Comprehensive Energy Audit
For
Akiak Health Clinic

Prepared For

Akiak Native Community

October 19, 2011

Prepared By:

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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 Akiak. 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 clinic staff and Mr. Ivan Ivan of the Native Village of Akiak.

1. EXECUTIVE SUMMARY

This report was prepared for the Native Village of Akiak. The scope of the audit focused on Akiak Clinic. 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 $9,446 for Electricity, $3,640 for #1 Oil, and total energy costs are $13,087 per year.

It should be noted that this facility received the power cost equalization subsidy last year. If it did not receive the PCE subsidy the annual electricity cost would have been $17,003 for Electricity, $3,640 for #1 Oil and total costs of $20,643 per year. All calculations have been made assuming continued receipt of the PCE subsidy.

Table 1.1 below summarizes the energy efficiency measures analyzed for the Akiak Clinic. 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	Other Electrical: Water Line Heat Tapes	Improve Manual Switching	$427	$10	272.70	0.0
2	Setback Thermostat: Main Clinic	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Main Clinic space.	$567	$600	14.16	1.1
3	Other Electrical: Appliances	Improve Manual Switching	$159	$100	9.63	0.6
4	Lighting: Exterior Lighting	Replace with 2 LED 17W Module Electronic	$295	$600	3.14	2.0
5	Air Tightening	Perform air sealing to reduce air leakage by 50 cfm at 50 Pascals.	$49	$300	1.66	6.2
6	Lighting: Fluorescent Lighting Interior	Replace with 24 LED Replacements	$530	$3,800	1.13	7.2
	TOTAL, all measures		**$2,026**	**$5,410**	**3.49**	**2.7**

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 $2,026 per year, or 15.5% of the buildings' total energy costs. These measures are estimated to cost $5,410, for an overall simple payback period of 2.7 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	$6,395	$0	$648	$1,663	$4,180	$0	$0	$0	$0	**$13,087**
With All Proposed Retrofits	$6,052	$0	$648	$629	$3,531	$0	$0	$0	$0	**$11,060**
SAVINGS	$344	$0	$0	$1,034	$649	$0	$0	$0	$0	**$2,026**

2. AUDIT AND ANALYSIS BACKGROUND

2.1 Program Description

This audit included services to identify, develop, and evaluate energy efficiency measures at the Akiak Clinic. 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 Akiak Clinic 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.

Akiak Clinic is classified as being made up of 2,350 square feet of health facility space.

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. Akiak Clinic

3.1. Building Description

The 2,350 square foot Akiak Clinic was constructed in 1990, with a normal occupancy of 3 people. The hours of operation for this building average eight per day, Monday through Friday.

Description of Building Shell

The exterior walls are 2x6 construction with 5.5 inches of polyurethane insulation.

The roof of the building is a cold roof with 10 inches of polyurethane insulation.

The floor of the building is constructed with 10 inches of polyurethane insulation and built on pilings.

Typical windows throughout the building are double paned, wood/vinyl operable windows.

There are two metal doors in the building with no thermal break.

Description of Heating and Cooling Plants

The Heating Plants used in the building are:

Forced Air Furnace	
Fuel Type:	#1 Oil
Input Rating:	140,000 BTU/hr
Steady State Efficiency:	74 %
Idle Loss:	1.5 %
Heat Distribution Type:	Air
Hot Water Heater	
Fuel Type:	#1 Oil
Input Rating:	115,000 BTU/hr
Steady State Efficiency:	83 %
Idle Loss:	1.5 %
Heat Distribution Type:	Water
Boiler Operation:	All Year

Space Heating Distribution Systems

Heat in the building is distributed through a forced air ventilation system in the ceiling, and is supposed to be controlled by two heating zones. However in operation the building uses one single zone.

Domestic Hot Water System
The domestic hot water system is rarely used, primarily when doctors and dentists are using the clinic and use hot water for showers.

