Feasibility Assessment for Biomass Heating Systems
Kodiak, Alaska

FINAL REPORT – 8/10/2015

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Abbreviations

ACF	Accumulated Cash Flow
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
AEA	Alaska Energy Authority
AFUE	Annual Fuel Utilization Efficiency
B/C	Benefit / Cost Ratio
BTU	British Thermal Unit
BTUH	BTU per hour
CCF	One Hundred Cubic Feet
CEI	Coffman Engineers, Inc.
CFM	Cubic Feet per Minute
Eff	Efficiency
F	Fahrenheit
ft	Feet
GPM	Gallons Per Minute
HP	Horsepower
HVAC	Heating, Ventilating, and Air-Conditioning
in	Inch(es)
kWh	Kilowatt-Hour
lb(s)	Pound(s)
MBH	Thousand BTUs per Hour
O&M	Operations and Maintenance
MMBTU	One Million BTUs
PC	Project Cost
R	R-Value
SF	Square Feet, Supply Fan
TEMP	Temperature
V	Volts
W	Watts

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I. Executive Summary

A preliminary feasibility assessment was completed in Kodiak, AK for the Kodiak Area Native Association (KANA) and four of their properties. The purpose of the assessment was to determine the technical and economic viability of biomass heating systems for the KANA Main Building, the CACPLL, the Anderson Construction Warehouse, and the Alaska Commercial (A/C) Building. Upgrades are evaluated per building in this study. Due to existing building heating systems, pellet boilers were evaluated for each facility, as major renovations would be required to integrate cord wood boilers for these projects. Pellet boilers were selected due to compatibility with existing building heating equipment.

At this time, biomass systems are not economically justified. However with the anticipated startup of sawmills in the Kodiak area, estimates have been prepared with pellet fuel costs that could be economically viable. This would give economic planners a target price when evaluating the development of a pellet production facility.

II. Introduction

A preliminary feasibility assessment was completed to determine the technical and economic viability of biomass heating systems for the KANA Main Building, CACPLL, Anderson Construction Warehouse, and the Alaska Commercial Building. The location of the building is shown in Figures 1, 2, and 3.

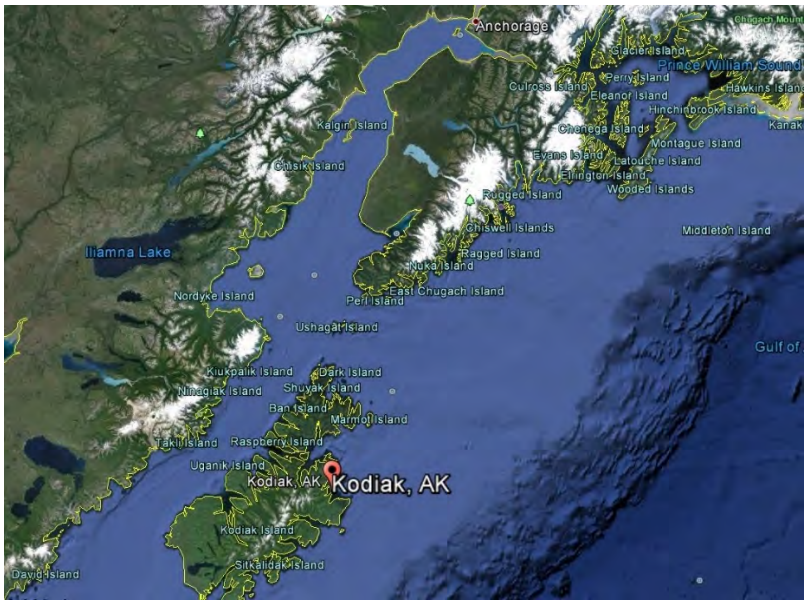


Figure 1 – Kodiak, Alaska – Google Maps

Figure 2 – Kodiak downtown, Alaska Commercial Building – Google Maps

Figure 3 – Kodiak, AK, KANA Campus site – Google Maps

III. Preliminary Site Investigation

Complete data and records for the buildings were not available at this time. All dates, quantities, and additional data is approximated as close as practical based on anecdotal evidence and surrounding properties.

Building Descriptions

The KANA Main Building is a 18,910 SF two-story building that was constructed in 1995. The lower floor is dedicated to healthcare services, while the upper floor is dedicated to office space and administrative services. The building is open during regular business hours, 8am-5pm, Monday through Friday. Approximately 30 employees use the space daily, and 2 to 3 visitors per hour occupy the building during regular business hours. There is only token usage by employees at other times of the day and week. No energy audit has been conducted for the building.

The CACPLL Building is a 10,125 SF single story building that was constructed in 1997. It has a mezzanine space for building heating and ventilation equipment. The east half of the building is a shop and warehouse space leased to a third party, and the west half of the building is an office space. The building is occupied during regular business hours, 8am-5pm, Monday through Friday. The full-time occupancy is 6 employees daily, and approximately 1 visitor per hour. No energy audit has been conducted.

