Comprehensive Energy Audit
For
Napaskiak West Well

Prepared For
City of Napaskiak

September 28, 2011

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PREFACE

The Energy Projects Group at the Alaska Native Tribal Health Consortium (ANTHC) prepared this document for the Native Village of Napaskiak. The authors of this report are Carl H. Remley, Certified Energy Auditor (CEA) and Certified Energy Manager (CEM) and Gavin Dixon.

The purpose of this report is to provide a comprehensive document that summarizes the findings and analysis that resulted from an energy audit conducted over the past couple months by the Energy Projects Group of ANTHC. This report analyzes historical energy use and identifies costs and savings of recommended energy efficiency measures. Discussions of site specific concerns and an Energy Efficiency Action Plan are also included in this report.

ACKNOWLEDGMENTS

The Energy Projects Group gratefully acknowledges the assistance of the staff at the Napaskiak water treatment system and Ms. Marcie Sherer, of AVCP.

1. EXECUTIVE SUMMARY

This report was prepared for the City of Napaskiak. The scope of the audit focused on Napaskiak West Well. The scope of this report is a comprehensive energy study, which included an analysis of building shell, interior and exterior lighting systems, HVAC systems, and plug loads.

Based on electricity and fuel oil prices in effect at the time of the audit, the annual predicted energy costs for the buildings analyzed are $4,130 for Electricity, $30,660 for #1 Oil and total energy costs are $34,790 per year.

It should be noted that this building appears to be receiving some power cost equalization subsidy from the state of Alaska. How PCE is currently being allocated and how it should be allocated should be investigated with Alaska Energy Authority. The potential for increased PCE subsidy and lower electrical costs is possible.

Table 1.1 below summarizes the energy efficiency measures analyzed for the Napaskiak West Well. Listed are the estimates of the annual savings, installed costs, and two different financial measures of investment return.

Table 1.1
PRIORITY LIST – ENERGY EFFICIENCY MEASURES

Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR[1]	Simple Payback (Years)[2]
1	Sludge Tank	Fixing the valves and having a utility support engineer come out for a day and ensure proper setting of the heat exchanger and thermostat would allow for the sludge tank to be kept heated only to avoid freezing, and not to its current 120+ degree temperature.	$11,747	$2,200	80.14	0.2
2	HVAC And DHW	Nozzles are oversized and should be .75 gph nozzles in non critical seasons. For the coldest periods in the winter .95 gph nozzles can be used. Additionally the boiler set points are too high and should be reset to (150 and 160). The cost includes a utility support specialist or engineer being utilized in the village for one day.	$3,052	$2,200	26.77	0.7
3	Setback Thermostat: Water Plant	Implement a Heating Temperature Unoccupied Setback to 55.0 deg F for the Water Plant space.	$503	$600	12.44	1.2
4	Lighting: Exterior Lighting	Replace with 5 LED 20W Module Electronic	$142	$1,250	1.39	8.8

Table 1.1 PRIORITY LIST – ENERGY EFFICIENCY MEASURES						
Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR[1]	Simple Payback (Years)[2]
	TOTAL, all measures		$15,443	$6,250	39.10	0.4

Table Notes:

[1] Savings to Investment Ratio (SIR) is a life-cycle cost measure calculated by dividing the total savings over the life of a project (expressed in today's dollars) by its investment costs. The SIR is an indication of the profitability of a measure; the higher the SIR, the more profitable the project. An SIR greater than 1.0 indicates a cost-effective project (i.e. more savings than cost). Remember that this profitability is based on the position of that Energy Efficiency Measure (EEM) in the overall list and assumes that the measures above it are implemented first.

[2] Simple Payback (SP) is a measure of the length of time required for the savings from an EEM to payback the investment cost, not counting interest on the investment and any future changes in energy prices. It is calculated by dividing the investment cost by the expected first-year savings of the EEM.

With all of these energy efficiency measures in place, the annual utility cost can be reduced by $15,443 per year, or 44.4% of the buildings' total energy costs. These measures are estimated to cost $6,250, for an overall simple payback period of 0.4 years.

Table 1.2 below is a breakdown of the annual energy cost across various energy end use types, such as Space Heating and Water Heating. The first row in the table shows the breakdown for the building as it is now. The second row shows the expected breakdown of energy cost for the building assuming all of the retrofits in this report are implemented. Finally, the last row shows the annual energy savings that will be achieved from the retrofits.

