



# Investigative Energy Audit For Circle Tribal Office



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Prepared For  
**Circle Native Community**

**May 31, 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 Rural Energy Initiative gratefully acknowledges the assistance of Circle Tribal Chief Jessica Fields and Circle Tribal Administrator Angela Ludwick.

## OVERVIEW

This report was prepared for the Circle Tribal Council. The scope of the audit focused on the Circle Tribal Office 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 Circle Tribal Office was constructed in in the 1980's and is approximately 1,081 square feet. The building serves as office space for the Circle Tribal Council.

## ENERGY BASELINE

Based on unsubsidized electricity and fuel oil prices in effect at the time of the audit, the total predicted energy costs are \$3,388 per year. This includes \$1,323 for unsubsidized electricity, \$1,055 for #1 fuel oil, and \$1,010 for cordwood.

The State of Alaska Power Cost Equalization (PCE) program provides a subsidy to rural communities across the state to lower electricity costs and make energy affordable in rural Alaska. In Circle, the cost of electricity without PCE is \$0.71/kWh and the cost of electricity with PCE is \$0.40/kWh. With the PCE subsidy, the electric utility cost to the Circle Native Community is \$745 and the cost to the State of Alaska is \$578.

Table 1 lists the predicted annual energy usage before and after the proposed retrofits for the Circle Tribal Office.

**Table 1: Predicted Annual Energy Use for the Circle Tribal Office**

Predicted Annual Fuel Use				
Fuel Use	Existing Building	With Proposed Retrofits	Total Energy Savings	Total Cost Savings (subsidized)
Electricity	2,266 kWh	1,805 kWh	461 kWh	\$187
#1 Oil	398 gallons	322 gallons	76 gallons	\$201
Spruce Wood	4.04 cords	3.33 cords	0.71 cords	\$213

## PROPOSED ENERGY EFFICIENCY MEASURES (EEM)

Table 2 below summarizes the energy efficiency measures analyzed for the Circle Tribal Office. Listed are the estimates of the annual savings, installed costs, and two different financial measures of investment return. All costs assume that local labor will be used with no additional cost associated for travel or administrative tasks.

**Table 2: Priority List – Energy Efficiency Measures**

Priority	Feature	Improvement Description	Annual Energy Savings	Installed Cost	Savings to Investment Ratio, SIR <sup>1</sup>	Simple Payback (Years) <sup>2</sup>	CO <sub>2</sub> Savings
High	Setback Thermostat: Office	Program the Toyo stove to implement an unoccupied setback of 60.0 deg F for the Office space.	\$319	\$500	8.16	1.6	1,357.0
High	Lighting: Office Lights (3 Rooms)	Replace with new, direct-wire LED equivalent lighting.	\$142	\$240	6.89	1.7	527.8
High	Lighting: Common Area	Replace with new, direct-wire LED equivalent lighting.	\$95	\$240	4.61	2.5	353.0
Low	Air Tightening	Add weather stripping around the entryways and seal the windows with caulking to prevent air leakage.	\$92	\$1,000	0.82	10.8	392.6
<b>TOTAL</b>			<b>\$648</b>	<b>\$1,980</b>	<b>3.87</b>	<b>3.1</b>	<b>2,630.4</b>

## **FACILITY DESCRIPTION**

The building was formerly used as a home before it was occupied by the Circle Tribal Council. The electrical system in the building is not fully functional, and as a result one half of the building has no working electricity. This includes the restroom, an old kitchen, and lighting near the primary entrance.

### **Building Occupancy Schedules**

The building is occupied from 8:00 AM – 4:00 PM every day and occupied by the Circle Tribal Council office staff.

### **Building Shell**

The building is constructed with 2x4 lumber construction for the exterior walls and is elevated on piles. The roof has 2x6 lumber construction. The building was formerly used as a residence but has been repurposed as the tribal office building.

There are six total windows in the building. Each window has double-pane glass with wood framing.

There are two entrances to the building. Both entrances have single wood doors with metal skin and half-lite windows. The side entrance is blocked during the winter months.

