LEVEL II - ENERGY AUDIT

Fare Share Co-op

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What Is an Energy Audit: The definition of an energy audit varies from a simple walk-through of a building to a comprehensive study including advanced computer modeling of the buildings and cost & benefits computations that are sufficiently comprehensive to take to an investor or bank. The Association of Energy Engineers (AEE) and the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) define three levels of energy audits.

1. Level 1- The Walk-through Audit: Includes a brief assessment of utility bills and their comparison to industry averages, a walk-through of the building with the owner and a brief narrative of the findings.
2. Level II – The Standard Audit: Quantifies energy use and loss through the building envelop, mechanical systems, production equipment (ie. Commercial kitchen equipment), and lighting. This audit provides simple payback analyses as well as some level of investment computations. The audit will be accompanied by a relatively complete report showing cost / benefit calculations and an itemized list of recommendations.
3. Level III – The Investment Grade Audit: Level III builds upon the Standard Audit and usually includes hourly computer simulation of the building, field testing and monitoring of energy using equipment, and cost & benefit calculations that take the time value of money into consideration to provide a Return on Investment calculation required by financial institutions before they will consider loaning money for a given project. This level is normally provided by a licensed engineer and / or Certified Energy Manager.

Disclaimer: Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not constitute or imply its endorsement, recommendation, or favoring by TCorp.

Please Note: The recommendations included in this report are provided to help reduce the energy consumption of the building. Recommendations effecting insulation levels, air sealing, mechanical systems and other components of the building have the potential to significantly impact air circulation and moisture levels in the building. Tighter buildings may require mechanical or additional mechanical ventilation to meet ASHRAE 62.1.

The implementation of recommendations made in this report should be carried out by a qualified individual with the appropriate training and experience. Efficiency improvements made to historic buildings should be reviewed by a qualified architectural historian.

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METHOD OF ANALYSIS

Information gathered during the initial site visit was evaluated for energy conservation and efficiency upgrade opportunities. Those opportunities are listed in order of cost-effectiveness from quickest rate of return on investment (ROI) to longest. We provide you with both simple pay-back and the discounted payback which considers the net present or time value of the investment. From this analysis we get the Savings-to-Investment Ratio (SIR); the greater the SIR the better the investment.

Building systems interact; heat from lighting reduces the need for energy from the boiler or furnace, heat gained from the sun or mechanical equipment within the building increases the refrigeration load in walk-in coolers, etc. Therefore, energy conservation measure (ECM) savings is typically interactive as well and we need to determine the interactive (Net) effect of our conservation efforts. Data that is gathered during the site visit is entered into an energy modeling program that can estimate the energy relationships throughout the building. From these calculations an energy usage pattern is developed and then compared to the historical energy use data. This helps the auditor evaluate the accuracy of the audit, estimate the efficiency of the energy using systems and determine the benefit of energy efficiency and conservation improvements to be recommended.

To calculate energy savings from purposed ECMs, the following equations are used:

$$\text{Area } [ft^2] \times (\text{U-Value Existing } (^1/_R) - \text{U-Value Purposed } (^1/_R)) \times (\text{HDD} \times 24) = \text{Annual Heat Loss Reduction [Btu]}$$

$$\text{Previous Years Usage [energy unit]} \times (\text{Purposed System Eff. \%} - \text{Existing System Eff. \%}) = \text{Anticipated Energy Savings [energy unit]}$$

The costs and savings are applied and a simple payback and savings to investment ratio are calculated.

$$\text{Project Net Cost [\$]} / \text{Annual Savings [\$/yr]} = \text{Simple Payback [yrs]}$$

$$\text{Total Present Value Savings [\$]} / \text{Project New Cost [\$]} = \text{Savings to Investment Ratio}$$

TABLE 1: ENERGY CONSERVATION MEASURE – ECONOMICS

Table 1 is a listing of Energy Conservation Measures (ECM) that if implemented would reduce the amount of energy consumed by the Fare Share Co-op building.

All ECM's were tested and presented in order of highest Savings to Investment Ratio (SIR). The SIR is a more accurate evaluation of return on investment (ROI) than the simple payback and considers the Time Value of Money. Only those ECM recommendations with a SIR greater than 1 are listed in Table 1.

NISTIR 85-3273-26 2011 Energy Price Indices and Discount Factors were used with a spreadsheet derived from the Building Life Cycle Costing (BLCC) software package developed for the Department of Energy.

what is back up system

ECM #	Action	Gross Cost	Estimated Utility Incentives	Net Cost	Annual Cost Savings	Savings / Investment Ratio	ECM Description
1	Insulate Foundation	$1500	0	$1500	$1800	16.7	Pg. 12
2	Lighting Retrofit	$3475	$1207	$2268	$680.75	2.92	Pg. 20
3	New Wood Pellet Boiler -Incremental	$15000	0	$15000	$1188	1.96	Pg. 20
4	Wood Pellet Boiler – Non-Incremental	$30000	0	$30000	$2610	1.71	Pg. 19
5	Instantaneous Domestic Hot Water	$1000 /unit	0	$1000	$170.50	1.88	Pg. 16
6	Walk-in Cooler Economizer	$6951	$2375	$4576	$782.46	1.34	Pg. 10
	New Oil Fired Boiler	$15000	0	$15000	$1092.41	1.01	Pg. 19
8	Compressor	3000-4000			—		

includes cooler T8's

Maine Energy Systems

Freez

no

$385.

chimney liner

soft case

grant / Lease

Package

door closers

Accountant conversations
Ed Damon

paint rubber roof white

replace vent caps

Walkthrough Narrative

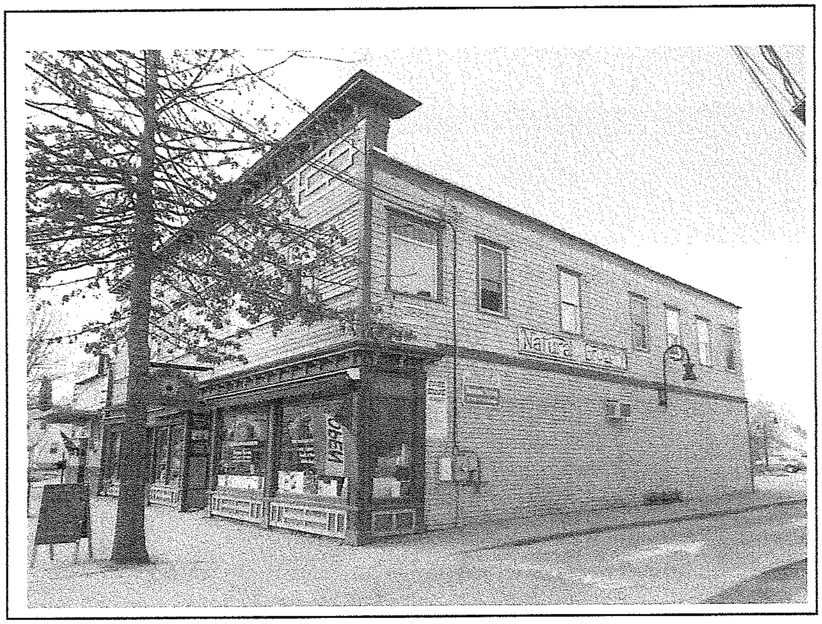


Figure 1: Fare Share Co-op Building, Main Street, Norway, Maine

TCorp visited the Fare Share Co-op on June 2nd, 2012 for the purpose of providing an ASHRAE Level II type energy audit.

The structure was built in 1916 and was originally a post office. The building is a wood structure with 2x4 wall construction. The interior of the building is divided into multiple areas of use including a grocery store and art gallery on the first level and offices on the second level.

The building is heated with three oil fired boilers with efficiencies from 79 to 73% (steady-state). System efficiencies will be approximately 8% less. These boilers are approximately 30 years old and show signs of age such as water seeping through seals and rust of the boiler jacket. They should be replaced.

Lighting is a mix of relatively new T8 lamped and older T12 lamped recessed 2 ft. by 4 ft. fixtures on the second level and old eight and four foot T12 open, industrial type fixtures in the grocery store. The gallery has ceiling mounted incandescent flood lights with Par 30 incandescent lamps.

Electricity is provided to the Co-op building by Central Maine Power for distribution and Dominion Retail, Inc. (Standard Offer provider) for energy supply. Oil for heating and propane for cooking, has been delivered by multiple service providers over the past few years.

The structure is in good condition, showing no obvious signs of deterioration. All but the South West and North West corner large fixed windows on the second floor have been replaced with thermal casement style, vinyl framed, operable, windows. On the West side, single glazed, stain-glass windows above the new casements remain in their original state. Vinyl double hung windows have replaced all other windows on the second level. The first floor grocery storefront windows on the West and South walls remain single pane fixed. The gallery fixed windows have been retrofitted with thermal-pane glass.

Attic ventilation is provided by holes drilled into the soffit of the roof on the north and south sides. Several of the metal vent caps have been lost leaving access to the attic space for rodents, bugs, weather and other nasty things. Replace these vent caps as soon as possible.

The building has received two energy usage evaluations in the past 10 years. Each gives a set of energy conservation recommendations based upon the knowledge and expertise of the auditor. These audits represent Level I energy audits as defined by the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE).

The first audit – circa 2003 – emphasizes reducing refrigeration costs by introducing outside air to the condensers located in the basement, programmable thermostats for unoccupied setback of conditioned space temperatures, insulation, making sure the Co-op is getting the best available electrical rate from suppliers and addressing the electrical distribution to tenants by installing sub-meters.

Energy audit – 2003 Recommendations

1. Supply 100% outside air to refrigeration condensing units in basement
2. Cover the reach – in display cases at night
3. Turn off anti-sweat heaters when outdoor temperatures are below 40 degrees F.
4. Install programmable thermostats
5. Add thermal insulation and reduce infiltration
6. Negotiate with electric suppliers for the most favorable rate
7. Sub-meter tenants' use of electricity

The second audit – circa 2007 – recommends many of the same energy conservation and cost control options and includes suggested lighting upgrade options and window replacement. Common to both reports is the need to address the refrigeration systems in the basement and their effects on the building.

Energy Audit – 2007 Recommendations

1. Lighting
2. Insulation
3. Windows
4. Night set-back of thermostats during heating season
5. Ventilation controls
6. Air conditioning
7. Refrigeration
8. Computer controls

Measures taken:

1. Programmable thermostats on second floor tenant's areas
2. Lighting retrofit on second floor
3. New windows on second floor
4. Thermal Windows for the Gallery
5. Vegetable display case removed
6. Glass door freezer removed – being replaced

Both previous auditors recommend moving the refrigeration compressors outside. I agree that this recommendation makes sense with the following caveats:

- All compressors are not designed to be installed outside.
    - A careful assessment of the remaining compressor by a qualified refrigeration technician should be provided to ascertain the capability of outside operations.
    - The Witt walk-in cooler compressor, located in the basement is not rated for outdoor use. It is clearly stamped "NO" in the Outdoor Use box.
- Compressors make noise
    - There are residential neighbors to consider, the issue will be most obvious when the summer temperatures are warmest and the neighbors have their windows open. This is also the time of year when the condenser fans will run the longest.
- Compressors have coils that must be kept clean and clear of ice, snow, leaves, dirt and other debris.
    - The compressors will most likely require a "dog-house" or shed type shelter that must be carefully designed and maintained so that air flow to the condenser coil is not restricted.

Four integrative design challenges in the basement:

- First and most important to your circumstance, drawing air out of your basement may affect the ability of your boilers to function properly. Depending on the amount of free air available to the boilers for combustion it is possible to create a negative pressure in the basement that can, as experience has shown, adversely affect the boiler's operation.
- Second, the condensers are designed to give off heat by forcing air through a coil much the same as a car cooling system does. The process depends on a temperature difference between the refrigeration gas and the air being drawn across the coil by the condenser fan. The hotter the air, the less heat the refrigerant can give off and the longer the condenser motor must run to keep the cooler, or freezer, at the desired temperature.

