Comprehensive Energy Audit
For
Shaktoolik Health Clinic

Prepared For

Native Village of Shaktoolik

July 18, 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 Shaktoolik and the Norton Sound Health Corporation. The authors of this report are Carl Remley, Certified Energy Auditor (CEA) and Certified Energy Manager (CEM), and Gavin Dixon.

The purpose of this report is to provide a comprehensive document of the findings and analysis that resulted from an energy audit conducted over the past several 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 ANTHC Energy Projects Group gratefully acknowledges the assistance of Ms. Fena Sagoonick of the Norton Sound Health Corporation and Ms. Carleen Sagoonik of the Native Village of Shaktoolik.

1. EXECUTIVE SUMMARY

This report was prepared for the Native Village of Shaktoolik. The scope of the audit focused on Shaktoolik Health 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 energy costs for the building analyzed were $6,752 for electricity and $5,141 for #1 oil resulting in a total energy cost of $11,893 per year.

It should be noted that for the last year, the clinic did not receive power cost equalization (PCE) which is a State of Alaska funded subsidy of electricity rates for rural Alaska. If the clinic did receive PCE, the energy costs would have been $7,666. It is recommended that the Tribal Council apply for PCE for the clinic.

Table 1.1 below summarizes the energy efficiency measures recommended for the health clinic. Listed are the recommended measures and the estimates of annual savings, installed costs, the savings to investment ratio and the simple payback[1] .

Table 1.1
PRIORITY LIST – RECOMMENDED ENERGY EFFICIENCY MEASURES

Rank	Feature	Recommendation	Annual Energy Savings	Installed Cost	SIR[2]	Payback (Years)
1	Setback Thermostat: Health Clinic	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Health Clinic space.	$769	$400	28.74	0.5
2	Other Electrical: Appliances	Add new Clock Timer or Other Scheduling Control	$229	$100	14.26	0.4
3	HVAC And DHW	This retrofit would convert the boiler to run only on demand from either for domestic hot water or a call for heat. It would also implement hot water reset based on outside temperature and insulate the approximately 150 feet of domestic hot water piping which varies from 1/2 inch to 1 inch.	$1,417	$2,000	13.63	1.4
4	Other Electrical: Computers	Improve Manual Switching	$45	$25	11.19	0.6
5	Air Tightening: Front Door	Perform air sealing to reduce air leakage by 420 CFM at 50 Pascals.	$264	$400	6.77	1.5
6	Lighting: Incandescent	Replace with 2 FLUOR CFL, A Lamp 15W	$23	$30	4.88	1.3

Table 1.1 PRIORITY LIST – RECOMMENDED ENERGY EFFICIENCY MEASURES						
Rank	**Feature**	**Recommendation**	**Annual Energy Savings**	**Installed Cost**	**SIR[2]**	**Payback (Years)**
7	Lighting: Clinic Fluorescent Lighting	Replace with 28 LED [Unknown Lamp] and Add new Occupancy Sensor	$1,907	$4,700	3.43	2.5
8	Lighting: Exterior Lighting	Replace with 2 LED 12W Module Std Electronic	$229	$500	4.00	2.2
9	Refrigeration: Convert to energy star refrigerator freezer	Replace with Energy Star16.5 cubic foot refrigerator freezer	$205	$1,000	1.73	4.9
10	Ceiling w/ Attic: Clinic	Add R-21 blown cellulose insulation to attic with Standard Truss.	$181	$4,197	1.16	23.2
	TOTAL		**$5,270**	**$13,352**	**5.1**	**2.5**

[1] Simple Payback (SP) *Simple payback period* is a measure of the length of time required for cumulative savings for an EEM to recover the initial and other accrued costs. Therefore, the simple payback method is a form of breakeven analysis.

[2] Savings to Investment Ration (SIR) is calculated by dividing the total savings over the life of each project (expressed in today's dollars), by its investment costs. This SIR is an indication of the profitability of each measure; the higher the SIR, the more profitable the project. An SIR greater than 1.0 indicates a cost-effective project. Remember that this profitability is based on the position of that EEM in the overall list, and on all of the measures above it being implemented first.

