Feasibility Assessment for Biomass Heating Systems at Victory Bible Camp’s Miracle Lodge

FINAL REPORT – 9/4/2018

800 F Street, Anchorage, AK 99501
p (907) 276-6664 f (907) 276-5042

Lee Bolling, PE
David Nicolai, PE
Appendices

Appendix A – Site Photos
Appendix B – Economic Analysis Spreadsheets
Appendix C – AWEDTG Field Data Sheets
# Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACF</td>
<td>Accumulated Cash Flow</td>
</tr>
<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating, and Air-Conditioning Engineers</td>
</tr>
<tr>
<td>AEA</td>
<td>Alaska Energy Authority</td>
</tr>
<tr>
<td>AFUE</td>
<td>Annual Fuel Utilization Efficiency</td>
</tr>
<tr>
<td>B/C</td>
<td>Benefit / Cost Ratio</td>
</tr>
<tr>
<td>BTU</td>
<td>British Thermal Unit</td>
</tr>
<tr>
<td>BTU/hr</td>
<td>BTU per hour</td>
</tr>
<tr>
<td>CFM</td>
<td>Cubic Feet per Minute</td>
</tr>
<tr>
<td>Eff</td>
<td>Efficiency</td>
</tr>
<tr>
<td>F</td>
<td>Feet</td>
</tr>
<tr>
<td>ft</td>
<td>Feet</td>
</tr>
<tr>
<td>GPM</td>
<td>Gallons Per Minute</td>
</tr>
<tr>
<td>HP</td>
<td>Horsepower</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilating, and Air-Conditioning</td>
</tr>
<tr>
<td>in</td>
<td>Inch(es)</td>
</tr>
<tr>
<td>kW</td>
<td>Kilowatt(s)</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatt-Hour</td>
</tr>
<tr>
<td>lb(s)</td>
<td>Pound(s)</td>
</tr>
<tr>
<td>MBH</td>
<td>Thousand BTUs per Hour</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Operations and Maintenance</td>
</tr>
<tr>
<td>MMBTU</td>
<td>One Million BTUs</td>
</tr>
<tr>
<td>PC</td>
<td>Project Cost</td>
</tr>
<tr>
<td>R</td>
<td>R-Value</td>
</tr>
<tr>
<td>SF</td>
<td>Square Feet, Supply Fan</td>
</tr>
<tr>
<td>TEMP</td>
<td>Temperature</td>
</tr>
<tr>
<td>TPY</td>
<td>Tons per Year</td>
</tr>
<tr>
<td>V</td>
<td>Volts</td>
</tr>
<tr>
<td>VBC</td>
<td>Victory Bible Camp</td>
</tr>
<tr>
<td>W</td>
<td>Watts</td>
</tr>
</tbody>
</table>
List of Figures

Figure 1 – Miracle Lodge .................................................................................................................. 2
Figure 2 – Existing Wood Boiler Building .................................................................................... 4
Figure 3 – Miracle Lodge Site Layout ......................................................................................... 5
Figure 4 – Garn WHS-3200 Wood Boiler .................................................................................... 6
Figure 5 – Building Site Map ........................................................................................................ 8

List of Tables

Table 1 – Executive Summary ...................................................................................................... 1
Table 2 – Energy Comparison Overview ..................................................................................... 1
Table 3 – Building Characteristics ............................................................................................... 3
Table 4 – Boiler Equipment ........................................................................................................... 3
Table 5 – Buildings for Potential District Heat System ................................................................. 7
Table 6 – Energy Comparison ...................................................................................................... 10
Table 7 – Existing Fuel Oil Consumption .................................................................................... 12
Table 8 – Proposed Biomass System Fuel Consumption ............................................................. 12
Table 9 – Estimate of Probable Costs ........................................................................................... 14
Table 10 – Discount and Escalation rates .................................................................................... 15
Table 11 – Economic Definitions ................................................................................................ 16
Table 12 – Economic Analysis Results ....................................................................................... 17
Table 13 – Sensitivity Analysis – Heating Oil Price vs Cord Wood Price ..................................... 18
Table 14 – Sensitivity Analysis – Cord Wood Price vs Project Cost ............................................ 18
1. Executive Summary

Coffman performed a preliminary biomass feasibility assessment for the Miracle Lodge at the Victory Bible Camp in Sutton, Alaska, to determine the technical and economic viability of biomass heating systems. The proposed biomass heating system is a cord wood boiler located in a detached building with a heat loop to the lodge. The cord wood boiler would supplement heat for the existing oil boiler system.

Four scenarios were evaluated with two different project costs (contractor labor vs volunteer labor) and two different cord wood prices ($250/cord and $90/cord). All of the scenarios evaluated have benefit to cost ratios greater than 1.0. Any project with a benefit to cost ratio greater than 1.0 is considered economically justified, and therefore all of the scenarios are economically justified at this time.

The benefit to cost ratios range from 1.85 (using contractor labor and $250/cord) all the way to 5.14 (with volunteer labor and $90/cord). These are good economic numbers and show that this project is viable over many different variables.

A summary of each projects economic analysis is shown in the following table.

<table>
<thead>
<tr>
<th>Item</th>
<th>Scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Capital Cost</td>
<td>($312,000)</td>
</tr>
<tr>
<td>Present Value of Project Benefits (20-year life)</td>
<td>$1,094,450</td>
</tr>
<tr>
<td>Present Value of Operating Costs (20-year life)</td>
<td>($516,134)</td>
</tr>
<tr>
<td>Benefit / Cost Ratio of Project (20-year life)</td>
<td>1.85</td>
</tr>
<tr>
<td>Net Present Value (20-year life)</td>
<td>$266,316</td>
</tr>
<tr>
<td>Year Cash Flow is Net Positive</td>
<td>First Year</td>
</tr>
<tr>
<td>Payback Period (Year Accumulated Cash Flow &gt; Project Capital Cost)</td>
<td>13 years</td>
</tr>
</tbody>
</table>

The current energy prices at Victory Bible Camp are shown in the following table. Cord wood is less expensive than heating oil and electricity on an energy basis.

<table>
<thead>
<tr>
<th>Community</th>
<th>Fuel Type</th>
<th>Units</th>
<th>Gross BTU/unit</th>
<th>System Efficiency</th>
<th>$/unit</th>
<th>Delivered $/MMBTU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victory Bible Camp</td>
<td>Cord Wood</td>
<td>cord</td>
<td>18,200,000</td>
<td>80%</td>
<td>$250</td>
<td>$17.17</td>
</tr>
<tr>
<td></td>
<td>Heating Oil</td>
<td>gal</td>
<td>134,000</td>
<td>65%</td>
<td>$2.55</td>
<td>$29.28</td>
</tr>
<tr>
<td></td>
<td>Electricity</td>
<td>kWh</td>
<td>3,412</td>
<td>99%</td>
<td>$0.18</td>
<td>$53.29</td>
</tr>
</tbody>
</table>
2. Introduction

A preliminary feasibility assessment was completed to determine the technical and economic viability of a biomass heating system for the Miracle Lodge at Victory Bible Camp (VBC). Victory Bible Camp operates and maintains the Miracle lodge and was awarded a biomass pre-feasibility study from the Fairbanks Economic Development Corporation (FEDC).

Figure 1 – Miracle Lodge
3. Preliminary Site Investigation

A site visit of Victory Bible Camp was completed by Coffman Engineers on June 28, 2018. The main focus of the study is on the Miracle Lodge, which is the largest building at the camp and the largest consumer of energy. During the site visit other buildings surrounding the Miracle Lodge were investigated for biomass potential.

Building Descriptions

The Miracle Lodge is occupied year-round and was built with typical construction methods in the Mat-Su Valley. For the Miracle Lodge, the square footage, date of construction, occupant characteristics and type of construction is shown in the following table.

<table>
<thead>
<tr>
<th>Building</th>
<th>Square Footage</th>
<th>Year Built</th>
<th>Occupants</th>
<th>Type of Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miracle Lodge</td>
<td>24,296</td>
<td>2002</td>
<td>320</td>
<td>CMU block and stick frame walls (R-19), composition shingles roof with batt insulation (R-38), and built-up flat roof with rigid insulation (R-38)</td>
</tr>
</tbody>
</table>

Existing Heating System

The Miracle Lodge is heated by a combination of a wood fired boiler, a fuel oil boiler, and two used oil boilers. These boilers serve perimeter baseboard, air handlers, and radiant floor using glycol as the circulating fluid. Domestic hot water (DHW) is also provided by these boilers, by means of indirect heat transfer in a separate storage tank. The Miracle Lodge does not have direct digital controls; however, there is an installed, custom built monitoring program that can display the critical information of the boiler system. The fuel oil boiler appears to be in good working condition. The two used oil boilers appear to be old and well-used, and one of the boilers is currently out of service. They plan to take the second used oil boiler out of service in the coming weeks. The following table shows the heating capacities of the boiler plants.

<table>
<thead>
<tr>
<th>Building</th>
<th>Boiler Plant</th>
<th>DHW Plant</th>
<th>Fuel Tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miracle Lodge</td>
<td>Econoburn Gasification Wood Boiler</td>
<td></td>
<td>Four 3,000 Gallon fuel tanks. Above Ground located in Fuel Oil Concrete Vault</td>
</tr>
<tr>
<td></td>
<td>Model EBW-500 500 MBH Gross Output</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weil McLain Fuel Oil Boiler 1,000 MBH Gross Output</td>
<td>A.O. Smith Indirect DHW Heater Model TJV 200A 200 gal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two New Yorker Used Oil Boilers 500 MBH Gross Output Each</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The boilers, central pumps and hot water heaters are located in mechanical rooms. The combustion efficiency of the boilers is unknown, as no combustion test reports were available. For this study, the Annual Fuel Utilization Efficiency of the oil boiler system is estimated at 65% to account for typical oil boiler inefficiencies, including short cycling, due to the age of the boilers.

**Existing Biomass Boiler**

Victory Bible Camp uses an existing cord wood boiler to supplement heat at the Miracle Lodge. The Econoburn EBW-500 boiler is located inside a detached boiler building on the south side of the Miracle Lodge. It is reported that the Econoburn does not work well and puts out less than 200,000 BTU/hr even though it is rated for 500,000 BTU/hr. The Econoburn has had issues with smoking and has had many maintenance issues. The actual efficiency of the unit is questionable and is estimated at around 55% based on these issues. Victory Bible Camp is interested in replacing the existing cord wood boiler with a new more efficient cord wood boiler system.

It appears that the detached boiler building shell and ventilation components is in need of upgrades and repairs to operate in a reliable manner.

---

**Available Space, Street Access, Fuel Storage and Site Constraints**

There are few site constraints associated with available space, access, and fuel storage. There is ample space for cord wood storage in the existing wood storage shelter. However, it was reported that the wood storage shelter does not have adequate air flow, and so it is recommended that active ventilation with fans be installed. Additionally, ventilation louvers or stacks could be added to provide additional natural ventilation. Should additional wood storage structures be required, there are locations throughout the site that are feasible to build on.

The oil boilers are located in a ground floor room that has limited access and no space for future biomass boilers or equipment. There are no other suitable locations inside the structure for biomass equipment. A detached biomass boiler module or addition is required. The existing wood boiler is located outside the structure near the mechanical room. The wood boiler structure could be demolished and replaced with a larger biomass boiler building.
The Miracle Lodge is built into a hill on the east side and is surrounded by a lake on the northern and western sides. This limits access to the north of the building. Due to these constraints, the proposed location of a new biomass boiler module is on the southern side of the building where the existing wood boiler is located. This location was used for the basis of estimate.

A site layout of the site constraints at Miracle Lodge is shown on the following page.

Figure 3 – Miracle Lodge Site Layout
4. Biomass System

Biomass System Options

Cordwood is currently the biomass heating fuel that is readily available at Victory Bible Camp and so a cordwood boiler system was selected as the preferred option for the Miracle Lodge. Additionally, the maintenance personnel are familiar with cord wood systems and thus minimal additional training would be required to operate the system. A Garn WHS-3200 wood boiler was selected as the basis of design.

The Garn WHS-3200 wood boiler has a 3,200-gallon water tank and is 7’-4” wide x 7’-8” high x 12’ long. The Garn boiler would be housed in a 10’ wide x 24’ long insulated building, that would be located in approximately the same location as the existing Econoburn wood boiler building. The boiler building would contain the Garn boiler, circulation pumps, piping, heat exchanger, electrical wiring, instrumentation and control panel. The manufacturer stated combustion efficiency of the Garn boiler is 85%. For this study, the Annual Fuel Utilization Efficiency for the Garn boiler is estimated at 80%, to account for heat loss in the system.

Using two smaller Garn WHS-2000 wood boilers is also an option, instead of a single WHS-3200. The benefit of using two WHS-2000 is that there is an extra unit in case one unit is down for service. However, the downsides are that the combined heat output of two WHS-2000 is less than a single WHS-3200; the foot print of the boiler building would need to be bigger; and more manual loading is needed because now two units need to be loaded and fired instead of one. The costs are comparable between the two. The WHS-3200 unit is $49,000. The WHS-2000 unit is $18,000/each, or $36,000 for two. Shipping costs, installation, foundation, and mechanical and electrical connections would be larger for two units.

Biomass System Integration

The Garn boiler creates heated water that would deliver heat to a heat exchanger inside the detached boiler building, which would transfer heat to a buried insulated piping loop system with 50% propylene glycol. This loop would deliver heat through a direct buried, insulated arctic pipe to the Miracle Lodge mechanical room and tie into the return side of the existing oil boiler. The buried piping run is a short
distance and so the risk of having a puncture in the buried piping is low, therefore a second heat exchanger in the Miracle Lodge mechanical room is not necessary. Not including a second heat exchanger will increase thermal performance. An injection pump would add heat from the Garn building heat exchanger to the oil boiler return piping.

By tying into the oil boiler return line, the wood boiler will be able minimize the firing of the oil boilers. In the event that the wood boiler cannot meet the heat demand of the building, the existing oil boilers will fire to provide the supplemental heat required. It is recommended that an aggressive outside temperature reset schedule on the oil boilers is used in order to maximize the utilization of the wood boiler. This allows the supply water temperature for the oil boilers to be set lower throughout the year, which allows the Garn unit to easily meet these water temperatures and deliver more heat to the lodge.

District Heating System

There are many other buildings on the Victory Bible Camp property. Most of the buildings are small seasonal cabins that are dispersed throughout the property, making them difficult to serve with a district heating system.

However, there is a group of larger buildings located to the south of the Miracle Lodge that could be candidates for a district heating system because they are relatively close together and are larger consumers of energy. These buildings are listed in the table below and shown in the following map.

<table>
<thead>
<tr>
<th>Map Number</th>
<th>Building</th>
<th>HVAC System</th>
<th>Heating Oil Usage (gal)</th>
<th>Cord Wood Usage (cords)</th>
<th>Equivalent amount of heating oil energy used if no wood is burned (gal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Miracle Lodge</td>
<td>Baseboard, Radiant, Convectors</td>
<td>4,500</td>
<td>120</td>
<td>18,300</td>
</tr>
<tr>
<td>19</td>
<td>Aspen</td>
<td>Baseboard</td>
<td>800</td>
<td></td>
<td>800</td>
</tr>
<tr>
<td>19A</td>
<td>Birch</td>
<td>Currently gutted and unoccupied</td>
<td>800</td>
<td></td>
<td>800</td>
</tr>
<tr>
<td>20</td>
<td>Cedar</td>
<td>Baseboard</td>
<td>700</td>
<td></td>
<td>700</td>
</tr>
<tr>
<td>21/22</td>
<td>Douglas</td>
<td>Baseboard</td>
<td>1,800</td>
<td></td>
<td>1,800</td>
</tr>
<tr>
<td>24</td>
<td>Spruce</td>
<td>Baseboard and Convector</td>
<td>1,500</td>
<td></td>
<td>1,500</td>
</tr>
<tr>
<td>27</td>
<td>Gym</td>
<td>Forced Air</td>
<td>500</td>
<td></td>
<td>500</td>
</tr>
<tr>
<td>25</td>
<td>Alder</td>
<td>Baseboard</td>
<td>800</td>
<td></td>
<td>800</td>
</tr>
<tr>
<td>31</td>
<td>Shop</td>
<td>Convector</td>
<td>20</td>
<td></td>
<td>2,300</td>
</tr>
<tr>
<td>30</td>
<td>Cranberry</td>
<td>Toyotomi Laser 56</td>
<td>150</td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>28</td>
<td>Raspberry</td>
<td>Toyotomi Laser 56</td>
<td>150</td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>29</td>
<td>Mossberry</td>
<td>Toyotomi Laser 56</td>
<td>15</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td></td>
<td><strong>11,715</strong></td>
<td><strong>140</strong></td>
<td><strong>27,815</strong></td>
</tr>
</tbody>
</table>

The challenge with this district system is that many of these buildings on the list are only used seasonally and have relatively low energy consumption compared to the Miracle Lodge. As can be seen, the Miracle Lodge consumes twice as much energy as all of the other buildings on the list combined.
Therefore, the most economical system will be to focus solely on the Miracle Lodge, which is the largest consumer of energy.