- Third, the heat being given off by the condenser coil has to be removed from the immediate area or the air temperature rises and the condenser has to work even harder.
- Fourth, energy is transferred from a warmer source to a cooler source, seeking equilibrium. That means that if the air around the condenser is 100 degrees and the room above it is 70 degrees, then the 70 degree area will eventually increase in temperature. If that 70 degree area is being maintained by an air conditioner, then the air conditioner will have to remove the additional heat to maintain 70 degrees.
    - Conversely, this will also affect the amount of heat needed from the boiler reducing fuel use. However, the cost per million BTU's for #2 fuel oil is $23.83 and the cost per million BTU's for electricity is $33.60.

There may be several reasons to keep the compressors in the basement including noise reduction, the cooler, below grade space in the summer, a cleaner environment and the option to capture some of that waste heat coming off the condenser coils. An alternative to moving everything outside is to build an isolated room and incorporate ventilation into the design so that sufficient air is drawn into the room from outside the building without effecting the boiler combustion air requirements. (Combustion air is another subject discussed in section Life Safety Concerns.)

- The room should be well insulated and sealed from the rest of the basement,
- Appropriate fire safety measures installed,
- Supply air should be matched to the air flow requirements of the condenser fans under design load,
- Supply air should come from the east side of the building to reduce solar effect.
- The compressors should be as close to the cases they service as possible to reduce heat gain which reduces the refrigeration effect of the coolant.
    - Copper is a great conductor of heat and will absorb energy from the surrounding air robbing the refrigerant of cooling capacity before it gets to the evaporator.
    - Longer supply lines mean more friction within the supply pipe which translates into heat which robs the refrigerant of its ability to cool the cases.

[An option would be to install a heat recovery system to transfer energy from the refrigeration gas to a water tank for preheating domestic hot water or return water to the boilers. Unfortunately, it is doubtful that there is sufficient waste heat energy available to make this measure cost-effective.]

LIFE SAFETY CONCERNS

- There may be a combination of events that could adversely affect the combustion process of the boilers.

- During the winter, snow and ice block the hopper windows which are used to provide both combustion air to the boilers and also to provide make-up air to the ventilation fan cooling the walk-in cooler condenser. Without adequate free air, the ventilation fan robs the boilers of sufficient combustion air.

The National Board of Boiler and Pressure Vessel Inspectors state that: Adequate air supply is critical for proper boiler operation. The requirements of the pertinent codes must be adhered to in order to assure good operation. If this is accomplished, a more efficient and safer installation will result.

Some *ASME Boiler and Pressure Vessel Code* requirements may have changed because of advances in material technology and/or actual experience. The reader is cautioned to refer to the latest edition and addenda of the *ASME Boiler and Pressure Vessel Code* for current requirements.

REFERENCES

- NFPA 54 - National Fuel Gas Code, 1992, section 5.3 Air for Combustion and Ventilation.

- NFPA 31 - Installation of Oil Burning Equipment, 1992, section 1-5 Air for Combustion and Ventilation.

- ASME CSD-1- Controls and Safety Devices for Automatically Fired Boilers, 1992 with addendum 1a 1993. section CG-260 Combustion Air.

- BOCA - National Mechanical Code, 1990, article 10, Combustion Air.

- SBCCI- Standard Mechanical Code, 1991, section 305 Combustion and Ventilation Air.

- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Handbook - Fundamentals, 1993, Chapter 15, page 15.9 Air For Combustion.

- Exit lights do not illuminate, probably lamps burned out and back-up batteries out dated.
- Combustion air for boilers not adequate
- Egress from second level:

NFPA 101, Life Safety Code, 2012 Edition, 31.2.2.1.3

"In non-high-rise buildings using Option 2, Option 3, or Option 4, exit stair doors shall be permitted to be 1-3⁄4 in. (44 mm) thick, solid-bonded wood-core doors that are self-closing and self-latching and in wood frames not less than 3⁄4 in. (19 mm) thick."

Neither door is self-closing. The door at the top of the West stairway is stuck open.

Recommendations for Improved Operations and Maintenance

The energy conservation measures described above represent the most significant opportunities to reduce energy consumption and achieve cost savings in the Fare Share Co-op building. However, the improvements listed below would also improve the performance of the building and reduce heating and electricity costs but have substantially longer payback periods.

1. Several of the soffit vent plugs have been lost allowing bugs, rodents and birds access to the interior. This should be remedied immediately.
2. Replace the North West and South West fixed windows with thermal or triple pane casement windows.
3. Apply storm window to exterior of stained glass windows.
4. Remove the existing fiberglass insulation from the ceiling, seal soffit vents and install 4 to 6 inches spray foam to underside of roof sheathing.
5. Install instantaneous water heater in second floor bathroom (energy and water savings)
6. Install Window covers for night time use on large fixed pane windows on west side of building.
7. Insulate water heater – install water heater jacket on unit in basement.

Refrigeration:

The existing walk-in cooler is in good condition and, other than the condenser in the basement shows no significant signs of wear or miss-use. The condenser, located in the basement is cooled with outside air taken from either the basement or the west side of the foundation wall via open hopper style basement windows. The west side of the building is a significant source of dirt, debris from street activity and heat absorbed by the street and sidewalk.

The cooler doors are Anthony Doors and have anti-sweat heaters – this auditor found no evidence of a switch to shut off the heaters when the humidity is low so this report assumes continuous operation. Evaporative fans within the cooler are standard fractional motors and defrost cycles are automatic whether the coils need defrosting or not.

Recommendation: ECM 6

Install a "Walk-in Cooler Economizer" to take advantage of outside air free-cooling when outside air temperatures are lower than the walk-in cooler setting;
Replace the standard efficiency evaporative motors with brushless dc evaporator fan motors;
Install anti-sweat heater controls;
Install defrost cycle controls.

a. Initial Cost: $6951.00

b. Estimated Utility Incentive: $2375.00
c. Net Cost: $4576.00
d. Annual Energy Savings: 6825 kilowatt hours
e. Estimated annual cost savings: $782.00
f. Simple Payback: 5.6 Years
g. Savings to Investment Ratio: 1.34

Thermal Envelope

To remain consistent throughout the report, window insulation values will be converted from their standard U-values and reported as R-values for two reasons.

R-Value = 1 / U-Value

The first reason is that by using R-values for the windows they can be easily compared to walls, ceilings and doors throughout the building.

Secondly, older existing windows and doors are typically an assembly without a clear rating; as in a "marriage" of a window with a storm window. An assembly R-value such as a wall, ceiling or door takes all the materials, combines the R-value of each product and its thickness and the amount of mass of each material and calculates the total assembly R-value. An example of how an assembly R-value is determined can be found in the Glossary.

The 2005 ASHRAE handbook was used to determine default R-values of the glass portion, perceived insulated glass, insulated or un-insulated frames, or non-glass areas.

Wall Assemblies

The post office building was built in 1916 and is a wood structure consisting of 2 inch by 4 inch walls, pine planking with a combination of shingles, shiplap siding and trim boards on the exterior. The interior wall surfaces have been retrofitted with sheet rock and are assumed to have 3 ½ inches of fiberglass between the studs.

The foundation is poured concrete, mostly below grade and there is no insulation applied to either the interior or exterior surfaces.

Recommendation: ECM 1

Insulate foundation walls with vinyl faced fiber glass from ceiling joist of basement down approximately 4 feet.

Initial Cost: $1500.00
Estimated Utility Incentive: $00.00

Net Cost: $1500.00
Annual Energy Savings: 547 Gallons #2 Fuel Oil
Simple Payback: .8 Year
Savings to Investment Ratio: 16.7

Conductive heat losses are measured by the following formula: U x A x ΔT = BTUs: U is the rate of conduction and is the inverse of R which is the value used for resistance to conductive heat losses, A is the area being calculated such as a wall or ceiling, and ΔT is the temperature difference between outside air and the temperature maintained inside.

For example, Eight inches of concrete has an R-value of .8 and its U value is (1/R) = 1.25, 3 ½ inches of fiber glass has an R-value of 11 and its U value is (1/R) =.09
The building is approximately 60 ft by 60 ft and the ground temperature against the first 4 feet of concrete foundation wall, from the floor joists above, down toward the concrete floor will be approximately the same temperature as the outdoor air. If the basement is at a constant temperature of 55 degrees F then the temperature difference will increase as the outside air temperature decreases; heat loss will increase proportionally to the increase in temperature difference.

Therefore: on the "design day (usually calculated at -20 degree F) the heat loss through an area of (60 ft*60 ft*4 ft) * (1.25 - .9) * (55 F – (-20)) = 378,000 BTU's per hour (BTUh) or approximately (378,000 BTUh / 138,500 BTU's per gallon of oil) / .75 (boiler efficiency) = 3.6 gallons lost per hour when the outside air temperature is -20.

Note: TCorp uses what is known as "Bin Calculations" which takes historical (to the area) temperature recordings "binned" into 5 degree F temperature increments and the number of hours per year where the outside temperature is within that degree bin to determine total heat loss through a particular area of a building.

One technique used to insulate unfinished basement walls uses vinyl faced fiberglass in the following way:

- Fasten horizontal nail strip (2x2 pine) onto foundation wall approximately 48 inches from bottom of ceiling joist.
- Fill rim band and sill boxes with un-faced fiber glass battens.
- Cut 1 inch blue-board to fit sill boxes and rim band to hold fiberglass in place and caulk to subfloor and sill.
- Starting approximately 12 inches from foundation wall, attach 6 mil poly sheeting to underside surface of ceiling joists toward sill.
- Attach poly to sill with strapping and let fall along foundation wall covering lower nail strip.
- Attach vinyl faced fiberglass to strapping at sill with second nail strip and double headed (duplex) nails.

- Let fiberglass battens fall along poly sheeting and "bag" by folding poly sheeting up over inside surface of vinyl and tape using WMP-VRR Patch Tape ordered with WMP-VRR Insulation with 1 " taped tab.
- Fasten duplex nails into horizontal nailing strip and run string cross wise from upper nailing strip to lower nailing strip to hold insulation in place.

ROOF

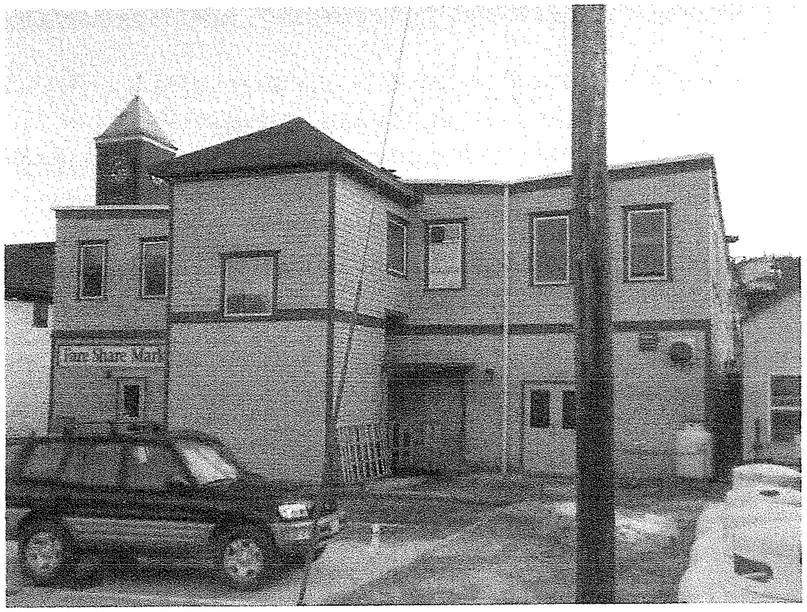


Figure 2: East Side of Fare Share Co-op Building

The roof of the Fare Share Co-op building is relatively flat with a pitched roof over the rear entry and incorporates 6 skylights over the rear second level, unheated hall. Holes approximately 6 inches in diameter have been cut into the north and south soffits for ventilation of the roof, approximately above the level of insulation. Six inches of fiberglass insulation (R-19 Batt with paper facing) which is installed between the roof joists; the north-east quadrant of the second floor has a sheetrock ceiling, all the rest is acoustical tile suspended ceiling approximately 6 inches below the insulation.

The insulation is installed adequately but does not maintain an air tight barrier from either the second floor warm air or the cold outside air coming in from the soffit vents.