The Anderson Construction Warehouse was purchased by KANA in 2014 and is a 3,000 SF single story building. The building consists of a prefabricated metal building and is used as an equipment shed. The building is not regularly occupied and only has token use when KANA staff require shop space or cold storage space. No energy audit has been conducted.

The Alaska Commercial Building was purchased by KANA in 2014 and is a 40,000 SF facility. It was formerly a grocery/department store and is currently mothballed pending an undetermined future use. The owner is willing to renovate for a future usage, however it is currently divided into two large spaces on the ground floor (what was previously the shopping area and the storage area) with offices in a mezzanine area, and a penthouse gathering room. No regular occupancy occurs at the facility. No energy audit has been conducted.

Existing Heating Systems

- The KANA Main building is heated with two Weil McLain series 78 boilers, model 678. They are rated for 5.5 GPH of fuel oil, and are paired with similarly rated Beckett burners. The boilers are located in a mechanical room on the north exterior wall of the building. The boilers serve two VAV air handling units, the perimeter baseboard system, and the domestic hot water sidearm heater. All of the mechanical equipment was installed with the building's original construction in 1995. The combustion efficiency of the boilers is roughly 80%. The boilers and air handling units are regularly well maintained and appear to be in great condition.

- The CACPLL is heated with a Weil McLain model 578 boiler rated for 4.45 GPH of fuel oil, paired with a similarly rated Carlin burner. The boiler is located in the mechanical mezzanine accessible from the shop side of the building. The boiler serves hydronic unit heaters in the shop side, baseboard perimeter heat in the office side, and the ventilation coils for the VAV air handling system serving the office side. All of the mechanical equipment was installed with the building's

original construction in 1997. The combustion efficiency of the boiler is roughly 80%. The boiler and air handler are regularly well maintained and appear to be in excellent condition.

- The Anderson Construction Warehouse is heated with an EnergyLogic waste oil heater. The nameplate on the burner and the unit were illegible. The heater is located in a corner in the warehouse space and directly distributes heated air. It serves the entire warehouse space. The mechanical equipment was installed with the original building construction, which was sometime approximately 20 to 25 years ago. The combustion efficiency is approximately 80%. The systems are maintained and in working order.

- The Alaska Commercial Building was built in 1964 and is heated with two Weil McLain 878 boilers, rated for 7.5 GPH of fuel oil. They are paired with similarly rated Gordon-Piatt burners. The boilers are located in the mechanical room along the southwest face of the building and distribute heating water to vertical unit heaters for space heating for freeze protection. The boilers were installed approximately 25 years ago; no exact age is known. The building underwent a change of use in 2013 when KANA acquired the facility. Rooftop AHUs were removed and the roof was patched. Baseboard heat was removed and the vertical unit heaters were added to provide space heating for freeze protection.

Domestic Hot Water

- Domestic hot water for the KANA Main building is provided by a Triangle Tube indirect hot water heater, with heat provided by a heating coil fed by the heating boilers. It has an 80 gallon capacity. Domestic hot water is used for the lavatories in restrooms, janitor's sinks, coffee sinks in breakrooms, and for handwashing sinks around the first floor.

- In the CACPLL, domestic hot water is provided by an electric hot water heater located in the boiler room. It has a 50 gallon capacity with a 4500W element. The domestic hot water is used by janitor sinks, lavatories in restrooms, and one shower.

- The Anderson Construction Warehouse has a tankless oil-fired on-demand domestic hot water heater. However it was not operational at the time of inspection. It was disabled from functioning for an unknown reason. If functional, it would serve a lavatory in a restroom.

- The domestic hot water for the A/C building is provided by an oil-fired 32 gallon water heater located in the boiler room, with a burner rated for 0.75 GPH of fuel oil. This corresponds to a recovery rate of roughly 114 GPH at a 90°F rise. The building does not have any regular or currently planned usage, however, the existing, unused, connected fixtures are lavatories, 2 kitchen sinks, and 2 handwashing sinks.

Building Envelope

- The KANA Main building is a modern construction steel frame stick built building with a 2"x8" wall construction with a stucco exterior finish. The roof is a built-up hot roof with an overall insulation value of approximately R-30. The windows in the building are double paned. Only the front entrance is provided with an arctic entryway.

- The CACPLL is a prefabricated metal building structure with a 2”x6” wall construction. The roof is a metal hot roof with energy-code minimum insulation of R-30. The windows in the building are double paned. Only the main entrance on the office side is provided with an arctic entry.

- The Anderson Construction Warehouse is an equipment-shed style prefabricated metal building. It has 2”x4” walls. The roof construction is also a 2”x4” construction, with R-13 insulation. There are no windows in the building. The short walls on either end of the building have large garage doors, of approximately R-7 construction. The weather seals on the garage doors require replacement to reduce drafts or undesired heat loss. There are no arctic entries provided for the facility.