With these energy efficiency measures in place, the annual utility cost can be reduced by $5,270 per year, or 44.3 % of the buildings' total energy costs. These measures are estimated to cost $13,352, for an overall simple payback period[1] of 2.5 years.

It should be noted that if the Tribal Council is successful in getting PCE re-instated, the simple payback would be increased to 3.9 years.

The recommended energy efficiency measures have also been analyzed from a life-cycle perspective. This analysis does not take into account any capital cost avoidance associated with implementing the energy efficiency measures, nor does it take into account any associated differential maintenance costs. These neglected issues will have minimal influence on the results, compared to the initial costs and energy costs associated with the systems.

Table 1.2 below is a breakdown of both the electricity cost and the fuel oil cost. The table also illustrates how the proposed energy efficiency retrofits will impact utility costs.

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	$4,967	$0	$266	$3,747	$2,132	$0	$22	$0	$60	**$11,893**
With Proposed Retrofits	$2,948	$0	$99	$1,152	$1,850	$0	$23	$0	$60	**$6,624**
SAVINGS	$2,020	$0	$167	$2,595	$282	$0	-$1	$0	$0	**$5,270**

2. AUDIT AND ANALYSIS BACKGROUND

2.1 Program Description

This audit included services to identify, develop, and evaluate energy efficiency measures at the Shaktoolik Health Clinic. The scope of this project included evaluating building shell, lighting and other electrical systems, and HVAC equipment, motors and pumps. Measures were selected based on a life-cycle-cost analysis which includes the initial cost of the equipment, life of the equipment, annual energy cost, annual maintenance cost, and discount rate.

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 spent and what opportunities exist within a building. The entire site is 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 Shaktoolik Health 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.

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 anticipate energy usage 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. When new equipment is proposed, energy consumption is calculated based on manufacturer's cataloged information.

Our analysis provides a number of tools for assessing the cost effectiveness of various improvement options.

Life-cycle costing 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 = **Savings** divided by **Investment**

"Savings" includes:

- Discounted dollar savings of the measure over its lifetime
- First year energy savings of the measure
- Discounted fuel price for measure during lifetime – from DOE
- Price of fuel saved by the measure
- Conversion factor for fuel price
- Fuel price index for
- Fractional discount rate

Investment = Labor and materials for installing the measure. **Simple payback** is a cost analysis method whereby the annual savings arising from an investment are estimated, and divided by the investment cost to give the number of years required to recover the cost of the investment. This may also be compared to the expected time to replacement of the system or component. For example, if a boiler costs $12,000 and results in a saving of $1,000 per year and has an expected life to replacement of 10 years, the payback time is 12 years and it would not be financially viable to make the investment. If the annual savings is doubled (e.g. due to increased electricity cost), then the payback becomes 5 years and the investment is now viable

Internal Rate of Return is the annualized return on investment, based on the amount saved in relation to the amount invested. This is compared with similar indicators, such as the interest rate that could have been earned in an investment account to determine whether the investment is cost effective.

Net Present Value is a method of assessing the present value of future costs and returns, using a 'discount rate' to quantify the relative value of having access to money now compared to having access to it in the future.

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 reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved. If multiple EEM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

Cost savings are calculated based on estimated existing 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. Maintenance savings are calculated where applicable and added to the energy savings for each EEM.

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. Budget for engineering and design of these projects is not included in the cost estimate for each measure.

3. Shaktoolik Health Clinic

3.1. Building Description

The 1,793 square foot Shaktoolik Health Clinic was constructed in 1999 and has a normal occupancy use of three to five people. The number of hours of operation for this building is eight hours per day, five days per week.

The building is on a post and pad foundation. The walls are 2 X 6 with R19 insulation, T1-11 exterior siding and paneling on the inside. Windows throughout the building are vinyl, double pane, and in fair condition. The roof is a warm roof with attic and the equivalent of R19 insulation above the ceiling and R-11 insulated sheathing.

Description of HVAC Systems

The existing system has a single zone for heat and an Amtrol tank for domestic hot water. The boiler information is as follows. The boiler currently maintains temperature at all times.

