Comprehensive Energy Audit
For
Akiak Native Community

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) Chris Mercer PE and CEA 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 Mr. Ivan Ivan of the Native Village of Akiak.

1. EXECUTIVE SUMMARY

This report was prepared for the ANC. The scope of the audit focused on Akiak Native Community building. 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 as follows, $6,050 for Electricity, and $8,626 for Waste Heat. This value of the waste heat is derived from other communities run by the Alaska Village Electrical Cooperative, which charges about $7.50 per million BTU's of waste heat. The total energy costs for the building currenty are estimated at $14,676 per year.

Akiak currently does not have a rate price for its waste heat, and the ANC building is receiving all its heat for free. For calculating the return rate on various energy conservation measures, we used the $7.50/million BTU rate to calculate paybacks. The waste heat savings could be applied as increased heat to other buildings, such as the water plant.

If the Akiak Native Community building were to lose its waste heat capability and have to use fuel oil to heat the building, we estimate that it would take 8,713 gallons of fuel oil per year to heat the building to its current level, at a value of $43,565.

Table 1.1 below summarizes the energy efficiency measures analyzed for the Akiak Native Community. 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: Coffee Machine	Add new Clock Timer or Other Scheduling Control	$360	$40	57.26	0.1
2	Other Electrical: Various Appliances	Improve Manual Switching	$295	$50	37.58	0.2
3	Setback Thermostat: Offices and Hallways	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Offices and Hallways space.	$262	$250	14.11	1.0
4	Setback Thermostat: Bathrooms, Mechanical Room, Washeteria,	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Bathrooms, Mechanical Room, Washeteria, space.	$273	$350	10.51	1.3
5	Setback Thermostat: Bingo Hall	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Bingo Hall space.	$181	$250	9.77	1.4

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]
6	Setback Thermostat: Hallways	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Hallways space.	$84	$250	4.51	3.0
7	Lighting: Bingo Fixtures	Replace with 25 LED Replacement Bulbs and Improve Manual Switching	$778	$3,010	2.25	3.9
8	Lighting: Office Fixtures in ANC Building	Replace with 39 LED Replacement Bulbs and Controls retrofit	$1,071	$4,760	1.95	4.4
9	Air Tightening	Perform air sealing to reduce air leakage by 2000 cfm at 50 Pascals.	$439	$2,600	1.59	5.9
10	Lighting: Hallway Fixtures	Replace with 14 LED Replacement Bulbs	$256	$1,750	1.27	6.8
11	Lighting: Other Rooms	Replace with 20 LED Replacement Bulbs and Improve Manual Switching	$317	$2,510	1.10	7.9
	TOTAL, all measures		**$4,316**	**$15,820**	**2.54**	**3.7**

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 $4,316 per year, or 29.4% of the buildings' total energy costs. These measures are estimated to cost $15,820, for an overall simple payback period of 3.7 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	$8,629	$0	$3	$4,621	$1,309	$0	$0	$0	$0	**$14,676**
With All Proposed Retrofits	$7,633	$0	$3	$2,008	$601	$0	$0	$0	$0	**$10,360**
SAVINGS	$996	$0	$0	$2,613	$707	$0	$0	$0	$0	**$4,316**

2. AUDIT AND ANALYSIS BACKGROUND

2.1 Program Description

This audit included services to identify, develop, and evaluate energy efficiency measures at the Akiak Native Community. 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 Native Community 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 Native Community is classified as being made up of the following activity areas:

1) Bingo Hall: 2,000 square feet
2) Offices and Hallways: 2,300 square feet
3) Hallways: 2,000 square feet
4) Bathrooms, Mechanical Room, Washeteria, : 1,600 square feet

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

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

2.3. Method of Analysis

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

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

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

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

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

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

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

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

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

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

2.4 Limitations of Study

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

3. Akiak Native Community

3.1. Building Description

The 7,900 square foot Akiak Native Community was constructed in 1975, with a normal occupancy of 10 people. The number of hours of operation for this building average 7.9 hours per day, considering all seven days of the week.

Description of Building Shell

The exterior walls are 2x4 construction with 3.5” of batt insulation.

The ceiling is insulated with R-11 batt insulation.

Description of Heating Plant

The Heating Plants used in the building are:

Waste Heat

Fuel Type:	Hot Wtr District Ht
Input Rating:	600,000 BTU/hr
Steady State Efficiency:	97 %
Idle Loss:	1.5 %
Heat Distribution Type:	Water
Boiler Operation:	All Year

If the boilers are ever to be used extensively It is recommended that they be thoroughly cleaned and tuned for efficiency with proper nozzle sizing and appropriate weighting of the dampeners.