Lighting

Lighting in the building consists primarily of T8 32 watt fluorescent lighting fixtures, and feature metal halide wall packs for exterior lighting.

Plug Loads

Medical Equipment, a server bank, computers, phone, printers and refrigerators make up the plug loads in the building. An additional significant load is the heat tapes used to keep the water and sewer lines from freezing in the winter time.

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: Akiak, City of - 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	$ 0.35/kWh
#1 Oil	$ 5.00/gallons

3.2.1.1 Total Energy Use and Cost Breakdown

At current rates, YKHC pays approximately $13,087 annually for electricity and other fuel costs for the Akiak Clinic.

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

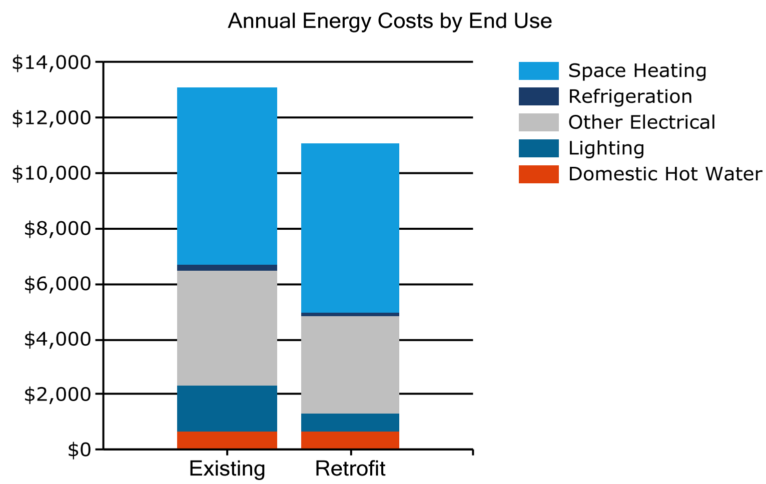


Figure 3.2 below shows how the annual energy cost of the building splits between the different fuels used by the building. The “Existing” bar shows the breakdown for the building as it is now; the “Retrofit” bar shows the predicted costs if all of the energy efficiency measures in this report are implemented.

Figure 3.2
Annual Energy Costs by Fuel Type

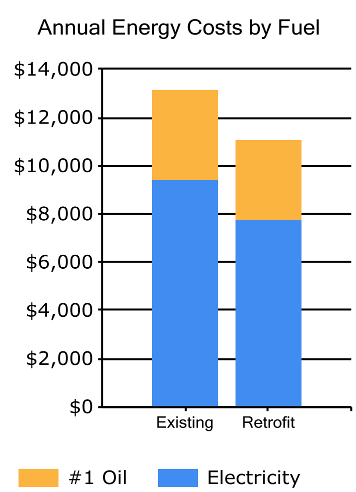
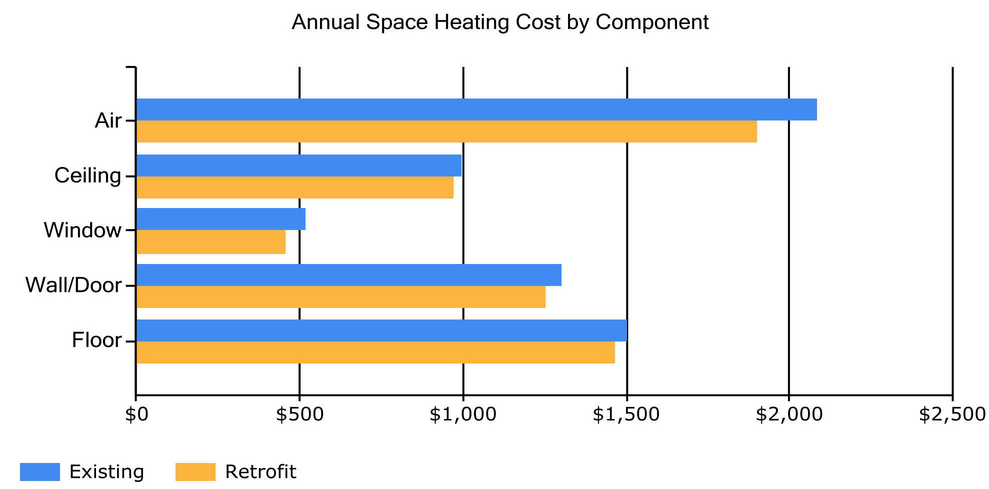


