



Comprehensive Energy Audit For Tribal Office



Prepared For
Native Village of Oscarville

June 30, 2011

Prepared By:

**ANTHC-DEHE
Alaska Native Tribal Health Consortium
1901 Bragaw St. Suite 200
Anchorage, Alaska
99508**

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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 Oscarville. The authors of this report are Carl Remley, Certified Energy Auditor (CEA) and Certified Energy Manager (CEM), and Kyle Monti.

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 month 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 Alexandria Henry of the Native Village of Oscarville.

1. EXECUTIVE SUMMARY

This report was prepared for the Native Village of Oscarville. The audit focused on the Oscarville Tribal Office. 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 Tribal Office Building were \$379 for electricity and \$3,980 for # 1 oil resulting in a total energy cost of \$4,359 per year.

It should be noted that if this facility did not receive the power cost equalization subsidy, the annual electricity cost would have been \$655 and the total annual energy cost would have been \$4,635.

Table 1.1 below summarizes the energy efficiency measures analyzed for the Tribal Office. 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, SIR¹	Simple Payback (Years)²
1	Setback Thermostat: Tribal office	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Tribal office space.	\$756	\$10	1133.26	0.0
2	Office floor near front door.	Fill empty 2x6 cavity with R-21 dense-pack blown-in dense pack insulation.	\$73	\$92	21.41	1.3
3	Air Tightening: Wall/ceiling interface and window/wall interface	Perform air sealing to reduce air leakage by 430 cfm at 50 Pascals.	\$456	\$500	9.38	1.1
4	Attic	Add R-38 fiberglass batts to attic with Standard Truss.	\$319	\$1,544	5.55	4.8
5	Above-Grade Wall: Tribal Office	Install R-30 rigid foam board to exterior and cover with T1-11 siding or equivalent.	\$530	\$8,752	1.63	16.5
6	Lighting: Exterior Entrance Light	Replace with LED 17Watt Wall Pack	\$31	\$150	1.01	4.9
	TOTAL, all Measures		\$2,165	\$11,048	3.71	5.1

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 \$2,165 per year, or 49.7% of the buildings’ total energy costs. These measures are estimated to cost \$11,048, for an overall simple payback period of 5.1 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	\$4,030	\$0	\$0	\$142	\$187	\$0	\$0	\$0	\$0	\$4,359
With All Proposed Retrofits	\$1,949	\$0	\$0	\$58	\$187	\$0	\$0	\$0	\$0	\$2,194
SAVINGS	\$2,081	\$0	\$0	\$84	\$0	\$0	\$0	\$0	\$0	\$2,165

2. AUDIT AND ANALYSIS BACKGROUND

2.1 Program Description

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

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 gain an understanding of how each building operates. Major Areas of interest are:

- 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 Tribal Office 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. 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 $SIR \geq 1$ 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 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.

3. Tribal Office

3.1. Building Description

The 420 square foot Tribal Office was constructed in approximately 1970, with a normal occupancy of four people. The number of hours of operation for this building is five hours per day, five days a week.

Description of Building Shell

The building is on a post and pad foundation. The walls are 2 X 4 with R11 insulation, T1-11 exterior siding and paneling on the inside. Windows throughout the building are Wood/Vinyl frame, double pane, and are in fair condition.

Description of Heating and Cooling Plants

The heating system of the building is a Monitor 2200. The system is on a thermostat, this method works by having a two preset temperature (Low and High). When the building temperature falls below the low set temperature then the heating unit will run until the building temperature reaches the predefined high temperature and the heating unit will shut off.

Monitor 2200

Fuel Type:	#1 Oil
Input Rating:	22,000 BTU/hr
Steady State Efficiency:	83 %
Idle Loss:	1 %
Heat Distribution Type:	Air

Space Heating Distribution Systems

The thermostat is built into the monitor. Distribution is by a fan within the Monitor.

Description of Building Ventilation System

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

Lighting

The interior of the building is lighted by compact florescent lights. (CFL)

Plug Loads

The plug loads consist mainly of computers and one coffee pot.

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). 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 Oscarville is provided by Bethel Utilities.