- The A/C Building is a stick-frame construction building with 2”x6” walls consisting of nominal R-19 insulation. The roof is an EPDM covered hot roof built on a 2”x 8” frame with a nominal R-30 insulation system. What few windows there are in the building are double paned. No arctic entries are provided at any entrance in the building.

Available Space

- The KANA Main building does not have unused interior space that would accommodate a wood boiler system. An addition or a detached plant building would be able to accommodate a new wood-fired system. Space for the addition or new boiler building would be towards the north, either extending into the parking lot, or developing a portion of the lawn next to the facility

- The CACPLL building would have the space to accommodate one pellet system, however no other commercially available compatible wood-fired system would fit in the available space in the building. No adequate space is available outside the building due to rights-of-way and existing yard laydown usage surrounding the building.

- The Anderson Construction Warehouse has ample interior space for almost any wood-fired system under consideration, but future space usage should be considered prior to installation of a wood-fired system. No space would be available around the exterior of the building due to required setbacks from property lines. Code variances could be investigated if an exterior option is desired.

- The Alaska Commercial Building has ample interior space to fit any wood-fired heating system. However, since the building is currently unoccupied, future and current space usage should be considered prior to installation of a wood-fired system. No space is available outside the building as it is located in a highly developed downtown area with adjacent structure and dedicated adjacent area usage.

Street Access and Fuel Storage

All four buildings have excellent site access for any size delivery vehicle for cordwood or pellets. The KANA Main, CACPLL, and the Anderson Construction Warehouse all have areas where dry storage could be installed, such as outdoor drying sheds for cordwood or for pellet bags. The A/C Building would require storage to be provided indoors, as space is limited outside the building.

Building or Site constraints

- For the KANA Main Building, there are several site constraints. There is a main road which cannot be encroached to the east, a road to the south, and parking lots to the west and north. Additionally, there is a rocky bluff to the northwest. The lawn would be ideal for an addition and is located between the building and the road to the northeast and east.

- The CACPLL also has site constraints. There is a main road to the west, another road to the north, a local access road to the south, and yard and laydown space to the east.

- The Anderson Construction Warehouse has significant site constraints on all sides with local access roads and other privately owned buildings to the west and east. Space is available for drying sheds or fuel storage on the ground along the west and east sides of the building, under the building eaves.

- The A/C Building has significant site constraints. Main roads are on the south and west sides of the building, a parking lot is to the north, and privately owned buildings to the east. No outdoor space is available for any additions or fuel storage.

Biomass System Integration

For all four buildings in Kodiak, biomass system integration is difficult.

- The KANA Main Building operates at high heating water temperatures with a 20°F temperature difference between the supply and the return. A cordwood, chip wood, or hog wood system would require terminal heating equipment to be capable of a large range of temperatures, and a much larger temperature drop. The lowest impact on the existing building services is a pellet fired boiler system, which is capable of maintaining higher temperatures and a matching temperature drop at the existing terminal heating equipment.

- The CACPLL Building has similar integration constraints as the KANA Main facility. A pellet fueled system would have the least impact on existing building services.

- The Anderson Construction Warehouse requires a space usage planning exercise prior to the introduction of a wood-fired heating system because it currently has minimal use and is rarely heated. Any installed wood boiler system would also require the installation of terminal heating equipment, as the existing waste oil heater has no capabilities for integration.

- The A/C Building has interior space to install a cordwood or pellet fired system, as well as the fuel storage for either system. This would require renovating some of the spaces near the mechanical room to accommodate the new heating equipment. Installing new heating equipment would be impractical without a future usage plan for the entire facility (as it is vacant and heated only for freeze protection). New terminal heating equipment would need to be selected and installed for the new space usage and with the biomass system in mind. It is recommended to perform another wood boiler evaluation when the facility is changed to its next usage.

Biomass System Options

Due to space constraints, wood chips or hog wood systems are not feasible for any of the facilities under consideration in Kodiak. These systems require conveyor and handling systems for the fuel delivery that take up a significant space. Cordwood systems are possible, but would require redesign and replacement terminal heating equipment. The simplest integration into existing systems are pellet fueled heating equipment.

- For the KANA Main, a Tarm Froling T4 150 is considered. The unit itself is 90” long x 64” wide x 70” tall. It would be installed in a building addition with minimum dimensions of 20’ long x 8’ wide x 8.5’ tall. The addition would contain the boiler, circulation pumps, a heat exchanger, controls, and other miscellaneous equipment. The Tarm boiler would heat water, delivering heat to a 50% propylene glycol (PG) solution in the heat exchanger and loop piping. The PG solution would deliver heat to the building through underground supply and return piping, and connect to the existing building heating system through a new heat exchanger.