Rough calculations were completed to see what the viability of a district system would be. The district system would feed both the Miracle Lodge and the rest of the buildings in the table above. Assuming that the district heating plant could offset 90% of the heating oil use with cord wood (approximately 150 cords) the entire district heating and wood boiler project would need to cost less than $810,000 to be economically viable, with a benefit to cost ratio greater than 1.0. This is based on $250/cord and $2.55/gal of heating oil.

A district system would require interconnections to each building and adding new low temperature heat emitters at the buildings. It would require a large buried piping loop and circulation pumps.

Burning this quantity of wood with a Garn boiler system will require a lot of manual labor loading and storing wood. If a district system is wanted, then a wood chip boiler system may be a better option because it is an automated system with less manual work. However, a source of chips would be required, or Victory Bible Camp would need to chip their own. A large chip storage building would be needed. The footprint of the detached boiler building containing the chip boiler, augers, hoppers, pumps, and heat exchanger would be larger than the Garn system.
Based on these preliminary results, a viable district heating system might be possible but requires a much larger initial capital construction outlay and further engineering to develop a more detailed cost estimate of the project. Providing just a system for the Miracle Lodge captures the majority of the energy savings with a significantly smaller initial construction cost.
5. Energy Consumption and Costs

Energy Costs

The table below shows the energy comparison of different fuel types in the community. The system efficiency is used to calculate the delivered MMBTU’s of energy to the building. The delivered cost of energy to the building, in $/MMBTU, is the most accurate way to compare costs of different energy types. As shown below, cord wood is cheaper than fuel oil and electricity on a $/MMBTU basis at Victory Bible Camp.

<table>
<thead>
<tr>
<th>Community</th>
<th>Fuel Type</th>
<th>Units</th>
<th>Gross BTU/unit</th>
<th>System Efficiency</th>
<th>$/unit</th>
<th>Delivered $/MMBTU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victory Bible Camp</td>
<td>Cord Wood (Donated)</td>
<td>cord</td>
<td>18,200,000</td>
<td>80%</td>
<td>$90</td>
<td>$6.18</td>
</tr>
<tr>
<td></td>
<td>Cord Wood</td>
<td>cord</td>
<td>18,200,000</td>
<td>80%</td>
<td>$250</td>
<td>$17.17</td>
</tr>
<tr>
<td></td>
<td>Rejected Jet Fuel</td>
<td>gal</td>
<td>118,000</td>
<td>65%</td>
<td>$1.50</td>
<td>$19.56</td>
</tr>
<tr>
<td></td>
<td>Heating Oil</td>
<td>gal</td>
<td>134,000</td>
<td>65%</td>
<td>$2.55</td>
<td>$29.28</td>
</tr>
<tr>
<td></td>
<td>Electricity</td>
<td>kWh</td>
<td>3,412</td>
<td>99%</td>
<td>$0.18</td>
<td>$53.29</td>
</tr>
</tbody>
</table>

Wood Energy

The gross energy content of a cord of wood varies depending on tree species and moisture content. Victory Bible Camp typically burns birch at 20% moisture content which has an energy content of 18,200,000 BTU/cord, according to the UAF Cooperative Extension. Wet or greenwood has higher moisture contents and require additional heat to evaporate moisture before the wood can burn. Thus, wood with higher moisture contents will have lower energy content. Seasoned or dry wood will typically have 20% moisture content.

Another option to improve moisture content, depending on source of wood and allowable timing of harvesting, is to cut wood in the late fall after the sap has left the tree trunk. Tok has indicated that wood harvested this way has a much lower moisture content and thus does not require as much seasoning time for the wood to get to useable moisture contents.

Cord Wood

Victory Bible Camp has two sources of cord wood. The most expensive option is to buy cord wood for $250/cord from a local source. The lower cost option is to collect donated wood from recently cleared land in the area and using volunteers to cut the wood at the camp. The only cost to Victory Bible Camp is for the transportation of the donated wood, which is around $90/cord. Donated cord wood is not always available and so is not counted on as a reliable source each year. For this study, these two cord wood prices were evaluated.
Wood Pellets and Chips

There is no local wood pellet manufacturer or distributor in the area, which means that wood pellets would have to be trucked into the community. Therefore, wood pellet costs will be higher than the cord wood resources available.

Wood chips could be an option at Victory Bible Camp, however there is no local seller of wood chips. The VBC could chip their own wood, but would need to buy a wood chipper to do this.

Since VBC is already using cord wood for heating, and has the infrastructure and knowledge to use cord wood boilers, it is recommended that cord wood continue to be used. Donated cord wood represents the cheapest form of energy.

Rejected Jet Fuel

Occasionally, Victory Bible Camp has access to rejected jet fuel from a Ted Stevens Anchorage International Airport fuel distributor which is 118,000 BTU/gal and costs around $1.50/gal. This energy source is used whenever it is available because of its low cost. However, it is not always available and is not counted on for yearly budgeting.

Heating Oil

The high price of fuel oil is the main economic driver for the use of lower cost biomass heating. Fuel oil is currently purchased at $2.55/gal. The price of fuel oil has fluctuated greatly over time, and currently appears to be at a lower price than in the recent past. The wide variation of fuel oil prices is a disadvantage compared to more stably priced wood pellets. For this study, the energy content of fuel oil is based on 134,000 BTU/gal, according to “Heating Values of Fuels” by the UAF Cooperative Extension, 2009.

Electricity

Electricity for Victory Bible Camp is provided by the Matanuska Electric Association (MEA). The effective electricity rate at the camp is $0.18/kWh. The effective electricity rate is the cost of all electric costs (demand, energy, customer charges) per kWh for a billing period. On a BTU basis, electricity is the most expensive energy source. There are 3,412 BTU per kWh.
Existing Fuel Oil Consumption

The Miracle Lodge consumes approximately 4,500 gallons of heating oil and 120 cords of birch every year, based on data provided by VBC. For this analysis, it is assumed that the existing Econoburn wood boiler will be replaced. Therefore, the economics for the new Garn boiler will be based on the Miracle Lodge’s consumption of energy based on heating oil only. 120 cords of birch being combusted by the Econoburn boiler (at 55% efficiency) is approximately 13,800 gal of heating oil. The total estimated heating oil consumption of the Miracle Lodge, without any wood burning, is 18,300 gallons.

<table>
<thead>
<tr>
<th>Building</th>
<th>Fuel Type</th>
<th>Annual Consumption</th>
<th>Net MMBTU/yr</th>
<th>Avg. Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miracle Lodge</td>
<td>Heating Oil #2</td>
<td>18,300 gal</td>
<td>1593.9</td>
<td>$46,665</td>
</tr>
</tbody>
</table>

Biomass System Consumption

It is estimated that the proposed biomass system will offset approximately 97% of the heating energy for the building. The remaining 3% of the heating energy will be provided by the existing oil boilers. This result is based on an analysis of the building’s annual heating oil consumption, the heat output of the Garn boiler and BIN weather data for the area. During the winter it is assumed that the Garn WHS-3200 is loaded three times per day, which will produce around 300,000 BTU/hr, per manufacturer documentation. More frequent loading is possible, which will increase BTU output and allow additional heating oil offset during colder times of the year. The annual energy consumption and energy savings of the projects are shown in the following table.

<table>
<thead>
<tr>
<th>Building</th>
<th>Fuel Type</th>
<th>% Heating Source</th>
<th>Net MMBTU/yr</th>
<th>Annual Consumption</th>
<th>Energy Cost</th>
<th>Total Energy Cost</th>
<th>Annual Energy Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miracle Lodge</td>
<td>Cord Wood</td>
<td>97%</td>
<td>1546.1</td>
<td>106 cords</td>
<td>$26,547.25</td>
<td>$28,037</td>
<td>$18,628</td>
</tr>
<tr>
<td></td>
<td>Fuel Oil</td>
<td>3%</td>
<td>47.8</td>
<td>549 gal</td>
<td>$1,400</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Additional Electricity</td>
<td>N/A</td>
<td>N/A</td>
<td>500 kWh</td>
<td>$90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note – Based on cord wood at $250/cord, heating oil at $2.55/gal and electricity at $0.18/kWh.*
6. Preliminary Cost Estimating

An estimate of probable costs was completed for installing the wood boiler system at the Miracle Lodge. The estimate is based on equipment quotes and from previous projects in Alaska.

Two different estimates were completed. The first estimate is using a contractor for the work, which is typically done on most biomass related projects. The second estimate is using volunteer labor for construction. Victory Bible Camp has an impressive volunteer base that is capable of taking on construction projects such as this, per the facility director. Many of the volunteers are professionals that work in the construction industry.

A 5% remote factor was used to account for increased shipping costs. Project and Construction Management was estimated at 5%. Engineering design and permitting was estimated at 20% and a 25% contingency was used. A 25% contingency is used as no specific design engineering effort has been completed, specific quotes for all materials have not been prepared, and all the integration components have not been determined. Thus, there are unknowns related to the extent of Mechanical, Electrical, and Civil work required for the proposed project.

It should be noted that the Project and Construction Management could be completed by Victory Bible Camp in-house. This would further lower the cost of the project.

It is assumed that the existing wood boiler heat exchanger (located in the mechanical room) and existing below grade piping between the wood boiler and lodge will need to be replaced. During final engineering design the heat exchanger size and below grade pipe size may need to be resized to optimize the Garn boiler performance.
## Table 9 – Estimate of Probable Costs

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>With Volunteer Labor</th>
<th>Using Contractor Labor (No Volunteer Effort)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Work</td>
<td>Site Grading for Module</td>
<td>$0</td>
<td>$2,000</td>
</tr>
<tr>
<td></td>
<td>Foundation</td>
<td>$2,000</td>
<td>$5,000</td>
</tr>
<tr>
<td></td>
<td>Buried Utilities</td>
<td>$500</td>
<td>$1,200</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td><strong>$2,500</strong></td>
<td><strong>$8,200</strong></td>
</tr>
<tr>
<td>Electrical Utilities</td>
<td>Service Entrance</td>
<td>$1,000</td>
<td>$3,000</td>
</tr>
<tr>
<td></td>
<td>Conduit and Wiring</td>
<td>$1,000</td>
<td>$3,000</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td><strong>$2,000</strong></td>
<td><strong>$6,000</strong></td>
</tr>
<tr>
<td>Wood Boiler Module</td>
<td>Boiler Bldg 10 ft x 24 ft ($200/SF)</td>
<td>$15,000</td>
<td>$48,000</td>
</tr>
<tr>
<td></td>
<td>Garn Boiler WHS-3200</td>
<td>$49,900</td>
<td>$49,900</td>
</tr>
<tr>
<td></td>
<td>Interior Installation, Piping, Pump &amp; Materials</td>
<td>$10,000</td>
<td>$35,000</td>
</tr>
<tr>
<td></td>
<td>Heat Exchanger</td>
<td>$5,000</td>
<td>$7,000</td>
</tr>
<tr>
<td></td>
<td>Fire Alarm Allowance</td>
<td>$5,000</td>
<td>$7,000</td>
</tr>
<tr>
<td></td>
<td>Controls Allowance</td>
<td>$2,000</td>
<td>$4,000</td>
</tr>
<tr>
<td></td>
<td>Electrical Allowance</td>
<td>$2,500</td>
<td>$7,000</td>
</tr>
<tr>
<td></td>
<td>Shipping</td>
<td>$5,000</td>
<td>$6,500</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td><strong>$94,400</strong></td>
<td><strong>$164,400</strong></td>
</tr>
<tr>
<td>Building Connection</td>
<td>Insulated Piping from Module</td>
<td>$1,500</td>
<td>$4,500</td>
</tr>
<tr>
<td></td>
<td>Boiler Room Modifications</td>
<td>$2,500</td>
<td>$5,000</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td><strong>$4,000</strong></td>
<td><strong>$9,500</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal Material and Installation Cost</strong></td>
<td><strong>$102,900</strong></td>
<td><strong>$188,100</strong></td>
</tr>
<tr>
<td>Remote Factor</td>
<td>5%</td>
<td>$5,145</td>
<td>$9,405</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td><strong>$108,045</strong></td>
<td><strong>$197,505</strong></td>
</tr>
<tr>
<td>Project and Construction Management</td>
<td>5%</td>
<td>$5,402</td>
<td>$9,875</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td><strong>$113,447</strong></td>
<td><strong>$207,380</strong></td>
</tr>
<tr>
<td>Design Fees and Permitting</td>
<td>20%</td>
<td>$22,689</td>
<td>$41,476</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td><strong>$136,136</strong></td>
<td><strong>$248,856</strong></td>
</tr>
<tr>
<td>Contingency</td>
<td>25%</td>
<td>$34,034</td>
<td>$62,214</td>
</tr>
<tr>
<td></td>
<td><strong>Total Project Cost</strong></td>
<td><strong>$170,170</strong></td>
<td><strong>$311,070</strong></td>
</tr>
<tr>
<td><strong>Total Budgetary Cost</strong></td>
<td></td>
<td><strong>$171,000</strong></td>
<td><strong>$312,000</strong></td>
</tr>
</tbody>
</table>
7. Economic Analysis

The following assumptions were used to complete the economic analysis for this study.

<table>
<thead>
<tr>
<th>Table 10 – Discount and Escalation rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Discount Rate for Net Present Value Analysis</td>
</tr>
<tr>
<td>Wood Fuel Escalation Rate</td>
</tr>
<tr>
<td>Fossil Fuel Escalation Rate</td>
</tr>
<tr>
<td>Electricity Escalation Rate</td>
</tr>
<tr>
<td>O&amp;M Escalation Rate</td>
</tr>
</tbody>
</table>

The real discount rate, or minimum attractive rate of return, is 3.0\% and is the current rate used for all Life Cycle Cost Analysis by the Alaska Department of Education and Early Development. This is a typical rate used for completing economic analysis for public entities in Alaska. The escalation rates used for the wood, heating oil, electricity and O&M rates are based on rates used in previous Alaska Energy Authority funded biomass pre-feasibility studies.

A net present value analysis was completed using real dollars (constant dollars) and the real discount rate, as required per the Alaska Department of Education and Early Development Life Cycle Cost Analysis Handbook.

Even though Victory Bible Camp is not a part of the Alaska Department of Education and Early Development, the life cycle cost analysis handbook is still followed because it is a best practice.

**O&M Costs**

Non-fuel related operations and maintenance costs (O&M) were estimated at $600 per year. The estimate is based on annual maintenance time for Garn boiler system. For only the first two years of service, the maintenance cost is doubled to account for maintenance staff getting used to operating the new system.

**Definitions**

There are many different economic terms used in this study. A listing of all the terms with their definition is provided below for reference.
<table>
<thead>
<tr>
<th>Economic Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Capital Cost</td>
<td>This is the opinion of probable cost for designing and constructing the project.</td>
</tr>
<tr>
<td>Present Value of Project Benefits (20-year life)</td>
<td>The present value of all of the heating oil that would have been consumed by the existing heating oil-fired heating system, over a 20-year period.</td>
</tr>
<tr>
<td>Present Value of Operating Costs (20-year life)</td>
<td>The present value of all of the proposed biomass systems operating costs over a 20-year period. This includes wood fuel, additional electricity, and O&amp;M costs for the proposed biomass system and the heating oil required by the existing equipment to supply the remaining amount of heat to the building.</td>
</tr>
<tr>
<td>Benefit / Cost Ratio of Project (20-year life)</td>
<td>This is the benefit to cost ratio over the 20-year period. A project that has a benefit to cost ratio greater than 1.0 is economically justified. It is defined as follows: $\frac{PV(\text{Project Benefits}) - PV(\text{Operating Costs})}{\text{Project Capital Cost}}$ Where: $PV = \text{The present value over the 20-year period}$ Reference Sullivan, Wicks and Koelling, “Engineering Economy”, 14th ed., 2009, pg. 440, Modified B-C Ratio.</td>
</tr>
<tr>
<td>Net Present Value (20-year life)</td>
<td>This is the net present value of the project over a 20-year period. If the project has a net present value greater than zero, the project is economically justified. This quantity accounts for the project capital cost, project benefits and operating costs.</td>
</tr>
</tbody>
</table>
| Payback Period (Year Accumulated Cash Flow > Project Capital Cost) | The Payback Period is the number of years it takes for the accumulated cash flow of the project to be greater than or equal to the project capital cost. This quantity includes escalating energy prices and O&M rates. This quantity is calculated as follows: $\sum_{k=0}^{J} R_k$ Where: $J = \text{Year that the accumulated cash flow is greater than or equal to the Project Capital Cost.}$ $R_k = \text{Project Cash flow for the kth year.}$
Results

An economic analysis was completed to determine the simple payback, benefit to cost ratio, and net present value of the proposed cord wood boiler system at the Miracle Lodge. A Garn cord wood boiler system and heat exchanger would be located in a detached building and a heating loop would connect to the lodge’s mechanical room. The cord wood boiler would supplement heat for the existing oil boiler system.