Table 1.2 Annual Energy Cost Estimate										
Description	Space Heating	Space Cooling	Water Heating	Lighting	Other Electrical	Cooking	Clothes Drying	Ventilation Fans	Service Fees	Total Cost
Existing Building	$16,614	$0	$0	$804	$2,787	$1,718	$12,809	$0	$0	**$34,790**
With All Proposed Retrofits	$13,060	$0	$0	$663	$2,787	$1,718	$1,061	$0	$0	**$19,346**
SAVINGS	$3,554	$0	$0	$142	$0	$0	$11,747	$0	$0	**$15,444**

2. AUDIT AND ANALYSIS BACKGROUND

2.1 Program Description

This audit included services to identify, develop, and evaluate energy efficiency measures at the Napaskiak West Well. The scope of this project included evaluating building shell, lighting and other electrical systems, and HVAC equipment, motors and pumps. Measures were analyzed based on life-cycle-cost techniques, which include the initial cost of the equipment, life of the equipment, annual energy cost, annual maintenance cost, and a discount rate of 3.0%/year in excess of general inflation.

2.2 Audit Description

Preliminary audit information was gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is used and what opportunities exist within a building. The entire site was surveyed to inventory the following to gain an understanding of how each building operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Building-specific equipment

The building site visit was performed to survey all major building components and systems. The site visit included detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager were collected along with the system and components to determine a more accurate impact on energy consumption.

Details collected from Napaskiak West Well enable a model of the building's energy usage to be developed, highlighting the building's total energy consumption, energy consumption by specific building component, and equivalent energy cost. The analysis involves distinguishing the different fuels used on site, and analyzing their consumption in different activity areas of the building.

Napaskiak West Well is classified as being made up of the following activity areas:

1) Water Plant: 1,053 square feet

In addition, the methodology involves taking into account a wide range of factors specific to the building. These factors are used in the construction of the model of energy used. The factors include:

- Occupancy hours
- Local climate conditions
- Prices paid for energy

2.3. Method of Analysis

Data collected was processed using AkWarm© Energy Use Software to estimate energy savings for each of the proposed energy efficiency measures (EEMs). The recommendations focus on the building envelope; HVAC; lighting, plug load, and other electrical improvements; and motor and pump systems that will reduce annual energy consumption.

EEMs are evaluated based on building use and processes, local climate conditions, building construction type, function, operational schedule, existing conditions, and foreseen future plans. Energy savings are calculated based on industry standard methods and engineering estimations.

Our analysis provides a number of tools for assessing the cost effectiveness of various improvement options. These tools utilize **Life-Cycle Costing**, which is defined in this context as a method of cost analysis that estimates the total cost of a project over the period of time that includes both the construction cost and ongoing maintenance and operating costs.

Savings to Investment Ratio (SIR) = **Savings** divided by **Investment**

Savings includes the total discounted dollar savings considered over the life of the improvement. When these savings are added up, changes in future fuel prices as projected by the Department of Energy are included. Future savings are discounted to the present to account for the time-value of money (i.e. money's ability to earn interest over time). The **Investment** in the SIR calculation includes the labor and materials required to install the measure. An SIR value of at least 1.0 indicates that the project is cost-effective—total savings exceed the investment costs.

Simple payback is a cost analysis method whereby the investment cost of a project is divided by the first year's savings of the project to give the number of years required to recover the cost of the investment. This may be compared to the expected time before replacement of the system or component will be required. For example, if a boiler costs $12,000 and results in a savings of $1,000 in the first year, the payback time is 12 years. If the boiler has an expected life to replacement of 10 years, it would not be financially viable to make the investment since the payback period of 12 years is greater than the project life.

The Simple Payback calculation does not consider likely increases in future annual savings due to energy price increases. As an offsetting simplification, simple payback does not consider the need to earn interest on the investment (i.e. it does not consider the time-value of money). Because of these simplifications, the SIR figure is considered to be a better financial investment indicator than the Simple Payback measure.

Measures are implemented in order of cost-effectiveness. The program first calculates individual SIRs, and ranks all measures by SIR, higher SIRs at the top of the list. An individual measure must have an individual SIR>=1 to make the cut. Next the building is modified and re-simulated with the highest ranked measure included. Now all remaining measures are re-evaluated and ranked, and the next most cost-effective measure is implemented. AkWarm goes through this iterative process until all appropriate measures have been evaluated and installed.