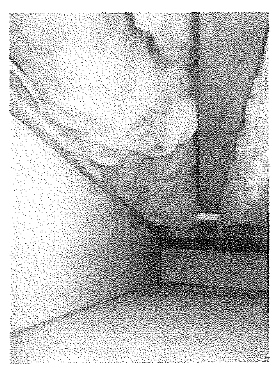


Figure 3 & 4: Second Floor Ceiling Insulation along Roof Edge

Recommendations:

1. Install a 6 mil poly vapor barrier to the underside of the roof joists.
2. Alternative: This is the best but much more expensive and disrupting to the tenants; remove the existing fiberglass insulation and spray foam the spaces between the roof joists.

WINDOWS

The windows on the first level are wood framed, fixed (non-opening) and the windows for the Gallery have been replaced with thermal pane glass. The grocery store windows are single pane and should be either replaced with thermal pane glass or have storm windows installed. The second level has a combination of vinyl casement, vinyl double-hung, and single pane (Leaded Stained Glass) fixed. There are several hopper style basement windows on the west side of the building that are in poor condition and should be replaced. Vinyl window replacements should be used to prevent deterioration due to water and debris collecting in the well.

Figure 4: Single Pane Store Front Windows of Co-op

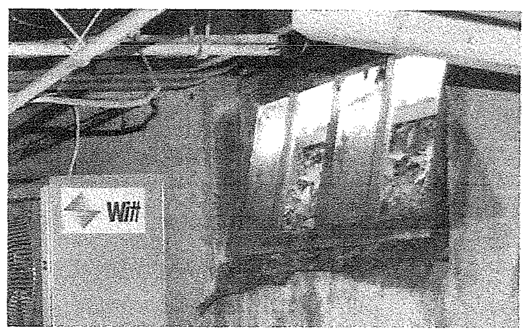


Figure 5: Basement Hopper Window with missing glass

Recommendations:

1. Have exterior storm windows made for the fixed pane windows of the store and second level stained glass.
2. Replace the basement hopper windows with thermal hopper windows.
   - This recommendation is more of a maintenance recommendation as the existing windows need repair or probably replacement anyway.

DOORS

The building's most used door is the west entry into the Fare Share Co-op. The condition of this door is fair and opens directly into the store. The door is metal, insulated and has a large glass thermal window. The overall R-value is estimated to be 5.

Recommendation: Inspect and maintain weather stripping and door sweep.
All doors leading into the building are insulated, metal doors with half glass (lites) which are double pane, except for the Gallery which as a full thermal lite.

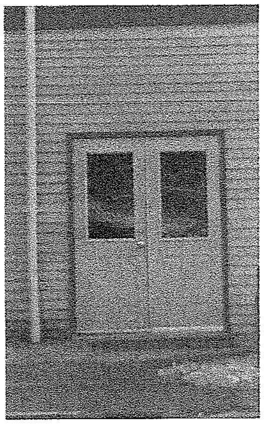


Figure 6: Co-op Loading Doors East Side of building

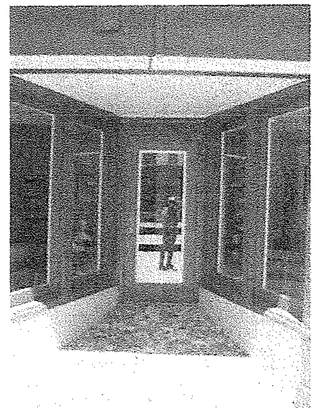


Figure 7: Front (West) Entry to Gallery

VENTILATION

There are five controlled ventilation systems within the building. One large ventilation fan protruding from the rear of the building near the double doors is for the kitchen and is controlled by a wall switch. There is a fan forcing air through a chute in the basement controlled by a wall mounted thermostat that is intended to remove heat from the refrigeration condenser in the basement and there are combination bathroom ventilation / light fixtures recessed into the ceilings of the three bathrooms; the bathroom fans are controlled by the light switch.

Recommendation:

1. Kitchen Fan: The kitchen fan should be controlled with a thermostat so that when the air inside is warmer than outside the fan operates. This will also ensure that when the gas range is being used, the fan operates.
    - Note: make up air is essential to the proper function of a commercial kitchen fan system so that unconditioned outside air is not drawn into the rest of the building
2. Remove the air shaft and construct a sealed room in the south-east corner of the basement. Move the condenser to that walk-in cooler into this room and provide dedicated outside air supply from the south side of the building. The fan should be mounted in such a manner as to draw air from within the sealed room to the outside.

DOMESTIC HOT WATER

Figure 8: Electric Water Heater in Basement

The domestic hot water in the building is provided by a 40 gallon electric heater that appears relatively new. It is located in the basement and supplies the kitchen and bathrooms on the first level and one bathroom on the second level and presumably the artist's sink.

Recommendation: Insulate the Water heater tank and the piping from the tank, 2 feet out for the cold water supply and as much of the exposed hot water supply piping as possible.

Recommendation: ECM 5
Install an instantaneous water heater in the second floor bathroom. Heated water has to flow two levels and therefore, has two run for some time before hot water reaches the faucet. An instantaneous water heat saves money and conserves water.

Recommendation: Install supply of hot water from the boiler(s) to the water heater serving the two bathrooms and the kitchen on the first level. Install a control valve between the supply line and the existing electric water heater so that when the boiler is not running, hot water can be supplied by the electric water heater.

HEAT DISTRIBUTION

Currently there are three boilers using #2 fuel oil.

- Boiler (A) is a Model V-36 manufactured by Burnham has a total MBTUh output of 302 and feeds the second floor four zones controlled by four thermostats, two are known to be programmable and are operating correctly. A combustion efficiency test performed 2009 (presumed to be the last time the systems were serviced) indicates a steady-state combustion efficiency of 73%. Based on a maximum rated fuel usage of 2.8 gallons per hour (GPH), the possible efficiency rating of this boiler is 78%.
    - Temperatures in the zones fluctuates and tenants indicate that some areas are too hot, evidenced by felt being used to insulate the baseboard fin tube in the Artist's room. The amount of baseboard in the artist's room is oversized.

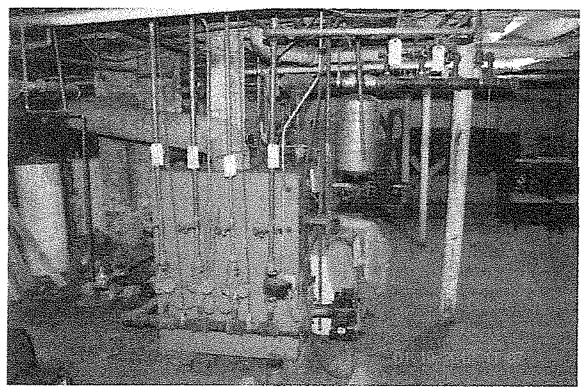


Figure 9: Burnham V36 Boiler in Basement

- Boiler (B) is a Model V-14 manufactured by Burnham has a total MBTUh output of 107.8 and feeds the Gallery. The combustion efficiency test indicated 79% during the 2009 service.
- Boiler (C) is a Model V-14 manufactured by Burnham has a total MBTUh output of 107.8 and feeds the Fare Share Co-op store. The combustion efficiency test indicated 79% during the 2009 service.

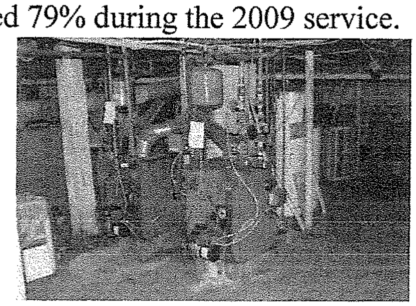


Figure 10: Two Burnham V14 Boilers in Basement

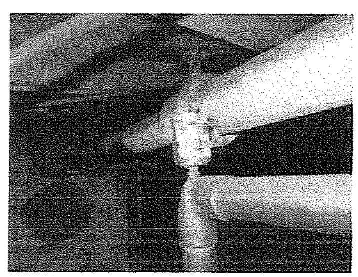


Figure 11: Air Relief Valve for heating supply piping - Green is from minerals in water

The physical condition of the boilers shows rust and metal fatigue as well as some water quality problems. Scaling and mineral buildup within a boiler and its piping system will reduce overall efficiencies by insulating the heat exchanger away from the hot water, and by causing restrictions in piping similar to plaque in an artery and can cause safety relief valves to fail. At a minimum, the piping system should be flushed by a professional boiler technician and an additive mixed into the heating water to slow down the corrosion process in the future.

A thorough inspection of the boilers should be provided by a qualified technician to determine the condition of the boiler heat exchangers, piping, valves, controls and burners. But by the looks of the boilers and their age, it would be prudent to consider installing new boilers.

New boilers are more efficient by design and re-designing the piping system so that the replacement boilers can supply all the needs of the building and be staged to deliver heat at maximum efficiency will greatly reduce the use of oil.

Alternatively, the use of a wood pellet fueled boiler system would significantly reduce costs and keep the money spent to heat the building local. Wood pellets are a renewable resource that is gaining in popularity and is a sustainable wood product in Maine. Modern wood burning boilers such as the OKOFEN offered by Maine Energy Systems located in Bethel, Maine are safe, efficient and clean burning. The automatic feed systems make delivering fuel and feeding the boiler much less energy intensive for the owner.
The cost equivalence between oil and wood pellets at $239 per ton of pellets is $1.96 per gallon of # 2 fuel oil. Oil purchased by the co-op in December, 2011 was $3.30 per gallon. Therefore, if the co-op uses 2400 gallons per year, the annual savings at today's prices would be approximately $7920.

Installed cost VS. Incremental cost

The installed cost of a wood pellet system would have a relatively long payback period if it wasn't for the fact that the oil boilers really need to be replaced. Therefore, I will evaluate two scenarios; first will be the replacement of the oil boilers with conventional boilers having an Energy Star rating of 85% or greater, such as the Buderus line of cast iron boilers. Along with the boilers, the piping changes will be designed so that each boiler services the entire building in a staged approach.

At the current thermal conditions of the building and not considering the waste heat generated in the basement by the refrigeration condensers, this building has a design load of approximately 175 Thousand BTU's per hr (MBTUh). (Design load is the amount of energy transferred from the conditioned space to the outdoors during the coldest hour of the year, normally considered to be -20 degrees F in northern New England. The total MBTUh capacity of the existing three boilers is approximately 478 MBTUh or approximately three times the capacity required.

METAL BUILDING INSULATION
A DIVISION OF BUILDING OUTLET CORP.

Date:	6/19/2012
Cust Svc Rep:	Jeremy Stieben

REMIT TO: Building Outlet Corp.
10390 Bradford Rd. Suite 140
Littleton, CO 80127
1-800-486-8415 Fax 303-948-2059

Purchase Order / Quote

Quoted To:

Buyer's Name	Peter Tousley
Contact:	Peter Tousley
Address:	
City, State, Zip:	
Phone:	802-735-0831
Fax:	
Email:	ptousely@tcorpinc.net

Ship To:

Job Name	
Contact:	
Address:	
City, State, Zip:	Norway, ME
Phone:	
Alt Phone:	

Bldg Dimensions and Info

Width:
Length:
Height:
Roof Pitch:
Roof Type:
Bldg Type:
Job Type:

Quantity Sq Ft	Item Description	Unit Price	Amount
	3" WMP-VRR Insulation w/ 1 Taped Tab		
4	48" wide x 60' long		
1	WMP-VRR Patch Tape		
	Total Delivered		$580.00
	4" WMP-VRR Insulation w/ 1 Taped Tab		
4	48" wide x 60' long		
1	WMP-VRR Patch Tape		
	Total Delivered	$630.00	Option

Notes:

Subtotal	$580.00
Sales Tax	Not Included
Freight	Included
Total US $	**$580.00**

Signature_______________ Date:_______________

All quotes subject to acceptance upon final review by an officer of Building Outlet Corporation. Actual delivery depends on parts / materials availability.

Recommendation: ECM 7

Replace all three boilers with a new, high efficiency, conventional boiler connected to a hot water supply header common to all areas of the building.