Manufacturer: Weil McLain Gold
Model: PWT 60-6

Fuel Type:	Oil_No_1
Input Rating:	212000 BTU/Hr
Steady State Efficiency:	86.8 %
Distribution System:	Water

Space Heating Plant and Cooling Plant Distribution

Single Zone Hydronic Baseboard heating accounts for 100 % of the buildings heating load.

Further Details of Building Domestic Hot Water

The domestic hot water usage of the building is about 10 gallons per day at 130 degrees and is stored in a 41 gallon Amtrol tank.

Description of Building Ventilation System

Building ventilation is accomplished by operable windows. As mentioned earlier, the windows are double pane, vinyl frame and in fair condition.

Lighting

The majority of the interior lighting is fluorescent with T12 lamps and magnetic ballasts. There is a 100 watt incandescent fixture in the entry and a 60 watt incandescent exterior fixture at the front door.

Plug Load

The plug loads in the building are significant, and include a server bank on 24/7, a number of computers and monitors, and a variety of copy and fax machines. Additionally there is a fair amount of medical equipment, which is used at varying levels based on medical staff in attendance and demand. There are also two refrigerators, one for use by staff and guests, and one in use as a medical refrigerator.

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). One KWH usage is equivalent to 1000 watts running for one hour. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges.

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

Electricity in Shaktoolik is provided by the Alaska Village Electric Cooperative (AVEC). The present rate structure is as follows. Please note that the rate listed does not include PCE. At the present time, the clinic is not receiving PCE.

AVEC-Shaktoolik - Commercial - Sm
Electricity, ($/kWh)

Rate1	$0.30 for 700
Rate2	$0.20
Surcharge	$0.29

The overall cost for energy use is calculated by dividing the total annual cost by the total annual fuel usage. The current average cost for energy at this building is as illustrated in Table 3.1 below.

Table 3.1 – Average Energy Cost	
Description	**Average Energy Cost**
Electric	$0.56 per KWH
Fuel	$3.42 per gallon

3.2.1.1 Total Energy Use and Cost Breakdown

At current rates, the Native Village of Shaktoolik pays approximately $11,893 annually for electricity and fuel oil costs for the Shaktoolik Health Clinic.

Figure 3.1 reflects the estimated distribution of costs of the primary end uses based on the AkWarm© computer simulation. This figure also illustrates the savings potential of implementing the energy efficiency measures recommended. As can be expected, the largest energy use is for space heating.

