# Comprehensive Energy Audit
# For

# Koliganek Water Treatment Plant

Prepared For

**New Koliganek Village Council**

**April 25, 2017**

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# 1. EXECUTIVE SUMMARY

This report was prepared for the New Koliganek Village Council. The scope of the audit focused on Koliganek Water Treatment Plant. 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 total predicted energy costs are $21,286 per year. Electricity represents the largest portion with an annual cost of approximately $19,732. This includes about $7,893 paid by the city and about $11,839 paid by the Power Cost Equalization (PCE) program through the State of Alaska. #1 Fuel Oil represents the remaining portion of the energy costs, with an annual cost of approximately $1,554.

The State of Alaska PCE program provides a subsidy to rural communities across the state to lower electricity costs and make energy affordable in rural Alaska. In Koliganek, the cost of electricity without PCE is $0.51/kWh and the cost of electricity with PCE is $0.20/kWh.

**Table 1.1: Predicted Annual Fuel Use for the Koliganek Water Treatment Plant**

| Predicted Annual Fuel Use | | |
|---|---|---|
| **Fuel Use** | **Existing Building** | **With Proposed Retrofits** |
| Electricity | 38,951 kWh | 25,841 kWh |
| #1 Oil | 311 gallons | 259 gallons |

Benchmark figures facilitate comparing energy use between different buildings. Table 1.2 lists several benchmarks for the audited building. More details can be found in section 3.2.2.

**Table 1.2: Building Benchmarks for the Koliganek Water Treatment Plant**

| Building Benchmarks | | | |
|---|---|---|---|
| **Description** | **EUI (kBtu/Sq.Ft.)** | **EUI/HDD (Btu/Sq.Ft./HDD)** | **ECI ($/Sq.Ft.)** |
| **Existing Building** | 165.2 | 14.61 | $20.21 |
| **With Proposed Retrofits** | 116.2 | 10.28 | $13.74 |
| EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area.<br>EUI/HDD: Energy Use Intensity per Heating Degree Day.<br>ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building. | | | |

Table 1.3 below summarizes the energy efficiency measures analyzed for the Koliganek Water Treatment Plant. Listed are the estimates of the annual savings, installed costs, and two different financial measures of investment return.

**Table 1.3: Summary of Recommended Energy Efficiency Measures**

| PRIORITY LIST – ENERGY EFFICIENCY MEASURES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Rank | Feature | Improvement Description | Annual Energy Savings | Installed Cost | Savings to Investment Ratio, SIR[1] | Simple Payback (Years)[2] | $CO_2$ Savings |
| 1 | Other Electrical: Lift Station Electric Plugin Heater | Lower electric heater power settings from the maximum to a medium setting. | $1,070 | $500 | 25.13 | 0.5 | 4,813.8 |
| 2 | Other Electrical: Well Heat Tape | Shut off heat tape and use only for emergency thaw purposes. | $749 | $500 | 17.59 | 0.7 | 3,369.9 |
| 3 | Lighting: Exterior Incandescents | Replace with new LED lighting. | $76 | $100 | 8.92 | 1.3 | 341.7 |
| 4 | Other Electrical: Watering Point Electric Heater | Lower setting on plug-in electric heater to low. Heat space to approximately 50 deg. F. | $573 | $1,000 | 6.73 | 1.7 | 2,578.9 |
| 5 | Lighting: Process Room Lights | Replace with new LED lighting and remove ballast. | $230 | $400 | 6.73 | 1.7 | 1,035.6 |
| 6 | Lighting: Water Plant Watering Point Exterior Light | Replace with new LED lighting and remove ballast. | $167 | $300 | 6.55 | 1.8 | 753.1 |
| 7 | Other Electrical: Watering Point Heat Tape | Shut off heat tape and use only for emergency thaw purposes. | $242 | $500 | 5.68 | 2.1 | 1,088.7 |
| 8 | Setback Thermostat: Water Treatment Plant | Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Water Treatment Plant space. | $274 | $1,000 | 3.70 | 3.7 | 1,157.4 |
| 9 | Other Electrical: Circulation Loop Pump | Replace with new, more energy-efficient circulation pumps. | $665 | $3,000 | 3.15 | 4.5 | 3,018.0 |
| 10 | Other Electrical: Transfer Pumps | Replace with VFD pumps, remove pressure tank and replace with smaller pressure tanks to reduce pumping requirements. | $2,383 | $20,000 | 1.70 | 8.4 | 10,801.3 |
| 11 | Air Tightening | Repair front door such that it will remain closed without a padlock. Add weather stripping to the building. | $241 | $3,000 | 0.75 | 12.4 | 1,021.0 |
| 12 | Exterior Door: Front Entrance | Remove existing door and install new insulated metal door. | $20 | $1,817 | 0.26 | 90.9 | 84.6 |
| 13 | Exterior Door: Back Entrance | Remove existing door and install new insulated metal door. | $20 | $1,817 | 0.26 | 92.3 | 83.3 |
| 14 | Above-Grade Wall: Walls | Seal insulation gaps with caulk and add a lip to the inside barrier to prevent moisture from reaching the wall material. | $104 | $11,835 | 0.21 | 114.2 | 438.4 |
| | **TOTAL, all measures** | | **$6,813** | **$45,769** | **1.95** | **6.7** | **30,585.6** |

***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 $6,813 per year, or 32.0% of the buildings' total energy costs. These measures are estimated to cost $45,769, for an overall simple payback period of 6.7 years.