It is important to note that the savings for each recommendation is calculated based on implementing the most cost effective measure first, and then cycling through the list to find the next most cost effective measure. Implementation of more than one EEM often affects the savings of other EEMs. The savings may in some cases be relatively higher if an individual EEM is implemented in lieu of multiple recommended EEMs. For example implementing a reduced operating schedule for inefficient lighting will result in relatively high savings. Implementing a reduced operating schedule for newly installed efficient lighting will result in lower relative savings, because the efficient lighting system uses less energy during each hour of operation. If multiple EEM's are recommended to be implemented, AkWarm calculates the combined savings appropriately.

Cost savings are calculated based on estimated initial costs for each measure. Installation costs include labor and equipment to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers.

2.4 Limitations of Study

All results are dependent on the quality of input data provided, and can only act as an approximation. In some instances, several methods may achieve the identified savings. This report is not intended as a final design document. The design professional or other persons following the recommendations shall accept responsibility and liability for the results.

3. Napaskiak West Well

3.1. Building Description

The 1,053 square foot Napaskiak West Well was constructed in 1985, with a normal occupancy of one person. The number of hours of operation for this building average 4 hours per day, considering all seven days of the week.

Description of Building Shell

The exterior walls are 2x8 construction with over seven inches of insulation in the newer part of the facility, and 2x6 with over five inches of batt insulation in the older part of the facility.

The roof is a cold roof with 12 inches of batt insulation.

The foundation is on pilings with over nine inches of batt insulation.

Typical windows throughout the building are double paned wood vinyl windows.

Doors are metal urethane with no thermal break.

Description of Heating and Cooling Plants

The Heating Plants used in the building are:

Weil McClain Gold Oil Boiler

Nameplate Information:	P-WGO-3, Beckett AFG burner.
Fuel Type:	#1 Oil
Input Rating:	115,000 BTU/hr
Steady State Efficiency:	71 %
Idle Loss:	50 %
Heat Distribution Type:	Water
Boiler Operation:	Oct - Jun
Notes:	The nozzle is size .95 gph.

Space Heating and Cooling Distribution Systems

The building is heated primarily through unit heaters, though jacket loss off the boiler provides asignificant maount of heat to the building as well.

Lighting

Interior lighting is made up of a series of electronic T* fluorescent fixtures with two 32 watt bulbs each. Exterior lighting is made up of two 70 watt metal halide fixtures for the watering point and five 50 watt metal halide fixtures for the rest of the facility.

Plug Loads

Plug loads for the building are made up of only a water treatement chemicals and sample refrigerator.

Major Equipment

Major equipment in the building includes the following:

¾ HP Well Pump
2 Aerator Pumps
2 Mixing motors
2 1 HP transfer pumps for the treatment tanks
2 3 HP backwash/pressure pumps
1 ¾ hp sludge pump

Additionally there are three heat traces in the facility used to keep the well line, water storage tank and sludge outfall from freezing. These are the largest electrical loads in the facility. Its possible that significant savings could be realized by not using the heat trace when the well pump is pumping and when the water storage tank circulation pump is working properly.

3.2 Predicted Energy Use

3.2.1 Energy Usage / Tariffs

The electric usage profile charts (below) represents the predicted electrical usage for the building. If actual electricity usage records were available, the model used to predict usage was calibrated to approximately match actual usage. The electric utility measures consumption in kilowatt-hours (kWh) and maximum demand in kilowatts (kW). One kWh usage is equivalent to 1,000 watts running for one hour.

The fuel oil usage profile shows the fuel oil usage for the building. Fuel oil consumption is measured in gallons. One gallon of #1 Fuel Oil provides approximately 132,000 BTUs of energy.

The following is a list of the utility companies providing energy to the building and the class of service provided:

Electricity: Napaskiak, Inc - Commercial - Sm

The average cost for each type of fuel used in this building is shown below in Table 3.1. This figure includes all surcharges, subsidies, and utility customer charges:

Table 3.1 – Average Energy Cost	
Description	**Average Energy Cost**
Electricity	$ 0.27/kWh
#1 Oil	$ 6.00/gallons

3.2.1.1 Total Energy Use and Cost Breakdown

At current rates, City of Napaskiak pays approximately $34,790 annually for electricity and other fuel costs for the Napaskiak West Well.

Figure 3.1 below reflects the estimated distribution of costs across the primary end uses of energy based on the AkWarm© computer simulation. Comparing the “Retrofit” bar in the figure to the “Existing” bar shows the potential savings from implementing all of the energy efficiency measures shown in this report.