[Note: A Header is a length of pipe sized to supply all zones with adequate flow (GPM) of water upon demand. It is usually constructed in loop called the primary supply loop from the supply side of the boiler to the return. Each zone is equipped with a valve that opens, allowing hot water to flow to that area when the thermostat calls for heat.]

h. Initial Cost: $15000.00
i. Estimated Utility Incentive: $00.00
j. Net Cost: $15000.00
k. Annual Energy Savings: 331 Gallons #2 Fuel Oil
l. Simple Payback: 14 Years
m. Savings to Investment Ratio: 1.01

Recommendation: ECM 4

Install a wood boiler such as the Okofen PES56 sized for 90% of the heating season. Provide "stub" off header for additional boiler for insurance against Okofen being too small to maintain building at 70 degrees F. during extreme temperatures. Note, the Okofen will produce 191 kBtu and will maintain reasonable temperatures throughout the winter, however, there will be approximately 6 % of the heating season where the boiler may not be able to maintain more than 65 degrees F. The heating in the building is split into 7 zones controlled by programmable thermostats that are set to varying degrees and occupancy times. The heat is distributed throughout the building by fan coil units in the Co-op and baseboard radiation everywhere else.

n. Initial Cost: $35,000.00
o. Estimated Utility Incentive: $00.00
p. Net Cost: $35,000.00
q. Annual Energy Savings: 2069 Gallons #2 Fuel Oil
r. Oil Cost Savings at $3.30 per gallon: $6828.00
s. Cost to for wood pellets: $4548.00
t. Net Savings: $2280.00
u. Simple Payback: 15.4 Years
v. Savings to Investment Ratio: 1.27

[Note: The boilers should be replaced with either a new oil fired boiler or other, in this assessment we are using a wood pellet fired boiler, and therefore, the initial cost of replacement with a new oil fired boiler is used as the baseline. Therefore, the investment in the wood pellet boiler is the incremental or $35,000 - $20,000 = $15,000 additional cost to install.]

Recommendation: ECM 3

Recommendation for Wood Pellet Boiler using Incremental Investment Cost:

a. Initial Cost: $20000.00
b. Estimated Utility Incentive: $00.00
c. Net Cost: $20000.00
d. Oil Cost Savings at $3.30 per gallon: $6828.00
e. Cost to for wood pellets: $4548.00
f. Net Savings: $2280.00
g. Simple Payback: 8.8 Years
h. Savings to Investment Ratio: 2.23

Recommendation: Replace existing thermostats with programmable thermostats, where existing, the building and teach the occupants how to program occupied and unoccupied periods.]

Energy savings depend upon the extent of daily variation in local temperatures and the setback settings. Department of Energy (DOE) estimates, that cost savings of approximately 10 percent per year are possible for heating and cooling by setting temperatures back to ten to 15 percent of the comfort level eight hours each day.[1]

AIR CONDITIONING

The only air conditioning to date is located in the Fare Share Co-op and the Gallery. Both are residential grade through the wall units of approximately one ton (12,000 BTUh of cooling) each. The units are not Energy Star and appear to be approximately 10 years old.

Recommendation:

1. Use the awnings on the west side of the building.
2. Reduce internal loads, primarily by upgrading the lighting.
3. Install thermal windows on the south and west side of the Co-op.

LIGHTING

Lighting is provided by a combination of eight foot long (F96T12) and four foot long (F34 T12 and F32T8) fluorescent lamps in the Co-op and second floor and incandescent flood lamps in the Gallery.

Recommendations: ECM 2

Renovate all lighting as recommended in Appendix C

a. Initial Cost: $4378.00
b. Estimated Utility Incentive: $1213.00
c. Net Cost: $3165.00

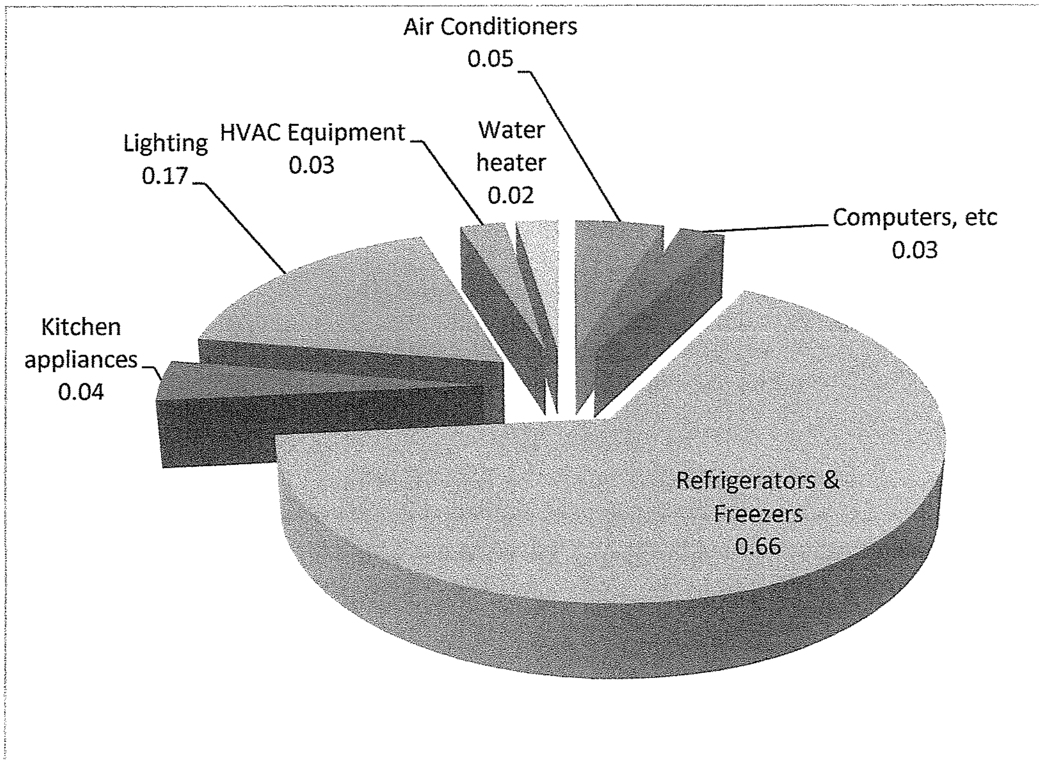
[1] NAHB Research Center, 400 Prince George's Blvd., Upper Marlboro, MD 20774

d. Annual Energy Savings: 11527 kWh
e. Annual Cost Savings: $1321.50
f. Simple Payback: 2.4 Years
g. Savings to Investment Ratio: 5.8

- Co-op: Replace all F96T12 lamps and ballsts with F32T8 – four foot, 28 watt lamps and low ballast factor (LBF = .78 - .74) electronic ballasts and a reflector designed for wide light dispersal. Install occupancy sensors to control the kitchen and stores areas. Replace the 2 Lamp F34T12 lamps and ballasts in the office, corridor to the Gallary and bathroom with 2, 28 watt T8 lamps and normal ballast factor electronic ballasts.
  - Example calculation for lighting savings:
    - 12 each 2 lamp 8 foot T12 fixtures = 1896 watts x .001 = 1.896 kW.
    - 1.896 kW x 3276 hours of operation per year = 6211 kilowatt hours (kWh) per year @ an average cost of $0.1033 per kWh = $641.61
    - 12 each 4 lamp, T8 retrofit with 28 watt lamps and .78 Ballast factor electronic ballast = (4x28x.78x.001) = .087 kW x 3276 hours of operation x $0.1033 per kWh = $28.62
    - $641.61 – $28.62 = $613 savings per year.
    - Estimated cost to install: $
- Gallery: Replace the incandescent lamp in each fixture with LED flood lamps that are rated for dimming.
- Second Floor: Replace T12 lamps and ballasts with T8 lamps and electronic ballasts.

ELECTRICAL END USE BREAKOUT – PERCENT SHARE OF TOTAL ANNUAL

USAGE OF ELECTRICITY PER END USE TYPE



The electricity use breakdown was compiled and compared to previous electricity bills that included refrigeration systems no longer used. However, no projection was made to consider the new freezer either. Therefore, this chart gives relative information regarding expected use percentages in the future.

By far the refrigeration systems use the lion's share of electricity in any grocery store. There are ways to reduce its use by using outside air when the temperature is less outside than within the walk-in cooler, using high efficiency fan motors, controlling the door anti-sweat heaters and installing LED lighting in the door openings. Another method is to ensure the refrigeration condenser receives the coolest air possible across its coil.

A detailed listing of all electrical users and estimated usages is located in appendix D.

APPENDIX

A. Life Cycle Cost Analyses
B. Energy History Summary
C. Lighting Information
D. Electrical End User Data Sheet

APPENDIX A - LIFE CYCLE COST ANALYSES

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Location:	Norway Maine	**Census Region**	1	**ECM #:**	ECM 1
Project Title	Insulate foundation walls and sill boxes - Fare Share Co-op			**Fiscal Year:**	
Analysis Date:	22-Jun-12	**Economic Life:**	15 Years		
Prepared By:	PCT	**Checked By:**			

#1 Investment Costs:

A.	Construction Costs:	$1,500.00	
B.	SIOH		(supervision + inspection + overhead)
C.	Design Costs		
D.	Total Cost (1A+1B+1C):		$ 1,500.00
E.	Salvage Value of Existing Equipment		
F.	Public Utility Company Rebate		$ -
G.	Total Investment (1D-1E-1F):		$ 1,500.00

#2 Energy & Demand Savings (+) / Costs (-)

Date of NISTR 85-3273-X Used For Discount Factors: 2011 Census Region: 1

NOTE: IN THIS ANALYSIS, MM = 1,000,000

	Energy Source	Cost $/MMBtu	Savings MMBtu/yr	Annual $ Savings (#3) (#1 X #2)	FEMP UPV Discount Factor (#4)	Present Value Savings (#5) (#3 X #4)
A.	Elect (Site)			$ -	0.00	$ -
B.	Dist. Oil	$ 23.83	75.80	$ 1,806.31	13.88	$ 25,071.64
C.	Resid. Oil			$ -	0.00	$ -
D.	Nat. Gas.			$ -	0.00	$ -
E.	PPG/LPG			$ -	0.00	$ -
F.	Wood			$ -	0.00	$ -
G.	Other			$ -	0.00	$ -
H.	Demand Savings			$ -	0.00	$ -
I.	Total		75.80	$ 1,806.31		$ 25,071.64

 # 3 Non-Energy Savings (+) / Cost (-)

A. Annual Recurring OM & R (+/-)

DOE UPV Discount Factor	0.00	
Discounted Savings / Cost (3A X 3AI)		$ -

B. Non-Recurring Savings (+) or Cost (-)

	Item	Savings (+) Cost (-) (#1)	Year of Occur. (#2)	DOE SPV Factor (#3)	Discounted Savings / Costs [+ / -] (#4)
a.					0
b.					0
c.					0
d.	Total:				0

C. Total Non-Energy Discounted Savings (3A2 + 3A)

#4	First Year Dollar Savings (2I3 +3A)	$ 1,806.31
#5	Simple Payback in Years (1G / #4)	0.83
#6	NPV = Net Present Value Savings (2I5 + 3C + 1G)	$ 23,571.64
#7	Total Present Value Savings (2I5 + 3A2)	$ 25,071.64
#8	Discounted Payback (1G / (#7 / Economic Life)	0.90
#9	Savings to Investment Ratio (SIR) (#7 / (1G - 3Bd4)	16.71

Location:	Norway Maine	**Census Region**	1	**ECM #:**	ECM 2
Project Title	Lighting Retrofit for the Fare Share Co-op			**Fiscal Year:**	
Analysis Date:	22-Jun-12	**Economic Life:**	15 Years		
Prepared By:	PCT	**Checked By:**			

#1 Investment Costs:

A.	Construction Costs:	$4,378.00	
B.	SIOH		(supervision + inspection + overhead)
C.	Design Costs		
D.	Total Cost (1A+1B+1C):		$ 4,378.00
E.	Salvage Value of Existing Equipment		
F.	Public Utility Company Rebate		$ 1,213.00
G.	Total Investment (1D-1E-1F):		$ 3,165.00

#2 Energy & Demand Savings (+) / Costs (-)
Date of NISTR 85-3273-X Used For Discount Factors: 2011 Census Region: 1
NOTE: IN THIS ANALYSIS, MM = 1,000,000