Table 1.4 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 1.4: Detailed Breakdown of Energy Costs in the Building**

| Annual Energy Cost Estimate | | | | | | |
|---|---|---|---|---|---|---|
| **Description** | **Space Heating** | **Lighting** | **Other Electrical** | **Water Circulation Heat** | **Tank Heat** | **Total Cost** |
| **Existing Building** | $1,475 | $726 | $18,739 | $25 | $64 | **$21,286** |
| **With Proposed Retrofits** | $1,212 | $247 | $12,668 | $25 | $64 | **$14,473** |
| **Savings** | $263 | $478 | $6,071 | $0 | $0 | **$6,813** |

# 2. AUDIT AND ANALYSIS BACKGROUND

## *2.1 Program Description*

This audit included services to identify, develop, and evaluate energy efficiency measures at the Koliganek Water Treatment Plant. The scope of this project included evaluating building shell, lighting and other electrical systems, and heating and ventilation 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 and ventilation equipment
- Lighting systems and controls
- Building-specific equipment
- Water consumption, treatment (optional) & disposal

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 Koliganek Water Treatment Plant 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.

Koliganek Water Treatment Plant is made up of the following zones:

1) Water Treatment Plant: 1,053 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. Koliganek Water Treatment Plant

### *3.1. Building Description*

The 1,053 square foot Koliganek Water Treatment Plant was constructed in 1971. An operator is present for approximately three hours per day for five days per week. The Koliganek Water Treatment Plant serves as the primary location for all water treatment and distribution services in the community.

The water treatment plant receives water from two wells located within 100 ft. of the building. The water is then treated with calcium carbonate to raise the pH using three filtration units. From there, the water flows to the water storage tank for storage before it flows back into the plant, is pressurized and feeds water to the two distribution lines that supply the community. One line is a non-circulating, deep buried arctic pipe that supplies water to the HUD housing near the airport. The other line is a circulation loop that feeds the rest of the community. It consists of a 4” diameter Arctic PVC pipe and is approximately 6,550 ft. long. Additionally, there is also a watering point in the water treatment plant that can be used by community residents to obtain water. This watering point is currently not operational.

**Figure 1: The Koliganek Water Storage Tank**

On the western side of the community is a small building that is used as a watering point for community residents who do not have circulating water and who desire easy access to a watering point without traveling to the water treatment plant on the opposite side of the community. The watering point is connected to the circulating loop and the service line is kept from freezing by a pit-orifice circulating service. The building is small and contains the watering point, a light, and a small electric heater for freeze protection.

**Figure 2: The Koliganek Watering Point building**

In the central region of the community is a lift station that is used to collect sewage from the community residents and transport it to a sewage lagoon outside of the community. The wet well is enclosed by a small building with a single room that houses the controls and heaters required for operation and freeze protection.

**Figure 3: The Koliganek Lift Station**

## Description of Building Shell

The exterior walls of the water plant are panel construction with spray foam insulation. The lower parts of the walls have experienced significant water damage that has reduced the insulation quality. Standing or frozen water was observed near the wall edges due to soaked insulation.

**Figure 4: Ice is shown near the bottom of the exterior walls where the insulation has been damaged.**

**Figure 5: The damaged insulation in the exterior wall can be seen near the ground level.**

The roof of the building is panel construction with spray foam insulation. The insulation is in fair condition.

The building is elevated on piles approximately 2-3 feet high. Parts of the building have been damaged from building differential settlement.

**Figure 6: Cracks can be seen in the floor of the water treatment plant. The cracks have been formed by building differential settlement.**

There are no windows in the Koliganek Water Treatment Plant.

There are two entrances into the Koliganek Water Treatment Plant. The main entrance has a single wood door with metal skin that has bad air leakage. When the door is closed without a padlock, the door will not stay in the closed position and will stay open slightly. The side entrance also has a wood door with metal skin.  This door has bad air leakage including holes around the door latch.

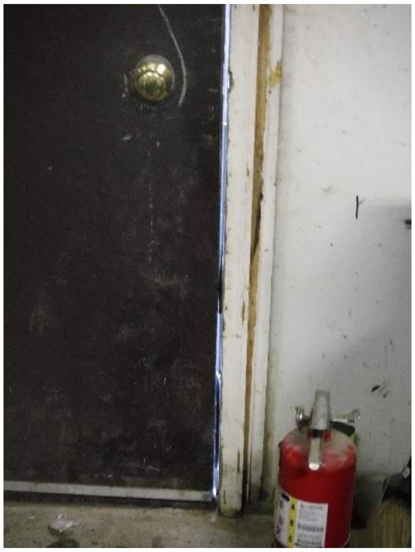


**Figure 7:  Air penetration near the front entrance.**

**Figure 8:  The front entrance door after it had been closed without a padlock.  It cannot remain closed without a padlock.**


**Figure 9:  Thermal imaging of the front entrance**

**Description of Heating Plants**

The heating plants 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 |

**Figure 10: Toyo Laser 73 Stove**

**Boiler 1**

| | |
|---|---|
| Nameplate Information: | Burnham PV73WC-GBWN25 105MBH<br>Beckett Model AFG Burner, 1.05 GPH<br>Pump=Grundfos UP 15-42F |
| Fuel Type: | #1 Oil |
| Input Rating: | 105,000 BTU/hr |
| Steady State Efficiency: | 78 % |
| Idle Loss: | 1.5 % |
| Heat Distribution Type: | Water |
| Boiler Operation: | All Year |