- An estimated was compiled for the A/C building to install a pellet boiler to match other systems proposed in this study at other buildings. The pellet boiler system matches the KANA Main Building. Due to the significant available space in the building, other wood-fired systems are possible options, but were not considered due to the lack of future space usage plans at this time.

- Pellet boilers were also evaluated to be installed inside the CACPLL and Anderson Construction Warehouse buildings. The CACPLL has an existing hydronic heating system which can be integrated into a new pellet system. The Anderson Construction Warehouse would require the installation of a hydronic system and new terminal heating equipment. The pellet systems evaluated for these buildings are the Tarm Froling P4s, which are similar in most respects to the T4, however they are smaller and are rated for a lower heat rating, more in line with expected loads at the CACPLL and the Anderson Construction Warehouse.

IV. Energy Consumption and Costs

Energy Costs

The table below shows the energy comparison of different fuel types. 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.

Table 1 – Energy Comparison

Fuel Type	Units	Gross BTU/unit	System Efficiency	$/unit	Delivered $/MMBTU
Cord Wood	cord	14,990,000	75%	$300	$26.68
Fuel Oil	gal	134,000	80%	$4.00	$37.31
Electricity	kWh	3,413	99%	$0.15	$59.19
Wood Pellets (Shipped to Kodiak)	ton	16,000,000	85%	$593	$43.60[1]

[1]Pellets were priced at $249 per ton in Seattle with a delivery cost of $344 per ton from Seattle. Currently, Alaska-based pellet sources are more expensive than Seattle options.

Note that in this analysis that wood pellets are more expensive than fuel oil, primarily due to shipping. Assuming fuel oil is constant at $4.00/gallon, wood pellets would provide a reasonable energy savings at a maximum delivered cost of approximately $200/ton or less. A rise in fuel oil price would shorten the payback time, and a decrease in fuel oil price would lengthen the payback. Additionally, cheaper delivered pellet costs would shorten the payback time and increase the benefit-cost ratio.

Wood Pellets

There is no local wood pellet manufacturer or distributer in Kodiak, which means that wood pellets would have to be barged into the community. Wood pellets are typically sold in 40 lb bags and shipped by the pallet (where 50 bags are loaded on a pallet). Each pallet is one ton of pellets. Wood pellets are currently sold in Anchorage for $295/ton. The cost for shipping one ton of wood pellets by barge to Kodiak was quoted by two shipping companies. Delivery costs from Anchorage are approximately $413/ton and $344/ton from Seattle. The total cost of wood pellets will be $593/ton, which is more expensive than heating oil on a BTU basis.

Future Local Pellet Production

If a sawmill local to Kodiak or the surrounding islands developed pellet fuel delivery capability, that total delivered cost to the KANA facilities would have to be approximately $200/ton or cheaper in order to provide a reasonable payback and benefit-cost ratio, assuming heating fuel costs remain at approximately $4.00/gallon.

Heating Oil

The high price of fuel oil is the main economic driver for the use of biomass heating. Fuel oil is shipped into Kodiak by barge and currently costs approximately $4.00/gal. For this study, the energy content of fuel oil is based on 134,000 BTU/gal, according to the UAF Cooperative Extension available data.

Electricity

Electricity is provided by the local power utility, Kodiak Electric Association. Electricity is sold to the KANA facilities at 14.98 cents per kWh for the first 300 kWH, and 12.85 cents per kWh for any further electrical usage. For the purposes of this project, 15 cents per kWh was used for economic analysis.

Existing Fuel Oil Consumption

An estimate of heating oil consumption was made based on information provided by KANA.

Table 2 – Existing Fuel Oil Consumption				
Building	**Fuel Type**	**Annual Consumption**	**Net MMBTU/yr**	**Avg. Annual Cost**
KANA Main	Fuel Oil	8,200 gal	879	$32,000
CACPLL Building	Fuel Oil	2,600 gal	279	$10,400
Anderson Construction Warehouse	Waste Oil	N/A	N/A	N/A[1]
A/C Building	Fuel Oil	10,000 gal	1,072	$40,000[2]

[1]Waste oil used was reclaimed without a direct cost.

[2]Estimated

Biomass System Consumption

It is estimated that the proposed biomass system will offset 80% of the heating energy for the building, by burning pellets. The remaining 20% of the heating energy will be provided by the existing oil boilers. This result is based on an analysis of the annual heating oil consumption and the heat output of the Tarm boiler. It is assumed that the Tarm system will produce 512,000 BTU/hr per manufacturer documentation. The chart below is first presented at quoted costs, and then again with a theoretical cost of $200 per ton.