Figure 3.1

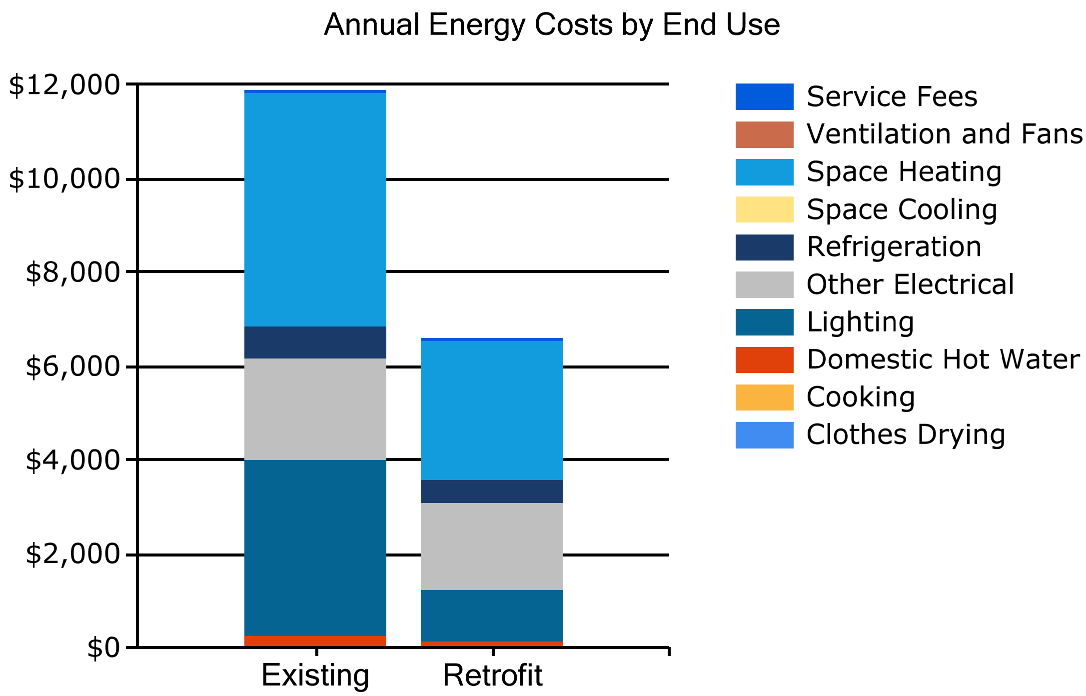


Figure 3.2 illustrates the annual energy costs by energy source. Electricity in the clinic is the largest cost, primarily due to the high plug loads and lighting demand in the building.

Figure 3.2

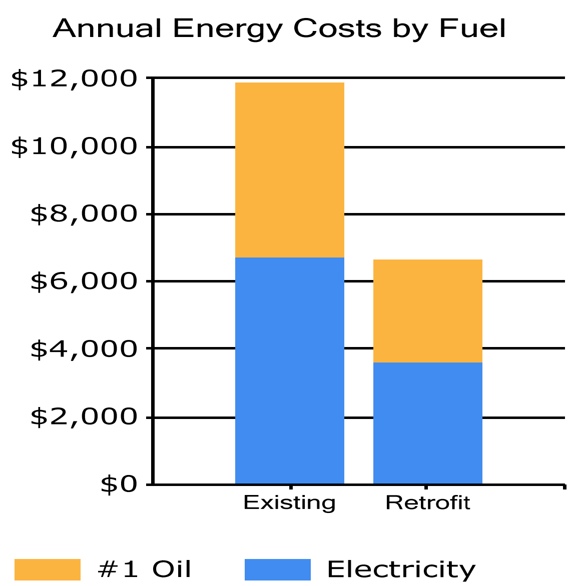
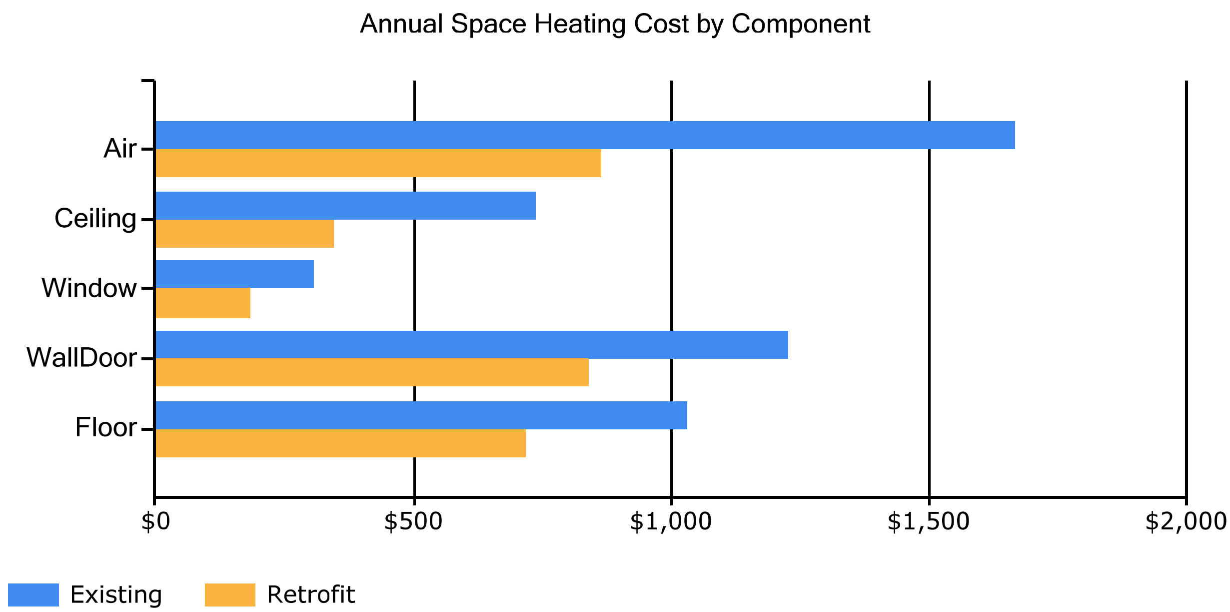


Figure 3.3 is a breakdown of the annual space heating cost by heat loss area. As can be seen, the largest loss is due to air leakage. There is a specific energy efficiency measure recommended to address this leakage. The net impact on energy costs of implementing all the

energy efficiency recommendations is illustrated by the difference in existing versus retrofit usage.