**Boiler 2**

| | |
|---|---|
| Nameplate Information: | Burnham PV73WC-GBWN25 105MBH<br>Beckett Model AFG Burner, 1.05 GPH<br>Pump= Bell & Gossett Circulator, NRF-22 |
| Fuel Type: | #1 Oil |
| Input Rating: | 105,000 BTU/hr |
| Steady State Efficiency: | 78 % |
| Idle Loss: | 1.5 % |

Heat Distribution Type: Water
Boiler Operation: All Year

**Figure 11: Boilers 1 and 2**

The two boilers have not been used by the community for approximately two years and the community relies on a high circulation flow rate to keep the water from freezing. Boiler 1 was identified as not operational and Boiler 2 has not been operated because of community choice. While the choice of using no heat is highly efficient from an energy efficiency perspective, this is not a recommended practice for standard use in a water treatment plant as the water circulation temperatures were around 33 deg. F. This margin of error is very slim in the event of a mechanical failure in the system

**<u>Space Heating Distribution Systems</u>**

All space heating is provided by the Toyo Laser 73 stove. There is an existing unit heater that is tied in to the hydronic system in the building. The motor on the unit heater was tested and was operational.

**Figure 12: Unit heater located in the upper corner of the water treatment plant**

## Lighting

The process room has five fixtures with four T12 4ft. fluorescent light bulbs in each fixture. The exterior has two explosion proof fixtures with a single incandescent 60W light bulb in each fixture as well as a metal halide wall pack light.

## Major Equipment

**Table 3.1: Major Equipment Information for the Koliganek Water Treatment Plant**

| Equipment | Rating (Watts) | Annual Usage (kWh) |
|---|---|---|
| Well Pumps (2) | 1500 W (2HP) | 2367 |
| Transfer Pumps (2) | 3750 W (5HP) | 14,113 |
| Circulation Loop Pump | 2250 W (3HP) | 10,697 |
| Air Compressor | 560 W (3/4 HP) | 344 |
| Well Heat Tape | 300 W | 1528 |
| Lift Station Electric Heater | 1500 W | 2522 |
| Lift Station Pump | 2250 W (3HP) | 1183 |
| Lift Station Heat Tape | 250 W | 13 |
| Watering Point Electric Heater | 1500 W | 4206 |
| Watering Point Heat Tape | 100 W | 509 |

There are two well pumps that run constantly to supply water to the water treatment plant. Each of the well pumps is an Aermotor Series A+ model rated for 2HP. The operator indicated that one of the well pumps is set approximately 20-feet higher than originally placed, due to dropping the old well pump to the bottom of the well. This potentially leads to well draw down and large amounts of air that gets pumped into the system and is causing problems with the air relief valves.

The transfer pumps are used to transfer water from the water storage tank to the pressure tank and circulating loop to maintain pressure in the system. The pressure tank is approximately 2000 gallons in size and is original to the water plant. The pressure tank is unable to maintain the system pressure adequately and as a result, both pumps will run simultaneously for approximately 25% of the time. The pumps are Baldor JML 1409T models rated for 5HP. It was measured to operate at 14 A and 13 A for the two pumps.

**Figure 13: Transfer Pumps**

**Figure 14: Pressure Tank**

The circulation loop pump operates constantly during the winter heating months and circulates the water to prevent it from freezing. The pump is a Baldor 36H16-203 model rated for 3 HP. It was measured to operate at 10.2 A. There are two pumps for redundancy.

**Figure 15: Circulation Loop Pumps**

## *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. One KW of electric demand is equivalent to 1,000 watts running at a particular moment. 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 #1 Fuel Oil provides approximately 132,000 BTUs of energy.

The Koliganek Village Council owns and operates an electric utility that provides electricity to the residential, public, and commercial buildings in the community.

The average cost for each type of fuel used in this building is shown below in Table 3.2. This figure includes all surcharges, subsidies, and utility customer charges:

**Table 3.2: Energy Cost Rates for Each Fuel Type**

| Average Energy Cost | |
|---|---|
| **Description** | **Average Energy Cost** |
| Electricity | $ 0.51/kWh |
| #1 Oil | $ 5.00/gallons |

### 3.2.1.1 Total Energy Use and Cost Breakdown

At current rates, New Koliganek Village Council pays approximately $21,286 annually for electricity and other fuel costs for the Koliganek Water Treatment Plant.

Figure 16 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.

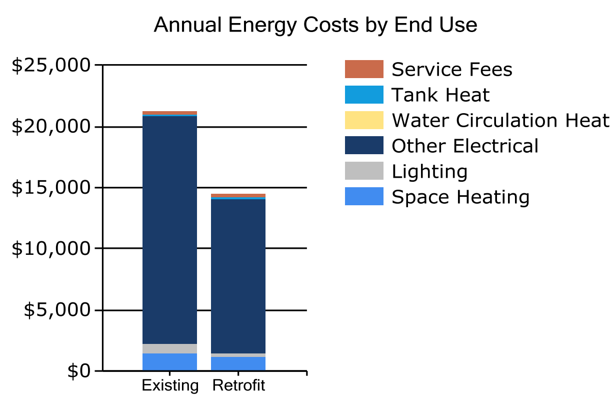



**Figure 16: Annual Energy Costs by End Use**

Figure 17 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 17: Annual Energy Costs by Fuel Type**

Figure 18 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.