	Energy Source	Cost $/MMBtu	Savings MMBtu/yr	Annual $ Savings (#3) (#1 X #2)	FEMP UPV Discount Factor (#4)	Present Value Savings (#5) (#3 X #4)
A.	Elect (Site)			$ -	0.00	$ -
B.	Dist. Oil	$ 33.60	39.33	$ 1,321.49	13.88	$ 18,342.25
C.	Resid. Oil			$ -	0.00	$ -
D.	Nat. Gas.			$ -	0.00	$ -
E.	PPG/LPG			$ -	0.00	$ -
F.	Wood			$ -	0.00	$ -
G.	Other			$ -	0.00	$ -
H.	Demand Savings			$ -	0.00	$ -
I.	Total		39.33	$ 1,321.49		$ 18,342.25

 # 3 Non-Energy Savings (+) / Cost (-)

A. Annual Recurring OM & R (+/-)

DOE UPV Discount Factor	0.00	
Discounted Savings / Cost (3A X 3AI)		$ -

B. Non-Recurring Savings (+) or Cost (-)

	Item	Savings (+) Cost (-) (#1)	Year of Occur. (#2)	DOE SPV Factor (#3)	Discounted Savings / Costs [+ / -] (#4)
a.					0
b.					0
c.					0
d.	Total:				0

C. Total Non-Energy Discounted Savings (3A2 + 3A)

#4	First Year Dollar Savings (2I3 +3A)	$ 1,321.49
#5	Simple Payback in Years (1G / #4)	2.40
#6	NPV = Net Present Value Savings (2I5 + 3C + 1G)	$ 15,177.25
#7	Total Present Value Savings (2I5 + 3A2)	$ 18,342.25
#8	Discounted Payback (1G / (#7 / Economic Life)	2.59
#9	Savings to Investment Ratio (SIR) (#7 / (1G - 3Bd4)	5.80

Location:	Norway Maine	**Census Region**	1	**ECM #:**	ECM 3
Project Title	Heat from oil to wood pellet, Fare Share Co-op (Incremental Cost)			**Fiscal Year:**	2012
Analysis Date:	22-May-12	**Economic Life:**	15 Years		
Prepared By:	PCT	**Checked By:**			

#1 Investment Costs:

A.	Construction Costs:	$15,000.00	
B.	SIOH		(supervision + inspection + overhead)
C.	Design Costs	$ 5,000.00	
D.	Total Cost (1A+1B+1C):		$ 20,000.00
E.	Salvage Value of Existing Equipment		
F.	Public Utility Company Rebate		$ -
G.	Total Investment (1D-1E-1F):		$ 20,000.00

#2 Energy & Demand Savings (+) / Costs (-)

Date of NISTR 85-3273-X Used For Discount Factors: 2011 Census Region: 1

NOTE: IN THIS ANALYSIS, MM = 1,000,000

	Energy Source	Cost $/MMBtu	Savings MMBtu/yr	Annual $ Savings (#3) (#1 X #2)	FEMP UPV Discount Factor (#4)	Present Value Savings (#5) (#3 X #4)
A.	Elect (Site)			$ -		$ -
B.	Dist. Oil	$ 23.83	287	$ 6,827.70	13.88	$ 94,768.48
C.	Resid. Oil			$ -		$ -
D.	Nat. Gas.			$ -		$ -
E.	PPG/LPG			$ -		$ -
F.	Wood	$ 16.61	-274	$ (4,547.65)	11.04	$ (50,206.07)
G.	Other			$ -		$ -
H.	Demand Savings			$ -		$ -
I.	Total		12.75	$ 2,280.05		$ 44,562.41

#3 Non-Energy Savings (+) / Cost (-)

A. Annual Recurring OM & R (+/-)

DOE UPV Discount Factor	0.00	
Discounted Savings / Cost (3A X 3AI)		$ -

B. Non-Recurring Savings (+) or Cost (-)

	Item	Savings (+) Cost (-) (#1)	Year of Occur. (#2)	DOE SPV Factor (#3)	Discounted Savings / Costs [+ / -] (#4)
a.					0
b.					0
c.					0
d.	Total:				0

C. Total Non-Energy Discounted Savings (3A2 + 3A)

#4	First Year Dollar Savings (2I3 +3A)	$ 2,280.05
#5	Simple Payback in Years (1G / #4)	8.77
#6	NPV = Net Present Value Savings (2I5 + 3C + 1G)	$ 24,562.41
#7	Total Present Value Savings (2I5 + 3A2)	$ 44,562.41
#8	Discounted Payback (1G / (#7 / Economic Life)	6.73
#9	Savings to Investment Ratio (SIR) (#7 / (1G - 3Bd4)	2.23

ECM3

Note: incremental cost. Co-op is due three boiler changeouts because of age and condition of existing boilers.

Comparison is between new 87% eff. Fuel boiler and wood pellet boiler at 85% eff.

comparison between existing boilers and new fuel boiler versus new boiler and wood pellet boiler:

Cost per gallon fuel oil	$	3.30		
Gallons fuel oil per year		2069		
Annual Cost	$	6,827.59		
BTU per gallon fuel oil		138,500		
MMBTU		287		
Cost per MMBTU	$	23.83		
Alternate Fuel - Wood Pellets				
Wood Pellets				
Cost per Ton	$	240.00		
BTU's per Ton		17000000		
System Efficiency		85%		
Actual MMBTU per ton		14.5		
Comparison				
Cost per MMBTU fuel Oil	$	23.83		
Cost per MMBTU Wood Pellet	$	16.61		
Tons of Wood Pellets per year		18.9	Formula:	(MMBTU fuel oil used / Actual MMBTU per ton of Wood Pellets)*1-(fuel oil system eff./ wood pellet system eff.)
MMBTU per year used		274		
Annual Cost	$	4,547.57		
Annual MMBTU Saved		12.75		
Annual Cost Savings	$	2,280.01		

Location:	Norway Maine	**Census Region**	1	**ECM #:**	ECM 4
Project Title	Heat from new oil boiler at 87% efficiency to wood pellet, Fare Share Co-op			**Fiscal Year:**	2012
Analysis Date:	17-Jul-12	**Economic Life:**	15 Years		
Prepared By:	PCT	**Checked By:**			

#1 Investment Costs:

A.	Construction Costs:	$30,000.00	
B.	SIOH		(supervision + inspection + overhead)
C.	Design Costs	$ 5,000.00	
D.	Total Cost (1A+1B+1C):		$ 35,000.00
E.	Salvage Value of Existing Equipment		
F.	Public Utility Company Rebate		$ -
G.	Total Investment (1D-1E-1F):		$ 35,000.00

#2 Energy & Demand Savings (+) / Costs (-)

Date of NISTR 85-3273-X Used For Discount Factors: 2011 Census Region: 1

NOTE: IN THIS ANALYSIS, MM = 1,000,000

	Energy Source	Cost $/MMBtu	Savings MMBtu/yr	Annual $ Savings (#3) (#1 X #2)	FEMP UPV Discount Factor (#4)	Present Value Savings (#5) (#3 X #4)
A.	Elect (Site)			$ -	0.00	$ -
B.	Dist. Oil	$ 23.83	287	$ 6,827.70	13.88	$ 94,768.48
C.	Resid. Oil			$ -	0.00	$ -
D.	Nat. Gas.			$ -	0.00	$ -
E.	PPG/LPG			$ -	0.00	$ -
F.	Wood	$ 16.61	-274	$ (4,547.65)	11.04	$ (50,206.07)
G.	Other			$ -	0.00	$ -
H.	Demand Savings			$ -	0.00	$ -
I.	Total		12.75	$ 2,280.05		$ 44,562.41

#3 Non-Energy Savings (+) / Cost (-)

A. Annual Recurring OM & R (+/-)

DOE UPV Discount Factor	0.00	
Discounted Savings / Cost (3A X 3AI)		$ -

B. Non-Recurring Savings (+) or Cost (-)

	Item	Savings (+) Cost (-) (#1)	Year of Occur. (#2)	DOE SPV Factor (#3)	Discounted Savings / Costs [+ / -] (#4)
a.					0
b.					0
c.					0
d.	Total:				0

C. Total Non-Energy Discounted Savings (3A2 + 3A)

#4	First Year Dollar Savings (2I3 +3A)	$ 2,280.05
#5	Simple Payback in Years (1G / #4)	15.35
#6	NPV = Net Present Value Savings (2I5 + 3C + 1G)	$ 9,562.41
#7	Total Present Value Savings (2I5 + 3A2)	$ 44,562.41
#8	Discounted Payback (1G / (#7 / Economic Life)	11.78
#9	Savings to Investment Ratio (SIR) (#7 / (1G - 3Bd4))	1.27

ECM 4

Note: Non- incremental cost. Co-op is due three boiler changeouts because of age and condition of existing boilers.

Actual usage takes into account system efficiency			75%	
Cost per gallon fuel oil	$	3.30		
Gallons fuel oil per year		2069		
Annual Cost	$	6,828		
BTU per gallon fuel oil		138,500		
MMBTU		287		
Cost per MMBTU	$	23.83		
Alternate Fuel - Wood Pellets				
Wood Pellets				
Cost per Ton	$	240.00		
BTU's per Ton		17000000		
System Efficiency		85%		
Actual MMBTU per ton		14.5		
Comparison				
Cost per MMBTU fuel Oil	$	23.83		
Cost per MMBTU Wood Pellet	$	16.61		
Tons of Wood Pellets per year		18.9	Formula:	(MMBTU fuel oil used / Actual MMBTU per ton of Wood Pellets)*1-(fuel oil system eff./ wood pellet system eff.)
MMBTU per year used		274		
Annual Cost	$	4,547.65		
Annual MMBTU Saved		12.75		
Annual Cost Savings	$	2,280.05		

Location:	Norway Maine	**Census Region**	1	**ECM #:**	ECM 5
Project Title	DHW, Fare Share Co-op			**Fiscal Year:**	
Analysis Date:	22-May-12	**Economic Life:**	15 Years		
Prepared By:	PCT	**Checked By:**			

#1 Investment Costs:

A.	Construction Costs:	$1,000.00	
B.	SIOH		(supervision + inspection + overhead)
C.	Design Costs		
D.	Total Cost (1A+1B+1C):		$ 1,000.00
E.	Salvage Value of Existing Equipment		
F.	Public Utility Company Rebate		$ -
G.	Total Investment (1D-1E-1F):		$ 1,000.00

#2 Energy & Demand Savings (+) / Costs (-)

Date of NISTR 85-3273-X Used For Discount Factors: 2011 Census Region: 1

NOTE: IN THIS ANALYSIS, MM = 1,000,000

	Energy Source	Cost $/MMBtu	Savings MMBtu/yr	Annual $ Savings (#3) (#1 X #2)	FEMP UPV Discount Factor (#4)	Present Value Savings (#5) (#3 X #4)
A.	**Elect (Site)**	$ 32.12	6.70	$ 215.20	11.04	$ 2,375.85
B.	**Dist. Oil**			$ -	0.00	$ -
C.	**Resid. Oil**			$ -	0.00	$ -
D.	**Nat. Gas.**			$ -	0.00	$ -
E.	**PPG/LPG**			$ -	0.00	$ -
F.	**Wood**	$ 20.00	-2.24	$ (44.70)	11.04	$ (493.49)
G.	**Other**			$ -	0.00	$ -
H.	**Demand Savings**			$ -	0.00	$ -
I.	**Total**		4.47	$ 170.50		$ 1,882.36

#3 Non-Energy Savings (+) / Cost (-)

A.	**Annual Recurring OM & R (+/-)**	$ -		
	DOE UPV Discount Factor		0.00	
	Discounted Savings / Cost (3A X 3AI)			$ -

B. Non-Recurring Savings (+) or Cost (-)

	Item	Savings (+) Cost (-) (#1)	Year of Occur. (#2)	DOE SPV Factor (#3)	Discounted Savings / Costs [+ / -] (#4)
a.					0
b.					0
c.					0
d.	Total:				0

C. Total Non-Energy Discounted Savings (3A2 + 3A)

#4	First Year Dollar Savings (2I3 +3A)	$ 170.50
#5	Simple Payback in Years (1G / #4)	5.86
#6	NPV = Net Present Value Savings (2I5 + 3C + 1G)	$ 882.36
#7	Total Present Value Savings (2I5 + 3A2)	$ 1,882.36
#8	Discounted Payback (1G / (#7 / Economic Life)	7.97
#9	Savings to Investment Ratio (SIR) (#7 / (1G - 3Bd4)	1.88

METAL BUILDING INSULATION
A DIVISION OF BUILDING OUTLET CORP.