Figure 3.3 below addresses only Space Heating costs. The figure shows how each heat loss component contributes to those costs; for example, the figure shows how much annual space heating cost is caused

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
Other_Electrical	1216	1108	1216	1177	1216	399	412	412	1177	1216	1177	1216
Lighting	434	396	434	420	434	300	310	310	420	434	420	434
Refrigeration	49	44	49	47	49	47	49	49	47	49	47	49
Ventilation_Fans	0	0	0	0	0	0	0	0	0	0	0	0
DHW	5	4	5	4	5	4	5	5	4	5	4	5
Space_Heating	827	753	824	794	816	790	816	816	790	819	796	827
Space_Cooling	0	0	0	0	0	0	0	0	0	0	0	0

Fuel Oil #1 Consumption (Gallons)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
DHW	11	10	11	10	11	10	11	11	10	11	10	11
Space_Heating	106	93	83	46	12	11	12	12	11	39	70	107

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):

Building Site EUI = *(Electric Usage in kBtu + Fuel Oil#1 Usage in kBtu + similar for other fuels)* / *Building Square Footage*

Building Source EUI = *(Electric Usage in kBtu X SS Ratio + Fuel Oil #1 in kBtu X SS Ratio + similar for other fuels)* / *Building Square Footage*

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

Table 3.4
Akiak Clinic 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	26,989 kWh	92,112	3.340	307,656
#1 Oil	728 gallons	96,109	1.010	97,070
Total		**188,221**		**404,725**
BUILDING AREA		2,350	Square Feet	
BUILDING SITE EUI		80	kBTU/Ft²/Yr	
BUILDING SOURCE EUI		172	**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 Akiak Clinic was modeled using AkWarm© energy use software to establish a baseline space heating and cooling energy usage. Climate data from Akiak 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 Akiak. 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
Akiak Clinic, Akiak, Alaska
PRIORITY LIST – ENERGY EFFICIENCY MEASURES

Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR	Simple Payback (Years)
1	Other Electrical: Water Line Heat Tapes	Improve Manual Switching	$427	$10	272.70	0.0
2	Setback Thermostat: Main Clinic	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Main Clinic space.	$567	$600	14.16	1.1

Table 4.1 Akiak Clinic, Akiak, Alaska PRIORITY LIST – ENERGY EFFICIENCY MEASURES						
Rank	**Feature**	**Improvement Description**	**Annual Energy Savings**	**Installed Cost**	**Savings to Investment Ratio, SIR**	**Simple Payback (Years)**
3	Other Electrical: Appliances	Improve Manual Switching	$159	$100	9.63	0.6
4	Lighting: Exterior Lighting	Replace with 2 LED 17W Module Electronic	$295	$600	3.14	2.0
5	Air Tightening	Perform air sealing to reduce air leakage by 50 cfm at 50 Pascals.	$49	$300	1.66	6.2
6	Lighting: Fluorescent Lighting Interior	Replace with 24 LED Replacements	$530	$3,800	1.13	7.2
	TOTAL, all measures		**$2,026**	**$5,410**	**3.49**	**2.7**

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 Building Shell Measures

4.3.1 Air Sealing Measures

Rank	**Location**	**Existing Air Leakage Level (cfm@50/75 Pa)**		**Recommended Air Leakage Reduction (cfm@50/75 Pa)**	
5		Air Tightness from Blower Door Test: 1200 cfm at 50 Pascals		Perform air sealing to reduce air leakage by 50 cfm at 50 Pascals.	
Installation Cost	$300	**Estimated Life of Measure (yrs)**	10	**Energy Savings (/yr)**	$49
Breakeven Cost	$499	**Savings-to-Investment Ratio**	1.7	**Simple Payback yrs**	6
Auditors Notes: Make sure doors close fully and windows are caulked to minimize leaks. Put in new weather stripping around doors to minimized air transfer.					