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	\$ 0.24/kWh
#1 Oil	\$ 5.29/gallons

3.2.1.1 Total Energy Use and Cost Breakdown

At current rates, Native Village of Oscarville pays approximately \$4,359 annually for electricity and fuel oil costs for the Tribal Office.

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

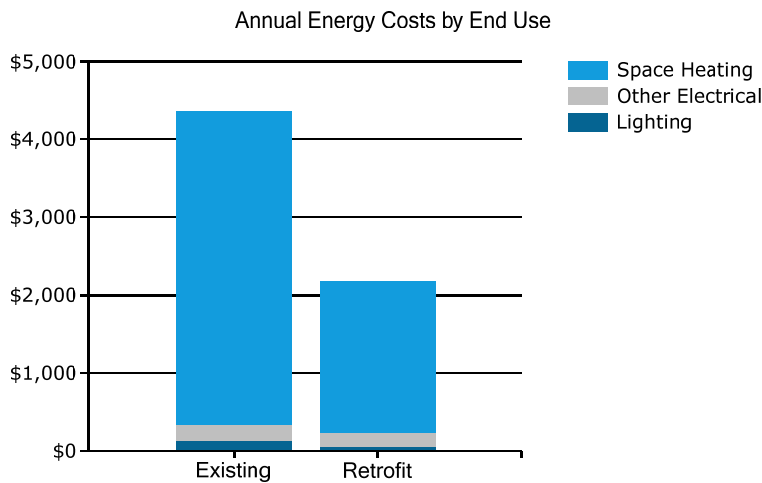


Figure 3.2 illustrates the annual energy costs by energy source. Fuel oil in the clinic is the largest cost, primarily due to the thermostat not being set back at night, the lack of insulation, and the air leaks in the building.

Figure 3.2
Annual Energy Costs by Fuel Type

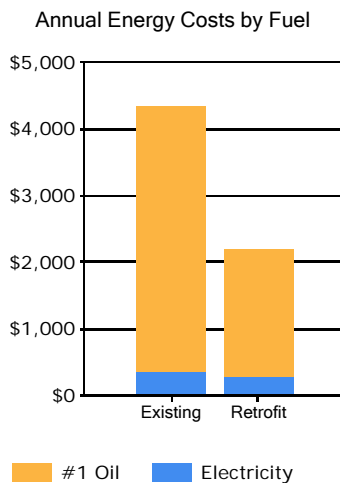
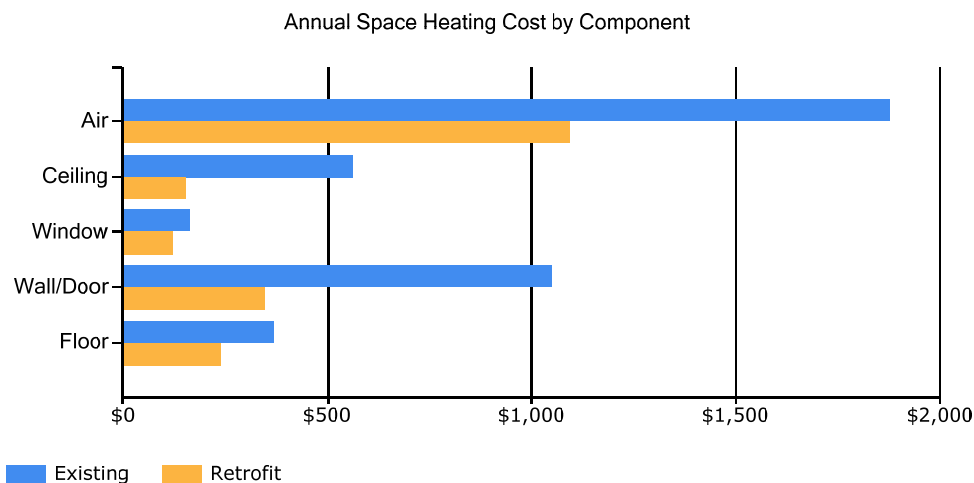


Figure 3.3 is a breakdown of the annual space heating cost by heat loss area. As can be seen, the largest loss is due to air leakage. There is a specific energy efficiency measure recommended to address this leakage. The net impact on energy costs of implementing all the energy efficiency recommendations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