Table 3 – Proposed Biomass System Fuel Consumption – 2015 Quoted Costs							
Building	**Fuel Type**	**% Heating Source**	**Net MMBTU/yr**	**Annual Consumption**	**Energy Cost**	**Total Energy Cost**	**Annual Energy Savings**
KANA Main	Wood Pellets	80%	703.2	52 Tons	$30,663	$37,260	($4,460)[1]
	Fuel Oil	20%	175.8	1,640 gal	$6,560		
	Additional Electricity	N/A	N/A	250 kWh	$50		
CACPLL Building	Wood Pellets	80%	223	16 Tons	$9,723	$11,840	($1,440)[1]
	Fuel Oil	20%	55.7	520 gal	$2,080		
	Additional Electricity	N/A	N/A	250 kWh	$50		
Anderson Construction Warehouse	Wood Pellets	80%	257.3	19 Tons	$11,219	$13,656	($1,656)[1]
	Fuel Oil	20%	64.3	600 gal	$2,400		
	Additional Electricity	N/A	N/A	250 kWh	$50		
A/C Building	Wood Pellets	80%	857.6	63 Tons	$37,394	$45,431	($5,431)[1]
	Fuel Oil	20%	214.4	2,000	$8,000		
	Additional Electricity	N/A	N/A	250 kWh	$50		

[1]These are negative numbers

Table 4 – Proposed Biomass System Fuel Consumption – Theoretical $200/Ton Costs							
Building	**Fuel Type**	**% Heating Source**	**Net MMBTU/yr**	**Annual Consumption**	**Energy Cost**	**Total Energy Cost**	**Annual Energy Savings**
KANA Main	Wood Pellets	80%	703.2	52 Tons	$10,342	$16,939	$15,861[1]
	Fuel Oil	20%	175.8	1,640 gal	$6,560		
	Additional Electricity	N/A	N/A	250 kWh	$50		
CACPLL Building	Wood Pellets	80%	223	16 Tons	$3,280	$5,397	$5,003[1]
	Fuel Oil	20%	55.7	520 gal	$2,080		
	Additional Electricity	N/A	N/A	250 kWh	$50		
Anderson Construction Warehouse	Wood Pellets	80%	257.3	19 Tons	$3,784	$6,221	$5,779[1]
	Fuel Oil	20%	64.3	600 gal	$2,400		
	Additional Electricity	N/A	N/A	250 kWh	$50		
A/C Building	Wood Pellets	80%	857.6	63 Tons	$12,612	$20,649	$19,351[1]
	Fuel Oil	20%	214.4	2,000	$8,000		
	Additional Electricity	N/A	N/A	250 kWh	$50		

[1]Compared to reported energy consumption from 2013 and 2014.

V. Preliminary Cost Estimating

An estimate of probable costs was completed for installing the boiler system at each building. The cost estimate is based on equipment quotes and from previous cost estimates created for similar projects. A 10% remote factor was used to account for increased shipping and installation costs in Kodiak. Project and Construction Management was estimated at 5%. Engineering design and permitting was estimated at 20% and a 15% contingency was used.

Table 5 – Estimate of Probable Cost – KANA Main

Category	Description	Cost
Site Work	Site Grading for Addition	$4,000
	Foundation (Timbers and Anchors)	$5,000
	Buried Utilities	$5,000
	Subtotal	**$14,000**
Electrical Utilities	Service Entrance	$5,000
	Conduit and Wiring	$5,000
	Subtotal	**$10,000**
Wood Boiler Addition	Insulated Addition 8 ft x 20 ft	$15,000
	Tarm Froling T4	$75,000
	Heat Exchanger	$5,000
	Installation, Piping & Materials	$30,000
	Fire Allowance	$6,000
	Controls Allowance	$5,000
	Electrical Allowance	$6,000
	Shipping	$15,000
	Site Installation	$10,000
	Subtotal	**$167,000**
Main Building Mechanical	Heat Exchanger	$5,000
	Installation, Piping & Materials	$10,000
	Subtotal	**$15,000**
Subtotal Material and Installation Cost		**$206,000**
Remote Factor	10%	$20,600
	Subtotal	**$226,600**
Project and Construction Management	5%	$11,330
	Subtotal	**$237,930**
Design Fees and Permitting	20%	$47,586.00
	Subtotal	**$285,516**
Contingency	15%	$42,827.40
Total Project Cost		**$328,343**

Table 6 – Estimate of Probable Cost – CACPLL		
Category	**Description**	**Cost**
Wood Boiler Install	Tarm Froling P4	$30,000
	Installation, Piping & Materials	$5,000
	Fire Allowance	$6,000
	Controls Allowance	$5,000
	Electrical Allowance	$6,000
	Shipping	$15,000
	Subtotal	**$67,000**
Remote Factor	10%	$6,700
	Subtotal	**$73,700**
Project and Construction Management	5%	$3,685
	Subtotal	**$77,385**
Design Fees and Permitting	20%	$15,477.00
	Subtotal	**$92,862**
Contingency	15%	$13,929.30
Total Project Cost		**$106,791**