Date:	6/19/2012
Cust Svc Rep:	Jeremy Stieben

REMIT TO: Building Outlet Corp.
10390 Bradford Rd. Suite 140
Littleton, CO 80127
1-800-486-8415 Fax 303-948-2059

Purchase Order / Quote

Quoted To:	
Buyer's Name	~~Peter Tousley~~
Contact:	~~Peter Tousley~~
Address:	
City, State, Zip:	
Phone:	[redacted]
Fax:	
Email:	[redacted]

Ship To:	
Job Name	
Contact:	
Address:	
City, State, Zip:	Norway, ME
Phone:	
Alt Phone:	

Bldg Dimensions and Info			
	Width:	Roof Pitch:	Bldg Type:
	Length:		
	Height:	Roof Type:	Job Type:

Quantity Sq Ft	Item Description	Unit Price	Amount
	3" WMP-VRR Insulation w/ 1 Taped Tab		
4	48" wide x 60' long		
1	WMP-VRR Patch Tape		
	Total Delivered		$580.00
	4" WMP-VRR Insulation w/ 1 Taped Tab		
4	48" wide x 60' long		
1	WMP-VRR Patch Tape		
	Total Delivered	$630.00	Option

Notes:

Subtotal	$580.00
Sales Tax	Not Included
Freight	Included
Total US $	**$580.00**

Signature_______________________________ Date:_______________

All quotes subject to acceptance upon final review by an officer of Building Outlet Corporation. Actual delivery depends on parts / materials availability.

Location:	Norway Maine	**Census Region**	1	**ECM #:**	ECM 6
Project Title	Walk in Cooler Economizer, Fare Share Co-op			**Fiscal Year:**	2012
Analysis Date:	22-May-12	**Economic Life:**	10 Years		
Prepared By:	PCT	**Checked By:**			

#1 Investment Costs:

A.	Construction Costs:	$6,951.00	
B.	SIOH		(supervision + inspection + overhead)
C.	Design Costs		
D.	Total Cost (1A+1B+1C):		$ 6,951.00
E.	Salvage Value of Existing Equipment		
F.	Public Utility Company Rebate		$ 2,375.00
G.	Total Investment (1D-1E-1F):		$ 4,576.00

#2 Energy & Demand Savings (+) / Costs (-)

Date of NISTR 85-3273-X Used For Discount Factors: 2011 Census Region: 1

NOTE: IN THIS ANALYSIS, MM = 1,000,000

	Energy Source	Cost $/MMBtu	Savings MMBtu/yr	Annual $ Savings (#3) (#1 X #2)	FEMP UPV Discount Factor (#4)	Present Value Savings (#5) (#3 X #4)
A.	**Elect (Site)**	$ 33.60	23.29	$ 782.46	7.84	$ 6,134.46
B.	**Dist. Oil**			$ -	0.00	$ -
C.	**Resid. Oil**			$ -	0.00	$ -
D.	**Nat. Gas.**			$ -	0.00	$ -
E.	**PPG/LPG**			$ -	0.00	$ -
F.	**Wood**			$ -	0.00	$ -
G.	**Other**			$ -	0.00	$ -
H.	**Demand Savings**			$ -	0.00	$ -
I.	**Total**		23.29	$ 782.46		$ 6,134.46

 # 3 Non-Energy Savings (+) / Cost (-)

A. Annual Recurring OM & R (+/-) $ -

DOE UPV Discount Factor	0.00	
Discounted Savings / Cost (3A X 3AI)		$ -

B. Non-Recurring Savings (+) or Cost (-)

	Item	Savings (+) Cost (-) (#1)	Year of Occur. (#2)	DOE SPV Factor (#3)	Discounted Savings / Costs [+ / -] (#4)
a.					0
b.					0
c.					0
d.	**Total:**				0

C. Total Non-Energy Discounted Savings (3A2 + 3A)

#4	First Year Dollar Savings (2I3 +3A)	$ 782.46
#5	Simple Payback in Years (1G / #4)	5.85
#6	NPV = Net Present Value Savings (2I5 + 3C + 1G)	$ 1,558.46
#7	Total Present Value Savings (2I5 + 3A2)	$ 6,134.46
#8	Discounted Payback (1G / (#7 / Economic Life)	7.46
#9	Savings to Investment Ratio (SIR) (#7 / (1G - 3Bd4)	1.34

freeaire

Cost & Energy Savings Worksheet

names addresses contact persons phone# fax# email addresses etc.

manufacturer Freeaire Refrigeration/R. H. Travers Company, 167-8 Mad River Canoe Road, Waitsfield, VT 05673 USA, Phone: 877-305-3733, web site: www.freeaire.com, Brad Long, 802-496-5205, cell: 802-595-3063 email: brad@freeaire.com

installer ESCO: TCorp, Energy Management and Engineering Services, Peter Tousley, CEM, president, 416 Roosevelt Highway Suite 203, Colchester, VT 05446, Tel: 802-238-7620, 802-735-0831, email: ptousley@tcorpinc.net, web site: www.tcorpinc.net Installer: Viking Electric LLC., 241 Pleasant Street, Mechanic Falls, ME 04256 Chuck Johnson 207-376-7606 e-mail:viking@roadrunner.com,

customer Fare Share Co-op, 445 Main Street, Norway, Maine 04268 207-743-9044

installation The walk-in cooler at the co-op

utilities Central Maine Power, Efficiency Maine

account#		utility rate class		average (blended) cost of electricity	$0.12950 /kwh
Date	1.27.2012	cooler? yes	freezer? no	walk-in use mostly beverages	length 15 feet
Condensing unit outside?	no	meter readings? no	On outside wall? yes	concrete walls? no	width 8 feet
pumpdown sytem?	Yes	access through ceiling and wall? ?		access through roof? ?	height 8 feet
compressor type	reciprocating	evaporator fan diameter ?		evaporator fan rotation ?	volume 960 cubic feet
other info	Bin data for Augusta, ME				hi temp. 42 °F

equipment	brand	model#	units	volts	phase	power factor	# fans /unit	doors /unit	amps /unit	Coefficient of Performance
evaporators	Witt	SA28-134B	1	120	1	60%	2		3.6	
condensing unit	Witt	PEH 215L44-D								
compressor			1	240	1				16.7	
condensing fans				240	1	85%	2		1.8	
door heaters	zero-energy doors		1	0	1	100%	0	6	0	2.8

INSTALLED COST

Qty	Item#	Item	$/ea.	total
0	70100	All Climate System	$2,557	$0
1	70200	All Climate System w/Polar Package	$4,335	$4,335
0	70400	All Climate w/Polar Pkg. & Hum. Cntl.	$4,735	$0
0	70300	Additional Polar Package	$1,840	$0
0	30100	Additional Adjustable Circ	$355	$0
0	20200	Additional Wallcap	$110	$0
0	40800	2"x16" disposable Carbon Filter	$55	$0
0	30200	summer plug	$45	$0
0	30250	BreezeShooter adjustable elbow	$75	$0
0	30600	Stocking Switch	$60	$0
0	70450	All Climate System w/Large Polar Pk & Hum Control	$8,700	$0
0	70350	Additional Large Polar Package	$5,500	$0
0	40801	2" x 24" disposable Carbon Filter	$95	$0
0	30160	Additional Large Circulating Fan	$900	$0
				$0
		subtotal		$4,335
		6% tax (VT shipments only)		$0
		shipping		$100
		installation labor		$1,700
		other materials & costs		$150
		total installed cost of Basic Freeaire system		$6,285
		estimated utiity rebate:		$0
		NET COST (after rebate) ALL CLIMATE & POLAR PKGS:		$6,285
2	40300	120V ECM (#5101)	$185	$370
0	40400	240V ECM (#5201)	$190	$0
		subtotal		$370
		6% tax (VT shipments only)		$0
		shipping		$10
		installation labor		$50
		total installed cost of evaporator fan motors		$430
		estimated utiity rebate		$0
		NET COST (after rebate) NEW EVAPORATOR FAN MOTORS		$430

ENERGY AND COST SAVINGS

Item	value	unit
total # of evaporator fans	2	fans
watts/each fan	130	watts
evaporator fan runtime without Freeaire system	100%	
annual evaporator fan energy use without Freeaire system	2,272	kwh/yr
expected reduction in evaporator fan runtime	50%	
hours/year evaporator fan operation will be reduced	4,383	hours
total kilowatt reduction when circ fans are on	0.24	KW
annual energy saved directly by controlling evap. fans	1,035	kwh
annual energy saved indirectly by condensing unit	370	kwh
total annual energy saved by controling evap fans	1,405	kwh
annual evaporator energy cost savings	$182	
condensing unit kilowatts	3.77	kw
ave. annual condensing unit runtime before Freeaire	50%	
annual condensing unit energy use before Freeaire	16,541	kwh/yr
condensing unit runtime in winter without outside air	40%	
days/yr outside air takes over refrigeration	124	days
outside air system kilowatts	0.17	kw
outside air system cold weather runtime	30%	
annual condensing unit energy saved by outside air	4,338	kwh
hours/year evap fan operation will be reduced	1,309	hours
annual evaporator fan energy saved by outside air	309	kwh
total annual energy saved by All Climate & Polar Pkgs.	6,052	kwh
annual cost savings from using All Climate & Polar Pkgs.	$784	
ALL CLIMATE & POLAR PKGS PAYBACK PERIOD	8.02	years
brushless dc evaporator fan motor wattage (each)	37	watts
total evaporator fan kilowattage reduction	0.19	kw
hours of yearly evaporator fan operation	3,074	hours
annual energy saved directly by new evap. fan motors	569	kwh
annual energy saved indirectly by condensing unit	203	kwh
total annual energy saved by new evap. fan motors	773	kwh
annual new evaporator fan motor energy cost savings	$100	
NEW EVAPORATOR FAN MOTORS PAYBACK PERIOD	4.3	years

TOTAL INSTALLED COST	**$6,715**	**TOTAL ENERGY SAVINGS**	**6,825**	**KWH**
TOTAL ESTIMATED UTILITY REBATE	**$0**	**% REDUCTION IN ENERGY USE**	**36%**	
NET COST (AFTER REBATE)	**$6,715**	**TOTAL ANNUAL COST SAVINGS**	**$884**	
		PAYBACK PERIOD	**7.6**	**YEARS**
		(IF ELECTRICITY GENERATED BY COAL) CARBON REDUCTION	**13,650**	**LB/YR**

Location:	Norway Maine	**Census Region**	1	**ECM #:**	ECM 7
Project Title	Install new oil fired boiler, Fare Share Co-op			**Fiscal Year:**	
Analysis Date:	22-May-12	**Economic Life:**	15 Years		
Prepared By:	PCT	**Checked By:**			

#1 Investment Costs:

A.	Construction Costs:	$15,000.00	
B.	SIOH		(supervision + inspection + overhead)
C.	Design Costs		
D.	Total Cost (1A+1B+1C):		$ 15,000.00
E.	Salvage Value of Existing Equipment		
F.	Public Utility Company Rebate		$ -
G.	Total Investment (1D-1E-1F):		$ 15,000.00

#2 Energy & Demand Savings (+) / Costs (-)

Date of NISTR 85-3273-X Used For Discount Factors: 2011 Census Region: 1

NOTE: IN THIS ANALYSIS, MM = 1,000,000

	Energy Source	Cost $/MMBtu	Savings MMBtu/yr	Annual $ Savings (#3) (#1 X #2)	FEMP UPV Discount Factor (#4)	Present Value Savings (#5) (#3 X #4)
A.	Elect (Site)			$ -	0.00	$ -
B.	Dist. Oil	$ 23.83	45.85	$ 1,092.41	13.88	$ 15,162.70
C.	Resid. Oil			$ -	0.00	$ -
D.	Nat. Gas.			$ -	0.00	$ -
E.	PPG/LPG			$ -	0.00	$ -
F.	Wood			$ -	0.00	$ -
G.	Other			$ -	0.00	$ -
H.	Demand Savings			$ -	0.00	$ -
I.	Total		45.85	$ 1,092.41		$ 15,162.70

 # 3 Non-Energy Savings (+) / Cost (-)

A. Annual Recurring OM & R (+/-)

DOE UPV Discount Factor	0.00	
Discounted Savings / Cost (3A X 3AI)		$ -

B. Non-Recurring Savings (+) or Cost (-)

	Item	Savings (+) Cost (-) (#1)	Year of Occur. (#2)	DOE SPV Factor (#3)	Discounted Savings / Costs [+ / -] (#4)
a.					0
b.					0
c.					0
d.	Total:				0

C. Total Non-Energy Discounted Savings (3A2 + 3A)

#4	First Year Dollar Savings (2I3 +3A)	$ 1,092.41
#5	Simple Payback in Years (1G / #4)	13.73
#6	NPV = Net Present Value Savings (2I5 + 3C + 1G)	$ 162.70
#7	Total Present Value Savings (2I5 + 3A2)	$ 15,162.70
#8	Discounted Payback (1G / (#7 / Economic Life)	14.84
#9	Savings to Investment Ratio (SIR) (#7 / (1G - 3Bd4))	1.01

ECM 7

Recommendation: Replace existing three boilers with one higher efficiency oil fired boiler with minimum efficiency of 87%.

