Investigative Energy Audit
For

Tanana Elder's Residence and Tribal Offices

Prepared For

Tanana Tribal Council

Prepared By

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May 16, 2017

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PREFACE

The purpose of this report is to provide guidance in reducing facility operating costs and enhance the sustainability of this community. The report assess the current energy usage of the facility, provide options for reducing the amount of energy used, and evaluate the cost vs. benefit of each option.

Discussions of site specific concerns, financing options, general facility information, and an Energy Efficiency Action Plan are also included in this report.

ACKNOWLEDGMENTS

The Energy Projects Group gratefully acknowledges the assistance of the Tanana Tribal Council's Maintenance Supervisor, Cliff Wiehl, and Executive Director, Shannon Erhart.

OVERVIEW

This report was prepared for the Tanana Tribal Council. The scope of the audit focused on the Elder's Residence and includes an analysis of building occupancy schedules, building shell, heating systems, heating and ventilations systems, domestic hot water, lighting, and other electrical loads. The Elder's Residence is approximately 9,670 square feet, and has been renovated numerous times since its original construction in 1957. The building was originally constructed as a housing facility to support the local hospital, and was later modified to serve as an elders' residential facility and tribal office space. Data was based on a site survey and interviews with the building manager and maintenance staff.

ENERGY BASELINE

Based on unsubsidized electricity and fuel oil prices in effect at the time of the audit, the total predicted energy costs are $44,900 per year. This includes $18,835 for electricity and $26,065 for #1 fuel oil.

Table 1 lists the predicted annual energy usage before and after the proposed retrofits.

Annual Energy Costs By Fuel

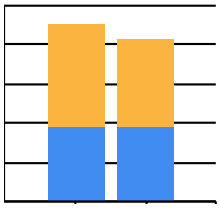


Table 1: Predicted Annual Energy Use

Predicted Annual Energy Use				
Fuel Use	**Existing Building**	**With Proposed Retrofits**	**Total Energy Savings**	**Total Cost Savings**
Electricity	28,457 kWh	28,381 kWh	76 kWh	$50
#1 Oil	6,133 gallons	5,236 gallons	897 gallons	$3,800

PROPOSED ENERGY EFFICIENCY MEASURES (EEM)

Table 2 below summarizes the energy efficiency measures analyzed for the Building. Listed are the estimates of the annual savings, installed costs, and two different financial measures of investment return.

Table 2: Priority List – Energy Efficiency Measures

Priority	Feature	Improvement Description	Cost Estimate	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR[1]	Simple Payback (Years)[2]
1	Air Tightening	Install weather stripping around all exterior doors	$50 materials/door 1hr labor/door @ $50/hr 6 doors 20% contingency	$571	$700	7.58	1.2
2	Insulate Exterior Concrete Wall	Install 4" spray foam insulation on basement conference room exterior wall	$5,000 spray foam $500 studs $800 sheetrock $1,000 misc materials 2 carpenters, 8hr/day, 10 days, $50/hr = $8,000 Shipping $1,000 50% logistics and contingency	$2,409	$25,000	2.41	10.4
3	Setback Thermostat: Elder Care Center	Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Elder Care Center space.	20 zones $100/thermostat $100/zone valve $200 misc parts/zone $4 hrs labor/zone @$50/hr 50% logistics and contingency 20% design/planning	$779	$21,000	0.50	27.0
		TOTAL		**$3,759**	**$46,700**	**1.60**	**12.1**

Highly Recommended
Recommended
Not Recommended (Based on Estimated Cost)

Note 1: It is recommended that the hot water and heating piping in the boiler room be insulated. This would save a significant amount of energy and help keep the building from overheating during the warmer months.

Note 2: The exterior concrete wall in the basement conference room is a major source of heat loss in the building. Although the cost to insulate it is fairly high, the amount of energy savings is very significant. Also note that the closed-cell spray foam insulation will seal to the concrete and prevent any condensation from developing between the concrete and insulation. It is recommended that at least a

Note 3: Although the programmable thermostat cost is more than the energy savings, they would make the building more comfortable in the summer by keeping water from circulating through the heating system when it is not needed and better controlling room temperatures in the winter. They would also allow the boiler to automatically go cold when it is not needed and save a little more energy than what is quantified in this report.