Table 7 – Estimate of Probable Cost – Anderson Construction Warehouse		
Category	**Description**	**Cost**
Wood Boiler Install	Tarm Froling P4	$30,000
	Installation, Piping & Materials	$5,000
	Fire Allowance	$6,000
	Controls Allowance	$5,000
	Electrical Allowance	$6,000
	Shipping	$15,000
	Subtotal	**$67,000**
Remote Factor	10%	$6,700
	Subtotal	**$73,700**
Project and Construction Management	5%	$3,685
	Subtotal	**$77,385**
Design Fees and Permitting	20%	$15,477.00
	Subtotal	**$92,862**
Contingency	15%	$13,929.30
Total Project Cost		**$106,791**

Table 8 – Estimate of Probable Cost – A/C Building		
Category	**Description**	**Cost**
Wood Boiler Install	Tarm Froling T4	$75,000
	Installation, Piping & Materials	$30,000
	Fire Allowance	$6,000
	Controls Allowance	$5,000
	Electrical Allowance	$6,000
	Shipping	$15,000
	Site Installation	$10,000
	Subtotal	**$147,000**
Remote Factor	10%	$14,700
	Subtotal	**$161,700**
Project and Construction Management	5%	$8,085
	Subtotal	**$169,785**
Design Fees and Permitting	20%	$33,957.00
	Subtotal	**$203,742**
Contingency	15%	$30,561.30
Total Project Cost		**$234,303**

VI. Economic Analysis

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

Table 9 – Inflation rates	
Cost per ton of Wood Pellets (required future manufacturing costs for viability)	$200
Discount Rate for Net Present Value Analysis	3%
Wood Fuel Escalation Rate	3%
Fossil Fuel Escalation Rate	5%
Electricity Escalation Rate	3%
O&M Escalation Rate	2%

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 the Alaska Energy Authority funded 2013 and 2014 biomass pre-feasibility studies. These are typical rates used for this level of evaluation and were used so that results are consistent and comparable to the previous studies.

O&M Costs

Non-fuel related operations and maintenance costs (O&M) were estimated at $400 per year. The estimate is based on annual maintenance time for the pellet boilers. For the first two years of service, the maintenance cost is doubled to account for maintenance staff getting familiar with operating the new system.

Definitions

There are many different economic terms used in this study. A listing of all of the terms with their definition is provided below for reference.

Table 10 – Economic Definitions

Economic Term	Description
Project Capital Cost	This is the opinion of probable cost for designing and constructing the project.
Simple Payback	The Simple Payback is the Project Capital Cost divided by the first year annual energy savings. The Simple Payback does not take into account escalated energy prices and is therefore not a good measure of project viability. $$Simple\ Payback = \frac{Installed\ Cost\ of\ ECM}{First\ Year\ Energy\ Savings\ of\ ECM}$$
Present Value of Project Benefits (20 year life)	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.
Present Value of Operating Costs (20 year life)	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&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.

Table 10 – Economic Definitions	
Economic Term	**Description**
Benefit / Cost Ratio of Project (20 year life)	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: $$Benefit\ /\ Cost\ Ratio = \frac{PV(Project\ Benefits) - PV(Operating\ Costs)}{Project\ Capital\ Cost}$$ Where: PV = The present value over the 20 year period Reference Sullivan, Wicks and Koelling, "Engineering Economy", 14th ed., 2009, pg. 440, Modified B-C Ratio.
Net Present Value (20 year life)	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.
Year Accumulated Cash Flow > Project Capital Cost	This 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 is similar to the project's simple payback, except that it incorporates the inflation rates. This quantity is the payback of the project including escalating energy prices and O&M rates. This quantity is calculated as follows: $$Installed\ Cost \leq \sum_{k=0}^{J} R_k$$ Where: J = Year that the accumulated cash flow is greater than or equal to the Project Capital Cost. R_k = Project Cash flow for the kth year.

Results

An economic analysis was completed in order to determine the simple payback, benefit to cost ratio, and net present value of the proposed pellet boiler systems, as shown in the tables below.

First, an analysis was conducted using quoted pellet prices as delivered to Kodiak, AK. As discussed, these prices of $593/ton are not economically viable.

Table 11 – Economic Analysis Results – Current Pellet Price $593/ton

Financial Value	KANA Main	CACPLL	ACW	A/C
Project Capital Cost	$328,343	$106,791	$106,791	$234,303
Present Value of Project Benefits (20 year life)	$769,269	$243,915	$281,440	$938,133
Present Value of Operating Costs (20 year life)	$761,203	$241,608	$283,656	$921,636
Benefit / Cost Ratio of Project (20 year life)	0.02	0.02	<0.00	0.07
Net Present Value (20 year life)	$320,277	$104,485	$109,008	$217,806
Year Accumulated Cash Flow is Net Positive	Year 18	Year 18	Year 20	Year 17
Year Accumulated Cash Flow > Project Capital Cost	>20 Years	>20 Years	>20 Years	>20 Years
Simple Payback	N/A	N/A	N/A	N/A

The proposed projects have varied benefit to cost ratios over the 20 year study period based on a proposed local sales cost that is very competitive. Any project with a benefit to cost ratio above 1.0 is considered economically justified.