Four scenarios were evaluated with two different project costs (contractor labor vs volunteer labor) and two different cord wood prices ($250/cord and $90/cord). All of the scenarios evaluated have benefit to cost ratios greater than 1.0. Any project with a benefit to cost ratio greater than 1.0 is considered economically justified, and therefore all of the scenarios are economically justified at this time.

The benefit to cost ratios range from 1.85 (using contractor labor and $250/cord) all the way to 5.14 (with volunteer labor and $90/cord). These are good economic numbers and show that this project is viable over many different variables.

The results are shown in the table below. Refer to Appendix B for the economic analysis spreadsheets for greater detail. (Note: values shown in red and parenthesis are negative numbers)

<table>
<thead>
<tr>
<th>Item</th>
<th>Scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Contractor Labor and $250/cord</td>
</tr>
<tr>
<td>Project Capital Cost</td>
<td>($312,000)</td>
</tr>
<tr>
<td>Present Value of Project Benefits (20-year life)</td>
<td>$1,094,450</td>
</tr>
<tr>
<td>Present Value of Operating Costs (20-year life)</td>
<td>($516,134)</td>
</tr>
<tr>
<td>Benefit / Cost Ratio of Project (20-year life)</td>
<td>1.85</td>
</tr>
<tr>
<td>Net Present Value (20-year life)</td>
<td>$266,316</td>
</tr>
<tr>
<td>Year Cash Flow is Net Positive</td>
<td>First Year</td>
</tr>
<tr>
<td>Payback Period (Year Accumulated Cash Flow &gt; Project Capital Cost)</td>
<td>13 years</td>
</tr>
</tbody>
</table>
Sensitivity Analysis

A sensitivity analysis was completed to show how changing heating oil prices, cord wood prices and project costs affect the benefit to cost (B/C) ratios of the project. As heating oil costs increase and wood costs decrease, the project becomes more economically viable. The B/C ratios greater than 1.0 are economically justified and are highlighted in green. B/C ratios less than 1.0 are not economically justified and are highlighted in orange.

As can be seen from the tables below, the project is economically viable over a wide range of variables.

<table>
<thead>
<tr>
<th>Table 13 – Sensitivity Analysis – Heating Oil Price vs Cord Wood Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/C Ratios</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Heating Oil Cost</td>
</tr>
<tr>
<td>$2.00/gal</td>
</tr>
<tr>
<td>$2.25/gal</td>
</tr>
<tr>
<td>$2.50/gal</td>
</tr>
<tr>
<td>$2.75/gal</td>
</tr>
<tr>
<td>$3.00/gal</td>
</tr>
<tr>
<td>$3.25/gal</td>
</tr>
<tr>
<td>$3.50/gal</td>
</tr>
<tr>
<td>$3.75/gal</td>
</tr>
<tr>
<td>$4.00/gal</td>
</tr>
<tr>
<td>$4.25/gal</td>
</tr>
<tr>
<td>$4.50/gal</td>
</tr>
</tbody>
</table>

Note: Based on project cost of $312,000.

<table>
<thead>
<tr>
<th>Table 14 – Sensitivity Analysis – Cord Wood Price vs Project Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/C Ratios</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Cord Wood Price</td>
</tr>
<tr>
<td>$90/cord</td>
</tr>
<tr>
<td>$100/cord</td>
</tr>
<tr>
<td>$150/cord</td>
</tr>
<tr>
<td>$200/cord</td>
</tr>
<tr>
<td>$250/cord</td>
</tr>
<tr>
<td>$300/cord</td>
</tr>
<tr>
<td>$350/cord</td>
</tr>
<tr>
<td>$400/cord</td>
</tr>
<tr>
<td>$450/cord</td>
</tr>
</tbody>
</table>

Note: Based on heating oil price of $2.55/gal.
8. Forest Resource and Fuel Availability Assessments

Fuel Availability

For this study, there are two sources of cord wood. The first is to buy cord wood from Valley Firewood that delivers cord wood by truck (www.valleyfirewoodak.com). The second is donated wood from the clearing of raw land on the Parks Highway. There appears to be adequate cord wood available in the area. No further forest resource assessments were obtained.

Air Quality Permitting

Currently, air quality permitting is regulated according to the Alaska Department of Environmental Conservation Section 18 AAC 50 Air Quality Control regulations. Per these regulations, a minor air quality permit is required if a new wood boiler or wood stove produces one of the following conditions per Section 18 AAC 50.502 (C)(1): 40 tons per year (TPY) of carbon dioxide (CO2), 15 TPY of particulate matter greater than 10 microns (PM-10), 40 TPY of sulfur dioxide, 0.6 TPY of lead, 100 TPY of carbon monoxide within 10 kilometers of a carbon monoxide nonattainment area, or 10 TPY of direct PM-2.5 emissions. These regulations assume that the device will operate 24 hours per day, 365 days per year and that no fuel burning equipment is used. If a new wood boiler or wood stove is installed in addition to a fuel burning heating device, the increase in air pollutants cannot exceed the following per AAC 50.502 (C)(3): 10 TPY of PM-10, 10 TPY of sulfur dioxide, 10 TPY of nitrogen oxides, 100 TPY of carbon monoxide within 10 kilometers of a carbon monoxide nonattainment area, or 10 TPY of direct PM-2.5 emissions. Per the Wood-fired Heating Device Visible Emission Standards (Section 18 AAC 50.075), a person may not operate a wood-fired heating device in a manner that causes black smoke or visible emissions that exceed 50 percent opacity for more than 15 minutes in any hour in an area where an air quality advisory is in effect.

From Coffman’s discussions with Patrick Dunn at the Alaska Department of Environmental Conservation, these regulations are focused on permitting industrial applications of wood burning equipment. In his opinion, it would be unlikely that an individual wood boiler would require an air quality permit unless several boilers were to be installed and operated at the same site. If several boilers were installed and operated together, the emissions produced could be greater than 40 tons of CO2 per year. This would require permitting per AAC 50.502 (C)(1) or (C)(3). Permitting would not be required on the residential wood fired stoves unless they violated the Wood-fired Heating Device Visible Emission Standards (Section 18 AAC 50.075). Recent similarly sized Garn wood fired boiler systems installed in Alaska have not required air quality permits.
9. General Biomass Technology Information

Heating with Wood Fuel

Wood fuels are among the most cost-effective and reliable sources of heating fuel for communities adjacent to forestland when the wood fuels are processed, handled, and combusted appropriately. Compared to other heating energy fuels, such as oil and propane, wood fuels typically have lower energy density and higher associated transportation and handling costs. Due to this low bulk density, wood fuels have a shorter viable haul distance when compared to fossil fuels. This short haul distance also creates an advantage for local communities to utilize locally-sourced wood fuels, while simultaneously retaining local energy dollars.

Most communities in rural Alaska are particularly vulnerable to high energy prices due to the large number of heating degree days and expensive shipping costs. For many communities, wood-fueled heating can lower fuel costs. For example, cordwood sourced at $250 per cord is just 25% of the cost per MMBTU as #1 fuel oil sourced at $7 per gallon. In addition to the financial savings, the local communities also benefit from the multiplier effect of circulating energy dollars within the community longer, more stable energy prices, job creation, and more active forest management.

The local cordwood market is influenced by land ownership, existing forest management and ecological conditions, local demand and supply, and the State of Alaska Energy Assistance program.

Types of Wood Fuel

Wood fuels are specified by energy density, moisture content, ash content, and granulometry. Each of these characteristics affects the wood fuel’s handling characteristics, storage requirements, and combustion process. Higher quality fuels have lower moisture, ash, dirt, and rock contents, consistent granulometry, and higher energy density. Different types of fuel quality can be used in wood heating projects as long as the infrastructure specifications match the fuel content characteristics. Typically, lower quality fuel will be the lowest cost fuel, but it will require more expensive storage, handling, and combustion infrastructure, as well as additional maintenance.

Projects in rural Alaska must be designed around the availability of wood fuels. Some fuels can be harvested and manufactured on site, such as cordwood, woodchips, and briquettes. Wood pellets can also be used, but typically require a larger scale pellet manufacturer to make them. The economic feasibility of manufacturing on site is determined by a financial assessment of the project. Typically, larger projects offer more flexibility in terms of owning and operating the wood harvesting and manufacturing equipment, such as a wood chipper, splitter, or equipment to haul wood out of forest, than smaller projects.
**High Efficiency Wood Pellet Boilers**

High efficiency pellet boilers are designed to burn wood pellets cleanly and efficiently. These boilers utilize pellet storage bins or silos that hold a large percentage of the building's annual pellet supply. Augers or vacuums transfer pellets from the silos to a pellet hopper adjacent to the pellet boiler, where pellets can be fed into the boiler for burning. Pellets are automatically loaded into the pellet boiler and do not require manual loading such as in a Garn cordwood boiler. The pellet boilers typically have a 3 to 1 turn down ratio, which allows the firing rate to modulate from 100% down to 33% fire. This allows the boiler to properly match building heat demand, increasing boiler efficiency. The efficiencies of these boilers can range from 85% to 92% efficiency depending on firing rate.

**High Efficiency Cordwood Boilers**

High Efficiency Low Emission (HELE) cordwood boilers are designed to burn cordwood fuel cleanly and efficiently. The boilers use cordwood that is typically seasoned to 25% moisture content (MC) or less and meet the dimensions required for loading and firing. The amount of cordwood burned by the boiler will depend on the heat load profile of the building and the utilization of the fuel oil system as back up. Two HELE cordwood boiler suppliers include Garn (www.garn.com) and TarmUSA (www.woodboilers.com). Both of these suppliers have units operating in Alaska. TarmUSA has a number of residential units operating in Alaska and has models that range between 100,000 to 300,000 BTU/hr. Garn boilers, manufactured by Dectra Corporation, are used in Tanana, Kasilof, Dot Lake, Thorne Bay, Coffman Cove and other locations to heat homes, washaterias, schools, and community buildings.

The Garn boiler has a unique construction, which is basically a wood boiler housed in a large water tank. Garn boilers come in several sizes and are appropriate for facilities using 100,000 to 1,000,000 BTUs per hour. The jacket of water surrounding the fire box absorbs heat and is piped into buildings via a heat exchanger, and then transferred to an existing building heating system, in-floor radiant tubing, unit heaters, or baseboard heaters. In installations where the Garn boiler is in a detached building, there are additional heat exchangers, pumps and a glycol circulation loop that are necessary to transfer heat to the building while allowing for freeze protection. Radiant floor heating is the most efficient heating method when using wood boilers such as Garns, because they can operate using lower supply water temperatures compared to baseboards.

Garn boilers are approximately 87% efficient and store a large quantity of water. For example, the Garn WHS-2000 holds approximately 1,825 gallons of heated water. Garns also produce virtually no smoke when at full burn, because of a primary and secondary gasification (2,000 °F) burning process. Garns are manually stocked with cordwood and can be loaded multiple times a day during periods of high heating demand. Garns are simple to operate with only three moving parts: a handle, door and blower. Garns produce very little ash and require minimal maintenance. Removing ash and inspecting fans are typical maintenance requirements. Fans are used to produce a draft that increases combustion temperatures and boiler efficiency. In cold climates, Garns can be equipped with exterior insulated storage tanks for extra hot water circulating capacity. Most facilities using cordwood boilers keep existing oil-fired systems operational to provide heating backup during biomass boiler downtimes and to provide additional heat for peak heating demand periods.

**Low Efficiency Cordwood Boilers**

Outdoor boilers are categorized as low-efficiency, high emission (LEHE) systems. These boiler systems are not recommended as they produce significant emission issues and do not combust wood fuels efficiently
or completely, resulting in significant energy waste and pollution. These systems require significantly more wood to be purchased, handled and combusted to heat a facility as compared to a HELE system. Additionally, several states have placed a moratorium on installing LEHE boilers because of air quality issues (Washington). These LEHE systems can have combustion efficiencies as low as 25% percent and produce more than nine times the emission rate of standard industrial boilers. In comparison, HELEs can operate around 87% efficiency.

**High Efficiency Wood Stoves**

Newer high efficiency wood stoves are available on the market that produce minimal smoke, minimal ash and require less firewood. New EPA-certified wood stoves produce significantly less smoke than older uncertified wood stoves. High efficiency wood stoves are easy to operate with minimal maintenance compared to other biomass systems. The Blaze King Classic high efficiency wood stove ([www.blazeking.com](http://www.blazeking.com)) is a recommended model, due to its built-in thermostats that monitor the heat output of the stove. This stove automatically adjusts the air required for combustion. This unique technology, combined with the efficiencies of a catalytic combustor with a built-in thermostat, provides the longest burn times of any wood stove. The Blaze King stove allows for optimal combustion and less frequent loading and firing times.

**Bulk Fuel Boilers**

Bulk fuel boilers usually burn wood chips, sawdust, bark or pellets and are designed around the wood resources that are available from the local forests or local industry. Several large facilities in Tok, Craig, and Delta Junction (Delta Greely High School) are using bulk fuel biomass systems. Tok uses a commercial grinder to process woodchips. The chips are then dumped into a bin and are carried by a conveyor belt to the boiler. The wood fuel comes from timber scraps, local sawmills and forest thinning projects. The Delta Greely High School has a woodchip bulk fuel boiler that heats the 77,000 square foot facility. The Delta Greely system, designed by Coffman engineers, includes a completely separate boiler building which includes a chip storage bunker and space for storage of tractor trailers full of chips (so handling of frozen chips could be avoided). Woodchips are stored in the concrete bunker and augers move the material on a conveyor belt to the boilers.

**Grants and Financing**

There are state, federal, and local grant opportunities for biomass work for feasibility studies, design and construction. If a project is pursued, a thorough search of websites and discussions with the AEA Biomass group is recommended to make sure no possible funding opportunities are missed. Below are some funding opportunities and existing past grants that have been awarded.

The U.S. Department of Agriculture Rural Development has over fifty financial assistance programs for a variety of rural applications. This includes energy efficiency and renewable energy programs.


The city of Nulato was awarded a $40,420 grant for engineering services for a wood energy project by the United States Department of Agriculture (USDA) and the United States Forest Service. Links regarding the award of the Woody Biomass Utilization Project recipients are shown below:

Delta Junction was awarded a grant for engineering from the Alaska Energy Authority from the Renewable Energy Fund for $831,203. This fund provides assistance to utilities, independent power producers, local governments, and tribal governments for feasibility studies, reconnaissance studies, energy resource monitoring, and work related to the design and construction of eligible facilities.

http://www.akenergyauthority.org/Programs/RenewableEnergyFund

The Alaska Wood Energy Development Task Group (AWEDTG) consists of a coalition of federal and state agencies and not-for-profit organizations that have signed a Memorandum of Understanding (MOU) to explore opportunities to increase the utilization of wood for energy and biofuels production in Alaska. A pre-feasibility study for Aleknagik was conducted in 2012 for the AWEDTG. The preliminary costs for the biomass system(s) are $346,257 for the city hall and health center system and $439,096 for the city hall, health center, and future washateria system.

http://www.akenergyauthority.org/Programs/AEEE/Biomass

The Emerging Energy Technology Fund grand program provides funds to eligible applicants for demonstrations projects of technologies that have a reasonable expectation to be commercially viable within five years and that are designed to: test emerging energy technologies or methods of conserving energy, improve an existing energy technology, or deploy an existing technology that has not previously been demonstrated in Alaska.

http://www.akenergyauthority.org/Programs/EETF1

The U.S. Forest Service also has grants available, such as the Wood Innovation Program. In 2018, there was $8 million of grant money available to communities to expand and accelerate wood products and wood energy markets.