Note 4: The building has no ventilation other than operable windows and exhaust fans in the kitchen and bathrooms. The windows cannot be opened during the colder months, which leaves the occupants with no ventilation. It is recommended that a Heat Recovery Ventilator (HRV) be installed to provide ventilation and create a healthier indoor environment, particularly during the winter months. The added ventilation would increase the heating utility bills, but the HRV would help minimize the added operating cost as much as possible.

Note 5: The current boiler controller is quite complicated and difficult to troubleshoot. The boiler is running inefficiently due to how the controller is set up. A much simpler controller that I expect would be much more feasible for the staff to keep operating properly is the Taco PC702.

[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.

FACILITY DESCRIPTION

Building Occupancy Schedules

The building is continuously occupied by resident elders and support staff. The kitchen also provides meals for local residents who visit the center during the day. The Tribal Offices located on the addition to the facility are typically occupied 8am-5pm, Monday-Friday. A large conference room is locate in the downstairs basement of the facility and used intermittently. There are also storage spaces located in the basement that are infrequently occupied as well.

Building Shell

The exterior walls are 2x6 wood-framed construction with fiberglass batt insulation.

The roof of the building is a structural truss with a cold attic space.

Portions of the building are constructed on top of a stem wall foundation while other portions are located above the concrete slab-on grade basement.

There are approximately 225 square feet of triple pane window surface area, 451 square feet of double pane window, and 10 square feet of single pane window.

There are 6 entrances into the building. Several of the doors were leaking significant amounts of air. The energy efficiency of the building could be significantly improved by performing better sealing around the doors.

Heating Systems

The heating systems used in the building are:

Boiler 1

Fuel Type:	#1 Oil
Input Rating:	256,000 BTU/hr
Steady State Efficiency:	86 %
Estimated Idle Loss:	1.5 %
Heat Distribution Type:	Water
Boiler Operation:	12 Months/Year

Boiler 2

Fuel Type:	#1 Oil
Input Rating:	256,000 BTU/hr
Steady State Efficiency:	86 %
Estimated Idle Loss:	1.5 %
Heat Distribution Type:	Water
Boiler Operation:	12 Months/Year

Space Heating Distribution Systems

The building is heated by a baseboard heating system that circulates hot water around the building. Each baseboard was controlled by a non-electronic modulating thermostatic valve. The valves did not appear to be properly controlling the indoor temperatures.

Building Ventilation Systems

The building relies on operable windows and exhaust fans for ventilation.

Domestic Hot Water System

Domestic hot water for the building is provided by a hot water heater with an approximate capacity of 76 gallons. The heater is indirectly heated by the 2 boilers. Note that this is an inefficient system as the boilers produce quite a bit of waste heat that causes the facility to over-heat in the summer.

Lighting

The interior space is lit with a combination of T8 and standard screw-in lighting element fixtures. All lights had previously been retrofitted with LED bulbs for an improved efficiency. The lights use an estimated 4,301 kWh annually.

Other Electrical Loads

The ceiling fans were apparently the largest source of electrical consumption in the facility. Each fan draws relatively little power, but there are quite a few of them and they run non-stop. The kitchen cooking range, electric clothes dryer, coffee pots, and computers are other large sources of electrical consumption in the facility. Limiting their usage will reduce the electric bills for the facility.

Major Equipment

Table 3: Major Electrical Equipment

Equipment	Rating (Watts)	Approx. Annual Usage (kWh)
Computer Monitor	~40	260
Laptop Computers	~60	400
Ceiling Fan	~75	6,700
Coffee Maker	~1,000	550
Washing Machine	~1,000	470
Oven / Cooking Range	~1000 per burner	1,100
Clothes Dryer	~5,000	3,800

PROJECT FINANCING

The total estimated cost of the recommended EEM's $25,700. The payback for the implemented EEM's is approximately 8.6 years. ANTHC is willing to assist the community with acquiring funds to complete the scope of work recommended in this energy audit.

There are several options for financing energy efficiency projects within the State of Alaska. These include the use of grants, loans, and other funding opportunities. Below is some information on potential funding opportunities.