Please refer to Appendix B for the economic analysis spreadsheet for greater detail.

Table 12 – Economic Analysis Results – KANA Main - $200/Ton

Project Capital Cost	$328,343
Present Value of Project Benefits (20 year life)	$769,269
Present Value of Operating Costs (20 year life)	$364,387
Benefit / Cost Ratio of Project (20 year life)	1.23
Net Present Value (20 year life)	$76,539
Year Accumulated Cash Flow is Net Positive	First Year
Year Accumulated Cash Flow > Project Capital Cost	Year 18
Simple Payback	21.9 years

Table 13 – Economic Analysis Results - CACPLL - $200/Ton	
Project Capital Cost	$106,791
Present Value of Project Benefits (20 year life)	$243,915
Present Value of Operating Costs (20 year life)	$119,511
Benefit / Cost Ratio of Project (20 year life)	1.16
Net Present Value (20 year life)	$17,614
Year Accumulated Cash Flow is Net Positive	First Year
Year Accumulated Cash Flow > Project Capital Cost	Year 18
Simple Payback	25 years

Table 14 – Economic Analysis Results – Anderson Construction Warehouse - $200/Ton	
Project Capital Cost	$106,791
Present Value of Project Benefits (20 year life)	$281,440
Present Value of Operating Costs (20 year life)	$138,666
Benefit / Cost Ratio of Project (20 year life)	1.34
Net Present Value (20 year life)	$32,983
Year Accumulated Cash Flow is Net Positive	First Year
Year Accumulated Cash Flow > Project Capital Cost	Year 17
Simple Payback	21.5 years

Table 15 – Economic Analysis Results – A/C Building - $200/Ton	
Project Capital Cost	$234,303
Present Value of Project Benefits (20 year life)	$938,133
Present Value of Operating Costs (20 year life)	$440,879
Benefit / Cost Ratio of Project (20 year life)	2.12
Net Present Value (20 year life)	$262,952
Year Accumulated Cash Flow is Net Positive	First Year
Year Accumulated Cash Flow > Project Capital Cost	Year 10
Simple Payback	12.6 years

Sensitivity Analysis

A sensitivity analysis was completed to show how changing heating oil costs and wood 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 red.

Table 16 – Sensitivity Analysis – KANA Main					
B/C Ratios		Pellet Cost			
		$200/ton	$250/ton	$300/ton	$593/ton
Heating Oil Cost	$3.50/gal	1.00	0.85	0.69	<0.00
	$3.75/gal	1.12	0.96	0.81	<0.00
	$4.00/gal	1.23	1.08	0.93	0.02
	$4.25/gal	1.35	1.20	1.04	0.14
	$4.50/gal	1.47	1.31	1.16	0.26

Table 17 – Sensitivity Analysis – CACPLL Building					
B/C Ratios		Pellet Cost			
		$200/ton	$250/ton	$300/ton	$593/ton
Heating Oil Cost	$3.50/gal	0.94	0.79	0.65	<0.00
	$3.75/gal	1.05	0.91	0.76	<0.00
	$4.00/gal	1.16	1.02	0.87	0.02
	$4.25/gal	1.28	1.13	0.99	0.14
	$4.50/gal	1.39	1.25	1.10	0.25

Table 18 – Sensitivity Analysis – Anderson Construction Warehouse					
B/C Ratios		Pellet Cost			
		$200/ton	$250/ton	$300/ton	$593/ton
Heating Oil Cost	$3.50/gal	1.07	0.90	0.73	<0.00
	$3.75/gal	1.21	1.03	0.86	<0.00
	$4.00/gal	1.34	1.16	0.99	<0.00
	$4.25/gal	1.47	1.30	1.12	0.11
	$4.50/gal	1.60	1.43	1.26	0.24

Table 19 – Sensitivity Analysis – A/C Building					
B/C Ratios		Pellet Cost			
		$200/ton	$225/ton	$300/ton	$593/ton
Heating Oil Cost	$3.50/gal	1.72	1.46	1.20	<0.00
	$3.75/gal	1.92	1.66	1.40	<0.00
	$4.00/gal	2.12	1.86	1.60	0.07
	$4.25/gal	2.32	2.06	1.80	0.27
	$4.50/gal	2.52	2.26	2.00	0.47

VII. Forest Resource and Fuel Availability Assessments

Forest Resource Assessments

In 2012 the Department of Natural Resources Division of Forestry wrote the "Assessment of Woody Biomass Energy Resources in the Cordova Area". This Forest Resource Assessment is a great resource that quantifies timber resources in the Cordova Area for biomass heating.

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 Garn boiler systems installed in Alaska have not required air quality permits.