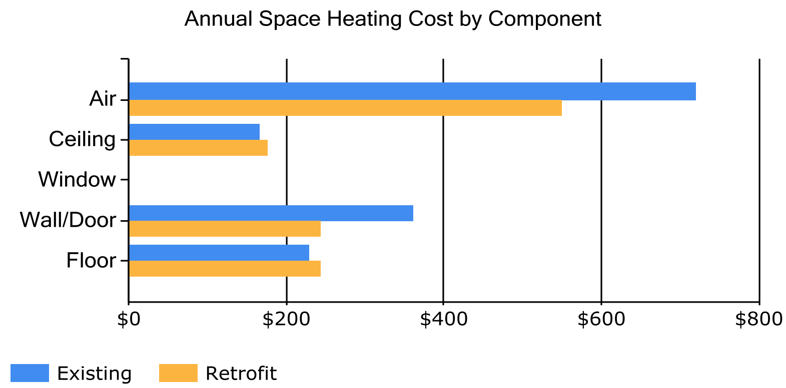



**Figure 18: Annual Space Heating Costs**

Tables 3.3 and 3.4 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.

### Table 3.3: Estimated Electrical Consumption by Category

| Electrical Consumption (kWh) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** | **Oct** | **Nov** | **Dec** |
| Space Heating | 5 | 4 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 5 |
| Lighting | 171 | 156 | 171 | 166 | 57 | 55 | 57 | 57 | 55 | 171 | 166 | 171 |
| Other Electrical | 4372 | 3984 | 4372 | 4231 | 1528 | 1479 | 1528 | 1528 | 1479 | 4372 | 4231 | 4372 |

### Table 3.4: Estimated Fuel Oil Consumption by Category

| Fuel Oil #1 Consumption (Gallons) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
| Space Heating | 44 | 37 | 31 | 17 | 24 | 17 | 18 | 18 | 18 | 18 | 25 | 27 |
| Water Circulation Heat | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| Tank Heat | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |

### 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):

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

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

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

**Table 3.5: Building EUI Calculations for the Koliganek Water Treatment Plant**

| Energy Type | Building Fuel Use per Year | Site Energy Use per Year, kBTU | Source/Site Ratio | Source Energy Use per Year, kBTU |
|---|---|---|---|---|
| Electricity | 38,951 kWh | 132,939 | 3.340 | 444,016 |
| #1 Oil | 311 gallons | 41,010 | 1.010 | 41,421 |
| **Total** | | **173,949** | | **485,436** |
| | | | | |
| BUILDING AREA | | 1,053 | Square Feet | |
| BUILDING SITE EUI | | 165 | kBTU/Ft²/Yr | |
| **BUILDING SOURCE EUI** | | 461 | **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 3.6: Building Benchmarks for the Koliganek Water Treatment Plant**

| Building Benchmarks | | | |
|---|---|---|---|
| **Description** | **EUI (kBtu/Sq.Ft.)** | **EUI/HDD (Btu/Sq.Ft./HDD)** | **ECI ($/Sq.Ft.)** |
| **Existing Building** | 165.2 | 14.61 | $20.21 |
| **With Proposed Retrofits** | 116.2 | 10.28 | $13.74 |
| EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area.<br>EUI/HDD: Energy Use Intensity per Heating Degree Day.<br>ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building. | | | |

## *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 systems 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 Koliganek Water Treatment Plant was modeled using AkWarm© energy use software to establish a baseline space heating energy usage. Climate data from Koliganek was used for analysis. From this, the model was be calibrated to predict the impact of theoretical energy savings measures. Once annual energy savings from a particular measure were predicted and the initial capital cost was estimated, payback scenarios were approximated.

***Limitations of AkWarm© Models***

• The model is based on typical mean year weather data for Koliganek. 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 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 are summarized in Table 4.1. Please refer to the individual measure descriptions later in this report for more detail.

| PRIORITY LIST – ENERGY EFFICIENCY MEASURES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Rank | Feature | Improvement Description | Annual Energy Savings | Installed Cost | Savings to Investment Ratio, SIR[1] | Simple Payback (Years)[2] | $CO_2$ Savings |
| 1 | Other Electrical: Lift Station Electric Plugin Heater | Lower electric heater power settings from the maximum to a medium setting. | $1,070 | $500 | 25.13 | 0.5 | 4,813.8 |
| 2 | Other Electrical: Well Heat Tape | Shut off heat tape and use only for emergency thaw purposes. | $749 | $500 | 17.59 | 0.7 | 3,369.9 |
| 3 | Lighting: Exterior Incandescents | Replace with new LED lighting. | $76 | $100 | 8.92 | 1.3 | 341.7 |
| 4 | Other Electrical: Watering Point Electric Heater | Lower setting on plug-in electric heater to low. Heat space to approximately 50 deg. F. | $573 | $1,000 | 6.73 | 1.7 | 2,578.9 |
| 5 | Lighting: Process Room Lights | Replace with new LED lighting and remove ballast. | $230 | $400 | 6.73 | 1.7 | 1,035.6 |
| 6 | Lighting: Water Plant Watering Point Exterior Light | Replace with new LED lighting and remove ballast. | $167 | $300 | 6.55 | 1.8 | 753.1 |
| 7 | Other Electrical: Watering Point Heat Tape | Shut off heat tape and use only for emergency thaw purposes. | $242 | $500 | 5.68 | 2.1 | 1,088.7 |
| 8 | Setback Thermostat: Water Treatment Plant | Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Water Treatment Plant space. | $274 | $1,000 | 3.70 | 3.7 | 1,157.4 |
| 9 | Other Electrical: Circulation Loop Pump | Replace with new, more energy-efficient circulation pumps. | $665 | $3,000 | 3.15 | 4.5 | 3,018.0 |
| 10 | Other Electrical: Transfer Pumps | Replace with VFD pumps, remove pressure tank and replace with smaller pressure tanks to reduce pumping requirements. | $2,383 | $20,000 | 1.70 | 8.4 | 10,801.3 |