Department of Energy (DOE) funding options can be accessed at these links:

https://www.energy.gov/energy-economy/funding-financing
https://www.energy.gov/eere/wipo/energy-efficiency-and-conservation-block-grant-program
https://www.energy.gov/eere/funding/apply-eere-funding-opportunities
https://archive.epa.gov/greenbuilding/web/html/funding.html#general

Also, the Alaska Housing Finance Corporation (AHFC) and DOE have revolving loan funds that can be used for energy improvements.

https://www.energy.gov/savings/energy-efficiency-revolving-loan-fund-program

Finally, clean energy grant programs in Alaska can be found at:
http://programs.dsireusa.org/system/program?fromSir=0&state=AK
Appendix A
Site Photos
Miracle Lodge

1. West Elevation of Building
2. South Elevation of Building
3. North Elevation of Building
4. North Elevation of Building Opposite Side
5. East Elevation of Building
6. Emergency Generator
<table>
<thead>
<tr>
<th>7.</th>
<th>Existing Econoburn Wood Boiler</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.</td>
<td>Fuel Oil Boiler</td>
</tr>
<tr>
<td>9.</td>
<td>Used Oil Boilers</td>
</tr>
<tr>
<td>10.</td>
<td>Hot Water Heater</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>11.</td>
<td>Hydronic Pumps</td>
</tr>
<tr>
<td>12.</td>
<td>Electrical Panels in Mechanical/Electrical Room</td>
</tr>
<tr>
<td>13.</td>
<td>Switchgear in Mechanical/Electrical Room</td>
</tr>
<tr>
<td>14.</td>
<td>Electrical Panels in Mechanical/Electrical Room</td>
</tr>
</tbody>
</table>
Appendix B
Economic Analysis Spreadsheets
### Economic Analysis Results

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit Cost</th>
<th>Heating Source Proportion</th>
<th>Annual Energy</th>
<th>Total Cost</th>
<th>Sterling 1</th>
<th>Sterling 2</th>
<th>Sterling 3</th>
<th>Sterling 4</th>
<th>Total Cost</th>
<th>Total Cost</th>
<th>Total Cost</th>
<th>Total Cost</th>
<th>Total Cost</th>
<th>Total Cost</th>
<th>Total Cost</th>
<th>Total Cost</th>
<th>Total Cost</th>
<th>Total Cost</th>
<th>Total Cost</th>
<th>Total Cost</th>
<th>Total Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fossil Fuel</td>
<td>$2.55</td>
<td>3%</td>
<td>549 gal</td>
<td>($1,400)</td>
<td>($1,470)</td>
<td>($1,543)</td>
<td>($1,621)</td>
<td>($1,702)</td>
<td>($1,787)</td>
<td>($1,876)</td>
<td>($1,970)</td>
<td>($2,068)</td>
<td>($2,172)</td>
<td>($2,280)</td>
<td>($2,394)</td>
<td>($2,514)</td>
<td>($2,640)</td>
<td>($2,772)</td>
<td>($2,910)</td>
<td>($3,056)</td>
<td>($3,209)</td>
<td>($3,369)</td>
</tr>
<tr>
<td>Additional Electricity</td>
<td>$0.18</td>
<td>500 kWh</td>
<td>($90)</td>
<td>($93)</td>
<td>($95)</td>
<td>($98)</td>
<td>($101)</td>
<td>($104)</td>
<td>($107)</td>
<td>($111)</td>
<td>($114)</td>
<td>($117)</td>
<td>($121)</td>
<td>($125)</td>
<td>($128)</td>
<td>($132)</td>
<td>($136)</td>
<td>($140)</td>
<td>($144)</td>
<td>($149)</td>
<td>($153)</td>
<td>($158)</td>
</tr>
<tr>
<td>Additional Operation and Maintenance Costs for first 2 years</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>Total Operating Cost</td>
<td>$29,190</td>
<td>$29,817</td>
<td>$29,834</td>
<td>$30,478</td>
<td>$31,137</td>
<td>$31,812</td>
<td>$32,503</td>
<td>$33,210</td>
<td>$33,934</td>
<td>$34,676</td>
<td>$35,436</td>
<td>$36,214</td>
<td>$37,012</td>
<td>$37,829</td>
<td>$38,666</td>
<td>$39,524</td>
<td>$40,403</td>
<td>$41,304</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Payback Value</td>
<td>($295,034)</td>
<td>($276,953)</td>
<td>($257,173)</td>
<td>($236,256)</td>
<td>($214,186)</td>
<td>($190,949)</td>
<td>($166,530)</td>
<td>($140,911)</td>
<td>($114,078)</td>
<td>($86,014)</td>
<td>($56,700)</td>
<td>($26,121)</td>
<td>$5,742</td>
<td>$38,907</td>
<td>$73,392</td>
<td>$109,218</td>
<td>$146,403</td>
<td>$184,967</td>
<td>$224,931</td>
<td>$266,316</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Victory Bible Camp**

**Sutton, Alaska**

**Project Capital Cost**

($312,000)

**Present Value of Project Benefits (20-year life)**

$1,094,450

**Present Value of Operating Costs (20-year life)**

($516,134)

**Benefit / Cost Ratio of Project (20-year life)**

1.85

**Net Present Value (20-year life)**

$266,316

**Year Accumulated Cash Flow is Net Positive**

First Year

**Payback Period (Year Accumulated Cash Flow > Project Capital Cost)**

13 years

**Discount Rate for Net Present Value Analysis**

3%

**Wood Fuel Escalation Rate**

2%

**Fossil Fuel Escalation Rate**

5%

**Electricity Escalation Rate**

3%

**O&M Escalation Rate**

2%
Appendix C
AWEDTG Field Data Sheets
# ALASKA WOOD ENERGY DEVELOPMENT TASK GROUP (AWEDTG)

## PRE-FEASIBILITY ASSESSMENT FIELD DATA SHEET

### APPLICANT:

**Victory Bible Camp**

- Local government
- State agency
- Federal agency
- School/School District
- Federally Recognized Tribe
- Regional ANCSA Corp.
- Village ANCSA Corp.
- Not-for-profit organization
- Private Entity that can demonstrate a Public Benefit
- Other (describe):

### Contact Name:

**Evan Busenitz**

### Mailing Address:

64741 S Victory Rd

### City:

**Sutton**

### State:

**AK**

### Zip Code:

**99674**

### Office phone:

(907) 745-4203

### Cell phone:

( )

### Fax:

(907)

### Email:

evanb@vbsalaska.org

### Facility Identification/Name:

**Same as above**

### Facility Contact Person:

### Facility Contact Telephone:

(907) ( )

### Facility Contact Email:

---

## SCHOOL/FACILITY INFORMATION (complete separate Field Data Sheet for each building)

### SCHOOL FACILITY (Name: ____________________________ )

<table>
<thead>
<tr>
<th>School Type: (check all that apply)</th>
<th>[ ] Pre-School</th>
<th>[ ] Junior High</th>
<th>[ ] Student Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ] Elementary</td>
<td>[ ] High School</td>
<td>[ ] Pool</td>
</tr>
<tr>
<td></td>
<td>[ ] Middle School</td>
<td>[ ] Campus</td>
<td>[ ] Gymnasium</td>
</tr>
<tr>
<td></td>
<td>[ ] Other (describe):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size of facility (sq. ft. heated):</th>
<th>Year built/age:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of floors:</th>
<th>Year(s) renovated:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of bldgs.:</th>
<th>Next renovation:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th># of Students:</th>
<th>Has an energy audit been conducted?</th>
<th>If Yes, when?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### OTHER FACILITY (Name: ____________ )

<table>
<thead>
<tr>
<th>Type: (check all that apply)</th>
<th>[ ] Health Clinic</th>
<th>[ ] Water Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ ] Public Safety Bldg.</td>
<td>[ ] Washerteria</td>
</tr>
<tr>
<td></td>
<td>[ ] Community Center</td>
<td>[ ] Public Housing</td>
</tr>
<tr>
<td></td>
<td>[ ] Multi-Purpose Bldg</td>
<td>[ ] District Energy System</td>
</tr>
<tr>
<td></td>
<td>[ ] Other (list):</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size of Facility (sq. ft. heated):</th>
<th>Year built/age:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,002</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of floors:</th>
<th>Year(s) renovated:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of bldgs.:</th>
<th>Next renovation:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency of Usage:</th>
<th># of Occupants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year Round</td>
<td>320</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Has an energy audit been conducted?</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If Yes, when? *</td>
<td></td>
</tr>
</tbody>
</table>

* If an Energy Audit has been conducted, please provide a copy.
HEATING SYSTEM INFORMATION

CONFIGURATION (check all that apply)

☐ Heat plant in one location: ☐ on ground level ☐ below ground level ☐ mezzanine ☐ roof ☐ at least 1 exterior wall
☐ Different heating plants in different locations: How many? ☐ 2 ☐ What level(s)? ☐ 1
☐ Individual room-by-room heating systems (space heaters)
☐ Is boiler room accessible to delivery trucks? ☐ Yes ☐ No

HEAT DELIVERY (check all that apply)

☐ Hot water: ☐ baseboard ☐ radiant heat floor ☐ cabinet heaters ☐ air handlers ☐ radiators ☐ other: ☐
☐ Steam: ☐
☐ Forced/ducted air
☐ Electric heat: ☐ resistance ☐ boiler ☐ heat pump(s)
☐ Space heaters

HEAT GENERATION (check all that apply)

☐ Hot water boiler: ☐ natural gas ☐ propane ☐ electric ☐ #1 fuel oil ☐ #2 fuel oil
☐ Steam boiler: ☐ natural gas ☐ propane ☐ electric ☐ #1 fuel oil ☐ #2 fuel oil
☐ Warm air furnace: ☐ natural gas ☐ propane ☐ electric ☐ #1 fuel oil ☐ #2 fuel oil
☐ Electric resistance: ☐ baseboard ☐ duct coils
☐ Heat pumps: ☐ air source ☐ ground source ☐ sea water
☐ Space heaters: ☐ woodstove ☐ Toyo/Monitor ☐ other: ☐

Heating capacity (Btu/h) | Annual Fuel Consumption | Cost
---|---|---
2,176,000 | 4500 Gallons | $7.53/gal

TEMPERATURE CONTROLS (type of system; check all that apply)

☒ Thermostats on individual devices/appliances; no central control system
☐ Pneumatic control system Manufacturer: ☐ ☐ Approx. Age: ☐
☐ Direct digital control system Manufacturer: ☐ ☐ Approx. Age: ☐

Record Name Plate data for boilers (use separate sheet if necessary):

Well: Murala | rated 1,771,720 Btu/h
3,988 | New Nov 2010 1,000,000 Btu/h

Describe locations of different parts of the heating system and what building areas are served:
components are in Mechanical Room. System only serves Minne Ledge

Describe age and general condition of existing equipment:

Functional Equipment

Who performs boiler maintenance? Evan Bogonita & Team Describe any current maintenance issues:

Where is piping or ducting routed through the building? (tunnels, utilidors, crawlspace, above false ceiling, attc, etc.):

Crawlspace, above ceiling

Describe on-site fuel storage: Number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.:

Four Fuel tanks on site 3,000 gal in Fuel Room.

If this fuel is also used for other purposes, please describe: Only for heating
DOMESTIC HOT WATER

USES OF DOMESTIC HOT WATER
Check all that apply:

☐ Lavatories
☐ Kitchen
☐ Showers
☐ Laundry
☐ Water treatment
☐ Other: ____________________________

TYPE OF SYSTEM
Check all that apply:

☐ Direct-fired, single tank
☐ Direct fired, multiple tanks
☐ Indirect, using heating boiler with separate storage tank
☐ Hot water generator with separate storage tank
☐ Other: ____________________________

What fuels are used to generate hot water? (Check all that apply):
☐ natural gas
☐ propane
☐ electric
☐ #1 fuel oil
☐ #2 fuel oil

Describe location of water heater(s): Mechanical Room

Describe on-site fuel storage: number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.:
4 tanks, Fuel Storage Room.

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): Stick Frame
Insulation Value: R-19

Roof type: Composition Shingles
Insulation Value: R-38

Windows: ☐ single pane ☑ double pane ☐ other:

Artic entry(s): ☑ none ☐ at main entrance only ☐ at multiple entrances ☐ at all entrances

Drawings available: ☑ architectural ☑ mechanical ☑ electrical

Outside Air/Air Exchange: ☑ HRV ☐ CO2 Sensor

ELECTRICAL

Utility company that serves the building or community: MEA

Type of grid: ☑ building stand-alone ☑ village/community power ☑ railbelt grid

Energy source: ☑ hydropower ☑ diesel generator(s) ☑ Other: Natural Gas

Electricity rate per kWh: $0.18 Demand charge: __________

Electrical energy phase(s) available: ☑ single phase ☐ 3-phase

Back-up generator on site? Yes ☐ No ☑ If Yes, provide output capacity: 60 Kw

Are there spare circuits in MDP and/or electrical panel?: Yes ☐ No

Record MDP and electrical panel name plate information: See photos

WOOD FUEL INFORMATION

- Wood pellet cost delivered to facility $________/ton Viable fuel source? Yes ☐ No
- Wood chip cost delivered to facility $________/ton Viable fuel source? Yes ☐ No
- Cord wood cost delivered to facility $250/cord Viable fuel source? Yes ☑ No
- Distance to nearest wood pellet and wood chip suppliers: Fairbanks
- Can logs or wood fuel be stockpiled on site or at a nearby facility? Yes

FACILITY SITE CONSIDERATIONS

Is there good access to site for delivery vehicles (trucks, chip vans, etc.)?
Yes

Are there any significant site constraints? (Playgrounds, other buildings, wetlands, underground utilities, etc.)?
Between two lakes. Structure is on a grade.

What are local soil conditions? Permafrost issues? Gravel. No permafrost.

Is the building in proximity to other buildings with biomass potential? If so, Which ones and How close?
Yes. South loop has biomass potential. Approx 400'-450' away.

Can building accommodate a biomass boiler inside, or would an addition for a new boiler be necessary? Where would addition go?
Addition located on existing boiler structure.

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from?
Current site supports additional utilities.

If necessary, can piping be run underground from a central plant to the building? Where would piping enter boiler room?
Possibility for underground piping.

OTHER INFORMATION

Provide any other information that will help describe the space heating and domestic hot water systems, such as

Is heat distribution system looping or branching?
For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot?

Any other energy using systems (kitchen equipment, lab equipment, pool etc.)? Fuel or energy source?

Any systems that could be added to the boiler system?

Are heating fuel records available?