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 thousands of 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 (DOE) 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 EUI for this building is calculated as follows. (See Table 3.2 for details):

$$\textit{Building Site EUI} = \frac{\textit{(Electric Usage in kBtu + Oil Usage in kBtu)}}{\textit{Building Square Footage}}$$

Building Source EUI = $\dfrac{\textit{Electric Usage in kBtu X SS Ratio + Oil Usage in kBtu X SS Ratio}}{\textit{Building Square Footage}}$

Table 3.2
Shaktoolik Health Clinic EUI Calculations

Energy Type	Building Energy Use per Year			Site Energy Use per Year	Site/Source	Source Energy Use per Year
	kWh	ccf	Gallons	kBTU	Ratio	kBTU
Electric (kWh)	12,022			41,030	3.340	137,041
Oil_No_1 (gallons)			1,503	198,435	1.010	200,420
Total	**12,022**		**1,503**	**239,466**		**337,461**
BUILDING AREA				1,793	SQUARE FEET	
BUILDING SITE EUI				134	kBtu/Ft²/Yr	
BUILDING SOURCE EUI				188	**kBtu/Ft²/Yr**	
* Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						

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, 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 Shaktoolik Health Clinic was modeled using AkWarm© energy use software to establish a baseline space heating and cooling energy usage. Climate data from Shaktoolik 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.

Limitations of AkWarm© Models

• The model is based on typical mean year weather data for Shaktoolik. 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 energy balances shown in Section 3.1 were derived from the output generated by the AkWarm© simulations.

4. RECOMMENDED ENERGY COST SAVING MEASURES

4.1 Summary of Results

The recommended measures are summarized in Table 4.1. Please refer to the individual measure descriptions later in this report for more detail.

Table 4.1
Shaktoolik Health Clinic, Shaktoolik, Alaska

PRIORITY LIST – RECOMMENDED ENERGY EFFICIENCY MEASURES						
Rank	**Feature**	**Recommendation**	**Annual Energy Savings**	**Installed Cost**	**SIR**	**Payback (Years)**
1	Setback Thermostat: Health Clinic	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Health Clinic space.	$769	$400	28.74	0.5
2	Other Electrical: Appliances	Add new Clock Timer or Other Scheduling Control	$229	$100	14.26	0.4
3	HVAC And DHW	This retrofit would convert the boiler to run only on demand from either for domestic hot water or a call for heat. It would also implement hot water reset based on outside temperature and insulate the approximately 150 feet of domestic hot water piping which varies from 1/2 inch to 1 inch.	$1,417	$2,000	13.63	1.4
4	Other Electrical: Computers	Improve Manual Switching	$45	$25	11.19	0.6
5	Air Tightening: Front Door	Perform air sealing to reduce air leakage by 420 CFM at 50 Pascals.	$264	$400	6.77	1.5
6	Lighting: Incandescent	Replace with 2 FLUOR CFL, A Lamp 15W	$23	$30	4.88	1.3
7	Lighting: Clinic Fluorescent Lighting	Replace with 28 LED [Unknown Lamp] and Add new Occupancy Sensor	$1,907	$4,700	3.43	2.5
8	Lighting: Exterior Lighting	Replace with 2 LED 12W Module Std Electronic	$229	$500	4.00	2.2
9	Refrigeration: Convert to energy star refrigerator freezer	Replace with Energy Star16.5 cubic foot refrigerator freezer	$205	$1,000	1.73	4.9
10	Ceiling w/ Attic: Clinic	Add R-21 blown cellulose insulation to attic with Standard Truss.	$181	$4,197	1.16	23.2
		TOTAL	**$5,270**	**$13,352**	**5.1**	**2.5**

4.2 Interactive Effects of Projects

Savings for the recommended measures were calculated assuming all recommended EEMs are implemented. If some EEMs are not implemented, savings for the remaining EEMs will be affected, in some cases positively and in others, negatively. For example, if the fan motors are not replaced with premium-efficiency motors, then the savings for the project to install variable-speed drives (VSDs) on the fans will be decreased.