Figure 3.1
Annual Energy Costs by End Use

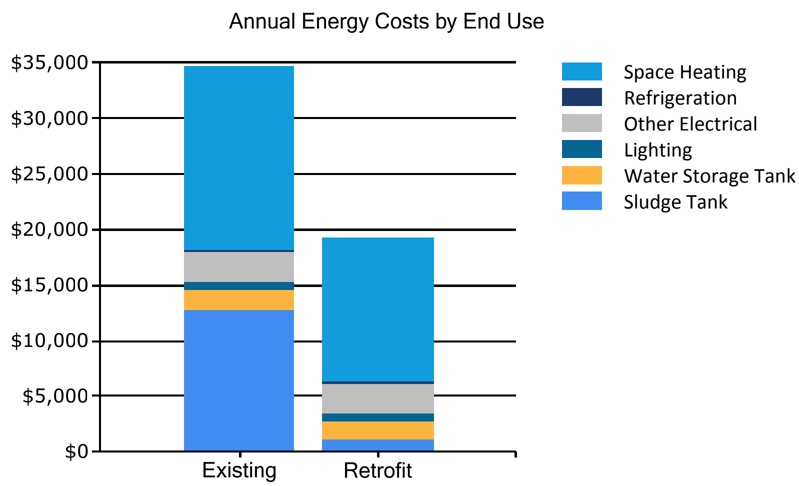


Figure 3.2 below shows how the annual energy cost of the building splits between the different fuels used by the building. The "Existing" bar shows the breakdown for the building as it is now; the "Retrofit" bar shows the predicted costs if all of the energy efficiency measures in this report are implemented.

Figure 3.2
Annual Energy Costs by Fuel Type

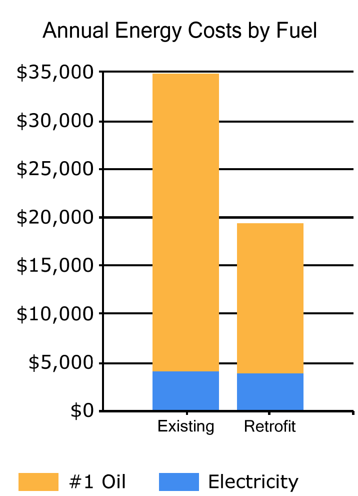
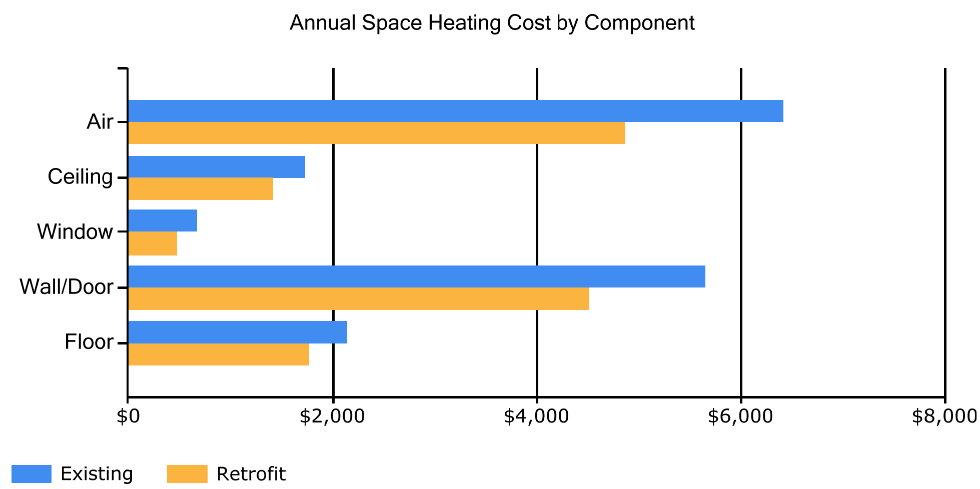


Figure 3.3 below addresses only Space Heating costs. The figure shows how each heat loss component contributes to those costs; for example, the figure shows how much annual space heating cost is caused by the heat loss through the Walls/Doors. For each component, the space heating cost for the Existing building is shown (blue bar) and the space heating cost assuming all retrofits are implemented (yellow bar) are shown.