### **Heating Systems**

The heating systems used in the building are:

### **Toyo Laser 73**

Fuel Type: #1 Oil  
Input Rating: 40,000 BTU/hr  
Steady State Efficiency: 90 %  
Idle Loss: 0 %  
Heat Distribution Type: Air

### **Wood Stove**

Fuel Type: Spruce Wood  
Input Rating: 50,000 BTU/hr  
Steady State Efficiency: 70 %  
Idle Loss: 1.5 %  
Heat Distribution Type: Air

### **Space Heating Distribution Systems**

Space heating is achieved through the use of a Toyotomi oil-fired stove and a cordwood stove located in the central room of the building. The oil-fired stove was set for 75 deg. F.

### **Lighting**

The building was experiencing electrical problems that caused an entire half of the building to not have functioning access to electricity. As a result, there are many pieces of electrical equipment that are not used because they are located in the powerless part of the building.

**Table 3: Lighting Information in the Circle Tribal Office**

Room	Bulb Type	Fixtures	Bulbs per Fixture	Annual Usage (kWh)
Common Area	Fluorescent T12	3	2	424
Offices (3)	Fluorescent T12	3	2	633
Kitchen	Fluorescent T12	1	1	0
Old Restroom	Incand. 60W	6	1	0
Restroom	Incand. 60W	1	1	0
Entryway	Incand. 60W	1	1	0

### **Other Electrical Loads**

There is a variety of office equipment and phones that are used during the day that use a small amount of energy throughout the year.

### **Major Equipment**

**Table 4: Major Electrical Equipment in the Circle Tribal Office**

Equipment	Rating (Watts)	Annual Usage (kWh)
Office Computers (5)	75 each	1096
Office Printers (3)	13 each	114

## PROJECT FINANCING

The total estimated cost of the recommended EEM’s \$1,980. The payback for the implemented EEM’s is approximately 3.1 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 –Energy Billing Data

The table below shows the fuel and electricity data used during the energy modeling process to confirm the accuracy of the energy distribution. For the Circle Tribal Office, complete electricity records were not available and there was data for six months.

<b>Month</b>	<b>Fuel Oil Use (gallons)</b>	<b>Electricity Use (kWh)</b>
January	70	192
February	58	166
March	35	141
April	25	193
May	15	0
June	0	0
July	0	0
August	0	158
September	25	0
October	35	0
November	55	0
December	70	222

# Appendix B – Energy Audit Report – Project Summary

ENERGY AUDIT REPORT – PROJECT SUMMARY	
General Project Information	
PROJECT INFORMATION	AUDITOR INFORMATION
<b>Building:</b> Circle Tribal Office	<b>Auditor Company:</b> ANTHC-DEHE
<b>Address:</b> PO Box 89	<b>Auditor Name:</b> Kevin Ulrich
<b>City:</b> Circle	<b>Auditor Address:</b> 4500 Diplomacy Dr. Anchorage, AK 99508
<b>Client Name:</b> Jessica Fields	<b>Auditor Phone:</b> (907) 729-3237
<b>Client Address:</b>	<b>Auditor FAX:</b>
<b>Client Phone:</b> (907) 773-2822	<b>Auditor Comment:</b>
<b>Client FAX:</b>	
Design Data	
<b>Building Area:</b> 1,081 square feet	<b>Design Space Heating Load:</b> Design Loss at Space: 29,109 Btu/hour with Distribution Losses: 29,109 Btu/hour Plant Input Rating assuming 82.0% Plant Efficiency and 25% Safety Margin: 44,373 Btu/hour Note: Additional Capacity should be added for DHW and other plant loads, if served.
<b>Typical Occupancy:</b> 0 people	<b>Design Indoor Temperature:</b> 75 deg F (building average)
<b>Actual City:</b> Circle	<b>Design Outdoor Temperature:</b> -58.3 deg F
<b>Weather/Fuel City:</b> Circle	<b>Heating Degree Days:</b> 16,349 deg F-days
Utility Information	
<b>Electric Utility:</b> Circle Native Community	<b>Average Annual Cost/kWh:</b> \$0.58/kWh

Annual Energy Cost Estimate				
Description	Space Heating	Lighting	Other Electrical	Total Cost
<b>Existing Building</b>	\$2,065	\$617	\$706	<b>\$3,388</b>
<b>With Proposed Retrofits</b>	\$1,686	\$348	\$706	<b>\$2,739</b>
<b>Savings</b>	\$379	\$269	\$0	<b>\$648</b>