In general, all projects are evaluated sequentially so energy savings associated with one EEM would not also be attributed to another EEM. For example, the night setback EEM was analyzed using the fan and heating load profile that will be achieved after the installation of the VSD project is complete. 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 were included in the lighting project analysis.

4.3 Building Shell Measures

ENERGY AUDIT REPORT – ENERGY EFFICIENT RECOMMENDATIONS					
1. Building Envelope					
Insulation					
Rank	**Location**	**Existing Type/R-Value**	**Recommendation Type/R-Value**	**Installed Cost**	**Annual Energy Savings**
10	Ceiling w/ Attic: Clinic	Framing Type: Standard Framing Spacing: 24 inches Insulated Sheathing: R-11 Batt: FG or RW, 3.5 inches Bottom Insulation Layer: R-19 Batt: FG or RW, 6 inches Top Insulation Layer: None Modeled R-Value: 32.2	Add R-21 blown cellulose insulation to attic with Standard Truss.	$4,197	$181
Air Leakage					
Rank	**Location**	**Estimated Air Leakage**	**Recommended Air Leakage Target**	**Installed Cost**	**Annual Energy Savings**
5	Front Door	Air Tightness from Blower Door Test: 1825 CFM at 50 Pascals	Perform air sealing to reduce air leakage by 420 CFM at 50 Pascals.	$400	$264

4.3.1. Energy Efficiency Measure: Add or Replace Insulation

4.3.1.1 Improvement: Rank 10
Location: Ceiling w/ Attic: Clinic
Area (Feet^2): 1,793

Existing Situation: Framing Type: Standard
Framing Spacing: 24 inches
Insulated Sheathing: R-11 Batt: FG or RW, 3.5 inches
Bottom Insulation Layer: R-19 Batt:FG or RW, 6 inches
Top Insulation Layer: None
Modeled R-Value: 32.2

Recommended Measures: Add R-21 blown cellulose insulation to attic with Standard Truss.
Annual Energy Savings: $181
Installed Costs:
Total Estimated Costs: $4,197
Simple Payback (Years): 23
Auditor Comments: None

4.3.2. Energy Efficiency Measure: Seal Air Leaks

Rank	Estimated Air Leakage	Recommended Air Leakage Target	Energy Auditor Comments	Cost	Savings
5	Air Tightness from Blower Door Test: 1825 CFM at 50 Pascals	Perform air sealing to reduce air leakage by 420 CFM at 50 Pascals.	Insulate and seal front door and door frame. The major leaks are that the door installation was never finished there is no trim or frame insulation.	$400	$264

Many buildings, especially older ones, have air leaks allowing heated and cooled air to escape when the air pressure differs between the inside and outside of the building. Because these leaks allow unconditioned air to enter as conditioned air is lost, air leaks can be a significant waste of energy and money. They also make the building drafty. During our energy audit, we performed a blower door test and found excess leakage. This can be reduced by adding weather stripping around the main entrance door and caulking around the door. Buildings with indoor air pollution caused by combustion heating, tobacco smoking, or moisture problems, may require more ventilation than average buildings.

4.4 Heating Measures

4.4.1. EEM Heating Plants and Distribution Systems

Recommendation: This retrofit would convert the boiler to run only on demand from either for domestic hot water or a call for heat. It would also implement hot water reset based on outside temperature and insulate the approximately 150 feet of domestic hot water piping which varies from 1/2 inch to 1 inch.

Estimated Cost: $2,000
Estimate Savings per Year: $1,417

Energy Auditor Comments: Single clock thermostat, plus a rework of boiler controls such that the boiler will be off except on a call for heat and outside air reset of boiler water temperature should be implemented. Several manufacturers make controls specifically for this purpose. The pipe insulation can be purchased at any of the building supply centers or from a insulation contractor.