| PRIORITY LIST – ENERGY EFFICIENCY MEASURES | | | | | | | |
|---|---|---|---|---|---|---|---|
| Rank | Feature | Improvement Description | Annual Energy Savings | Installed Cost | Savings to Investment Ratio, SIR[1] | Simple Payback (Years)[2] | $CO_2$ Savings |
| 11 | Air Tightening | Repair front door such that it will remain closed without a padlock. Add weather stripping to the building. | $241 | $3,000 | 0.75 | 12.4 | 1,021.0 |
| 12 | Exterior Door: Front Entrance | Remove existing door and install new insulated metal door. | $20 | $1,817 | 0.26 | 90.9 | 84.6 |
| 13 | Exterior Door: Back Entrance | Remove existing door and install new insulated metal door. | $20 | $1,817 | 0.26 | 92.3 | 83.3 |
| 14 | Above-Grade Wall: Walls | Seal insulation gaps with caulk and add a lip to the inside barrier to prevent moisture from reaching the wall material. | $104 | $11,835 | 0.21 | 114.2 | 438.4 |
| | **TOTAL, all measures** | | **$6,813** | **$45,769** | **1.95** | **6.7** | **30,585.6** |

## *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. Lighting-efficiency improvements are anticipated to slightly increase heating requirements. Heating penalties were included in the lighting project analysis.

## *4.3 Building Shell Measures*

### *4.3.1 Insulation Measures*

| Rank | Location | | Existing Type/R-Value | | Recommendation Type/R-Value | |
|---|---|---|---|---|---|---|
| 14 | Above-Grade Wall: Walls | | Wall Type: Stressed Skin Panel<br>Siding Configuration: Siding and Sheathing<br>Panel Insulation: Polyurethane (PLUR), 5.5 inches<br>Insulation Quality: Very Damaged<br>Modeled R-Value: 20.7 | | Seal insulation gaps with caulk and add a lip to the inside barrier to prevent moisture from reaching the wall material. | |
| **Installation Cost** | | $11,835 | **Estimated Life of Measure (yrs)** | 30 | **Energy Savings ($/yr)** | $104 |
| **Breakeven Cost** | | $2,449 | **Simple Payback (yrs)** | 114 | **Energy Savings (MMBTU/yr)** | 2.7 MMBTU |
| | | | **Savings-to-Investment Ratio** | 0.2 | | |
| Auditors Notes: The insulation in the walls near the floor is badly damaged around the building from water damage and there are locations with frozen and standing water near the walls as a result. Seal the gaps and add a lip to the inside barrier to prevent water from settling into the insulation and wall structural material to avoid further damage. | | | | | | |

### *4.3.2 Door Measures*

| Rank | Location | | Size/Type, Condition | | Recommendation | |
|---|---|---|---|---|---|---|
| 12 | Exterior Door: Front Entrance | | Door Type: Entrance, Wood, solid core flush, 1-3/4"<br>Modeled R-Value: 2.6 | | Remove existing door and install standard pre-hung insulated door. | |
| **Installation Cost** | | $1,817 | **Estimated Life of Measure (yrs)** | 30 | **Energy Savings ($/yr)** | $20 |
| **Breakeven Cost** | | $472 | **Simple Payback (yrs)** | 91 | **Energy Savings (MMBTU/yr)** | 0.5 MMBTU |
| | | | **Savings-to-Investment Ratio** | 0.3 | | |
| Auditors Notes: The existing door has no locking mechanism and has holes in the door material. Additionally, the door will not remain closed without a padlock. Replace the door with a new, insulated model for better insulation. | | | | | | |

| Rank | Location | | Size/Type, Condition | | Recommendation | |
|---|---|---|---|---|---|---|
| 13 | Exterior Door: Back Entrance | | Door Type: Entrance, Wood, solid core flush, 1-3/4"<br>Modeled R-Value: 2.6 | | Remove existing door and install standard pre-hung insulated door. | |
| **Installation Cost** | | $1,817 | **Estimated Life of Measure (yrs)** | 30 | **Energy Savings ($/yr)** | $20 |
| **Breakeven Cost** | | $465 | **Simple Payback (yrs)** | 92 | **Energy Savings (MMBTU/yr)** | 0.5 MMBTU |
| | | | **Savings-to-Investment Ratio** | 0.3 | | |
| Auditors Notes: The existing door has noticeable damage and air leaks around the sides. Replace the door for better insulation. | | | | | | |

### 4.3.3 Air Sealing Measures

| Rank | Location | | Existing Air Leakage Level (cfm@50/75 Pa) | | Recommended Air Leakage Reduction (cfm@50/75 Pa) | |
|---|---|---|---|---|---|---|
| 11 | | | Air Tightness estimated as: 2000 cfm at 50 Pascals | | Perform air sealing to reduce air leakage by 25%. | |
| **Installation Cost** | $3,000 | | **Estimated Life of Measure (yrs)** | 10 | **Energy Savings ($/yr)** | $241 |
| **Breakeven Cost** | $2,241 | | **Simple Payback (yrs)** | 12 | **Energy Savings (MMBTU/yr)** | 6.3 MMBTU |
| | | | **Savings-to-Investment Ratio** | 0.7 | | |
| Auditors Notes: Air reduction includes door sealing and replacement, insulation around bottom of building walls where water damage has penetrated the existing insulation. | | | | | | |