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
Lighting	50	45	50	48	50	48	50	50	48	50	48	50
Other Electrical	65	60	65	63	65	63	65	65	63	65	63	65
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	29	26	25	18	11	7	6	7	10	17	22	29
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	0	0	0	0	0	0	0	0	0	0	0	0
Space Heating	115	103	97	66	36	18	13	17	29	60	84	116

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):

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

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

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

**Table 3.4
Tribal Office 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	1,559 kWh	5,320	3.340	17,770
#1 Oil	752 gallons	99,322	1.010	100,315
Total		104,642		118,085
BUILDING AREA 420 Square Feet				
BUILDING SITE EUI		249 kBtu/Ft ² /Yr		
BUILDING SOURCE EUI		281 kBtu/Ft ² /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, increasing

heat recovery, installing high efficiency boilers, adjusting outside air ventilation and adding cogeneration systems.

For the purposes of this study, the Tribal Office was modeled using AkWarm© energy use software to establish a baseline space heating energy usage. Climate data from Oscarville was used for analysis. From this, the model was 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 Oscarville. This data represents the average ambient weather profile as observed over approximately 30 years. As such, the oil 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 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 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. ENERGY COST SAVING MEASURES

4.1 Summary of Results

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

Table 4.1 Tribal Office, Oscarville, Alaska PRIORITY LIST – ENERGY EFFICIENCY MEASURES						
Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR	Simple Payback (Years)
1	Setback Thermostat: Tribal office	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Tribal office space.	\$756	\$10	1133.26	0.0
2	Office near front door.	Fill empty 2x6 cavity with R-21 dense-pack blown-in dense pack insulation.	\$73	\$92	21.41	1.3
3	Air Tightening: Wall/ceiling interface and window/wall interface	Perform air sealing to reduce air leakage by 430 cfm at 50 Pascals.	\$456	\$500	9.38	1.1
4	Attic	Add R-38 fiberglass batts to attic with Standard Truss.	\$319	\$1,544	5.55	4.8
5	Above-Grade Wall: Tribal Office	Install R-30 rigid foam board to exterior and cover with T1-11 siding or equivalent.	\$530	\$8,752	1.63	16.5

Table 4.1
Tribal Office, Oscarville, Alaska
PRIORITY LIST – ENERGY EFFICIENCY MEASURES

Rank	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR	Simple Payback (Years)
6	Lighting: Exterior Entrance Light	Replace with LED 17W Module	\$31	\$150	1.01	4.9
	TOTAL, all measures		\$2,165	\$11,048	3.71	5.1

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

ENERGY AUDIT REPORT – ENERGY EFFICIENCY MEASURES					
1. Building Envelope					
Insulation					
Rank	Location	Existing Type/R-Value	Recommendation Type/R-Value	Installed Cost	Annual Energy Savings
2	Office floor near front door.	Framing Type: 2 x Lumber Insulating Sheathing: None Top Insulation Layer: None Bottom Insulation Layer: None Modeled R-Value: 7.7	Fill empty 2x6 cavity with R-21 dense-pack blown-in dense pack insulation.	\$92	\$73

4	Attic	Framing Type: Standard Framing Spacing: 24 inches Insulated Sheathing: None Bottom Insulation Layer: R-11 Batt:FG or RW, 3.5 inches Top Insulation Layer: None Insulation Quality: Damaged Modeled R-Value: 12.4	Add R-38 fiberglass batts to attic with Standard Truss.	\$1,544	\$319
5	Above-Grade Wall: Tribal Office	Wall Type: Single Stud Siding Configuration: Just Siding Insul. Sheathing: None Structural Wall: 2 x 4, 16 inches on center R-11 Batt:FG or RW, 3.5 inches Window and door headers: Insulated Insulation Quality: Damaged Modeled R-Value: 10.1	Install R-30 rigid foam board to exterior and cover with T1-11 siding or equivalent.	\$8,752	\$530

4.3.1. Energy Efficiency Measure: Add or Replace Insulation

4.3.1.1 Improvement: Rank 2

Location: Office floor near front door.

Area (Feet²): 56

Existing Situation: Framing Type: 2 x Lumber

Insulating Sheathing: None

Top Insulation Layer: None

Bottom Insulation Layer: None

Modeled R-Value: 7.7

Recommended Measures: Fill empty 2x6 cavity with R-21 dense-pack blown-in dense pack insulation.