4.4.2 Programmable Thermostat

Location	Existing Situation	Recommended Improvement	Install Cost	Annual Savings	Notes
Health Clinic	Existing Unoccupied Heating Setpoint: 72.0 deg F	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Health Clinic space.	$400	$769	

At present, the thermostat is left at 72 degrees at all times. Implementing the EEM shown above will significantly reduce that consumption.

4.5 LIGHTING UPGRADES

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

4.5.1 Lighting Upgrade – Replace Existing Fixtures and Bulbs

Location	Existing Lighting	Recommended Improvement	Install Cost	Annual Savings	Notes
Incandescent	2 INCAN A Lamp, Std 60W with Manual Switching	Replace with 2 FLUOR CFL, A Lamp 15W	$30	$23	Replace the 60 watt incandescent lamps with 14 watt CFLs.
Clinic Fluorescent Lighting	28 FLUOR (2) T12 4' F40T12 34W Energy-Saver EfficMagnetic with Manual Switching	Replace with 28 LED [Unknown Lamp] and Add new Occupancy Sensor	$4,700	$1,907	Replacement of some of the fixtures, and all of the bulbs with 18W LED Replacement lamps. The fixtures with missing covers should be replaced. They are available at any of the electrical supply companies in Anchorage.

Exterior Lighting	2 INCAN A Lamp, Std 60W with Manual Switching	Replace with 2 LED 12W Module StdElectronic	$500	$229	This retrofit requires replacing the fixtures. New fixtures can be purchased through any of the electrical supply companies in Anchorage.

Description:

Multiple lighting recommendations are appropriate for the clinic. Replacing incandescent bulbs in the building with 14 CFL's is a simple solution with quick payback.

This fluorescent lighting EEM includes replacement of the existing fixtures containing T8 lamps and electronic ballasts with fixtures containing LED Replacement lamps and no ballasts. The new energy efficient LED Lamps will provide adequate lighting and will save the owner on electrical costs due to the better performance of the lamp and increased efficiency from no ballast losses. This EEM will also provide maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of an LED Lamp is approximately 50,000 burn-hours, in comparison to the existing T8 lamps which is approximately 30,000 burn-hours. The building will need 60% less lamps replaced per year.

This exterior lighting EEM replaces the existing 70 watt metal halide exterior lighting fixture with a new 14 watt LED fixture.

4.5.2 Lighting Controls

Location	Existing Lighting Controls	Recommended Improvement	Install Cost	Annual Savings	Notes
Clinic Fluorescent Lighting	Manual Switching	Manual Switching, Occupancy Sensor	$700	Included in above savings.	Install occupancy sensors in exam rooms and offices.

Description:
In some areas the lighting is left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left, or on when a room is first occupied. This is common in storage rooms occupied for only short periods and only a few times per day. In some instances lights are left on due to the misconception it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are off for at least a two minute interval, then it pays to shut them off.

Implementing Occupancy sensors will help to control lighting that is left on accidently. Replacement of existing broken fixtures is included in this cost.

4.7 Appliances

4.7.1 Refrigerator

Refrigerators consume more electricity than any other appliance in most kitchens, and today's efficient refrigerators use about half the electricity of those made 15 years ago. When buying a refrigerator, ask for an Energy Star® model which uses about 10% less energy.

Location	Life in Years	Size in ft^3	Description	Recommendation	Cost	Annual Savings	Notes
Convert to energy star refrigerator or freezer	10	Unknown	Standard 16.5 cubic foot refrigerator freezer	Replace with Energy Star 16.5 cubic foot refrigerator freezer	$1,000	$205	Replace existing refrigerator/freezer with energy star model

4.7.4 Other Electrical

Location	Life in Years	Description	Recommendation	Cost	Savings	Notes
Appliances	7	Appliances on 24/7	Add new Clock Timer or Other Scheduling Control	$100	$229	Implement timers to shut off redundant copy machines.
Computers	7	3 Computers/Monitors with Manual Switching	Improve Manual Switching	$25	$45	

Description: Many appliances in the clinic are left on needlessly. Computers and monitors in particular should be shut off when not in use, as well as printers and copy machines that aren't required to be on for fax receipt twenty four hours a day. The Afhcan machine additionally can be turned off when not in use. One way to reduce computer electrical usage is to use power management settings on the computer. Computers and monitors should be set to hibernate or shut down when left inactive for long periods of time. Installation of timers on the printers and copy machines set to turn off when the clinic is closed would substantially reduce energy use and removes forgetting to manually switch the machines on and off as a problem.