PICTURE / VIDEO CHECKLIST

Exterior
Main entry
Building elevations
Several near boiler room and where potential addition/wood storage and/or exterior piping may enter the building
Access road to building and to boiler room
Power poles serving building
Electrical service entry
Emergency generator

Interior
Boilers, pumps, domestic water heaters, heat exchangers – all mechanical equipment in boiler room and in other parts of the building.
Boiler room piping at boiler and around boiler room
Piping around domestic water heater
MDP and/or electrical panels in or around boiler room
Pictures of available circuits in MDP or electrical panel (open door).
Picture of circuit card of electrical panel
Picture of equipment used to heat room in the building (i.e. baseboard fin tube, unit heaters, unit ventilators, air handler, fan coil)
Pictures of any other major mechanical equipment
Pictures of equipment using fuel not part of heating or domestic hot water system (kitchen equip., lab equip., pool, etc.)
Pictures of building plans (site plan, architectural floor plan, mechanical plan, boiler room plan, electrical power plan)
**APPLICANT:** Victory Bible Camp  

**Eligibility:** (check one)  
- [ ] Local government  
- [ ] State agency  
- [ ] Federal agency  
- [ ] School/School District  
- [ ] Federally Recognized Tribe  
- [ ] Regional ANCSA Corp.  
- [ ] Village ANCSA Corp.  
- [X] Not-for-profit organization  
- [ ] Private Entity that can demonstrate a Public Benefit  
- [ ] Other (describe):  

**Contact Name:** Evan Bisenitz  
**Mailing Address:** 4741 S Victory Rd  
**City:**  
**State:** AK  
**Zip Code:** 99674  
**Office phone:** (907) 475-4203  
**Cell phone:** ( )  
**Fax:** (907)  
**Email:**  

**Facility Identification/Name:** Same as above  
**Facility Contact Person:**  
**Facility Contact Telephone:** (907)  
**Facility Contact Email:**  

**SCHOOL/FACILITY INFORMATION** (complete separate Field Data Sheet for each building)  

**SCHOOL FACILITY** (Name: Spruce)  

<table>
<thead>
<tr>
<th>School Type:</th>
<th>Pre-School</th>
<th>Elementary</th>
<th>Middle School</th>
<th>Junior High</th>
<th>High School</th>
<th>Campus</th>
<th>Student Housing</th>
<th>Pool</th>
<th>Gymnasium</th>
<th>Other (describe):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size of facility (sq. ft. heated):</th>
<th>Year built/age:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of floors:</td>
<td>Year(s) renovated:</td>
</tr>
<tr>
<td>Number of bldgs.:</td>
<td>Next renovation:</td>
</tr>
<tr>
<td># of Students:</td>
<td>Has an energy audit been conducted?:</td>
</tr>
</tbody>
</table>

**OTHER FACILITY** (Name: Spruce)  

<table>
<thead>
<tr>
<th>Type:</th>
<th>Health Clinic</th>
<th>Public Safety Bldg.</th>
<th>Community Center</th>
<th>Water Plant</th>
<th>Washeteria</th>
<th>Public Housing</th>
<th>Multi-Purpose Bldg</th>
<th>District Energy System</th>
<th>Other (list):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size of Facility (sq. ft. heated):</th>
<th>Year built/age:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of floors:</td>
<td>Year(s) renovated:</td>
</tr>
<tr>
<td>Number of bldgs.:</td>
<td>Next renovation:</td>
</tr>
<tr>
<td>Frequency of Usage:</td>
<td># of Occupants</td>
</tr>
<tr>
<td>Has an energy audit been conducted?:</td>
<td>If Yes, when? *</td>
</tr>
</tbody>
</table>

* If an Energy Audit has been conducted, please provide a copy.
HEATING SYSTEM INFORMATION

CONFIGURATION (check all that apply)

- ☑ Heat plant in one location: ☐ on ground level ☐ below ground level ☐ mezzanine ☐ roof ☐ at least 1 exterior wall
- ☑ Different heating plants in different locations. How many? _________ What level(s)? _______________________
- ☑ Individual room-by-room heating systems (space heaters)
- ☑ Is boiler room accessible to delivery trucks? ☐ Yes ☐ No

HEAT DELIVERY (check all that apply)

- ☐ Hot water: ☐ baseboard ☐ radiant heat floor ☐ cabinet heaters ☐ air handlers ☐ radiators ☐ other: __________________________
- ☑ Steam: __________________________
- ☐ Forced/ducted air
- ☑ Electric heat: ☐ resistance ☐ boiler ☐ heat pump(s)
- ☑ Space heaters

HEAT GENERATION (check all that apply)

- ☑ Hot water boiler: ☐ natural gas ☐ propane ☐ electric ☐ #1 fuel oil ☐ #2 fuel oil
- ☑ Steam boiler: ☐ natural gas ☐ propane ☐ electric ☐ #1 fuel oil ☐ #2 fuel oil
- ☑ Warm air furnace: ☐ natural gas ☐ propane ☐ electric ☐ #1 fuel oil ☐ #2 fuel oil
- ☑ Electric resistance: ☐ baseboard ☐ duct coils
- ☑ Heat pumps: ☐ air source ☐ ground source ☐ sea water
- ☑ Space heaters: ☐ woodstove ☐ Toyo/Monitor ☐ other: __________________________

HEATING capacity (Btu/h, kWh) | Annual Fuel Consumption | Cost
---------------------------------|------------------------|-----
182,160                           | 182,160                | $500/yr

TEMPERATURE CONTROLS (type of system; check all that apply)

- ☐ Thermostats on individual devices/appliances; no central control system
- ☑ Pneumatic control system Manufacturer: __________________________ Approx. Age: _________
- ☑ Direct digital control system Manufacturer: __________________________ Approx. Age: _________

Record Name Plate data for boilers (use separate sheet if necessary):

Black Gold Boiler 200

Describe locations of different parts of the heating system and what building areas are served:

Components are in boiler room. Water heater is located underfloor in ½ crawlspace. Serves entire building.

Describe age and general condition of existing equipment:

Equipment is functional

Who performs boiler maintenance? Even Buczkewicz & Staff Describe any current maintenance issues:

Where is piping or ducting routed through the building? (tunnels, utilidor, crawlspace, above false ceiling, attic, etc.):

½ crawlspace

Describe on-site fuel storage: Number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.: One exterior fuel tank ~ 300gal, good condition

If this fuel is also used for other purposes, please describe: Only for heating.
DOMESTIC HOT WATER

USES OF DOMESTIC HOT WATER
Check all that apply:
- Lavatories
- Kitchen
- Showers
- Laundry
- Water treatment
- Other: ________________________________

TYPE OF SYSTEM
Check all that apply:
- Direct-fired, single tank
- Direct-fired, multiple tanks
- Indirect, using heating boiler with separate storage tank
- Hot water generator with separate storage tank
- Other: ________________________________

What fuels are used to generate hot water? (Check all that apply):
- natural gas
- propane
- electric
- #1 fuel oil
- #2 fuel oil

Describe location of water heater(s): ____________

Describe on-site fuel storage: number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.:
- Interior Fuel Storage ~ 500 gal,Susan Extention, No Containment.

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): Stick Frame 4'
Insulation Value: _______

Roof type: Composition Shingles
Insulation Value: _______

Windows: □ single pane □ double pane □ other:

Arctic entry(s): □ none □ at main entrance only □ at multiple entrances □ at all entrances

Drawings available: □ architectural □ mechanical □ electrical

Outside Air/Air Exchange: □ HRV □ CO2 Sensor

ELECTRICAL

Utility company that serves the building or community: MEA

Type of grid: □ building stand-alone □ village/community power □ railbelt grid

Energy source: □ hydropower □ diesel generator(s) □ Other: Natural Gas

Electricity rate per kWh: 0.18
Demand charge: ______________

Electrical energy phase(s) available: □ single phase □ 3-phase

Back-up generator on site: □ Yes □ No
If Yes, provide output capacity: ______________

Are there spare circuits in MDP and/or electrical panel?: □ Yes □ No

Record MDP and electrical panel name plate information: See photos

WOOD FUEL INFORMATION

- Wood pellet cost delivered to facility $_______/ton Viable fuel source? Yes □ No □
- Wood chip cost delivered to facility $_______/ton Viable fuel source? Yes □ No □
- Cord wood cost delivered to facility $250/cord Viable fuel source? Yes □ No □
- Distance to nearest wood pellet and wood chip suppliers: Fairbanks
- Can logs or wood fuel be stockpiled on site or at a nearby facility? Yes

FACILITY SITE CONSIDERATIONS

Is there good access to site for delivery vehicles (trucks, chip vans, etc.)? 
Yes.

Are there any significant site constraints? (Playgrounds, other buildings, wetlands, underground utilities, etc.)? 
Gravel. No permafrost.

What are local soil conditions? Permafrost issues? 
Gravel. No permafrost.

Is the building in proximity to other buildings with biomass potential? If so, Which ones and How close? 
Yes. Southern Loop.

Can building accommodate a biomass boiler inside, or would an addition for a new boiler be necessary? Where would addition go?  
Not possible inside structure.

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from? 
Current Site.

If necessary, can piping be run underground from a central plant to the building? Where would piping enter boiler room? 
Yes. Enter through exterior wall.

OTHER INFORMATION

Provide any other information that will help describe the space heating and domestic hot water systems, such as

Is heat distribution system looping or branching?  
For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot? 
Any other energy using systems (kitchen equipment, lab equipment, pool etc.)? Fuel or energy source? 
Any systems that could be added to the boiler system? 
Are heating fuel records available?

PICTURE / VIDEO CHECKLIST

Exterior
Main entry  
Building elevations  
Several near boiler room and where potential addition/wood storage and/or exterior piping may enter the building  
Access road to building and to boiler room  
Power poles serving building  
Electrical service entry  
Emergency generator

Interior
Boilers, pumps, domestic water heaters, heat exchangers – all mechanical equipment in boiler room and in other parts of the building.  
Boiler room piping at boiler and around boiler room  
Piping around domestic water heater  
MDP and/or electrical panels in or around boiler room  
Pictures of available circuits in MDP or electrical panel (open door).  
Picture of circuit card of electrical panel  
Picture of equipment used to heat room in the building (i.e. baseboard fin tube, unit heaters, unit ventilators, air handler, fan coil)  
Pictures of any other major mechanical equipment  
Pictures of equipment using fuel not part of heating or domestic hot water system (kitchen equip., lab equip., pool, etc.)  
Pictures of building plans (site plan, architectural floor plan, mechanical plan, boiler room plan, electrical power plan)
ALASKA WOOD ENERGY DEVELOPMENT TASK GROUP (AWEDTG)
PRE-FEASIBILITY ASSESSMENT FIELD DATA SHEET

<table>
<thead>
<tr>
<th>APPLICANT:</th>
<th>Victory Bible Camp</th>
</tr>
</thead>
</table>
| Eligibility: (check one) | □ Local government □ State agency □ Federal agency □ School/School District
□ Federally Recognized Tribe □ Regional ANCSA Corp. □ Village ANCSA Corp.
☑ Not-for-profit organization □ Private Entity that can demonstrate a Public Benefit
□ Other (describe): |
| Contact Name: | Evan Busenitz |
| Mailing Address: | 6478 N Victory Rd |
| City: | Sutton |
| State: | AK |
| Zip Code: | 99674 |
| Office phone: | (907) 745-14203 |
| Fax: | (907) |
| Email: | |

Facility Identification/Name: Same as above
Facility Contact Person: 
Facility Contact Telephone: (907) 
Facility Contact Email: 

SCHOOL/FACILITY INFORMATION (complete separate Field Data Sheet for each building)

SCHOOL FACILITY (Name: )

<table>
<thead>
<tr>
<th>School Type: (check all that apply)</th>
<th>[ ] Pre-School</th>
<th>[ ] Junior High</th>
<th>[ ] Student Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Elementary</td>
<td>[ ] High School</td>
<td>[ ] Pool</td>
<td></td>
</tr>
<tr>
<td>[ ] Middle School</td>
<td>[ ] Campus</td>
<td>[ ] Gymnasium</td>
<td>[ ] Other (describe):</td>
</tr>
</tbody>
</table>

Size of facility (sq. ft. heated): [ ]
Year built/age: [ ]
Number of floors: [ ]
Year(s) renovated: [ ]
Number of bldgs.: [ ]
Next renovation: [ ]
# of Students: [ ]
Has an energy audit been conducted?: [ ]
If Yes, when? *

OTHER FACILITY (Name: Douglas)

<table>
<thead>
<tr>
<th>Type:</th>
<th>[ ] Health Clinic</th>
<th>[ ] Water Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Public Safety Bldg.</td>
<td>[ ] Multi-Purpose Bldg</td>
<td></td>
</tr>
<tr>
<td>[ ] Community Center</td>
<td>[ ] District Energy System</td>
<td></td>
</tr>
<tr>
<td>[ ] Public Housing</td>
<td>[ ] Other (list):</td>
<td></td>
</tr>
</tbody>
</table>

Size of Facility (sq. ft. heated): [ ]
Year built/age: [ ]
Number of floors: [ ]
Year(s) renovated: [ ]
Number of bldgs.: [ ]
Next renovation: [ ]
Frequency of Usage: As Needed/Seasonal
# of Occupants: [ ]

Has an energy audit been conducted?: [ ]
If Yes, when? *</br>

* If an Energy Audit has been conducted, please provide a copy.
HEATING SYSTEM INFORMATION

CONFIGURATION (check all that apply)

☐ Heat plant in one location: ☐ on ground level ☐ below ground level ☐ mezzanine ☐ roof ☐ at least 1 exterior wall

☐ Different heating plants in different locations: How many? ___________ What level(s)? ______________________

☐ Individual room-by-room heating systems (space heaters)

☐ Is boiler room accessible to delivery trucks? ☐ Yes ☐ No

HEAT DELIVERY (check all that apply)

☐ Hot water: ☐ baseboard ☐ radiant heat floor ☐ cabinet heaters ☐ air handlers ☐ radiators ☐ other: ______________________

☐ Steam: ______________________

☐ Forced/ducted air

☐ Electric heat: ☐ resistance ☐ boiler ☐ heat pump(s)

☐ Space heaters

HEAT GENERATION (check all that apply)

☐ Hot water boiler: ☐ natural gas ☐ propane ☐ electric ☐ #1 fuel oil ☐ #2 fuel oil ______________________

☐ Steam boiler: ☐ natural gas ☐ propane ☐ electric ☐ #1 fuel oil ☐ #2 fuel oil ______________________

☐ Warm air furnace: ☐ natural gas ☐ propane ☐ electric ☐ #1 fuel oil ☐ #2 fuel oil ______________________

☐ Electric resistance: ☐ baseboard ☐ duct coils ______________________

☐ Heat pumps: ☐ air source ☐ ground source ☐ sea water ______________________

☐ Space heaters: ☐ woodstove ☐ Toyo/Monitor ☐ other: ______________________

<table>
<thead>
<tr>
<th>Heating capacity (Btu/h)</th>
<th>Annual Fuel Consumption</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>384,340</td>
<td>1800 Gallons</td>
<td>$2.60/gal</td>
</tr>
</tbody>
</table>

TEMPERATURE CONTROLS (type of system; check all that apply)

☐ Thermostats on individual devices/appliances; no central control system

☐ Pneumatic control system Manufacturer: ______________________ Approx. Age: _________

☐ Direct digital control system Manufacturer: ______________________ Approx. Age: _________

Record Name Plate data for boilers (use separate sheet if necessary):

CRANE Sunnyday 23 boiler

Describe locations of different parts of the heating system and what building areas are served:

Entire building served, system located in main room

Describe age and general condition of existing equipment:

Functional Equipment

Who performs boiler maintenance? [Name: Bracey & Staff] Describe any current maintenance issues:

Where is piping or ducting routed through the building? (tunnels, utilidors, crawlspace, above false ceiling, attic, etc.):

Through floor joist

Describe on-site fuel storage: Number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.:

One underground 1,000gal tank. Unknown condition

If this fuel is also used for other purposes, please describe: Only for heating.
DOMESTIC HOT WATER

USES OF DOMESTIC HOT WATER
Check all that apply:
- Lavatories
- Kitchen
- Showers
- Laundry
- Water treatment
- Other: ___________________________

What fuels are used to generate hot water? (Check all that apply):
- natural gas
- propane
- electric
- #1 fuel oil
- #2 fuel oil

Describe location of water heater(s): _____ Adjacent to boiler _____

Describe on-site fuel storage: number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.:

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): Stick Frame 4" Insulation Value: ________

Roof type: Composition Shingles Insulation Value: ________

Windows: □ single pane □ double pane □ other: __________________________

Arctic entry(s): □ none □ at main entrance only □ at multiple entrances □ at all entrances

Drawings available: □ architectural □ mechanical □ electrical

Outside Air/Air Exchange: □ HRV □ CO₂ Sensor

ELECTRICAL

Utility company that serves the building or community: ________ MCA ________

Type of grid: □ building stand-alone □ village/community power □ railbelt grid

Energy source: □ hydropower □ diesel generator(s) □ Other: _____ Natural Gas ______

Electricity rate per kWh: $0.18 Demand charge: ____________

Electrical energy phase(s) available: □ single phase □ 3-phase

Back-up generator on site: □ Yes □ No If Yes, provide output capacity: ____________

Are there spare circuits in MDP and/or electrical panel?: □ Yes □ No

Record MDP and electrical panel name plate information: See photos

WOOD FUEL INFORMATION

- Wood pellet cost delivered to facility $________/ton Viable fuel source? Yes □
- Wood chip cost delivered to facility $________/ton Viable fuel source? Yes □
- Cord wood cost delivered to facility $250/cord Viable fuel source? □ No
- Distance to nearest wood pellet and wood chip suppliers: ________
- Can logs or wood fuel be stockpiled on site or at a nearby facility? Yes

FACILITY SITE CONSIDERATIONS

Is there good access to site for delivery vehicles (trucks, chip vans, etc)?

Are there any significant site constraints? (Playgrounds, other buildings, wetlands, underground utilities, etc)?

What are local soil conditions? Permafrost issues?

Is the building in proximity to other buildings with biomass potential? If so, Which ones and How close?