## 4.4 Mechanical Equipment Measures

### 4.4.1 Night Setback Thermostat Measures

| Rank | Building Space | | | | Recommendation | |
|---|---|---|---|---|---|---|
| 8 | Water Treatment Plant | | | | Implement a Heating Temperature Unoccupied Setback to 60.0 deg F for the Water Treatment Plant space. | |
| **Installation Cost** | $1,000 | | **Estimated Life of Measure (yrs)** | 15 | **Energy Savings ($/yr)** | $274 |
| **Breakeven Cost** | $3,704 | | **Simple Payback (yrs)** | 4 | **Energy Savings (MMBTU/yr)** | 7.1 MMBTU |
| | | | **Savings-to-Investment Ratio** | 3.7 | | |
| Auditors Notes: Lowering the temperature when not in use will reduce excess heating costs. This can be accomplished through programming of the Toyo Laser 73 stove. | | | | | | |

## 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 | |
|---|---|---|---|---|---|---|
| 3 | Exterior Incandescents | | INCAN A Lamp, Std 60W | | Replace with new energy-efficient LED light bulbs. | |
| **Installation Cost** | $100 | | **Estimated Life of Measure (yrs)** | 15 | **Energy Savings ($/yr)** | $76 |
| **Breakeven Cost** | $892 | | **Simple Payback (yrs)** | 1 | **Energy Savings (MMBTU/yr)** | 0.5 MMBTU |
| | | | **Savings-to-Investment Ratio** | 8.9 | | |
| Auditors Notes: There are two total light bulbs to be replaced with 12 Watt Led equivalent light bulbs. | | | | | | |

| Rank | Location | Existing Condition | | Recommendation | |
|---|---|---|---|---|---|
| 5 | Process Room Lights | 5 FLUOR (4) T12 4' F40T12 40W Standard StdElectronic | | Replace with new energy-efficient LED light bulbs. | |
| **Installation Cost** | $400 | **Estimated Life of Measure (yrs)** | 15 | **Energy Savings ($/yr)** | $230 |
| **Breakeven Cost** | $2,690 | **Simple Payback (yrs)** | 2 | **Energy Savings (MMBTU/yr)** | 1.5 MMBTU |
| | | **Savings-to-Investment Ratio** | 6.7 | | |
| Auditors Notes: There are five fixtures with four T12 4ft. fluorescent light bulbs in each fixture. Replace these light bulbs with two 18 Watt LED equivalent light bulbs for a total of ten new light bulbs. | | | | | |

| Rank | Location | Existing Condition | | Recommendation | |
|---|---|---|---|---|---|
| 6 | Water Plant Watering Point Exterior Light | MH 100 Watt StdElectronic | | Replace with new energy-efficient LED light bulbs. | |
| **Installation Cost** | $300 | **Estimated Life of Measure (yrs)** | 15 | **Energy Savings ($/yr)** | $167 |
| **Breakeven Cost** | $1,966 | **Simple Payback (yrs)** | 2 | **Energy Savings (MMBTU/yr)** | 1.1 MMBTU |
| | | **Savings-to-Investment Ratio** | 6.6 | | |
| Auditors Notes: There is a single light bulb to be replaced with an LED outdoor wall pack that Is rated for 40 Watts. | | | | | |

| Rank | Location | Description of Existing | | Efficiency Recommendation | |
|---|---|---|---|---|---|
| 1 | Lift Station Electric Plugin Heater | Electric Heater | | Lower electric heater power settings from the maximum to a medium setting. | |
| **Installation Cost** | $500 | **Estimated Life of Measure (yrs)** | 15 | **Energy Savings ($/yr)** | $1,070 |
| **Breakeven Cost** | $12,566 | **Simple Payback (yrs)** | 0 | **Energy Savings (MMBTU/yr)** | 7.3 MMBTU |
| | | **Savings-to-Investment Ratio** | 25.1 | | |
| Auditors Notes: Lowering the electric heater setting will allow the heater to maintain freeze protection while reducing excess heating usage. | | | | | |

### *4.5.2 Other Electrical Measures*

| Rank | Location | Description of Existing | | Efficiency Recommendation | |
|---|---|---|---|---|---|
| 2 | Well Heat Tape | Heat Tape | | Shut off heat tape and use only for emergency thaw purposes. | |
| **Installation Cost** | $500 | **Estimated Life of Measure (yrs)** | 15 | **Energy Savings ($/yr)** | $749 |
| **Breakeven Cost** | $8,796 | **Simple Payback (yrs)** | 1 | **Energy Savings (MMBTU/yr)** | 5.1 MMBTU |
| | | **Savings-to-Investment Ratio** | 17.6 | | |
| Auditors Notes: The heat tapes are intended to be used as emergency freeze protection and should not have to be run constantly for a long period of time. | | | | | |