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 the boiler controls, implementation of these measures should be scheduled to occur simultaneously.

Attached to this reports are Appendix A and Appendix B. The objective of Appendix A is to illustrate how the simple payback would be affected if the clinic did get the PCE subsidy. The objective of Appendix B is to provide the Tribal Council with a wide range of energy conservation websites to further your knowledge of energy conservation.

Appendix A Energy Efficiency Table with Power Cost Equalization (PCE)

Appendix B Listing of energy conservation websites

Appendix A

Energy Efficiency Table with Power Cost Equalization (PCE)

PRIORITY LIST – RECOMMENDED ENERGY EFFICIENCY MEASURES						
Rank	**Feature**	**Recommendation**	**Annual Energy Savings**	**Installed Cost**	**SIR**	**Payback (Years)**
1	Setback Thermostat: Health Clinic	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Health Clinic space.	$760	$400	28.45	0.5
2	HVAC And DHW	This retrofit would convert the boiler to run only on demand from either for domestic hot water or a call for heat. It would also implement hot water reset based on outside temperature and insulate the approximately 150 feet of domestic hot water piping which varies from 1/2 inch to 1 inch.	$1,406	$2,000	13.55	1.4
3	Air Tightening: Front Door	Perform air sealing to reduce air leakage by 420 CFM at 50 Pascals.	$260	$400	6.69	1.5
4	Other Electrical: Appliances	Add new Clock Timer or Other Scheduling Control	$73	$100	4.28	1.4
5	Other Electrical: Computers	Improve Manual Switching	$14	$25	3.37	1.7
6	Lighting: Incandescent	Replace with 2 FLUOR CFL, A Lamp 15W	$8	$30	1.51	3.9
7	Lighting: Exterior Lighting	Replace with 2 LED 12W Module StdElectronic	$82	$500	1.43	6.1
8	Ceiling w/ Attic: Clinic	Add R-21 blown cellulose insulation to attic with Standard Truss.	$170	$4,197	1.09	24.7
9	Lighting: Clinic Fluorescent Lighting	Replace with 28 LED [Unknown Lamp] and Add new Occupancy Sensor	$572	$4,700	0.95	8.2
10	Refrigeration: Convert to energy star refrigerator freezer	Replace with Energy Star16.5 cubic foot refrigerator freezer	$49	$1,000	0.37	20.5
	TOTAL		**$3,393**	**$13,352**	**3.88**	**3.9**

Appendix B

Listing of Energy Conservation 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/

Caliper Program – http://www1.eeere.energy.gov/buildings/ssl/caliper.html

Solid State Lighting Gateway Demonstrations – http://www1/eere/energy.gov/buildings/ssl/gatewaydemos.html

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

Tank less DHW Heaters -
http://apps1.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=12820

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

AHRI –Residential Water Heaters - http://ari.org/Content/ResidentialWaterHeaters_594.aspx

American Council for Energy-Efficient Economy -
http://www.aceee.org/consumerguide/waterheating.htm#heatpump

Solar Water Heating

DOE Energy and Efficiency and Renewable Energy Solar Energy Technologies Program –
http://www1.eere.energy.gov/solar/solar_heating.html

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

FEMP Case Studies – www.eere.energy.gov/femp/technologies/renewable_casestudies.html

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

Top 10 energy efficient desktop PCs –
http://crave.cnet.co.uk/cnetuk/crave/greentech/0,250000598,10001753,00.htm

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

- AWEA Small wind toolbox: www.awea.org/smallwind/

NWTC Web Site – http:www.nreal.gov/wind

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

Best Links: www.freash-energy.org

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