Energy Efficiency Revolving Loan Program – This is a loan administered by the Alaska Housing Finance Corporation (AHFC) for use by any applicant who is also the owner of the building where the work will take place. It provides a loan for permanent energy-efficiency projects with a completion window of one year.

Sustainable Energy Transmission and Supply Program – This is a loan administered by the Alaska Energy Authority (AEA) for a government, business, or other organized body of people. It provides a loan for energy-efficiency or power transmission or distribution projects.

USDA-RD Communities Facilities Direct Loan & Grant Program - This is a loan or grant provided by the US Department of Agriculture – Rural Development (USDA-RD) for any essential community facility in a rural area. It provides a loan or grant to develop essential community facilities with upgrades or equipment for improvement.

MEASUREMENT AND VERIFICATION

The results of these recommended measures can be measured through the collection of energy use data through the monthly bills provided by the local electric utility and the local fuel oil supplier. Collecting data and performing a historical comparison is the simplest method of validating the energy and cost savings seen by the measures. Additionally, active remote monitoring systems are available that can collect and store data regarding energy and fuel usage. These systems allow the user to track the usage in real time and can be shared more easily with partners across the state.

APPENDICES

Appendix A – Scanned Energy Billing Data

Appendix B – Energy Audit Report – Project Summary

ENERGY AUDIT REPORT – PROJECT SUMMARY

General Project Information

PROJECT INFORMATION	AUDITOR INFORMATION
Building: Elder Care Center	**Auditor Company:** ANTHC
Address: Front Street	**Auditor Name:** Curtis Boudreau
City: Tanana	**Auditor Address:** Auditor Address
Client Name: Shannon Erhart	
Client Address:	**Auditor Phone:** (907) 729-3528
	Auditor FAX:
Client Phone: (907) 366-7160	**Auditor Comment:**
Client FAX:	

Design Data

Building Area: 9,670 square feet	**Design Space Heating Load:** Design Loss at Space: 131,065 Btu/hour with Distribution Losses: 163,831 Btu/hour Plant Input Rating assuming 82.0% Plant Efficiency and 25% Safety Margin: 249,742 Btu/hour Note: Additional Capacity should be added for DHW and other plant loads, if served.
Typical Occupancy: 0 people	**Design Indoor Temperature:** 75 deg F (building average)
Actual City: Tanana	**Design Outdoor Temperature:** -41.9 deg F
Weather/Fuel City: Tanana	**Heating Degree Days:** 14,590 deg F-days

Utility Information

Electric Utility: Tanana Power Company, Inc - Commercial - Sm	**Natural Gas Provider:** None
Average Annual Cost/kWh: $0.662/kWh	**Average Annual Cost/ccf:** $0.000/ccf

Annual Energy Cost Estimate

Description	Space Heating	Space Cooling	Water Heating	Ventilation Fans	Lighting	Refrigeration	Other Electrical	Service Fees	Total Cost
Existing Building	$25,486	$0	$7,223	$167	$2,847	$530	$8,649	$0	**$44,900**
With Proposed Retrofits	$21,547	$0	$7,300	$167	$2,847	$530	$8,649	$0	**$41,039**
Savings	$3,938	$0	-$77	$0	$0	$0	$0	$0	**$3,861**

Building Benchmarks

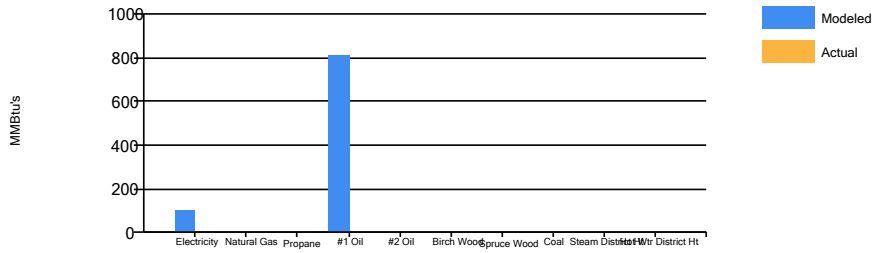
Description	EUI (kBtu/Sq.Ft.)	EUI/HDD (Btu/Sq.Ft./HDD)	ECI ($/Sq.Ft.)
Existing Building	93.8	6.43	$4.64
With Proposed Retrofits	81.5	5.59	$4.24

EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area.
EUI/HDD: Energy Use Intensity per Heating Degree Day.
ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building.