Figure 3.3
Annual Space Heating Cost by Component



The tables below show AkWarm's estimate of the monthly fuel use for each of the fuels used in the building. For each fuel, the fuel use is broken down across the energy end uses. Note, in the tables below "DHW" refers to Domestic Hot Water heating.

Electrical Consumption (kWh)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Refrigeration	18	16	18	17	18	17	18	18	17	18	17	18
Lighting	306	279	306	296	207	111	115	115	111	382	370	382
Other_Electrical	1159	1057	1159	1122	631	132	136	136	132	1569	1518	1569
Water Storage Tank	60	54	60	58	60	0	0	0	0	60	58	60
Sludge Tank	0	0	0	0	0	0	0	0	0	0	0	0
Ventilation_Fans	0	0	0	0	0	0	0	0	0	0	0	0
DHW	0	0	0	0	0	0	0	0	0	0	0	0
Space_Heating	159	144	153	140	75	15	13	15	21	188	189	204

Fuel Oil #1 Consumption (Gallons)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Water Storage Tank	34	31	34	33	34	0	0	0	0	34	33	34
Sludge Tank	237	216	237	229	237	68	70	70	68	237	229	237
DHW	0	0	0	0	0	0	0	0	0	0	0	0
Space_Heating	324	295	324	314	324	40	33	39	55	324	314	324

3.2.2 Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (Btu) or kBtu, and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of

Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.
The site and source EUIs for this building are calculated as follows. (See Table 3.4 for details):

$$\text{Building Site EUI} = \frac{\text{(Electric Usage in kBtu + Fuel Oil Usage in kBtu + similar for other fuels)}}{\text{Building Square Footage}}$$

$$\text{Building Source EUI} = \frac{\text{(Electric Usage in kBtu X SS Ratio + Fuel Oil Usage in kBtu X SS Ratio + similar for other fuels)}}{\text{Building Square Footage}}$$

where "SS Ratio" is the Source Energy to Site Energy ratio for the particular fuel.

Table 3.4
Napaskiak West Well EUI Calculations

Energy Type	Building Fuel Use per Year	Site Energy Use per Year, kBTU	Source/Site Ratio	Source Energy Use per Year, kBTU
Electricity	15,296 kWh	52,206	3.340	174,370
#1 Oil	5,110 gallons	674,518	1.010	681,263
Total		**726,725**		**855,633**
BUILDING AREA		1,053	Square Feet	
BUILDING SITE EUI		690	kBTU/Ft²/Yr	
BUILDING SOURCE EUI		813	**kBTU/Ft²/Yr**	
* Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued March 2011.				

3.3 AkWarm© Building Simulation

An accurate model of the building performance can be created by simulating the thermal performance of the walls, roof, windows and floors of the building. The HVAC system and central plant are modeled as well, accounting for the outside air ventilation required by the building and the heat recovery equipment in place.

The model uses local weather data and is trued up to historical energy use to ensure its accuracy. The model can be used now and in the future to measure the utility bill impact of all types of energy projects, including improving building insulation, modifying glazing, changing air handler schedules, increasing heat recovery, installing high efficiency boilers, using variable air volume air handlers, adjusting outside air ventilation and adding cogeneration systems.

For the purposes of this study, the Napaskiak West Well was modeled using AkWarm© energy use software to establish a baseline space heating and cooling energy usage. Climate data from Napaskiak was used for analysis. From this, the model was be calibrated to predict the impact of theoretical energy savings measures. Once annual energy savings from a particular measure were predicted and the initial capital cost was estimated, payback scenarios were approximated. Equipment cost estimate calculations are provided in Appendix D.

Limitations of AkWarm© Models

• The model is based on typical mean year weather data for Napaskiak. This data represents the average ambient weather profile as observed over approximately 30 years. As such, the gas and electric profiles generated will not likely compare perfectly with actual energy billing information from any single year. This is especially true for years with extreme warm or cold periods, or even years with unexpectedly moderate weather.
• The heating and cooling load model is a simple two-zone model consisting of the building's core interior spaces and the building's perimeter spaces. This simplified approach loses accuracy for buildings that have large variations in cooling/heating loads across different parts of the building.
• The model does not model HVAC systems that simultaneously provide both heating and cooling to the same building space (typically done as a means of providing temperature control in the space).

The energy balances shown in Section 3.1 were derived from the output generated by the AkWarm© simulations.

4. ENERGY COST SAVING MEASURES

4.1 Summary of Results

The energy saving measures are summarized in Table 4.1. Please refer to the individual measure descriptions later in this report for more detail. Calculations and cost estimates for analyzed measures are provided in Appendix C.