Space Heating and Cooling Distribution Systems

Heat is distributed through hydronic baseboard.

Waste Heat Recovery Information

The building currently receives all of its waste heat from the adjacent power plant. Akwarm estimates put the heat recovered for use in the building at 1,1508 million BTU’s per year.

Description of Building Ventilation System

The existing building ventilation system consists of doors opening and closing, holes in doors, broken windows, and leaky roof.

Lighting

The buildings lighting is made up of various T8 and T12 fixtures and bulbs throughout the building.

Plug Loads

The plug loads in the building consist of computers, monitors, printers, radios, wireless routers and time clocks. The bingo board had been out of use at the time of the audit, but its repair would also yield significant electrical plug loads. A Bunn coffee machine is the single biggest electricity user in the building.

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
Hot Wtr District Ht	$ 7.50/million Btu

3.2.1.1 Total Energy Use and Cost Breakdown

At current rates, ANC pays approximately $14,676 annually for electricity and other fuel costs for the Akiak Native Community.

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

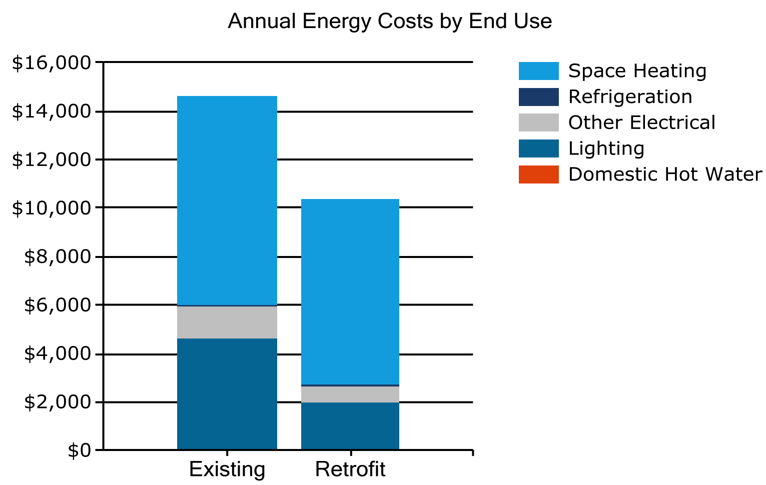
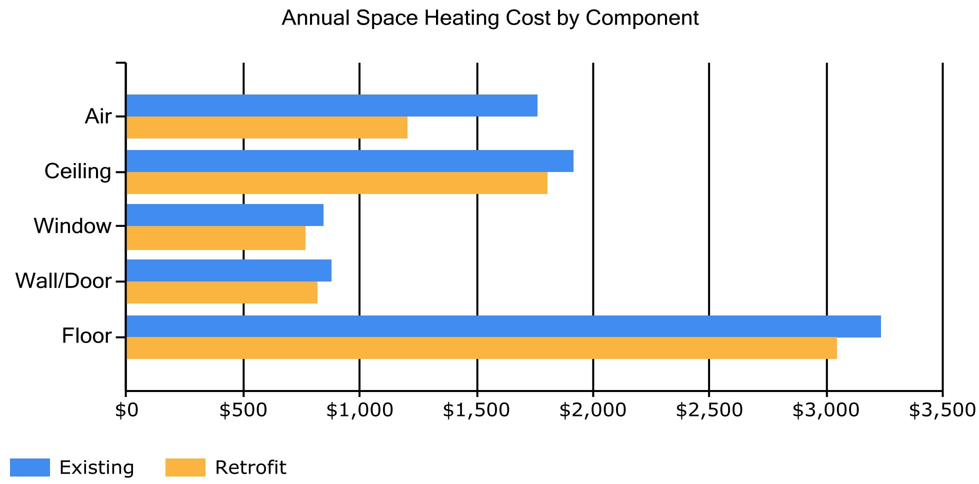


Figure 3.2 below shows how the annual energy cost of the building splits between the different fuels used by the building. The "Existing" bar shows the breakdown for the building as it is now; the "Retrofit" bar shows the predicted costs if all of the energy efficiency measures in this report are implemented.