Annual Energy Savings: \$73

Installed Costs:

Material Costs: Not Available

Labor Costs: Not Available

Total Estimated Costs: \$92

Simple Payback (Years): 1

Auditor Comments: This area of the building was once a porch and has been converted to an office but the floor was not insulated. The floor should be insulated.

4.3.1.2 Improvement: Rank 4

Location: Attic

Area (Feet²): 420

Existing Situation: Framing Type: Standard

Framing Spacing: 24 inches

Insulated Sheathing: None

Bottom Insulation Layer: R-11 Batt:FG or RW, 3.5 inches

Top Insulation Layer: None
 Insulation Quality: Damaged
 Modeled R-Value: 12.4

Recommended Measures: Add R-38 fiberglass batts to attic with Standard Truss.

Annual Energy Savings: \$319

Installed Costs:

Material Costs: Not Available

Labor Costs: Not Available

Total Estimated Costs: \$1,544

Simple Payback (Years): 5

Auditor Comments: The insulation in the attic varies from none to about 6 inches. It should be much more.

4.3.1.3 Improvement: Rank 5

Location: Above-Grade Wall: Tribal Office

Area (Feet²): 598

Existing Situation: Wall Type: Single Stud

Siding Configuration: Just Siding

Insul. Sheathing: None

Structural Wall: 2 x 4, 16 inches on center

R-11 Batt:FG or RW, 3.5 inches

Window and door headers: Insulated

Insulation Quality: Damaged

Modeled R-Value: 10.1

Recommended Measures: Install R-30 rigid foam board to exterior and cover with T1-11 siding or equivalent.

Annual Energy Savings: \$530

Installed Costs:

Material Costs: Not Available

Labor Costs: Not Available

Total Estimated Costs: \$8,752

Simple Payback (Years): 17

Auditor Comments: None

4.3.4. Energy Efficiency Measure: Seal Air Leaks

Rank	Estimated Air Leakage	Recommended Air Leakage Target	Energy Auditor Comments	Cost	Savings
3	Air Tightness from Blower Door Test: 1480 cfm at 50 Pascals	Perform air sealing to reduce air leakage by 430 cfm at 50 Pascals.	Need to seal the interface where the walls meet the ceiling, need to seal where the addition to the building meets the ceiling, and need to see where the windows meet the walls.	\$500	\$456

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. Many buildings have hidden air leaks requiring a weatherization technician to find and seal. Buildings with indoor air pollution caused by combustion heating, tobacco smoking, or moisture problems, may require more ventilation than average buildings.

4.4 Heating and Cooling Measures

4.4.1. EEM Heating Plants and Distribution Systems

A heating system is expected to last approximately 20-25 years, depending on the system. If the system is nearing the end of its life, it is better to replace it sooner rather than later to avoid being without heat for several days when it fails. This way, you will have time to compare bids, check references and ensure the contractors are bonded and insured.

4.4.2 Programmable Thermostat

Location	Existing Situation	Recommended Improvement	Install Cost	Annual Savings	Notes
Tribal office	Existing Unoccupied Heating Set point: 68.0 deg F	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Tribal office space.	\$10	\$756	

4.5 LIGHTING UPGRADES

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.

The Lighting Audit appendix outlines the proposed retrofits, costs, savings, and payback periods for each location.

4.5.1 Lighting Upgrade – Replace Existing Fixtures and Bulbs

Location	Existing Lighting	Recommended Improvement	Install Cost	Annual Savings	Notes
Exterior Entrance Light	INCAN Reflector, Std 100W R30 with Manual Switching	Replace with LED 17W Module LED Wall Pack	\$150	\$31	Convert to a LED wall pack

Description:

This EEM includes replacement of the existing exterior over door light with a new 17 watt LED wall pack.

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 Tribal Office Building. 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 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 contractor is used to both install the floor insulation as the attic insulation, implementation of these measures should be scheduled simultaneously.

Attached to this report is Appendix A. The objective of this appendix is to provide the Tribal Council with a wide range of websites to further your knowledge of energy conservation and renewable energy.

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/>

Caliper Program – <http://www1.eere.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.nrel.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>