4.4 Mechanical Equipment Measures

4.4.1 Night Setback Thermostat Measures

Rank	Building Space			Recommendation	
2	Main Clinic			Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Main Clinic space.	
Installation Cost	$600	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$567
Breakeven Cost	$8,493	**Savings-to-Investment Ratio**	14.2	**Simple Payback yrs**	1
Auditors Notes: The DDC system designed for this clinic is not functional. A new simple thermostat should be set up that can do nighttime and weekend setback temperatures. A setback temperature of 60 degrees would yield significant savings.					

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.

4.5.1. Lighting Measures – Replace Existing Fixtures/Bulbs

Rank	Location	Existing Condition		Recommendation	
6	Fluorescent Lighting Interior	24 FLUOR (3) T8 4' F32T8 32W Standard Instant Electronic with Manual Switching, Occupancy Sensor		Replace with 24 LED Replacements	
Installation Cost	$3,800	**Estimated Life of Measure (yrs)**	10	**Energy Savings (/yr)**	$530
Breakeven Cost	$4,312	**Savings-to-Investment Ratio**	1.1	**Simple Payback yrs**	7
Auditors Notes: Replacing the fluorescent lighting in the clinic would reduce maintenance in addition to energy savings. New LED replacement bulbs can fit into existing sockets, and don’t require the use of a ballast to regulate light levels. These LED bulbs use less energy, and last significantly longer, as well as function better in cold temperatures.					

Rank	Location	Existing Condition		Recommendation	
4	Exterior Lighting	2 MH 70 Watt Magnetic with On/Off Photoswitch		Replace with 2 LED 17W Module Electronic	
Installation Cost	$600	**Estimated Life of Measure (yrs)**	7	**Energy Savings (/yr)**	$295
Breakeven Cost	$1,886	**Savings-to-Investment Ratio**	3.1	**Simple Payback yrs**	2
Auditors Notes: Replacing current Metal Halide lighting with LED wall packs will reduce energy use, provide longer lasting fixtures, and work more effectively in cold temperatures.					

4.5.2 Other Electrical Measures

Rank	Location	Description of Existing	Efficiency Recommendation		
3	Appliances	19 Computers, radios, phones, paper shredders, kitchen items with Manual Switching	Improve Manual Switching		
Installation Cost	$100	**Estimated Life of Measure (yrs)**	7	**Energy Savings (/yr)**	$159
Breakeven Cost	$963	**Savings-to-Investment Ratio**	9.6	**Simple Payback yrs**	1
Auditors Notes: Turning off appliances, including computers, monitors and radios when not in use would yield a significant energy savings. Most computers come with power management software to help do this automatically, but need to have their settings adjusted. Having computers set to shut down after a period of half an hour of inactivity would be effective. Items such as the CB radio and microwave should be unplugged at the end of the day to minimize electrical load in hours when they are not being used.					

Rank	Location	Description of Existing	Efficiency Recommendation		
1	Water Line Heat Tapes	Heat Tape with Manual Switching	Improve Manual Switching		
Installation Cost	$10	**Estimated Life of Measure (yrs)**	7	**Energy Savings (/yr)**	$427
Breakeven Cost	$2,727	**Savings-to-Investment Ratio**	272.7	**Simple Payback yrs**	0
Auditors Notes: Using the heat tape only in recovery or when temperatures are very cold would be a significant savings. All this requires is a flip of the switch, but it is important to recognize the immense electrical load of heat tape, and that it should be used sparingly when needed, especially with the water, which is circulated and should not need heat tape to keep from freezing.					

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.

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