| Rank | Location | Description of Existing | | Efficiency Recommendation | |
|---|---|---|---|---|---|
| 4 | Watering Point Electric Heater | Electric Heater | | Lower setting on plug-in electric heater to low. Heat space to approximately 50 deg. F. | |
| **Installation Cost** | $1,000 | **Estimated Life of Measure (yrs)** | 15 | **Energy Savings ($/yr)** | $573 |
| **Breakeven Cost** | $6,732 | **Simple Payback (yrs)** | 2 | **Energy Savings (MMBTU/yr)** | 3.9 MMBTU |
| | | **Savings-to-Investment Ratio** | 6.7 | | |
| Auditors Notes: Lowering the electric heater setting will allow the heater to maintain freeze protection while reducing excess heating usage. | | | | | |

| Rank | Location | Description of Existing | | Efficiency Recommendation | |
|---|---|---|---|---|---|
| 7 | Watering Point Heat Tape | Heat Tape | | Shut off heat tape and use only for emergency thaw purposes. | |
| **Installation Cost** | $500 | **Estimated Life of Measure (yrs)** | 15 | **Energy Savings ($/yr)** | $242 |
| **Breakeven Cost** | $2,842 | **Simple Payback (yrs)** | 2 | **Energy Savings (MMBTU/yr)** | 1.7 MMBTU |
| | | **Savings-to-Investment Ratio** | 5.7 | | |
| Auditors Notes: The heat tapes are intended to be used as emergency freeze protection and should not have to be run constantly for a long period of time. | | | | | |

| Rank | Location | Description of Existing | | Efficiency Recommendation | |
|---|---|---|---|---|---|
| 9 | Circulation Loop Pump | Circulation Pump | | Replace with new, more energy-efficient circulation pumps. | |
| **Installation Cost** | $3,000 | **Estimated Life of Measure (yrs)** | 20 | **Energy Savings ($/yr)** | $665 |
| **Breakeven Cost** | $9,437 | **Simple Payback (yrs)** | 5 | **Energy Savings (MMBTU/yr)** | 2.6 MMBTU |
| | | **Savings-to-Investment Ratio** | 3.1 | | |
| Auditors Notes: The current pumps are old and inefficient. Replace with a newer model pump for better efficiency and operations. | | | | | |

| Rank | Location | Description of Existing | | Efficiency Recommendation | |
|---|---|---|---|---|---|
| 10 | Transfer Pumps | 2 Transfer Pumps | | Replace with VFD pumps, remove pressure tank and replace with smaller pressure tanks to reduce pumping requirements. | |
| **Installation Cost** | $20,000 | **Estimated Life of Measure (yrs)** | 20 | **Energy Savings ($/yr)** | $2,383 |
| **Breakeven Cost** | $34,012 | **Simple Payback (yrs)** | 8 | **Energy Savings (MMBTU/yr)** | 10.7 MMBTU |
| | | **Savings-to-Investment Ratio** | 1.7 | | |
| Auditors Notes: The existing pressure tank is oversized and requires the current transfer pumps to operate 25% of the time, making the operations very expensive. The air compressor must also run to maintain pressure in the oversized system. Remove the existing pressure tank and replace it with several appropriately sized Amtrol pressure tanks to reduce the pressure pump requirements. Replace the transfer pumps with new Variable Frequency Drive (VFD) controlled pumps that will modulate the flow and reduce the high-amperage starts.<br><br>Replace the air relief valves and air vents on the water system intake. These are causing major inefficiencies in air flow and damage to the equipment. | | | | | |

# 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.

In the near future, a representative of ANTHC will be contacting the New Koliganek Village Council to follow up on the recommendations made in this report. Funding has been provided to ANTHC through a Rural Alaska Village Grant and the Denali Commission to provide the community with assistance in understanding the report and implementing the recommendations. ANTHC will work to complete the recommendations in the 2017.

# APPENDICES

## Appendix A – Energy Audit Report – Project Summary

| ENERGY AUDIT REPORT – PROJECT SUMMARY | |
|---|---|
| **General Project Information** | |
| **PROJECT INFORMATION** | **AUDITOR INFORMATION** |
| **Building:** Koliganek Water Treatment Plant | **Auditor Company:** ANTHC-DEHE |
| **Address:** P.O. Box 5057 | **Auditor Name:** Kevin Ulrich and Cody Uhlig |
| **City:** Koliganek | **Auditor Address:** 4500 Diplomacy Dr. Anchorage, AK 99508 |
| **Client Name:** Alexie Ishnook | |
| **Client Address:** P.O. Box 5057 Koliganek, AK 99576 | **Auditor Phone:** (907) 729-3237 |
| | **Auditor FAX:** |
| **Client Phone:** (907) 596-3434 | **Auditor Comment:** |
| **Client FAX:** | |
| **Design Data** | |
| **Building Area:** 1,053 square feet | **Design Space Heating Load:** Design Loss at Space: 13,939 Btu/hour<br>with Distribution Losses: 13,939 Btu/hour<br>Plant Input Rating assuming 82.0% Plant Efficiency and 25% Safety Margin: 21,248 Btu/hour<br>Note: Additional Capacity should be added for DHW and other plant loads, if served. |
| **Typical Occupancy:** 0 people | **Design Indoor Temperature:** 67 deg F (building average) |
| **Actual City:** Koliganek | **Design Outdoor Temperature:** -19.3 deg F |
| **Weather/Fuel City:** Koliganek | **Heating Degree Days:** 11,306 deg F-days |
| | |
| **Utility Information** | |
| **Electric Utility:** Koliganek Village Council | **Average Annual Cost/kWh:** $0.51/kWh |