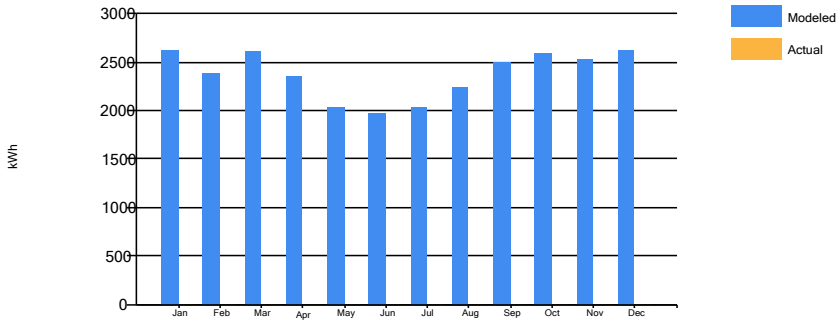
Appendix C – Actual Fuel Use versus Modeled Fuel Use

The graphs below show the modeled energy usage results of the energy audit process compared to the actual energy usage report data. The model was completed using AkWarm modeling software. The orange bars show actual fuel use, and the blue bars are AkWarm's prediction of fuel use.

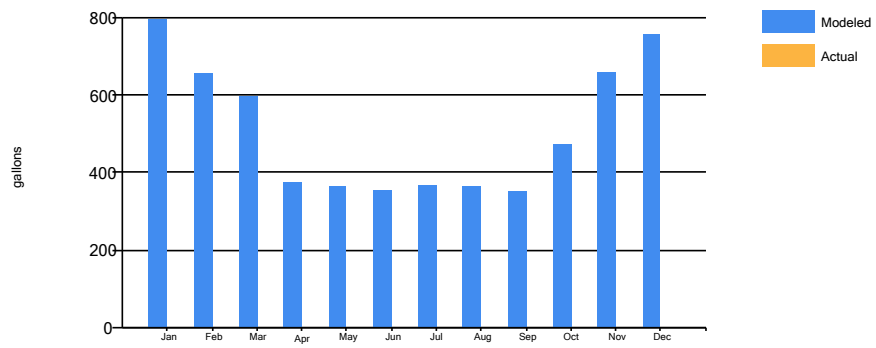
Annual Energy Use



Electricity Use



#1 Fuel Oil Use



Appendix D - EUI Calculation Details

The Tanana Power Company provides electricity to the residents of Tanana as well as to all commercial and public facilities.

The average cost for each type of fuel used in this building is shown below in Table 4. This figure includes all surcharges, subsidies, and utility customer charges:

Table 4: Energy Cost Rates for each Fuel Type.

Average Energy Cost	
Description	**Average Energy Cost**
Electricity	$ 0.6619/kWh
#1 Oil	$ 4.25/gallons

Table 5 shows the calculated results for the building Energy Use Index (EUI), which determines the total energy usage for a type of building for comparison with other buildings of the same type. This allows the user to determine the relative energy use of a building in relation to others of the same type or use.

Table 5: 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	28,457 kWh	97,125	3.340	324,398
#1 Oil	6,133 gallons	809,540	1.010	817,635
Total		**906,665**		**1,142,033**
BUILDING AREA		9,670	Square Feet	
BUILDING SITE EUI		94	kBTU/Ft²/Yr	
BUILDING SOURCE EUI		118	**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.				

Table 6 shows information on common energy use benchmarks used to characterize the efficiency of a building.

Table 6: Energy Efficiency Benchmarks for Building

Building Benchmarks			
Description	**EUI (kBtu/Sq.Ft.)**	**EUI/HDD (Btu/Sq.Ft./HDD)**	**ECI ($/Sq.Ft.)**
Existing Building	**93.8**	**6.43**	**$4.64**
With Proposed Retrofits	**81.5**	**5.59**	**$4.24**
EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area. EUI/HDD: Energy Use Intensity per Heating Degree Day. ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building.			

