heat/cool on/off cycle that is typical in high bay spaces.

It is also important to understand that the thermostats are typically installed at approximately five feet above the finished floor. Rooms with high ceilings have to heat the entire air column to satisfy the thermostat setting which typically results in a peak ceiling temperature that is 5 to 10 degrees warmer than the floor temperature. Therefore, thermal equalization enhances comfort and reduces energy consumption. These will also limit the amount of warm air that travels to the upper section of the building.

This technology can be viewed at: http://www.mainegreenbuilding.org/Instance-20.html .

This technology may help in reducing heating cost. Many business owners have reported reduced energy consumption (between 10% - 30%) after installing these de-stratification fans. It is estimated that the Equalizers could reduce fuel consumption by 5 to 15 % for the space.

Airius Thermal Equalizers							
Model	Height	Diameter	Weight	Watts @ 60 Hz	Volts	Coverage*	Ceiling Height*
10	22 in.	13 in.	12 lbs.	15	120/230	1200 sq. ft.	Up to 12 feet
15	22 in.	13 in.	12 lbs.	17	120/230	1200 sq. ft.	Up to 18 feet
25	22 in.	13 in.	12 lbs	35	120/230/277	1200 sq. ft	Up to 30 feet
35	22 in.	13 in.	12 lbs.	76	120/230/277	1200 sq. ft.	Up to 40 feet

9. Miscellaneous Equipment

The station has two vending machines, one that has refrigeration. It is recommended to install vending misers on each machine

A typical vending machine consumes approximately $300 of electricity per year. By using a Vending Miser http://www.vendingmiserstore.com, you can reduce electricity use of each cold drink vending machine by an average of 40%. Since the drink dispenser vending machine is a refrigerator, the heat exhausted from the condensing coil in the back of the vending machine can reach over 100ºF. This adds to the heat load of the building. Ensure the machine does not get placed next to a thermostat, ice machine, etc.

Vending Machines		
Pepsi Machine		
Estimated Annual Savings		$294.00
Miser Cost		$175.00
Simple Payback- yrs		1.68
Snack Machine		
Estimated Annual Savings		$93.00
Miser Cost		$165.00
Simple Payback-yrs		0.56