	Existing Boiler	New Boiler	
Actual usage takes into account system efficiency	75%	87%	Savings
Cost per gallon fuel oil	$ 3.30		
Gallons fuel oil per year	2400	2069	331
Annual Cost	$ 7,920	$ 6,828	$ 1,092
BTU per gallon fuel oil	138,500		
MMBTU	332.4	286.6	45.8
Cost per MMBTU	$ 23.83		

Alternate Fuel - Wood Pellets	
Wood Pellets	
Cost per Ton	$ 240.00
BTU's per Ton	17000000
System Efficiency	85%
Actual MMBTU per ton	14.5

Appendix B – Energy History Summary

Input Account Info Here	Electricity 2011-2012	
	kWh	Cost
January	7,037.0	$ 708.73
February	9,248.0	$ 865.82
March	8,725.0	$ 852.60
April	8,571.0	$ 871.10
May	9,554.0	$ 918.54
June	5,972.0	$ 605.08
July	6,571.0	$ 652.11
August	4,657.0	$ 540.62
September	5,420.0	$ 664.09
October	4,591.0	$ 638.33
November	5,107.0	$ 503.35
December	4,058.0	$ 393.32
Totals	**79,511.0**	**$ 8,213.69**
Average Cost per kWh		**$ 0.10**
Annual MMBtu	**271.4**	
Cost per MMBtu		**$ 30.27**
EUI by Fuel and Year	**38.8**	

Input Account Info Here	# 2 Fuel Oil			
	2010		2011	
	Gallons	Cost	Gallons	Cost
January	508.0	$ 1,747.52	293.0	$ 966.61
February	195.0	$ 670.61	137.0	$ 451.96
March	224.0	$ 770.34	163.0	$ 537.74
April	308.0	$ 1,059.21	0.0	$ -
May	0.0	$ -	0.0	$ -
June	0.0	$ -	0.0	$ -
July	0.0	$ -	0.0	$ -
August	0.0	$ -	0.0	$ -
September	241.0	$ 828.80	0.0	$ -
October	0.0	$ -	0.0	$ -
November	425.0	$ 1,402.08	0.0	$ -
December	492.0	$ 1,623.11	1,000.0	$ 3,299.00
Totals	**2,393.0**	**$ 8,101.66**	**1,593.0**	**$ 5,255.31**
Average Cost per Gallon		**$ 3.39**		**$ 3.30**
Annual MMBtu	**331.9**		**220.93**	
Cost per MMBtu		**$ 24.41**		**$ 23.79**
EUI by Fuel and Year	**47.4**		**31.56**	

Input account info here	Propane			
	2010		2011	
	Gallons	Cost	Gallons	Cost
January	0.0	$ -	0.0	$ -
February	84.5	$ 290.60	0.0	$ -
March	0.0	$ -	0.0	$ -
April	0.0	$ -	82.0	$ 299.22
May	0.0	$ -	0.0	$ -
June	0.0	$ -	0.0	$ -
July	0.0	$ -	51.0	$ 166.21
August	0.0	$ -	0.0	$ -
September	0.0	$ -	0.0	$ -
October	0.0	$ -	52.2	$ 190.48
November	91.5	$ 301.86	0.0	$ -
December	0.0	$ -	0.0	$ -
Totals	**176.0**	**$ 592.45**	**185.2**	**$ 655.90**
Average Cost per Gallon		**$ 3.37**		**$ 3.54**
Annual MMBtu	**16.1**		**16.9**	
Cost per MMBtu		**$ 36.86**		**$ 38.78**
EUI by Fuel and Year	**2.3**		**2.4**	

APPENDIX C - LIGHTING INFORMATION

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Fare Share Co-op Building		Existing Lighting										Operating Costs		
AREA	Fixture types	Lamp Desc.	# of lamps per fixture	Ballast Desc.	Number of fixtures	Watts per fixture	Total Watts	Hours of operation	Annual kWh usage	Average $ per kWh		Electrical cost per year	Maintenance Cost per year	Operating cost per year
Walk-in Cooler	F72T12CWHO	F72	1	Std	7	95	665	3,276	2,179	$	0.11	$ 249.83	$ 16.35	$ 266.18
Grocery Store	F96T12CWEco	F96	2	EEMag	9	158	1,422	3,276	4,658	$	0.11	$ 534.23	$ 42.05	$ 576.28
Grocery Store	F96T12CWEco	F96	2	EEMag	3	158	474	8,760	4,152	$	0.11	$ 476.18	$ 14.02	$ 490.19
Hall between gallary & store	F40T12CW	F40	2	EEMag	2	70	140	3,276	459	$	0.11	$ 52.60	$ 8.18	$ 60.77
Store office	F40T12CW	F40	2	EEMag	2	70	140	3,276	459	$	0.11	$ 52.60	$ 8.18	$ 60.77
First Floor Bathrooms (2)	F40T12CW	F40	2	EEMag	2	70	140	500	70	$	0.11	$ 8.03	$ 8.18	$ 16.20
Kitchen	F40T12CW	F40	2	EEMag	1	70	70	3,276	229	$	0.11	$ 26.30	$ 4.09	$ 30.39
Stock Room	F96T12CWEco	F96	2	EEMag	4	158	632	3,276	2,070	$	0.11	$ 237.44	$ 18.69	$ 256.12
Gallery	incandescent	inc	2	na	6	90	540	1,800	972	$	0.11	$ 111.47	$ 105.12	$ 216.59
Tcorp Office - Small	F32T8CW	F32	3	QT3x32/IS	2	74	148	1,000	148	$	0.11	$ 16.95	$ 8.76	$ 25.71
Tcorp Office - large	F32T8CW	F32	3	QT3x32/IS	2	74	148	1,400	207	$	0.11	$ 23.76	$ 8.76	$ 32.52
Tcorp Office - Large	F34T12CW	F40	3	Univ 446-L-S	2	102	204	1,400	286	$	0.11	$ 32.75	$ 12.26	$ 45.02
Upstairs Hallway	F32T8CW	F32	3	Adv Centium	1	84	84	1,600	135	$	0.11	$ 15.50	$ 4.38	$ 19.88
Upstairs Hallway	F32T8CW	F32	3	Triad B 3321	1	86	86	1,600	138	$	0.11	$ 15.78	$ 4.38	$ 20.16
Bathroom	incandescent	Inc	1	NA	1	100	100	250	25	$	0.11	$ 2.87	$ 8.76	$ 11.63
Old TV Station	F32T8CW	F32	5	Triad B 3321	3	86	258	0	0	$	0.11	$ -	$ 21.90	$ 21.90
Old TV Station	incandescent	Inc	1	NA	4	100	400	0	0	$	0.11	$ -	$ 35.04	$ 35.04
Norway Downtown	F32T8CW	F32	3	QT3x32/IS	5	74	370	1,000	370	$	0.11	$ 42.43	$ 21.90	$ 64.33
David Boothby	F32T8CW	F32	3	QT3x32/IS	7	74	518	1,000	518	$	0.11	$ 59.40	$ 30.66	$ 90.06
WFLT	Track - Incandescent	inc	1	NA	8	90	720	1,000	720	$	0.11	$ 82.57	$ 70.08	$ 152.65
WFLT	Track - CFL	cfl	1	Elect	2	13	26	1,000	26	$	0.11	$ 2.98	$ 8.76	$ 11.74
Artist Room	F32T8CW	F32	3	Triad B 3321	2	86	172	350	60	$	0.11	$ 6.90	$ 8.76	$ 15.66
Artist Room	incandescent	inc	1	NA	3	100	300	350	105	$	0.11	$ 12.04	$ 26.28	$ 38.32
Darkroom	Track - Incandescent	inc	1	NA	3	100	300	100	30	$	0.11	$ 3.44	$ 26.28	$ 29.72
					82		**8,057**		**18,016**			**$ 2,066.05**	**$ 521.80**	**$ 2,587.85**

Purposed Lighting

AREA	Fixture types	Lamp Desc.	# of lamps per fixture	Ballast Desc.	Number of fixtures	Watts per fixture	Total Watts	Watt Savings	New or retrofitted fixture
Walk-in Cooler	LED	LED	1	NA	7	15	105	560	Retrofit
Grocery Store	2LT84ft REF	F32	2	Elect	6	47	282	1,140	Retrofit
Grocery Store	2LT84ft REF	F32	3	Elect	6	47	282	192	Retrofit
Hall between gallary & store	1LT84ft REF	F32	1	Elect	2	25	50	90	New
Store office	1LT84ft REF	F32	1	Elect	2	32	64	76	Retrofit
First Floor Bathrooms (2)	1LT84ft REF	F32	1	Elect	2	25	50	90	Retrofit
Kitchen	2LT84ft Enclosed	F32	2	Elect	1	47	47	23	New
Stock Room	2LT84ft REF	F32	2	Elect	4	47	188	444	Retrofit
Tcorp Office - Small	F32T8CW	F32	3	QT3x32/IS	2	74	148	0	
Tcorp Office - large	F32T8CW	F32	3	QT3x32/IS	2	74	148	0	
Tcorp Office - Large	F32T8-841-Ref	F32	2	QTP 2x32T8	2	47	94	110	Retrofit
Upstairs Hallway	F32T8-841-Ref	F32	2	QTP 2x32T8	1	47	47	37	Retrofit
Upstairs Hallway	F32T8-841-Ref	F32	2	QTP 2x32T8	1	47	47	39	Retrofit
Bathroom	incandescent	inc					0	100	
Old TV Station	F32T8CW	F32	5	Triad B 3321	3	86	258	0	
Old TV Station	incandescent	inc	1	NA	4	100	400	0	
Norway Downtown	F32T8CW	F32	3	QT3x32/IS	5	74	370	0	
David Boothby	F32T8CW	F32	3	QT3x32/IS	7	74	518	0	
WFLT	Track - LED	LED	1	NA	8	15	120	600	Retrofit
WFLT	Track - CFL	cfl	1	Elect	2	13	26	0	
Artist Room	F32T8CW	F32	3	Triad B 3321	2	86	172	0	
Artist Room	incandescent	inc	1	NA	3	100	300	0	
Darkroom	Track - Incandescent	inc	1	NA	3	100	300	0	
					75		**4,016**	**3,501**	