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
Lighting	1120	1021	1120	1084	1120	1084	1120	1120	1084	1120	1084	1120
Other_Electrical	317	289	317	307	317	307	317	317	307	317	307	317
Refrigeration	28	25	28	27	28	27	28	28	27	28	27	28
Ventilation_Fans	0	0	0	0	0	0	0	0	0	0	0	0
DHW	1	1	1	1	1	1	1	1	1	1	1	1
Space_Heating	1	1	1	1	1	1	1	1	1	1	1	1
Space_Cooling	0	0	0	0	0	0	0	0	0	0	0	0

Hot Water District Ht Consumption (Million Btu)												
	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	175	156	150	103	56	26	17	24	45	93	129	176

3.2.2 Energy Use Index (EUI)

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

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

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

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

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

Table 3.4
Akiak Native Community 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	17,285 kWh	58,993	3.340	197,036
Hot Wtr District Ht	1,150.18 million Btu	1,150,178	1.280	1,472,227
Total		**1,209,170**		**1,669,264**
BUILDING AREA		7,900	Square Feet	
BUILDING SITE EUI		153	kBTU/Ft²/Yr	
BUILDING SOURCE EUI		211	**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 Native Community 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 Native Community, 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: Coffee Machine	Add new Clock Timer or Other Scheduling Control	$360	$40	57.26	0.1
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3	Setback Thermostat: Offices and Hallways	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Offices and Hallways space.	$262	$250	14.11	1.0
4	Setback Thermostat: Bathrooms, Mechanical Room, Washeteria,	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Bathrooms, Mechanical Room, Washeteria, space.	$273	$350	10.51	1.3

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8	Lighting: Office Fixtures in ANC Building	Replace with 39 LED Replacement Bulbs and Controls retrofit	$1,071	$4,760	1.95	4.4
9	Air Tightening	Perform air sealing to reduce air leakage by 2000 cfm at 50 Pascals.	$439	$2,600	1.59	5.9
10	Lighting: Hallway Fixtures	Replace with 14 LED Replacement Bulbs	$256	$1,750	1.27	6.8
11	Lighting: Other Rooms	Replace with 20 LED Replacement Bulbs and Improve Manual Switching	$317	$2,510	1.10	7.9
	TOTAL, all measures		**$4,316**	**$15,820**	**2.54**	**3.7**

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)	
9			Air Tightness from Blower Door Test: 7500 cfm at 50 Pascals		Perform air sealing to reduce air leakage by 2000 cfm at 50 Pascals.	
Installation Cost	$2,600	**Estimated Life of Measure (yrs)**	10	**Energy Savings (/yr)**	$439	
Breakeven Cost	$4,137	**Savings-to-Investment Ratio**	1.6	**Simple Payback yrs**	6	
Auditors Notes: There are many open holes in the building, notably in doors in the washeteria andback doors, which should be sealed to prevent heat loss. All the doors need weather stripping and windows should be caulked and/or sealed over to prevent heat loss. Many of the windows are leaky and could be replaced if it were cost effective to do so.						

4.4 Mechanical Equipment Measures

4.4.3 Night Setback Thermostat Measures

Rank	Building Space		Recommendation		
6	Hallways		Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Hallways space.		
Installation Cost	$250	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$84
Breakeven Cost	$1,128	**Savings-to-Investment Ratio**	4.5	**Simple Payback yrs**	3
Auditors Notes:					

4.4.3 Night Setback Thermostat Measures

Rank	Building Space		Recommendation		
5	Bingo Hall		Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Bingo Hall space.		
Installation Cost	$250	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$181
Breakeven Cost	$2,442	**Savings-to-Investment Ratio**	9.8	**Simple Payback yrs**	1
Auditors Notes:					

Rank	Building Space		Recommendation		
4	Bathrooms, Mechanical Room, Washeteria,		Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Bathrooms, Mechanical Room, Washeteria, space.		
Installation Cost	$350	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$273
Breakeven Cost	$3,677	**Savings-to-Investment Ratio**	10.5	**Simple Payback yrs**	1
Auditors Notes:					

Rank	Building Space			Recommendation	
3	Offices and Hallways			Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Offices and Hallways space.	
Installation Cost	$250	**Estimated Life of Measure (yrs)**	15	**Energy Savings (/yr)**	$262
Breakeven Cost	$3,527	**Savings-to-Investment Ratio**	14.1	**Simple Payback yrs**	1
Auditors Notes:					

Putting in a series of thermostats that can be programmed to set back at night would be a large waste heat savings for the building. Currently the entire building is heated to 70 degrees. If setback thermostats were put in multiple locations throughout the building, it would be easy to control the temperature in the building based on usage. For example, offices could be heated to 70 degrees only during office hours, and the bingo hall could be heated to 70 degrees only during bingo and other events when the hall is used.