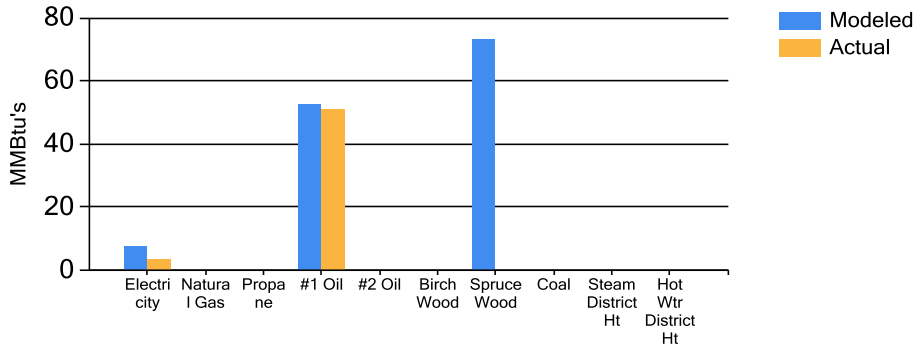
Building Benchmarks			
Description	EUI (kBtu/Sq.Ft.)	EUI/HDD (Btu/Sq.Ft./HDD)	ECI (\$/Sq.Ft.)
<b>Existing Building</b>	123.4	7.55	\$3.13
<b>With Proposed Retrofits</b>	100.8	6.16	\$2.53
EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area. EUI/HDD: 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.			



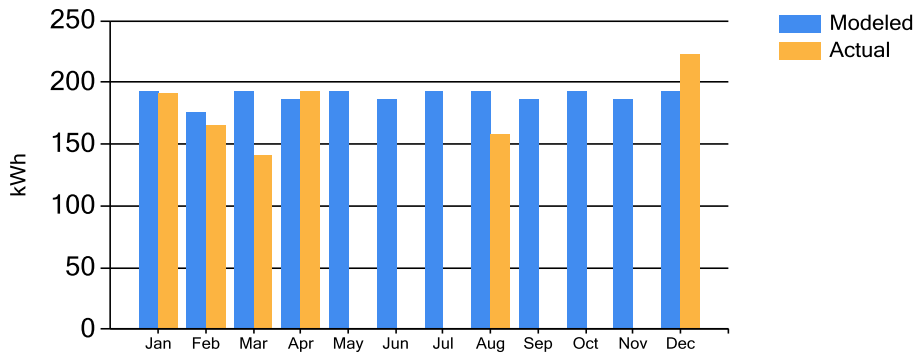
# Appendix C – Actual Fuel Use versus Modeled Fuel Use

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.