Appendix F – Materials Specifications

Robertshaw®

9701i2

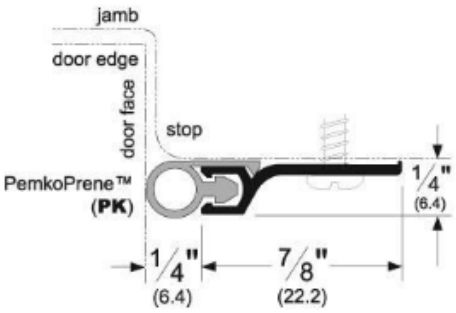
Menu Driven Display
7 Day Programmable with 2, 4 or 6 Events Per Day
9701i2 - 1 Heat / 1 Cool

Worry-Free Memory Storage
Even during power outages, the thermostat maintains set point and programmed parameters.

Man-Door Gasket for Top Sill and Side Jambs

Pemko 303_PK (PG) Standard Perimeter Gasketing

- Category J gaskets for use with listed steel frames and/or classified steel covered composite, hollow metal doors rated up to and including 3 hours; wood and plastic covered composite doors rated up to and including 1-1/2 hours; and wood core doors rated for 20 minutes.
- Rigid jamb weatherstrip is shown mounted on openings with 1/16" gaps; however, each weatherstrip can seal gaps up to the depth of its seal.
- Seal depth is provided on each illustration.
- Stainless Steel fasteners are standard.
- Other fasteners are available.
- Model 303_ is available with self-adhesive, two-sided tape (TST) and tek screws (3 slotted holes per part) for easy installation.
- To obtain this option, add "TST" to the end of the part number when ordering (i.e. 303APK36TST).



- This perimeter gasketing is supplied with a PemkoPrene® ("PK") insert - item number PK47 (available in gray or black).

Ratings

Air Infiltration Tested

BHMA Certified

Smoke Tested - UL1784

Fire Rated - UL10C - Positive Pressure

Underwriters Laboratory 4L10

Environmental Product Declaration

Health Product Declaration

Declare

GREENGUARD Gold Certified

Finishes

303APK: A - Mill Finish Aluminum Aluminum with Gray PemkoPrene insert

303BDGPK: BDG - Bright Dip Gold Anodized Aluminum with Black PemkoPrene insert

303CPK: C - Clear Anodized Aluminum with Gray PemkoPrene insert

303DPK: D - Dark Bronze Anodized Aluminum with Black PemkoPrene insert

303GPK: G - Gold Anodized Aluminum with Black PemkoPrene insert

303PWPK: PW - Painted White Aluminum with Black PemkoPrene insert

303SNPK: SN - Satin Nickel Anodized Aluminum with Black PemkoPrene insert

Man-Door Bottom Sweep

Pemko 18062_NB Brush Seal/180 Degree Aluminum Retainer

- This brush gasketing is supplied with a Nylon Brush ("NB") insert - item number P38062 (available in gray or black).
- Painted white insert is item number P516062W.

Ratings

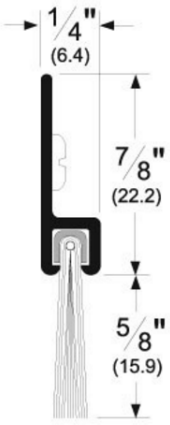
BHMA Certified

Smoke Tested - UL1784

Fire Rated - UL10C - Positive Pressure

Underwriters Laboratory 4L10

GREENGUARD Gold Certified



Finishes

18062CNB: C - Clear Anodized Aluminum with Gray Nylon Brush insert

18062DNB: D - Dark Bronze Anodized Aluminum with Black Nylon Brush insert

18062GNB: G - Gold Anodized Aluminum with Black Nylon Brush insert

18062PWNB: PW - Painted White Aluminum with White Nylon Brush insert

Attic Access Hatch Weather-Stripping

PRODUCT	SKU	UPC	SPECS	COLOR
D-Section 1/4" Thick - Fits Medium Gaps	V25GA	077578012551	5/16" W, 1/4" T, 17 ft L, D-Section	Grey
	V25BA	077578011776	5/16" W, 1/4" T, 17 ft L, D-Section	Brown
	V25WA	077578011783	5/16" W, 1/4" T, 17 ft L, D-Section	White
	V25BK	077578059228	5/16" W, 1/4" T, 17 ft L, D-Section	Black