Table 4.1
Napaskiak West Well, Napaskiak, Alaska
PRIORITY LIST – ENERGY EFFICIENCY MEASURES

Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR	Simple Payback (Years)
1	Sludge Tank	Retro-commission the Sludge tank heating supply controls. Cost includes one day effort from utility support personnel. See notes.	$11,747	$2,200	80.14	0.2

Table 4.1 Napaskiak West Well, Napaskiak, Alaska PRIORITY LIST – ENERGY EFFICIENCY MEASURES						
Rank	**Feature**	**Improvement Description**	**Annual Energy Savings**	**Installed Cost**	**Savings to Investment Ratio, SIR**	**Simple Payback (Years)**
2	HVAC And DHW	Nozzles are oversized and should be .75 gph nozzles in non critical seasons. For the coldest periods in the winter .95 gph nozzles can be used. Additionally the boiler set points are too high and should be reset to (150 and 160). The cost includes a utlity support specialist or engineer being utilized in the village for one day.	$3,052	$2,200	26.77	0.7
3	Setback Thermostat: Water Plant	Implement a Heating Temperature Unoccupied Setback to 55.0 deg F for the Water Plant space.	$503	$600	12.44	1.2
4	Lighting: Exterior Lighting	Replace with 5 LED 20W Module StdElectronic	$142	$1,250	1.39	8.8
	TOTAL, all measures		**$15,443**	**$6,250**	**39.10**	**0.4**

4.2 Interactive Effects of Projects

The savings for a particular measure are calculated assuming all recommended EEMs coming before that measure in the list are implemented. If some EEMs are not implemented, savings for the remaining EEMs will be affected. For example, if ceiling insulation is not added, then savings from a project to replace the heating system will be increased, because the heating system for the building supplies a larger load.

In general, all projects are evaluated sequentially so energy savings associated with one EEM would not also be attributed to another EEM. By modeling the recommended project sequentially, the analysis accounts for interactive affects among the EEMs and does not “double count” savings.

Interior lighting, plug loads, facility equipment, and occupants generate heat within the building. When the building is in cooling mode, these items contribute to the overall cooling demands of the building; therefore, lighting efficiency improvements will reduce cooling requirements in air-conditioned buildings. Conversely, lighting-efficiency improvements are anticipated to slightly increase heating requirements. Heating penalties and cooling benefits were included in the lighting project analysis.

4.3 Mechanical Equipment Measures

4.4.1 Heating/Cooling/Domestic Hot Water Measure

Rank	Recommendation				
2	Nozzles are oversized for the normal facility load. Suggested size is .75 gph nozzles for non-critical seasons. For the coldest periods in the winter .95 gph nozzles may used if needed. Additionally, the boiler set points are too high and should be reset to (150 and 160). The cost includes a utility support specialist or engineer being utilized in the village for one day, with test equipment.				
Installation Cost	$2,200	**Estimated Life of Measure (yrs)**	20	**Energy Savings (/yr)**	$3,052
Breakeven Cost	$58,887	**Savings-to-Investment Ratio**	26.8	**Simple Payback yrs**	1
Auditors Notes: Boiler will provide maximum system efficiency with long sustained burn rates. Smaller nozzles will aid in this, and can be changed as needed throughout the season. The nozzle should only be considered too small if a well tuned boiler is unable to meet systems demands under constant fire conditions. A change in either nozzle size or pump pressure will require a change in air band settings, test equipment will be need to be on-site for proper burner adjustment. Gains in efficiency assume that boilers are cleaned and maintained regularly, and appropriate stack temperatures are set to avoid condensation problems.					

4.4.2 Ventilation System Measures (There were no improvements in this category)

4.4.3 Night Setback Thermostat Measures

Rank	Building Space			Recommendation	
3	Water Plant			Implement a Heating Temperature Unoccupied Setback to 55.0 deg F for the Water Plant space.	
Installation Cost	$600	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$503
Breakeven Cost	$7,463	**Savings-to-Investment Ratio**	12.4	**Simple Payback yrs**	1
Auditors Notes: Installing a heating setback for periods when the facility is unoccupied would reduce the heating demand of the building. Installation of a setback thermostat in the water plant area would be the easiest way to control this.					