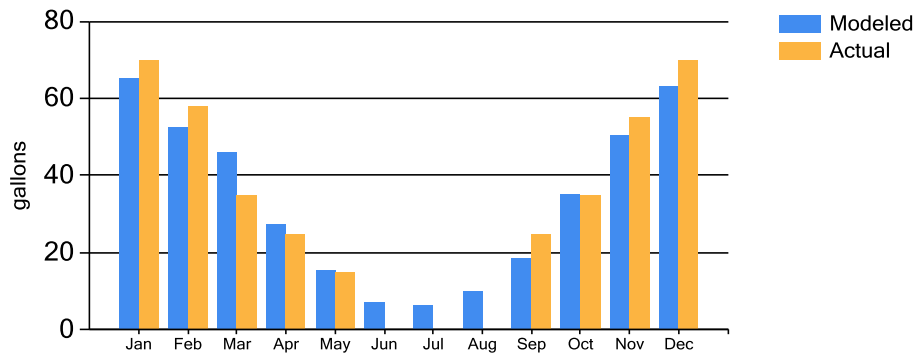
**Annual Energy Use**



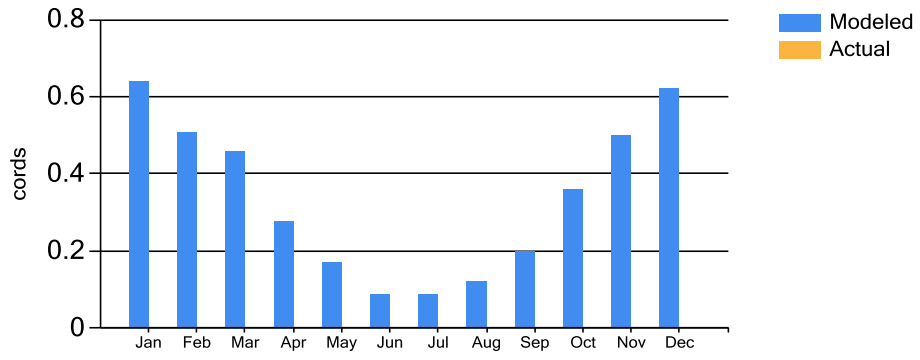
**Electricity Use**



**#1 Fuel Oil Use**



### Spruce Wood Use



## Appendix D - EUI Calculation Details

The Circle Native Community owns a utility that provides electricity to the residents of Circle 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 5. This figure includes all surcharges, subsidies, and utility customer charges:

**Table 5: Energy Cost Rates for each Fuel Type.**

Average Energy Cost	
Description	Average Energy Cost
Electricity	\$ 0.58/kWh
#1 Oil	\$ 2.65/gallons
Spruce Wood	\$ 300/cords

Table 6 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 6: EUI Building Calculations for the Circle Tribal Office**

Energy Type	Building Fuel Use per Year	Site Energy Use per Year, kBTU	Source/Site Ratio	Source Energy Use per Year, kBTU
Electricity	2,266 kWh	7,734	3.340	25,832
#1 Oil	398 gallons	52,563	1.010	53,088
Spruce Wood	4.04 cords	73,109	1.000	73,109
<b>Total</b>		<b>133,406</b>		<b>152,030</b>
BUILDING AREA		1,081	Square Feet	
BUILDING SITE EUI		123	kBTU/Ft <sup>2</sup> /Yr	
<b>BUILDING SOURCE EUI</b>		<b>141</b>	<b>kBTU/Ft<sup>2</sup>/Yr</b>	
* Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued March 2011.				

Table 7 shows information on common energy use benchmarks used to characterize the efficiency of a building.

**Table 7: Building Benchmarks for the Circle Tribal Office**

Building Benchmarks			
Description	EUI (kBtu/Sq.Ft.)	EUI/HDD (Btu/Sq.Ft./HDD)	ECI (\$/Sq.Ft.)
Existing Building	123.4	7.55	\$3.13
With Proposed Retrofits	100.8	6.16	\$2.53
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 E – Materials List and Labor Estimation

Table 8 & 9: Materials List and Cost Estimation for Circle Tribal Office EEM's

Energy Retrofit	Required Materials	Quantity	Cost per Item	Total Materials Cost
Setback Thermostat	None, Toyo Programming	0	150	0
Air Tightning	Weather Stripping, Caulking	2	100	200
LED Lighting	T8 LED Equivalent 4 ft.	12	15	180

Category	Cost (\$)
Labor	1,691
Travel	2,370
Materials	380
Freight	57
Indirect	450
<b>Total</b>	<b>\$4,948</b>

It should be noted that the energy audit cost information in Table 2 does not consider travel or indirect costs. These would only be added if outside labor is used to perform the tasks.

# Appendix F – Materials Specifications



# LED T8 | T12

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## DESCRIPTION

## SPECIFICATIONS

## REVIEWS

### EarthLED Total Product Insight

#### PERFORMANCE SPECIFICATIONS

REPLACEMENT FOR:	T8 OR T12 4 FOOT FLUORESCENT TUBE
BRIGHTNESS (LUMENS):	2000
COLOR TEMPERATURE:	4000K   5000K
COLOR ACCURACY (CRI):	80
DIMENSIONS	1.02" X 47.2"
POWER CONSUMPTION:	18 WATTS
VOLTAGE:	120-277 VOLTS
DIMMABLE:	NO

#### DIMENSIONS / ADDITIONAL DATA

CERTIFICATIONS:	UL, DESIGNLIGHTS (DLC)
PRODUCT/ORDER CODE:	4000K - 18WT8P-4F-40K-BYP 5000K - 18WT8P-4F-50K-BYP

#### LIFESPAN / COST TO RUN

PROJECTED LIFE: @3 HRS/DAY	50,000 HRS
YEARLY ENERGY COST: 3 HRS/DAY @ .11 KWH	\$2.17

#### WARRANTY

5 YEAR THINKLUX LIGHTING LIMITED WARRANTY  
EARTHLED PRODUCT PROTECTION PLAN IS AVAILABLE