**Annual Energy Cost Estimate**

| Description | Space Heating | Lighting | Other Electrical | Water Circulation Heat | Tank Heat | Total Cost |
|---|---|---|---|---|---|---|
| Existing Building | $1,475 | $726 | $18,739 | $25 | $64 | **$21,286** |
| With Proposed Retrofits | $1,212 | $247 | $12,668 | $25 | $64 | **$14,473** |
| Savings | $263 | $478 | $6,071 | $0 | $0 | **$6,813** |

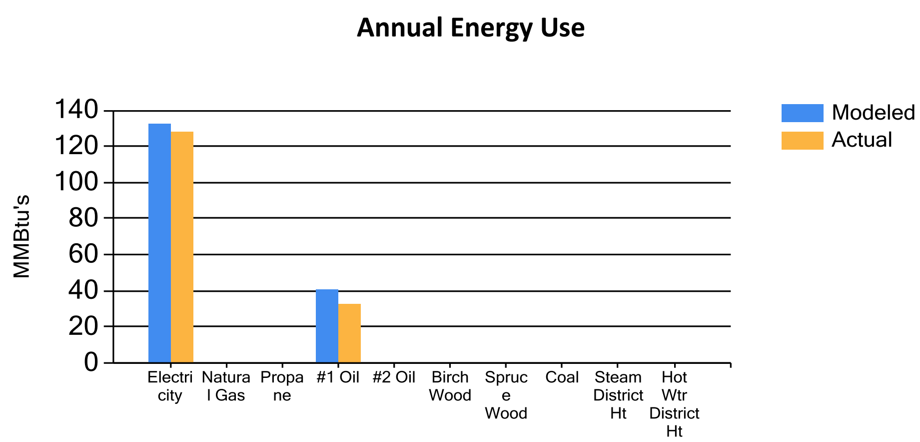
**Building Benchmarks**

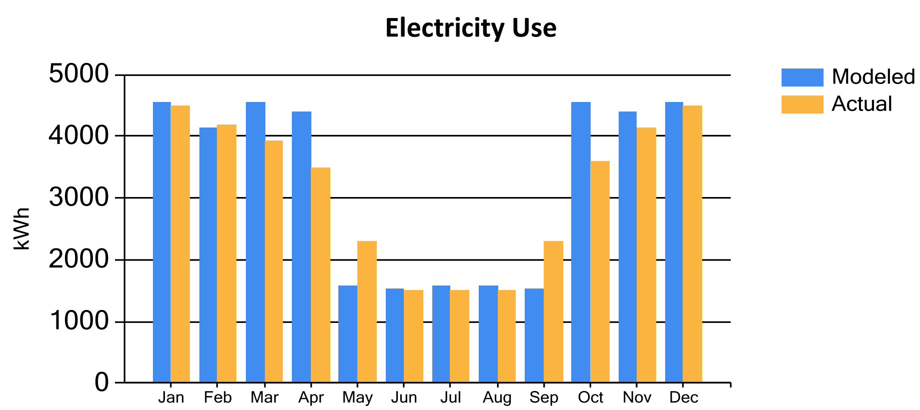
| Description | EUI (kBtu/Sq.Ft.) | EUI/HDD (Btu/Sq.Ft./HDD) | ECI ($/Sq.Ft.) |
|---|---|---|---|
| Existing Building | 165.2 | 14.61 | $20.21 |
| With Proposed Retrofits | 116.2 | 10.28 | $13.74 |

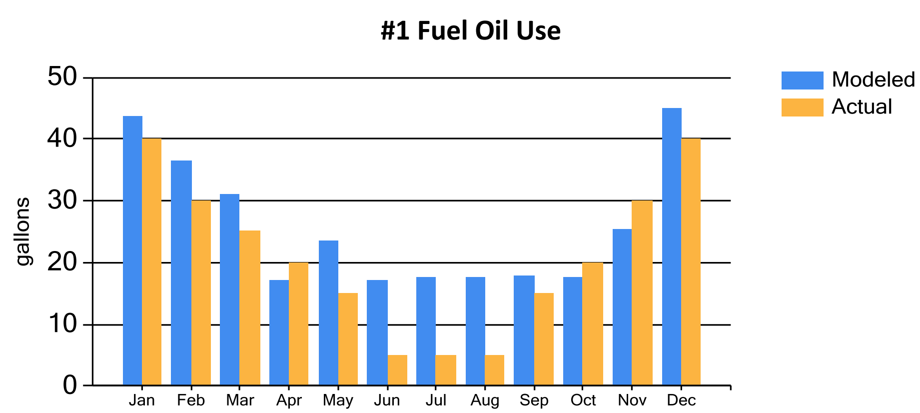
EUI: Energy Use Intensity - The annual site energy consumption divided by the structure's conditioned area.
EUI/HDD: Energy Use Intensity per Heating Degree Day.
ECI: Energy Cost Index - The total annual cost of energy divided by the square footage of the conditioned space in the building.

# Appendix B – 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.



# Appendix C - Electrical Demands

| Estimated Peak Electrical Demand (kW) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| **Current** | 7.1 | 7.1 | 7.1 | 7.1 | 3.1 | 3.1 | 3.1 | 3.1 | 3.1 | 7.1 | 7.1 | 7.1 |
| **As Proposed** | 4.5 | 4.5 | 4.5 | 4.5 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 4.5 | 4.5 | 4.5 |

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AkWarmCalc Ver 2.6.1.0, Energy Lib 8/9/2016