Can building accommodate a biomass boiler inside, or would an addition for a new boiler be necessary? Where would addition go?

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from?

If necessary, can piping be run underground from a central plant to the building? Where would piping enter boiler room?

OTHER INFORMATION

Provide any other information that will help describe the space heating and domestic hot water systems, such as

Is heat distribution system looping or branching?
For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot?
Any other energy using systems (kitchen equipment, lab equipment, pool etc)? Fuel or energy source?
Any systems that could be added to the boiler system?
Are heating fuel records available?

PICTURE / VIDEO CHECKLIST

Exterior
Main entry
Building elevations
Several near boiler room and where potential addition/wood storage and/or exterior piping may enter the building
Access road to building and to boiler room
Power poles serving building
Electrical service entry
Emergency generator

Interior
Boilers, pumps, domestic water heaters, heat exchangers – all mechanical equipment in boiler room and in other parts of the building.
Boiler room piping at boiler and around boiler room
Piping around domestic water heater
MDP and/or electrical panels in or around boiler room
Pictures of available circuits in MDP or electrical panel (open door).
Picture of circuit card of electrical panel
Picture of equipment used to heat room in the building (i.e. baseboard fin tube, unit heaters, unit ventilators, air handler, fan coil)
Pictures of any other major mechanical equipment
Pictures of equipment using fuel not part of heating or domestic hot water system (kitchen equip., lab equip., pool, etc.)
Pictures of building plans (site plan, architectural floor plan, mechanical plan, boiler room plan, electrical power plan)
ALASKA WOOD ENERGY DEVELOPMENT TASK GROUP (AWEDTG)
PRE-FEASIBILITY ASSESSMENT FIELD DATA SHEET

<table>
<thead>
<tr>
<th>APPLICANT:</th>
<th>Victory Bible Camp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligibility:</td>
<td></td>
</tr>
<tr>
<td>(check one)</td>
<td></td>
</tr>
<tr>
<td>☐ Local government</td>
<td>☐ State agency</td>
</tr>
<tr>
<td>☐ Federal agency</td>
<td>☐ School/School District</td>
</tr>
<tr>
<td>☐ Federally Recognized Tribe</td>
<td>☐ Regional ANCSA Corp.</td>
</tr>
<tr>
<td>☐ Not-for-profit organization</td>
<td>☐ Village ANCSA Corp.</td>
</tr>
<tr>
<td>☐ Other (describe):</td>
<td></td>
</tr>
<tr>
<td>Contact Name:</td>
<td>Evan Buschutz</td>
</tr>
<tr>
<td>Mailing Address:</td>
<td>64711 S Victory Rd</td>
</tr>
<tr>
<td>City:</td>
<td>Sutton</td>
</tr>
<tr>
<td>State:</td>
<td>AK</td>
</tr>
<tr>
<td>Zip Code:</td>
<td>99674</td>
</tr>
<tr>
<td>Office phone:</td>
<td>(907) 745-4203</td>
</tr>
<tr>
<td>Fax:</td>
<td>(907)</td>
</tr>
<tr>
<td>Email:</td>
<td></td>
</tr>
</tbody>
</table>

Facility Identification/Name: Same as above
Facility Contact Person:               
Facility Contact Telephone: (907)      
Facility Contact Email:                

SCHOOL/FACILITY INFORMATION (complete separate Field Data Sheet for each building)

SCHOOL FACILITY (Name: ________________________ )

<table>
<thead>
<tr>
<th>School Type: (check all that apply)</th>
<th>[ ] Pre-School</th>
<th>[ ] Junior High</th>
<th>[ ] Student Housing</th>
<th>[ ] Other (describe):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of facility (sq. ft. heated):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year built/age:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of floors:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year(s) renovated:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of bldgs.:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Next renovation:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td># of Students:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has an energy audit been conducted?</td>
<td></td>
<td></td>
<td></td>
<td>If Yes, when? *</td>
</tr>
</tbody>
</table>

OTHER FACILITY (Name: ________________________ )

| Type: [ ] Health Clinic [ ] Water Plant [ ] Multi-Purpose Bldg [ ] Other (list): |
|---------------------------------------------|-----------------------------------------------|-----------------------------------|
| Size of Facility (sq. ft. heated): 2600     | Year built/age: 1968                        |
| Number of floors: 2                       | Year(s) renovated:                          |
| Number of bldgs.: 1                       | Next renovation:                            |
| Frequency of Usage: As Needed/Seasonal     | # of Occupants: 18                          |
| Has an energy audit been conducted? No     | If Yes, when? *                             |

* If an Energy Audit has been conducted, please provide a copy.
HEATING SYSTEM INFORMATION

CONFIGURATION (check all that apply)

- □ Heat plant in one location: □ on ground level □ below ground level □ mezzanine □ roof □ at least 1 exterior wall
- □ Different heating plants in different locations: How many? ________________ What level(s)? ___________________
- □ Individual room-by-room heating systems (space heaters)
- □ Is boiler room accessible to delivery trucks? □ Yes □ No

HEAT DELIVERY (check all that apply)

- □ Hot water: □ baseboard □ radiant heat floor □ cabinet heaters □ air handlers □ radiators □ other: ________________
- □ Steam: ________________________________
- □ Forced/ducted air
- □ Electric heat: □ resistance □ boiler □ heat pump(s)
- □ Space heaters

HEAT GENERATION (check all that apply)

- □ Hot water boiler: □ natural gas □ propane □ electric □ #1 fuel oil □ #2 fuel oil
- □ Steam boiler: □ natural gas □ propane □ electric □ #1 fuel oil □ #2 fuel oil
- □ Warm air furnace: □ natural gas □ propane □ electric □ #1 fuel oil □ #2 fuel oil
- □ Electric resistance: □ baseboard □ duct coils
- □ Heat pumps: □ air source □ ground source □ sea water
- □ Space heaters: □ woodstove □ Toyo/Monitor □ other: __________________________

HEATING capacity

<table>
<thead>
<tr>
<th>Heating capacity</th>
<th>Annual Fuel Consumption</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Btu, kWh)</td>
<td></td>
<td>700 Gallons</td>
</tr>
</tbody>
</table>

TEMPERATURE CONTROLS (type of system; check all that apply)

- □ Thermostats on individual devices/appliances; no central control system
- □ Pneumatic control system
  Manufacturer: ____________________________ Approx. Age: _________
- □ Direct digital control system
  Manufacturer: ____________________________ Approx. Age: _________

Record Name Plate data for boilers (use separate sheet if necessary):

CRANE Sunday 5 # 5-5

Describe locations of different parts of the heating system and what building areas are served:

Serves Entire building. Heating system located in mechanical room

Describe age and general condition of existing equipment:

FUNCTIONAL EQUIPMENT. Significant corrosion on HW heater

Who performs boiler maintenance? Ewan Buicenit & Staff Describe any current maintenance issues:

Where is piping or ducting routed through the building? (tunnels, utilidors, crawlspace, above false ceiling, attc, etc.):

Through walls & Floor joists

Describe on-site fuel storage: Number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.:

Two External tanks n sparged Each. Good condition

If this fuel is also used for other purposes, please describe: Only for heating.
DOMESTIC HOT WATER

USES OF DOMESTIC HOT WATER
Check all that apply:
☑️ Lavatories
☑️ Kitchen
☑️ ☑️ Showers
☑️ ☑️ Laundry
☐ Water treatment
☐ Other: __________________________

TYPE OF SYSTEM
Check all that apply:
☐ Direct-fired, single tank
☐ Direct fired, multiple tanks
☐ Indirect, using heating boiler with separate storage tank
☐ Hot water generator with separate storage tank
☐ Other: __________________________________________

What fuels are used to generate hot water? (Check all that apply):
☐ natural gas ☐ propane ☑️ electric ☐ #1 fuel oil ☐ #2 fuel oil

Describe location of water heater(s): In Mechanical room, adjacent to Boiler

Describe on-site fuel storage: number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.:
2 Fuel tanks 300 gal

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): Stick Frame 14" Insulation Value: ______

Roof type: Composite Shingles Insulation Value: ______

Windows: ☐ single pane ☑️ double pane ☐ other: __________________________

Arctic entry(s): ☐ none ☐ at main entrance only ☑️ at multiple entrances ☐ at all entrances

Drawings available: ☐ architectural ☐ mechanical ☐ electrical

Outside Air/Air Exchange: ☐ HRV ☐ CO₂ Sensor

ELECTRICAL

Utility company that serves the building or community: MCA

Type of grid: ☐ building stand-alone ☐ village/community power ☑️ railbelt grid

Energy source: ☐ hydropower ☐ diesel generator(s) ☐ Other: Natural Gas

Electricity rate per kWh: $0.18 Demand charge: ______________

Electrical energy phase(s) available: ☑️ single phase ☐ 3-phase

Back-up generator on site: ☐ Yes ☑️ No If Yes, provide output capacity: __________________________

Are there spare circuits in MDP and/or electrical panel?: ☑️ Yes ☐ No

Record MDP and electrical panel name plate information: See photos

WOOD FUEL INFORMATION

- Wood pellet cost delivered to facility $________/ton Viable fuel source? Yes ☑️
- Wood chip cost delivered to facility $________/ton Viable fuel source? Yes ☑️
- Cord wood cost delivered to facility $250/cord Viable fuel source? ☑️ Yes ☐ No
- Distance to nearest wood pellet and wood chip suppliers: Fairbanks
- Can logs or wood fuel be stockpiled on site or at a nearby facility? Yes

FACILITY SITE CONSIDERATIONS

Is there good access to site for delivery vehicles (trucks, chip vans, etc.)?  
Yes, front only

Are there any significant site constraints? (Playgrounds, other buildings, wetlands, underground utilities, etc.)?  
No

What are local soil conditions? Permafrost issues?

Is the building in proximity to other buildings with biomass potential? If so, Which ones and How close?  
Yes, Southern Loop

Can building accommodate a biomass boiler inside, or would an addition for a new boiler be necessary? Where would addition go?  
Cannot accommodate inside

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from?  
Existing Site

If necessary, can piping be run underground from a central plant to the building? Where would piping enter boiler room?  
Yes, enter through exterior wall

OTHER INFORMATION

Provide any other information that will help describe the space heating and domestic hot water systems, such as

Is heat distribution system looping or branching?

For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot?

Any other energy using systems (kitchen equipment, lab equipment, pool etc.)? Fuel or energy source?

Any systems that could be added to the boiler system?

Are heating fuel records available?

PICTURE / VIDEO CHECKLIST

Exterior
Main entry
Building elevations
Several near boiler room and where potential addition/wood storage and/or exterior piping may enter the building
Access road to building and to boiler room
Power poles serving building
Electrical service entry
Emergency generator

Interior
Boilers, pumps, domestic water heaters, heat exchangers – all mechanical equipment in boiler room and in other parts of the building.
Boiler room piping at boiler and around boiler room
Piping around domestic water heater
MDP and/or electrical panels in or around boiler room
Pictures of available circuits in MDP or electrical panel (open door).
Picture of circuit card of electrical panel
Picture of equipment used to heat room in the building (i.e. baseboard fin tube, unit heaters, unit ventilators, air handler, fan coil)
Pictures of any other major mechanical equipment
Pictures of equipment using fuel not part of heating or domestic hot water system (kitchen equip., lab equip., pool, etc.)
Pictures of building plans (site plan, architectural floor plan, mechanical plan, boiler room plan, electrical power plan)
**APPLICANT:** Victory Bible Camp

**Eligibility:**
- ☐ Local government
- ☐ State agency
- ☐ Federal agency
- ☐ School/School District
- ☐ Federally Recognized Tribe
- ☐ Regional ANCSA Corp.
- ☐ Village ANCSA Corp.
- ☐ Not-for-profit organization
- ☐ Private Entity that can demonstrate a Public Benefit
- ☐ Other (describe):

**Contact Name:** Evan Busenitz

**Mailing Address:** 64741 S Victory Rd

**City:** Sutton

**State:** AK

**Zip Code:** 99674

**Office Phone:** (907) 745-4203

**Cell Phone:**

**Fax:** (907)

**Email:**

**Facility Identification/Name:** Same as above

**Facility Contact Person:**

**Facility Contact Telephone:** (907)

**Facility Contact Email:**

---

**SCHOOL/FACILITY INFORMATION** (complete separate Field Data Sheet for each building)

**SCHOOL FACILITY (Name: [Name of School Facility])**

<table>
<thead>
<tr>
<th>School Type</th>
<th>Pre-School</th>
<th>Elementary</th>
<th>Middle School</th>
<th>Junior High</th>
<th>High School</th>
<th>Campus</th>
<th>Student Housing</th>
<th>Pool</th>
<th>Gymnasium</th>
<th>Other (describe):</th>
</tr>
</thead>
<tbody>
<tr>
<td>(check all that apply)</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Size of facility (sq. ft. heated):**

**Number of floors:**

**Number of bldgs.:**

**# of Students:**

**Year built/age:**

**Year(s) renovated:**

**Next renovation:**

**Has an energy audit been conducted?:**

**If Yes, when? *:**

**OTHER FACILITY (Name: [Name of Other Facility])**

<table>
<thead>
<tr>
<th>Type</th>
<th>Health Clinic</th>
<th>Public Safety Bldg.</th>
<th>Community Center</th>
<th>Water Plant</th>
<th>Washeteria</th>
<th>Public Housing</th>
<th>Multi-Purpose Bldg</th>
<th>District Energy System</th>
<th>Other (list):</th>
</tr>
</thead>
<tbody>
<tr>
<td>(check all that apply)</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Size of Facility (sq. ft. heated):** 3800

**Year built/age:** 1965

**Number of floors:** 2

**Number of bldgs.:** 1

**Frequency of Usage:** As Needed/Seasonal

**# of Occupants:** 20

**Has an energy audit been conducted?:** No

**If Yes, when? *:**

---

* If an Energy Audit has been conducted, please provide a copy.
HEATING SYSTEM INFORMATION

CONFIGURATION (check all that apply)
- ☐ Heat plant in one location: ✔ on ground level  ☐ below ground level  ☐ mezzanine  ☐ roof  ☐ at least 1 exterior wall
- ☐ Different heating plants in different locations: How many? ______ What level(s)? ______________________
- ☐ Individual room-by-room heating systems (space heaters)
- ☐ Is boiler room accessible to delivery trucks? ☐ Yes  ☐ No

HEAT DELIVERY (check all that apply)
- ☐ Hot water: ☑ baseboard  ☐ radiant heat floor  ☐ cabinet heaters  ☐ air handlers  ☐ radiators  ☐ other: ______________
- ☐ Steam: __________________________________________________________
- ☐ Forced/ducted air
- ☐ Electric heat: ☐ resistance  ☐ boiler  ☐ heat pump(s)
- ☐ Space heaters

HEAT GENERATION (check all that apply)

<table>
<thead>
<tr>
<th>Hot water boiler:</th>
<th>☐ natural gas</th>
<th>☐ propane</th>
<th>☐ electric</th>
<th>☐ #1 fuel oil</th>
<th>☐ #2 fuel oil</th>
<th>Heating capacity (Btu/h)</th>
<th>Annual Fuel Consumption</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 Gallons</td>
<td>2.59/gal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>________________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steam boiler:</td>
<td>☐ natural gas</td>
<td>☐ propane</td>
<td>☐ electric</td>
<td>☐ #1 fuel oil</td>
<td>☐ #2 fuel oil</td>
<td>________________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warm air furnace:</td>
<td>☐ natural gas</td>
<td>☐ propane</td>
<td>☐ electric</td>
<td>☐ #1 fuel oil</td>
<td>☐ #2 fuel oil</td>
<td>________________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric resistance:</td>
<td>☐ baseboard</td>
<td>☐ duct coils</td>
<td></td>
<td></td>
<td></td>
<td>________________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heat pumps:</td>
<td>☐ air source</td>
<td>☐ ground source</td>
<td>☐ sea water</td>
<td></td>
<td></td>
<td>________________________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space heaters:</td>
<td>☐ woodstove</td>
<td>☐ Toyo/Monitor</td>
<td>☐ other:</td>
<td></td>
<td></td>
<td>________________________</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TEMPERATURE CONTROLS (type of system; check all that apply)
- ☐ Thermostats on individual devices/appliances; no central control system
- ☐ Pneumatic control system  Manufacturer: ____________________  Approx. Age: __________
- ☐ Direct digital control system  Manufacturer: ____________________  Approx. Age: __________

Record Name Plate data for boilers (use separate sheet if necessary):

Weil-McLain WTGO-3 100,000 BTU Gold Oil Boiler. #386-100-832

Describe locations of different parts of the heating system and what building areas are served:

Entire system in main room. Serves entire building

Describe age and general condition of existing equipment:

Functional Equipment

Who performs boiler maintenance? Evan Busenite & Staff  Describe any current maintenance issues:

Where is piping or ducting routed through the building? (tunnels, utilidors, crawlspace, above false ceiling, attic, etc.):

Through walls & floor joists

Describe on-site fuel storage: Number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.:

Two exterior tanks stored each. Good condition. No spill containment

If this fuel is also used for other purposes, please describe: Only for heating
DOMESTIC HOT WATER

USES OF DOMESTIC HOT WATER
Check all that apply:
- Lavatories
- Kitchen
- Showers
- Laundry
- Water treatment
- Other: ___________________________

TYPE OF SYSTEM
Check all that apply:
- Direct-fired, single tank
- Direct fired, multiple tanks
- Indirect, using heating boiler with separate storage tank
- Hot water generator with separate storage tank
- Other: ___________________________

What fuels are used to generate hot water? (Check all that apply):
- natural gas
- propane
- electric
- #1 fuel oil
- #2 fuel oil

Describe location of water heater(s): 
Next to boiler in Mechanical Room

Describe on-site fuel storage: number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.: 
Same as oil boiler.