4.5 Electrical & Appliance Measures

4.5.1 Lighting Measures

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

4.5.1a Lighting Measures – Replace Existing Fixtures/Bulbs

Rank	Location	Existing Condition		Recommendation	
11	Other Rooms	20 FLUOR (2) T12 4' F40T12 40W Standard StdElectronic with Manual Switching		Replace with 20 LED Replacement Bulbs and Improve Manual Switching	
Installation Cost	$2,510	**Estimated Life of Measure (yrs)**	10	**Energy Savings (/yr)**	$317
Breakeven Cost	$2,751	**Savings-to-Investment Ratio**	1.1	**Simple Payback yrs**	8
Auditors Notes:					

Rank	Location	Existing Condition		Recommendation	
10	Hallway Fixtures	14 FLUOR (2) T12 4' F40T12 40W Standard Magnetic with Manual Switching		Replace with 14 LED Replacement Bulbs	
Installation Cost	$1,750	**Estimated Life of Measure (yrs)**	10	**Energy Savings (/yr)**	$256
Breakeven Cost	$2,226	**Savings-to-Investment Ratio**	1.3	**Simple Payback yrs**	7
Auditors Notes:					

Rank	Location	Existing Condition		Recommendation	
8	Office Fixtures in ANC Building	39 FLUOR (2) T12 4' F40T12 40W Standard Magnetic with Manual Switching		Replace with 39 LED Replacement Bulbs and Controls retrofit	
Installation Cost	$4,760	**Estimated Life of Measure (yrs)**	10	**Energy Savings (/yr)**	$1,071
Breakeven Cost	$9,302	**Savings-to-Investment Ratio**	2.0	**Simple Payback yrs**	4

Auditors Notes: Turning off lights when not in use, or when the building is recieving lots of natural light would significantly reduce enerhy demand. Using more efficient LED Replacement bulbs would also yield significant savings.

Rank	Location		Existing Condition		Recommendation	
7	Bingo Fixtures		25 FLUOR (2) T12 4' F40T12 40W Standard Magnetic with Manual Switching		Replace with 25 LED Replacement Bulbs and Improve Manual Switching	
Installation Cost		$3,010	**Estimated Life of Measure (yrs)**	10	**Energy Savings (/yr)**	$778
Breakeven Cost		$6,761	**Savings-to-Investment Ratio**	2.2	**Simple Payback yrs**	4
Auditors Notes:						

Many of the fixtures in the ANC building are broken or have the incorrect bulbs fitted for their fixtures. Replacing all the bulbs in the building with 4 foot LED replacement bulbs would yield a significant electrical savings. LED bulbs use significantly less energy, last longer than t8 and t12 bulbs and don't require a ballast, which is beneficial in places where power quality is inconsistent, such as Akiak and other communities in rural Alaska. Ballasts, particularly t8 ballasts fail at a higher rate when faced with inconsistent power quality. These savings do not include the reduced maintenance cost of replacing bulbs that have gone out.

Additionally, making sure that lights are turned off at the end of the day or when rooms are not in use will save a sigifnicant amount of energy. Installing occupancy sensors on lights can help to ensure that lights get turned off when the room is not occupied.

4.5.3 Other Electrical Measures

Rank	Location		Description of Existing		Efficiency Recommendation	
2	Various Appliances		15 Computers, Printers, Routers, Radios, Time Clocks with Manual Switching		Improve Manual Switching	
Installation Cost		$50	**Estimated Life of Measure (yrs)**	7	**Energy Savings (/yr)**	$295
Breakeven Cost		$1,879	**Savings-to-Investment Ratio**	37.6	**Simple Payback yrs**	0
Auditors Notes: Having computers, monitors, and pritners shut down when not in use will yield significant energy savings. There is no damage done to the machine, and using the power management software already available on your computers operating system can be an easy way to reduce electrical usage. Set computers to shut down or go into sleep mode after 15 minutes of inactivity. Unplugging radios when not in use can save additional electricity.						

Rank	Location		Description of Existing		Efficiency Recommendation	
1	Coffee Machine		Bunn with Manual Switching		Add new Clock Timer or Other Scheduling Control	
Installation Cost		$40	**Estimated Life of Measure (yrs)**	7	**Energy Savings (/yr)**	$360
Breakeven Cost		$2,290	**Savings-to-Investment Ratio**	57.3	**Simple Payback yrs**	0
Auditors Notes: While the ANC building is heavily used, access to the BUNN coffee pot upstairs is limited during non working hours. Putting a timer on this device to shut off completely at night would save a significant electrical load while still allowing for the convenience of day to day heavy use. Another option would be to use a smaller batch coffee pot, and then storing the coffee in an insulated thermos. BUNN coffee pots are good for high turnover situations in which pots of coffee have to be made quickly. Otherwise they use lots of energy in order to keep water hot at all times ready to brew a new pot. Avoiding these unnecessary heating cycles can save a lot of energy.						

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