4.5 Electrical & Appliance Measures

4.5.1 Lighting Measures

The goal of this section is to present any lighting energy conservation measures that may also be cost beneficial. It should be noted that replacing current bulbs with more energy-efficient equivalents will have a small effect on the building heating and cooling loads. The building cooling load will see a small decrease from an upgrade to more efficient bulbs and the heating load will see a small increase, as the more energy efficient bulbs give off less heat.

4.5.1a Lighting Measures – Replace Existing Fixtures/Bulbs

Rank	Location		Existing Condition		Recommendation	
4	Exterior Lighting		5 MH 50 Watt StdElectronic with Manual Switching		Replace with 5 LED 20W Module StdElectronic	
Installation Cost		$1,250	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$142
Breakeven Cost		$1,738	**Savings-to-Investment Ratio**	1.4	**Simple Payback yrs**	9
Auditors Notes: Replacing the wall pack metal hallides with LED equivalents will reduce energy usage, require less replacement of bulbs and allow for better exterior lighting functioning in the cold.						

4.5.2 Sludge Tank Measures

Rank	Location		Description of Existing		Efficiency Recommendation	
1					Retro-commission the Sludge tank heating supply controls. Cost includes one day effort from utility support personnel. See notes.	
Installation Cost		$2,200	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$11,747
Breakeven Cost		$176,309	**Savings-to-Investment Ratio**	80.1	**Simple Payback yrs**	0
Auditors Notes: The backwash sludge holding tank was found with improperly wired controls; this error was causing the holding tank temperature to closely resemble the hydronic heating system temperature and is assumed to be around 150 degrees Fahrenheit. Controls should be retro-commissioned, and tank temperatures need to be closely monitored. This measure has additional associated savings, as the extra boiler run time is increasing jacket losses and overheating the facility accounting for excess heat loss. Additional savings could be realized by isolating the tank between backwash cycles. Heat is only required to prevent freezing during the period between backwashing and tank pumping, if the tank is pumped dry shortly after the backwash cycle is complete, the heating could be turned off, and very little heat will be needed.						

5. ENERGY EFFICIENCY ACTION PLAN

Through inspection of the energy-using equipment on-site and discussions with site facilities personnel, this energy audit has identified several energy-saving measures. The measures will reduce the amount of fuel burned and electricity used at the site. The projects will not degrade the performance of the building and, in some cases, will improve it.

Several types of EEMs can be implemented immediately by building staff, and others will require various amounts of lead time for engineering and equipment acquisition. In some cases, there are logical advantages to implementing EEMs concurrently. For example, if the same electrical contractor is used to install both lighting equipment and motors, implementation of these measures should be scheduled to occur simultaneously.

APPENDICES

Appendix A – Listing of Energy Conservation and Renewable Energy Websites

Lighting
Illumination Engineering Society - http://www.iesna.org/

Energy Star Compact Fluorescent Lighting Program - www.energystar.gov/index.cfm?c=cfls.pr_cfls

DOE Solid State Lighting Program - http://www1.eere.energy.gov/buildings/ssl/

DOE office of Energy Efficiency and Renewable Energy - http://apps1.eere.energy.gov/consumer/your_workplace/

Energy Star – http://www.energystar.gov/index.cfm?c=lighting.pr_lighting

Hot Water Heaters

Heat Pump Water Heaters -
http://apps1.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=12840

Solar Water Heating

FEMP Federal Technology Alerts – http://www.eere.energy.gov/femp/pdfs/FTA_solwat_heat.pdf

Solar Radiation Data Manual – http://rredc.nrel.gov/solar/pubs/redbook

Plug Loads

DOE office of Energy Efficiency and Renewable Energy – http:apps1.eere.energy.gov/consumer/your_workplace/

Energy Star – http://www.energystar.gov/index.cfm?fuseaction=find_a_product

The Greenest Desktop Computers of 2008 - http://www.metaefficient.com/computers/the-greenest-pcs-of-2008.html

Wind

AWEA Web Site – http://www.awea.org

National Wind Coordinating Collaborative – http:www.nationalwind.org

Utility Wind Interest Group site: http://www.uwig.org

WPA Web Site – http://www.windpoweringamerica.gov

Homepower Web Site: http://homepower.com

Windustry Project: http://www.windustry.com

Solar

NREL – http://www.nrel.gov/rredc/

Firstlook – http://firstlook.3tiergroup.com

TMY or Weather Data – http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/

State and Utility Incentives and Utility Policies - http://www.dsireusa.org