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): 
Struc frame li
Insulation Value: ___________________________

Roof type: ___________________________
Insulation Value: ___________________________

Windows: 
- single pane
- double pane
- other: ___________________________

Arctic entry(s): 
- none
- main entrance only
- at multiple entrances
- at all entrances

Drawings available:
- architectural
- mechanical
- electrical

Outside Air/Air Exchange: 
- HRV
- CO₂ Sensor

ELECTRICAL

Utility company that serves the building or community: 
MEA

Type of grid:
- building stand-alone
- village/community power
- railbelt grid

Energy source:
- hydropower
- diesel generator(s)
- other: Natural Gas

Electricity rate per kWh: $0.18
Demand charge: ___________________________

Electrical energy phase(s) available:
- single phase
- 3-phase

Back-up generator on site: 
- Yes
- No
- If Yes, provide output capacity: ___________________________

Are there spare circuits in MDP and/or electrical panel?: 
- Yes
- No

Record MDP and electrical panel name plate information: See photos

WOOD FUEL INFORMATION

- Wood pellet cost delivered to facility $________/ton
- Viable fuel source? Yes
- Wood chip cost delivered to facility $________/ton
- Viable fuel source? Yes
- Cord wood cost delivered to facility $250/cord
- Viable fuel source? No
- Distance to nearest wood pellet and wood chip suppliers: Fairbanks
- Can logs or wood fuel be stockpiled on site or at a nearby facility? Yes

Who manages local forests? Village Native Corp, Regional Native Corp, State of Alaska, Forest Service, BLM, USF&W, Other: 
Alaska
FACILITY SITE CONSIDERATIONS

Is there good access to site for delivery vehicles (trucks, chip vans, etc)?

Yes. From front only

Are there any significant site constraints? (Playgrounds, other buildings, wetlands, underground utilities, etc.)?

On an embankment

What are local soil conditions? Permafrost issues? Gravel. No permafrost.

Is the building in proximity to other buildings with biomass potential? If so, Which ones and How close?

Yes. Southern Loop

Can building accommodate a biomass boiler inside, or would an addition for a new boiler be necessary? Where would addition go?

Addition needed

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from?

Existing site

If necessary, can piping be run underground from a central plant to the building? Where would piping enter boiler room?

Yes. Enter through exterior wall.

OTHER INFORMATION

Provide any other information that will help describe the space heating and domestic hot water systems, such as

Is heat distribution system looping or branching?

For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot?

Any other energy using systems (kitchen equipment, lab equipment, pool etc)? Fuel or energy source?

Any systems that could be added to the boiler system?

Are heating fuel records available?

PICTURE / VIDEO CHECKLIST

Exterior

Main entry
Building elevations
Several near boiler room and where potential addition/wood storage and/or exterior piping may enter the building
Access road to building and to boiler room
Power poles serving building
Electrical service entry
Emergency generator

Interior

Boilers, pumps, domestic water heaters, heat exchangers – all mechanical equipment in boiler room and in other parts of the building.
Boiler room piping at boiler and around boiler room
Piping around domestic water heater
MDP and/or electrical panels in or around boiler room
Pictures of available circuits in MDP or electrical panel (open door).
Picture of circuit card of electrical panel
Picture of equipment used to heat room in the building (i.e. baseboard fin tube, unit heaters, unit ventilators, air handler, fan coil)
Pictures of any other major mechanical equipment
Pictures of equipment using fuel not part of heating or domestic hot water system (kitchen equip., lab equip., pool, etc.)
Pictures of building plans (site plan, architectural floor plan, mechanical plan, boiler room plan, electrical power plan)

Page 4 of 4
# ALASKA WOOD ENERGY DEVELOPMENT TASK GROUP (AWEDTG)
## PRE-FEASIBILITY ASSESSMENT FIELD DATA SHEET

**APPLICANT:** Victory Bible Camp

<table>
<thead>
<tr>
<th>Eligibility: (check one)</th>
<th>☐ Local government</th>
<th>☐ State agency</th>
<th>☐ Federal agency</th>
<th>☐ School/School District</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Federally Recognized Tribe</td>
<td>☐ Regional ANCSA Corp.</td>
<td>☐ Village ANCSA Corp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☑ Not-for-profit organization</td>
<td>☐ Private Entity that can demonstrate a Public Benefit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☐ Other (describe):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Contact Name:** Evan Busenitz

**Mailing Address:** 64741 S Victory Rd

**City:** Sutton

**State:** AK

**Zip Code:** 99674

**Office phone:** (907) 454-1123

**Cell phone:** ( )

**Fax:** (907)

**Email:**

**Facility Identification/Name:** Same as above

**Facility Contact Person:**

**Facility Contact Telephone:** (907)

**Facility Contact Email:**

## SCHOOL/FACILITY INFORMATION (complete separate Field Data Sheet for each building)

### SCHOOL FACILITY (Name: _______________________

| School Type: (check all that apply) | | | | |
|------------------------------------|-----------------|-----------------|-----------------|
| ☐ Pre-School | ☐ Elementary | ☐ Middle School | ☐ High School |

| Size of facility (sq. ft. heated): | | |
|------------------------------------|-----------------|
| Number of floors: | |
| Number of bldgs.: | |
| # of Students: | |
| Year built/age: | |
| Year(s) renovated: | |
| Next renovation: | |
| Has an energy audit been conducted?: | |

### OTHER FACILITY (Name: Gymnasium)

<table>
<thead>
<tr>
<th>Type:</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Health Clinic</td>
<td>☐ Water Plant</td>
<td>☐ Multi-Purpose Bldg</td>
<td></td>
</tr>
<tr>
<td>☐ Public Safety Bldg.</td>
<td>☐ Washeteria</td>
<td>☐ District Energy System</td>
<td></td>
</tr>
<tr>
<td>☐ Community Center</td>
<td>☐ Public Housing</td>
<td>☐ Other (list): Gymnasium</td>
<td></td>
</tr>
</tbody>
</table>

| Size of Facility (sq. ft. heated) | 7200 | |
|------------------------------------|-----------------|
| Number of floors: | 1 |
| Number of bldgs.: | 1 |
| Frequency of Usage: | As needed | |
| # of Occupants: | |
| Year(s) renovated: | 1960's |
| Next renovation: | | |
| Has an energy audit been conducted? | No |

* If an Energy Audit has been conducted, please provide a copy.
HEATING SYSTEM INFORMATION

CONFIGURATION (check all that apply)

☐ Heat plant in one location: ☐ on ground level ☐ below ground level ☒ mezzanine ☐ roof ☐ at least 1 exterior wall

☐ Different heating plants in different locations: How many? ____________ What level(s)? _______________________

☐ Individual room-by-room heating systems (space heaters)

☐ Is boiler room accessible to delivery trucks? ☐ Yes ☒ No

HEAT DELIVERY (check all that apply)

☐ Hot water: ☐ baseboard ☐ radiant heat floor ☐ cabinet heaters ☐ air handlers ☐ radiators ☐ other: ________________________

☐ Steam: ________________________

☒ Forced/ducted air

☐ Electric heat: ☐ resistance ☐ boiler ☐ heat pump(s)

☐ Space heaters

HEAT GENERATION (check all that apply)

☒ Hot water boiler: ☐ natural gas ☐ propane ☐ electric ☐ #1 fuel oil ☒ #2 fuel oil

☐ Steam boiler: ☐ natural gas ☐ propane ☐ electric ☐ #1 fuel oil ☐ #2 fuel oil

☐ Warm air furnace: ☐ natural gas ☐ propane ☐ electric ☐ #1 fuel oil ☐ #2 fuel oil

☐ Electric resistance: ☐ baseboard ☐ duct coils

☐ Heat pumps: ☐ air source ☐ ground source ☐ sea water

☐ Space heaters: ☐ woodstove ☐ Toyo/Monitor ☐ other: ________________________

<table>
<thead>
<tr>
<th>Heating capacity</th>
<th>Annual Fuel Consumption</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Btu/h) (kWh)</td>
<td></td>
<td>$2.55/yr</td>
</tr>
<tr>
<td>500 Gallons</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TEMPERATURE CONTROLS (type of system; check all that apply)

☐ Thermostats on individual devices/appliances; no central control system

☐ Pneumatic control system Manufacturer: ________________________ Approx. Age: ________

☐ Direct digital control system Manufacturer: ________________________ Approx. Age: ________

Record Name Plate data for boilers (use separate sheet if necessary):

Clean Burn As-291, 079 # CB3500

Describe locations of different parts of the heating system and what building areas are served:

Serves Gym only, heating system located on mezzanine

Describe age and general condition of existing equipment:

Equipment is in workable condition

Who performs boiler maintenance? Even Busenitz & Staff Describe any current maintenance issues:

Where is piping or ducting routed through the building? (tunnels, utilidors, crawlspace, above false ceiling, attic, etc.):

Piping is run on surface

Describe on-site fuel storage: Number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.:

Used oil stored in external structure located on the south wall of the gym. Outside access only. Single tank.

If this fuel is also used for other purposes, please describe: Only for heating
DOMESTIC HOT WATER

USES OF DOMESTIC HOT WATER
Check all that apply:

- [ ] Lavatories
- [ ] Kitchen
- [ ] Showers
- [ ] Laundry
- [ ] Water treatment
- [x] Other: NO SYSTEM

Type of System
Check all that apply:

- [ ] Direct-fired, single tank
- [ ] Direct-fired, multiple tanks
- [ ] Indirect, using heating boiler with separate storage tank
- [ ] Hot water generator with separate storage tank
- [x] Other: NO SYSTEM

What fuels are used to generate hot water? (Check all that apply):

- [ ] natural gas
- [ ] propane
- [ ] electric
- [ ] #1 fuel oil
- [ ] #2 fuel oil

Describe location of water heater(s):

Describe on-site fuel storage: number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.:

Used oil stored in external structure located on the south wall of the gym. Outside access only. Single tank.

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): Corrugated metal Insulation Value:

Roof type: Corrugated metal Insulation Value:

Windows: [ ] single pane  [ ] double pane  [x] Other: NO WINDOWS

Arctic entry(s): [ ] none  [x] at main entrance only  [ ] at multiple entrances  [ ] at all entrances

Drawings available: [ ] architectural  [ ] mechanical  [ ] electrical

Outside Air/Air Exchange: [ ] HRV  [ ] CO₂ Sensor

ELECTRICAL

Utility company that serves the building or community: MEA

Type of grid: [ ] building stand-alone  [ ] village/community power  [x] railbelt grid

Energy source: [ ] hydropower  [ ] diesel generator(s)  [x] Other: Natural Gas

Electricity rate per kWh: $0.18 Demand charge:

Electrical energy phase(s) available: [ ] single phase  [ ] 3-phase

Back-up generator on site: [ ] Yes  [ ] No  If Yes, provide output capacity:

Are there spare circuits in MDP and/or electrical panel?: [ ] Yes  [ ] No

Record MDP and electrical panel name plate information: See photos

WOOD FUEL INFORMATION

- Wood pellet cost delivered to facility $________/ton Viable fuel source? Yes [x]
- Wood chip cost delivered to facility $________/ton Viable fuel source? Yes [x]
- Cord wood cost delivered to facility $250/cord Viable fuel source? [x] No
- Distance to nearest wood pellet and wood chip suppliers: Fairbanks [x]
- Can logs or wood fuel be stockpiled on site or at a nearby facility? [x] Yes

FACILITY SITE CONSIDERATIONS

Is there good access to site for delivery vehicles (trucks, chip vans, etc)?
Yes

Are there any significant site constraints? (Playgrounds, other buildings, wetlands, underground utilities, etc)?
No


Is the building in proximity to other buildings with biomass potential? If so, Which ones and How close?
Yes, Summon loop & maintenance snap

Can building accommodate a biomass boiler inside, or would an addition for a new boiler be necessary? Where would addition go?
No. Exterior addition needed

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from?
Existing site

If necessary, can piping be run underground from a central plant to the building? Where would piping enter boiler room?
Yes.

OTHER INFORMATION

Provide any other information that will help describe the space heating and domestic hot water systems, such as

Is heat distribution system looping or branching?

For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot?

Any other energy using systems (kitchen equipment, lab equipment, pool etc)? Fuel or energy source?

Any systems that could be added to the boiler system?

Are heating fuel records available?

PICTURE / VIDEO CHECKLIST

Exterior
Main entry
Building elevations
Several near boiler room and where potential addition/wood storage and/or exterior piping may enter the building
Access road to building and to boiler room
Power poles serving building
Electrical service entry
Emergency generator

Interior
Boilers, pumps, domestic water heaters, heat exchangers – all mechanical equipment in boiler room and in other parts of the building.
Boiler room piping at boiler and around boiler room
Piping around domestic water heater
MDP and/or electrical panels in or around boiler room
Pictures of available circuits in MDP or electrical panel (open door).
Picture of circuit card of electrical panel
Picture of equipment used to heat room in the building (i.e. baseboard fin tube, unit heaters, unit ventilators, air handler, fan coil)
Pictures of any other major mechanical equipment
Pictures of equipment using fuel not part of heating or domestic hot water system (kitchen equip., lab equip., pool, etc.)
Pictures of building plans (site plan, architectural floor plan, mechanical plan, boiler room plan, electrical power plan)
**ALASKA WOOD ENERGY DEVELOPMENT TASK GROUP (AWEDTG)**

**PRE-FEASIBILITY ASSESSMENT FIELD DATA SHEET**

<table>
<thead>
<tr>
<th>APPLICANT:</th>
<th>Victory Bible Camp</th>
</tr>
</thead>
</table>

| Eligibility: (check one) | □ Local government | □ State agency | □ Federal agency | □ School/School District |
| □ Federally Recognized Tribe | □ Regional ANCSA Corp. | □ Village ANCSA Corp. |
| ☑ Not-for-profit organization | □ Private Entity that can demonstrate a Public Benefit |
| □ Other (describe): | |

| Contact Name: | Evan Busenitz |
| Mailing Address: | 64741 S Victory Rd |
| City: | Sutton |
| State: | AK |
| Zip Code: | 99674 |
| Office phone: | (907) 745-4203 |
| Cell phone: | ( ) |
| Fax: | (907) |
| Email: | evamb@vbcakaska.org |

**Facility Identification/Name:** Same as above

**Facility Contact Person:**

**Facility Contact Telephone:** (907) ( )

**Facility Contact Email:**

---

### SCHOOL/FACILITY INFORMATION (complete separate Field Data Sheet for each building)

**SCHOOL FACILITY** (Name: ____________________________)

| School Type: (check all that apply) | [ ] Pre-School | [ ] Junior High | [ ] Student Housing |
| [ ] Elementary | [ ] High School | [ ] Pool |
| [ ] Middle School | [ ] Campus | [ ] Gymnasium |
| [ ] Other (describe): | |

| Size of facility (sq. ft. heated): | Year built/age: |
| Number of floors: | Year(s) renovated: |
| Number of bldgs.: | Next renovation: |
| # of Students: | Has an energy audit been conducted? If Yes, when? * |