Purposed Lighting

Installation Costs

AREA	Annual kWh savings	Lighting control reduction %	Incentive per fixture	Occupancy control mount type	# of occupancy controls	Daylighting control mount type	# of daylighting controls	Estimated incentive offer	Estimated cost per fixture	Estimated $ per Occ. sensor	Estimated $ per daylight sensor	Estimated Installed Cost	Net Installation Cost
Walk-in Cooler	1,835	0%	$ 75.00					$ 525	$ 150.00			$ 1,050	$ 525
Grocery Store	3,735	0%	$ 25.00					$ 150				$ 900	$ 750
Grocery Store	1,682	0%	$ 26.00					$ 156				$ 900	$ 744
Hall between gallary & store	295	0%	$ 25.00					$ 50				$ 70	$ 20
Store office	301	25%	$ 12.00	switch	1			$ 25				$ 250	$ 225
First Floor Bathrooms (2)	45	0%	$ 12.00					$ 24				$ 70	$ 46
Kitchen	152	50%	$ 25.00	switch	1			$ 25				$ 35	$ 10
Stock Room	1,609	25%	$ 25.00	Remote	1			$ 50				$ 100	$ 50
Tcorp Office - Small	0	0%	$ -					$ -				$ -	$ -
Tcorp Office - large	0	0%	$ -					$ -				$ -	$ -
Tcorp Office - Large	154	0%	$ 12.00					$ 24				$ 300	$ 276
Upstairs Hallway	60	0%	$ 12.00					$ 12				$ 150	$ 138
Upstairs Hallway	62	0%	$ 12.00					$ 12				$ 150	$ 138
Bathroom	25	0%	$ -					$ -				$ -	$ -
Old TV Station	0	0%	$ -					$ -				$ -	$ -
Old TV Station	0	0%	$ -					$ -				$ -	$ -
Norway Downtown	0	0%	$ -					$ -				$ -	$ -
David Boothby	0	0%	$ -					$ -				$ -	$ -
WFLT	600	0%	$ 20.00					$ 160	$ 50.00			$ 400	$ 240
WFLT	0	0%	$ -					$ -				$ -	$ -
Artist Room	0	0%	$ -					$ -				$ -	$ -
Artist Room	0	0%	$ -					$ -				$ -	$ -
Darkroom	0	0%	$ -					$ -				$ -	$ -
								$ -				$ -	$ -
	10,555							**$ 1,213**				**$ 4,375**	**$ 3,162**

Purposed Lighting	Savings				
AREA	Electrical cost savings per year	Maintenance cost savings per year	Operating cost savings per year	Simple Payback (yrs)	Annual usage with new fixtures (kWh)
Walk-in Cooler	$ 210.39	$ 65.00	$ 275.39	1.9	344
Grocery Store	$ 428.29	$ 24.53	$ 452.81	1.7	924
Grocery Store	$ 192.88	$ (12.26)	$ 180.62	4.1	2,470
Hall between gallary & store	$ 33.81	$ 5.26	$ 39.07	0.5	164
Store office	$ 34.56	$ 5.26	$ 39.82	5.7	157
First Floor Bathrooms (2)	$ 5.16	$ 5.26	$ 10.42	4.4	25
Kitchen	$ 17.47	$ 1.17	$ 18.64	0.5	77
Stock Room	$ 184.46	$ 7.01	$ 191.47	0.3	462
Tcorp Office - Small	$ -	$ -	$ -	0.0	148
Tcorp Office - large	$ -	$ -	$ -	0.0	207
Tcorp Office - Large	$ 17.66	$ 6.42	$ 24.08	11.5	132
Upstairs Hallway	$ 6.88	$ 1.46	$ 8.34	16.6	75
Upstairs Hallway	$ 7.16	$ 1.46	$ 8.62	16.0	75
Bathroom	$ 2.87	$ 8.76	$ 11.63	0.0	0
Old TV Station	$ -	$ -	$ -	0.0	0
Old TV Station	$ -	$ -	$ -	0.0	0
Norway Downtown	$ -	$ -	$ -	0.0	370
David Boothby	$ -	$ -	$ -	0.0	518
WFLT	$ 68.81	$ 23.06	$ 91.87	2.6	120
WFLT	$ -	$ -	$ -	0.0	26
Artist Room	$ -	$ -	$ -	0.0	60
Artist Room	$ -	$ -	$ -	0.0	105
Darkroom	$ -	$ -	$ -	0.0	30
	$ 1,210.39	**$ 142.37**	**$ 1,352.76**	**2.3**	**6,489**

Appendix D – Electrical End User Data Sheet

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Electrical End User Breakout

Area	Appliance	Watts per Unit	# Units	Hrs/Day	Day/Wk	Load Factor	kWh per Wk	Wks/Yr	kWh/Yr (note)
Second Level	computers	160	4	6	5	0.65	12.5	52	649.0
second level	printers	150	3	6	5	0.15	2.0	52	105.3
Fare Share	computers	200	3	10	6	0.65	23.4	52	1216.8
Fare Share	printers	150	1	10	6	0.25	2.3	52	117.0
Fare Share	Walk in Cooler - evap	260	1	24	7	1	43.7	52	2271.4
Fare Share	Walk in Cooler - Comp	3770	1	24	7	0.85	538.4	52	27994.5
Fare Share	Freezer - chest	1800	1	24	7	0.65	196.6	52	10221.1
Fare Share	Coffiee maker	750	2	10	6	0.35	31.5	52	1638.0
Basement	DHW	4500	1	24	7	0.05	37.8	52	1965.6
Fare Share	Soup Pot	750	2	10	6	0.35	31.5	52	1638.0
Fare Share	Modine fan motors	187	3	24	7	0.65	61.1	34	2077.3
Fare Share	True Bev. Cooler	598	1	24	7	0.65	65.3	52	3395.7
Fare Share	Sanitizer	1800	1	1	6	0.15	1.6	52	84.2
Fare Share	AC in Co-op	1800	1	24	7	0.5	151.2	18	2721.6
Gallary	AC in Gallary	1800	1	24	7	0.25	75.6	18	1360.8
Fare Share	Walk in Cooler Door htr	168	6	24	7	1	169.3	52	8805.9
Lighting	Store	2544	1				0.0	52	10089.0
Lighting	Gallery	1662	1				0.0	52	1007.0
Lighting	2nd floor	1670	1				0.0	52	2767.6
Heating	Hot water Circ.	0.04	7	24	7	0.65	0.0285	34	1.0
Ventilation	Basement Ref fan	0.19	1	24	7	0.75	0.023	52	1.2
	Total Load (kW)	**24.6**					**Total Energy (kWh)**		**80,128.0**

APPENDIX E - GLOSSARY

ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers.

Btu (British thermal unit) – the amount of heat required to raise the temperature of one pound of water (at or near 39.4 degrees Fahrenheit) by one degree Fahrenheit; i.e. – the amount of heat generated by one lighted match stick.

MMBtu – 1 million Btu.

Btu/h – Btu per hour.

kBtu/h – 1 thousand Btu per hour.

CFL (Compact Fluorescent Lamp) – newer light bulb, designed to replace the incandescent. Some can cut energy usages of incandescent up to 70%.

Cooling Degree Day (CDD) – are quantitative indices designed to reflect the demand of energy needed to cool a home or business. These indices are derived from daily temperature observations, and the cooling requirements for a given structure at a specific location.

Energy Star Window and Door Standards:
Windows: ENERGY STAR Qualification Criteria for Residential Windows and Skylights provides the qualification criteria for each ENERGY STAR climate zone. ENERGY STAR criteria use U-factor (measured in British thermal units over hours times square-feet times degrees Fahrenheit) and Solar Heat Gain Coefficient (or SHGC, a fraction of incident solar radiation) ratings. The qualification criteria for windows are as follows: In the Northern Zone, there are prescriptive and equivalent energy performance criteria. The prescriptive criteria require a U-factor of 0.30 or less and any SHGC. With the equivalent energy performance criteria, U-factor can go up to 0.31 provided the window has an SHGC of 0.35 or greater or the U-factor can go up to 0.32 provided the window has an SHGC of 0.40 or greater.

Doors: ENERGY STAR Qualification Criteria for Residential Doors provides the qualification criteria for each glazing level. Glazing level refers to the amount of glass in the door. An opaque door has no glass. A door that is less than or equal to half-lite is comprised of approximately half glass or less. A door that is greater than half-lite is mostly glass; this category includes fully glazed or full-lite doors such as sliding glass doors. ENERGY STAR criteria use U-factor (measured in British thermal units over hours times square-feet times degrees Fahrenheit) and Solar Heat Gain Coefficient (or SHGC, a fraction of incident solar radiation) ratings. The qualification criteria for doors are as follows: Opaque doors must have a U-factor of 0.21 or less and there is no requirement for SHGC. Less than or equal to half-lite doors must have a U-factor of 0.27 or less and an SHGC of 0.30 or less. Greater than half-lite doors must have a U-factor of 0.32 or less and an SHGC of 0.30 or less.

EUI (Energy Utilization Index) – the measure of the total energy consumed in cooling or heating of a building or facility in a period of time, expressed as British thermal unit (Btu) per (cooled or heated) gross square foot.

Heating Degree Days (HDD) – are quantitative indices designed to reflect the demand for energy needed to heat a home or business. These indices are derived from daily temperature observations, and the heating requirements for a given structure at a specific location.

Incandescent – older style light bulb; most of the electrical input is converted into heat and less than 10% to light.

kWh – kilowatt hour: standard unit of electricity or consumption equal to 1000 watts over one hour. For instance, if a 100 watt bulb is turned on and left on for 10 hours it would use one kWh.

LED (Light Emitting Diode) – next generation of light sources. Generates little heat, turns on instantly and uses less energy than either the incandescent or the CFL.

Low-E (low emissivity) – is a strategy that can improve energy efficiency of windows by reducing solar heat gain and refers to a transparent metallic coating applied to one surface of an insulating glass unit. A window with low-E glass can lower an energy bill because in the summer it reduces the amount of the sun's heat from entering the home, lowering the cooling demand; conversely in the winter, low-E reflects some of the interior heat back into the home, reducing the need for heating. Some types of low-E glass are designed primarily for summer cooling and some for winter heating.

R-values – a measure of resistance to the flow of heat through a given thickness of a material (as insulation) with higher numbers indicating better insulating properties.

Total Assembly R-values – the total assembled R-value of a system such as a wall or ceiling. The resistance to heat transfer of an assembly includes each material such as sheetrock, the wood for wall construction, and exterior and interior air surfaces. For an example, a 2x4 wall is 12.05 where the Rated R value of the insulation is 11.

Calculating Assembly Wall R-Value*
Formula: Assembly R-value = 1 / (Assembly U-value) = 1 / (U-studs x % + U-cavity x %)

Component	R-Value Studs	R-Value Cavity	Assembly R-Value
Wall - Outside Air Film	0.17	0.17	
Siding - Wood Bevel	0.80	0.80	
Plywood Sheathing - 1/2"	0.63	0.63	
3 1/2" Fiberglass Batt		11.00	
3 1/2" Stud	4.38		

1/2" Drywall	0.45	0.45	
Inside Air Film	0.68	0.68	
Percent for 16" o.c. + Additional studs	15%	85%	
Total Wall Component R-Values	7.12	13.73	
Wall Component U-Values	0.1404	0.0728	
Total Wall Assembly R-Value			12.05

* This example is just for wood frame construction. Steel studs are a more complicated calculation.
http://www.coloradoenergy.org/

Savings to Investment Ratio (SIR) – a ratio of economic performance computed from a numerator of discounted energy and/or water savings, plus (or less) savings in other operation-related costs, and a denominator of increased initial investment costs plus (or less) increased (or decreased) replacement costs, net of residual value (all in present-value terms), as compared with a base case; useful when evaluating two or more design options.

Simple Payback – the length of time needed to pay back the initial capital investment, usually expressed in years. This is the simplest form of cost-benefit analysis, and is suitable for small projects and general discussion. Simple payback does not take into account costs or savings beyond the first cost, so is limited in use for more intensive capital investment projects.

[FIRST-COST ($) ÷ ANNUAL ENERGY COST SAVINGS ($) = YEARS
EXAMPLE: $150,000 ÷ $50,000 = 3.0 years until costs are recouped]

Thermal Envelope – is the thermal insulation within the building enclosure. The purpose of envelope insulation is to provide a continuous barrier to minimize heat flow through the walls, ceiling and floor.

U-factor – a measure of resistance to the flow of heat through a given thickness of material (typically windows and doors). The lower the number the better, indicates a window or door's resistance to heat flow and the better its insulating value. U-value is the inverse of R-value when looking at a single material. For example a U-value of 0.25 would be an R-value of 4.