**OTHER FACILITY** (Name: Aspen)

| Type: | [ ] Health Clinic | [ ] Water Plant |
| [ ] Public Safety Bldg. | [ ] Multi-Purpose Bldg |
| [ ] Community Center | [ ] District Energy System |
| [ ] Public Housing | [ ] Other (list): |

| Size of Facility (sq. ft. heated): | Year built/age: |
| Number of floors: | Year(s) renovated: |
| Number of bldgs.: | Next renovation: |
| Frequency of Usage: As Needed/Seasonal | # of Occupants |
| Has an energy audit been conducted? | No |
| If Yes, when? * |

*If an Energy Audit has been conducted, please provide a copy.*
HEATING SYSTEM INFORMATION

CONFIGURATION (check all that apply)
- [x] Heat plant in one location: [ ] on ground level  [ ] below ground level  [ ] mezzanine  [ ] roof  [ ] at least 1 exterior wall
- [ ] Different heating plants in different locations: How many? __________  What level(s)? ______________________
- [ ] Individual room-by-room heating systems (space heaters)
- [ ] Is boiler room accessible to delivery trucks?  [ ] Yes  [ ] No

HEAT DELIVERY (check all that apply)
- [x] Hot water: [ ] baseboard  [ ] radiant heat floor  [ ] cabinet heaters  [ ] air handlers  [ ] radiators  [ ] other: ______________________
- [ ] Steam: ______________________
- [ ] Forced/ducted air
- [ ] Electric heat: [ ] resistance  [ ] boiler  [ ] heat pump(s)
- [ ] Space heaters

HEAT GENERATION (check all that apply)
- [x] Hot water boiler: [ ] natural gas  [ ] propane  [ ] electric  [ ] #1 fuel oil  [x] #2 fuel oil  [ ] 800 Gallons  [ ] 800 Gallons  [ ] $2.50\$/gal
- [ ] Steam boiler: [ ] natural gas  [ ] propane  [ ] electric  [ ] #1 fuel oil  [ ] #2 fuel oil
- [ ] Warm air furnace: [ ] natural gas  [ ] propane  [ ] electric  [ ] #1 fuel oil  [ ] #2 fuel oil
- [ ] Electric resistance: [ ] baseboard  [ ] duct coils
- [ ] Heat pumps: [ ] air source  [ ] ground source  [ ] sea water
- [ ] Space heaters: [ ] woodstove  [ ] Toyo/Monitor  [ ] other: ______________________

TEMPERATURE CONTROLS (type of system; check all that apply)
- [x] Thermostats on individual devices/appliances; no central control system
- [ ] Pneumatic control system  Manufacturer: ______________________  Approx. Age: _________
- [ ] Direct digital control system  Manufacturer: ______________________  Approx. Age: _________

Record Name Plate data for boilers (use separate sheet if necessary):
Weil-McLain WTGO-3 100,000 BTU Gold Oil Boiler. #386-100-832

Describe locations of different parts of the heating system and what building areas are served:
Entire System in Mechanical Room

Describe age and general condition of existing equipment:
Functional Equipment

Who performs boiler maintenance?  Even/Eugenitz & Staff  Describe any current maintenance issues:

Where is piping or ducting routed through the building? (tunnels, utilidors, crawlspace, above false ceiling, attic, etc.):
Through walls and between floor joists.

Describe on-site fuel storage: Number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.:
Underground Tank

If this fuel is also used for other purposes, please describe:  Only for heating.
DOMESTIC HOT WATER

USES OF DOMESTIC HOT WATER
Check all that apply:
☐ Avatories
☐ Kitchen
☐ Shower 5
☐ Laundry
☐ Water treatment
☐ Other: ________________________________

What fuels are used to generate hot water? (Check all that apply): ☐ natural gas ☑ propane ☐ electric ☐ #1 fuel oil ☐ #2 fuel oil

Describe location of water heater(s): Boiler Room

Describe on-site fuel storage: number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.: Same as boiler.

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): ☑ Stick frames Insulation Value: ______

Roof type: ☑ Comp Batts Insulation Value: ______

Windows: ☐ single pane ☑ double pane ☐ other: ________________________________

Arctic entry(s): ☐ none ☐ at main entrance only ☑ at multiple entrances ☐ at all entrances

Drawings available: ☐ architectural ☐ mechanical ☐ electrical

Outside Air/Air Exchange: ☐ HRV ☐ CO2 Sensor

ELECTRICAL

Utility company that serves the building or community: ☑ MEA

Type of grid: ☐ building stand-alone ☐ village/community power ☑ railbelt grid

Energy source: ☐ hydropower ☐ diesel generator(s) ☑ Other: ☑ Natural Gas

Electricity rate per kWh: $0.12 Demand charge: ____________

Electrical energy phase(s) available: ☑ single phase ☐ 3-phase

Back-up generator on site: ☑ Yes ☐ No If Yes, provide output capacity: ________________________________

Are there spare circuits in MDP and/or electrical panel? ☑ Yes ☐ No

Record MDP and electrical panel name plate information: See photos

WOOD FUEL INFORMATION

- Wood pellet cost delivered to facility $________ /ton Viable fuel source? ☑ Yes ☐ No
- Wood chip cost delivered to facility $________ /ton Viable fuel source? ☑ Yes ☐ No
- Cord wood cost delivered to facility $250 /cord Viable fuel source? ☑ Yes No
- Distance to nearest wood pellet and wood chip suppliers: Fairbanks
- Can logs or wood fuel be stockpiled on site or at a nearby facility? Yes

FACILITY SITE CONSIDERATIONS

Is there good access to site for delivery vehicles (trucks, chip vans, etc)?

Front only

Are there any significant site constraints? (Playgrounds, other buildings, wetlands, underground utilities, etc.)?

No

What are local soil conditions? Permafrost issues?

Is the building in proximity to other buildings with biomass potential? If so, Which ones and How close?

Yes, Southern loop

Can building accommodate a biomass boiler inside, or would an addition for a new boiler be necessary? Where would addition go?

New addition

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from?

Existing site

If necessary, can piping be run underground from a central plant to the building? Where would piping enter boiler room?

Yes, enter through main room Exterior wall

OTHER INFORMATION

Provide any other information that will help describe the space heating and domestic hot water systems, such as

- Is heat distribution system looping or branching?
- For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot?
- Any other energy using systems (kitchen equipment, lab equipment, pool etc)? Fuel or energy source?
- Any systems that could be added to the boiler system?
- Are heating fuel records available?

PICTURE / VIDEO CHECKLIST

Exterior
Main entry
Building elevations
Several near boiler room and where potential addition/wood storage and/or exterior piping may enter the building
Access road to building and to boiler room
Power poles serving building
Electrical service entry
Emergency generator

Interior
Boilers, pumps, domestic water heaters, heat exchangers – all mechanical equipment in boiler room and in other parts of the building.
Boiler room piping at boiler and around boiler room
Piping around domestic water heater
MDP and/or electrical panels in or around boiler room
Pictures of available circuits in MDP or electrical panel (open door).
Picture of circuit card of electrical panel
Picture of equipment used to heat room in the building (i.e. baseboard fin tube, unit heaters, unit ventilators, air handler, fan coil)
Pictures of any other major mechanical equipment
Pictures of equipment using fuel not part of heating or domestic hot water system (kitchen equip., lab equip., pool, etc.)
Pictures of building plans (site plan, architectural floor plan, mechanical plan, boiler room plan, electrical power plan)
**ALASKA WOOD ENERGY DEVELOPMENT TASK GROUP (AWEDTG)**

**PRE-FEASIBILITY ASSESSMENT FIELD DATA SHEET**

<table>
<thead>
<tr>
<th>APPLICANT:</th>
<th>Victory Bible Camp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligibility: (check one)</td>
<td></td>
</tr>
<tr>
<td>□ Local government</td>
<td>□ State agency</td>
</tr>
<tr>
<td>□ Federally Recognized Tribe</td>
<td>□ Federal agency</td>
</tr>
<tr>
<td>□ Not-for-profit organization</td>
<td>□ School/School District</td>
</tr>
<tr>
<td>□ Other (describe):</td>
<td>□ Regional ANCSA Corp.</td>
</tr>
<tr>
<td>□ Private Entity that can demonstrate a Public Benefit</td>
<td>□ Village ANCSA Corp.</td>
</tr>
</tbody>
</table>

| Contact Name: | Evan Basenishi |
| Mailing Address: | 64741 S Victory Rd |
| City: | Sutton |
| State: | AK |
| Zip Code: | 99674 |
| Office phone: | (907) 748-4203 |
| Cell phone: | ( ) |
| Fax: | (907) |
| Email: | |

**Facility Identification/Name:** Same as above

**Facility Contact Person:**

**Facility Contact Telephone:** (907)  

**Facility Contact Email:**

---

**SCHOOL/FACILITY INFORMATION** (complete separate Field Data Sheet for each building)

**SCHOOL FACILITY** (Name: __________)

| School Type: | [ ] Pre-School |
| (check all that apply) | [ ] Elementary |
| [ ] Junior High | [ ] High School |
| [ ] Middle School | [ ] Campus |
| [ ] Student Housing | [ ] Pool |
| [ ] Gymnasium | [ ] Other (describe): |

| Size of facility (sq. ft. heated): | Year built/age: |
| Number of floors: | Year(s) renovated: |
| Number of bldgs.: | Next renovation: |
| # of Students: | Has an energy audit been conducted?: If Yes, when? * |

**OTHER FACILITY** (Name: __________)

| Type: | [ ] Health Clinic |
| (list): | [ ] Public Safety Bldg. |
| [ ] Water Plant | [ ] Multi-Purpose Bldg |
| [ ] Washeteria | [ ] District Energy System |
| [ ] Public Housing | [ ] Other (list): |

| Size of Facility (sq. ft. heated): 4700 | Year built/age: 19605 |
| Number of floors: 2 | Year(s) renovated: |
| Number of bldgs.: 1 | Next renovation: |
| Frequency of Usage: Year round | # of Occupants 0-6 |
| Has an energy audit been conducted?: No | If Yes, when? * |

* If an Energy Audit has been conducted, please provide a copy.
HEATING SYSTEM INFORMATION

CONFIGURATION (check all that apply)
- □ Heat plant in one location: □ on ground level □ below ground level □ mezzanine □ roof □ at least 1 exterior wall
- □ Different heating plants in different locations: How many? 3 □ What level(s)? First Floor
- □ Individual room-by-room heating systems (space heaters)
- □ Is boiler room accessible to delivery trucks? □ Yes □ No

HEAT DELIVERY (check all that apply)
- □ Hot water: □ baseboard □ radiant heat floor □ cabinet heaters □ air handlers □ radiators □ other: __________________________
- □ Steam: __________________________
- □ Forced/ducted air
- □ Electric heat: □ resistance □ boiler □ heat pump(s)
- □ Space heaters

HEAT GENERATION (check all that apply)
- □ Hot water boiler: □ natural gas □ propane □ electric □ #1 fuel oil □ #2 fuel oil
- □ Steam boiler: □ natural gas □ propane □ electric □ #1 fuel oil □ #2 fuel oil
- □ Warm air furnace: □ natural gas □ propane □ electric □ #1 fuel oil □ #2 fuel oil
- □ Electric resistance: □ baseboard □ duct coils
- □ Heat pumps: □ air source □ ground source □ sea water
- □ Space heaters: □ wood stove □ Toyo Monitor □ other: __________________________

Heating capacity (Btu/h / kwh) | Annual Fuel Consumption | Cost
--- | --- | ---
0 Gallons | 0 | 0

TEMPERATURE CONTROLS (type of system; check all that apply)
- □ Thermostats on individual devices/appliances; no central control system
- □ Pneumatic control system Manufacturer: __________________________ Approx. Age: __________
- □ Direct digital control system Manufacturer: __________________________ Approx. Age: __________

Record Name Plate data for boilers (use separate sheet if necessary): See below.

Describe locations of different parts of the heating system and what building areas are served:

Heat units and Toyo Stoves throughout. Wood boiler located outside.

Describe age and general condition of existing equipment:
Functional

Who performs boiler maintenance? Ewan Buzenits & Staff Describe any current maintenance issues:

Where is piping or ducting routed through the building? (tunnels, utilidors, crawlspace, above false ceiling, attic, etc.): Surface

Describe on-site fuel storage: Number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.: Propane tank located at rear (South) of building. Unused fuel oil tank also on site.

If this fuel is also used for other purposes, please describe: Hot water heater.
DOMESTIC HOT WATER

USES OF DOMESTIC HOT WATER
Check all that apply:

☐ Lavatories
☐ Kitchen
☐ Showers
☐ Laundry
☐ Water treatment
☐ Other: ________________________________

TYPE OF SYSTEM
Check all that apply:

☐ Direct-fired, single tank
☐ Direct fired, multiple tanks
☐ Indirect, using heating boiler with separate storage tank
☐ Hot water generator with separate storage tank
☐ Other: ________________________________

What fuels are used to generate hot water? (Check all that apply):

☐ natural gas
☐ propane
☐ electric
☐ #1 fuel oil
☐ #2 fuel oil

Describe location of water heater(s): _______________________________________

Describe on-site fuel storage: number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.: Same as Unit heaters.

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): Stick Frame
Insulation Value: ________________

Roof type: Composition Shingles
Insulation Value: ________________

Windows: ☐ single pane ☐ double pane ☐ other: ________________________________

Arctic entry(s): ☐ none ☐ at main entrance only ☐ at multiple entrances ☐ at all entrances

Drawings available: ☐ architectural ☐ mechanical ☐ electrical

Outside Air/Air Exchange: ☐ HRV ☐ CO₂ Sensor

ELECTRICAL

Utility company that serves the building or community: MEA

Type of grid: ☐ building stand-alone ☐ village/community power ☐ railbelt grid

Energy source: ☐ hydropower ☐ diesel generator(s) ☐ Other: Natural Gas

Electricity rate per kWh: $0.18 Demand charge: ________________________________

Electrical energy phase(s) available: ☐ single phase ☐ 3-phase

Back-up generator on site: ☐ Yes ☐ No If Yes, provide output capacity: ________________________________

Are there spare circuits in MDP and/or electrical panel?: ☐ Yes ☐ No

Record MDP and electrical panel name plate information: See photos

WOOD FUEL INFORMATION

- Wood pellet cost delivered to facility $________/ton Viable fuel source? Yes ☐ No ☐
- Wood chip cost delivered to facility $________/ton Viable fuel source? Yes ☐ No ☐
- Cord wood cost delivered to facility $250/cord Viable fuel source? Yes ☐ No ☐
- Distance to nearest wood pellet and wood chip suppliers? Fairbanks
- Can logs or wood fuel be stockpiled on site or at a nearby facility? Yes


Page 3 of 4
FACILITY SITE CONSIDERATIONS

Is there good access to site for delivery vehicles (trucks, chip vans, etc.)?  Yes

Are there any significant site constraints? (Playgrounds, other buildings, wetlands, underground utilities, etc.)?  No


Is the building in proximity to other buildings with biomass potential? If so, Which ones and How close?  Gym

Can building accommodate a biomass boiler inside, or would an addition for a new boiler be necessary? Where would addition go?  Exterior only. New structure

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from?  Current site

If necessary, can piping be run underground from a central plant to the building? Where would piping enter boiler room?  Yes! However no current boiler room.

OTHER INFORMATION

Provide any other information that will help describe the space heating and domestic hot water systems, such as

Is heat distribution system looping or branching?

For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot?

Any other energy using systems (kitchen equipment, lab equipment, pool etc.) Fuel or energy source?

Any systems that could be added to the boiler system?

Are heating fuel records available?

PICTURE / VIDEO CHECKLIST

Exterior
Main entry
Building elevations
Several near boiler room and where potential addition/wood storage and/or exterior piping may enter the building
Access road to building and to boiler room
Power poles serving building
Electrical service entry
Emergency generator

Interior
Boilers, pumps, domestic water heaters, heat exchangers – all mechanical equipment in boiler room and in other parts of the building.
Boiler room piping at boiler and around boiler room
Piping around domestic water heater
MDP and/or electrical panels in or around boiler room
Pictures of available circuits in MDP or electrical panel (open door).
Picture of circuit card of electrical panel
Picture of equipment used to heat room in the building (i.e. baseboard fin tube, unit heaters, unit ventilators, air handler, fan coil)
Pictures of any other major mechanical equipment
Pictures of equipment using fuel not part of heating or domestic hot water system (kitchen equip., lab equip., pool, etc.)
Pictures of building plans (site plan, architectural floor plan, mechanical plan, boiler room plan, electrical power plan)