VIII. 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 cord wood 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.

Two of the best quality pellet boilers in the U.S. market are the Maine Energy Systems PES boilers and the Froling P4 boilers. These boilers have high end controls, automatic ash removal and have a good reputation for quality. The Maxim Pellet Boiler is a less costly option and can be used directly outdoors if needed. According to Chad Shumacher, General Manager of Superior Pellets, his Maxim boiler automation does not operate as well as the Maine Energy Systems units, but they are less than half the price. The working lifespan of the Maxim boilers also may be less than the higher quality units.

High Efficiency Cord Wood 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, infloor 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 ^{o}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 Cord Wood 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 twenty five (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) 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

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

Currently, there is a funding opportunity for tribal communities that develop clean and renewable energy resources through the U.S. Department of Energy. On April 30, 2013, the Department of Energy announced up to $7 million was available to deploy clean energy projects in tribal communities to reduce reliance on fossil fuel and promote economic development on tribal lands. The Energy Department's Tribal

Energy Program, in cooperation with the Office of Indian Energy, will help Native American communities, tribal energy resource development organizations, and tribal consortia to install community or facility scale clean energy projects.

http://apps1.eere.energy.gov/tribalenergy/

The Department of Energy (DOE), Alaska Native programs, focus on energy efficiency and add ocean energy into the mix. In addition the communities are eligible for up to $250,000 in energy-efficiency aid. The Native village of Kongiganak will get help strengthening its wind-energy infrastructure, increasing energy efficiency and developing "smart grid technology". Koyukuk will get help upgrading its energy infrastructure, improving energy efficiency and exploring biomass options. The village of Minto will explore all the above options as well as look for solar-energy ideas. Shishmaref, an Alaska Native village faced climate-change-induced relocation, will receive help with increasing energy sustainability and building capacity as it relocates. And the Yakutat T'lingit Tribe will also study efficiency, biomass and ocean energy. This DOE program would be a viable avenue for biomass funding.

http://energy.gov/articles/alaska-native-communities-receive-technical-assistance-local-clean-energy-development

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:

http://www.fs.fed.us/news/2012/releases/07/renewablewoods.shtml

http://www.usda.gov/wps/portal/usda/usdahome?contentid=2009/08/0403.xml

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/re-fund-6/4_Program_Update/FinalREFStatusAppendix2013.pdf

http://www.akenergyauthority.org/PDF%20files/PFS-BiomassProgramFactSheet.pdf

http://www.akenergyauthority.org/RenewableEnergyFund/RFA_Project_Locations_20Oct08.pdf

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 washeteria system.

http://www.akenergyauthority.org/biomasswoodenergygrants.html

http://www.akenergyauthority.org/BiomassWoodEnergy/Aleknagik%20Final%20Report.pdf

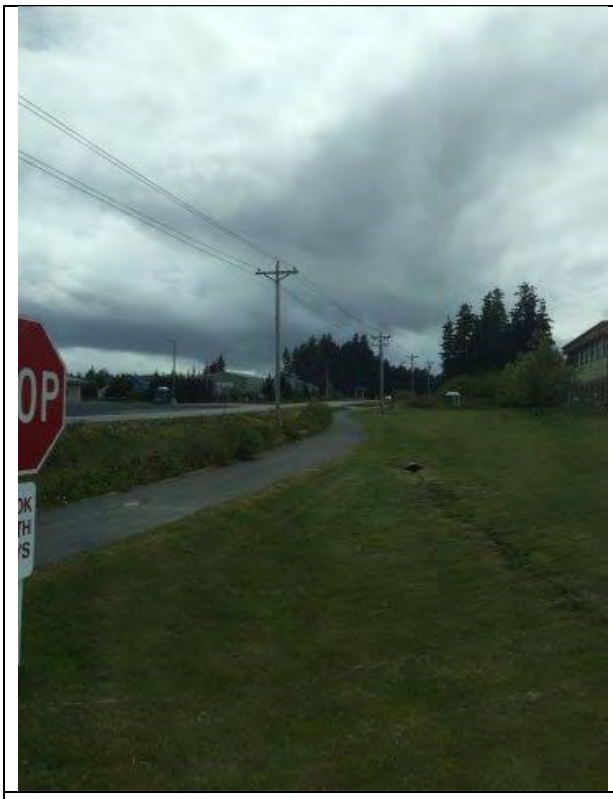
The Emerging Energy Technology Fund grand program provides funds to eligible applicants for demonstrations projects of technologies that have a reasonable expectation to be commercially viable

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/EETFundGrantProgram.html

Appendix A
Site Photos

KANA Main	
1. South and East elevation of building	2. East and North elevation of building
3. West elevation of building	4. West and South elevation of building
5. Northwest elevation of Building	6. 5,000 gallon underground storage tank for #1 heating oil



7. Yard Space for Boiler Addition

8. Electrical Meter

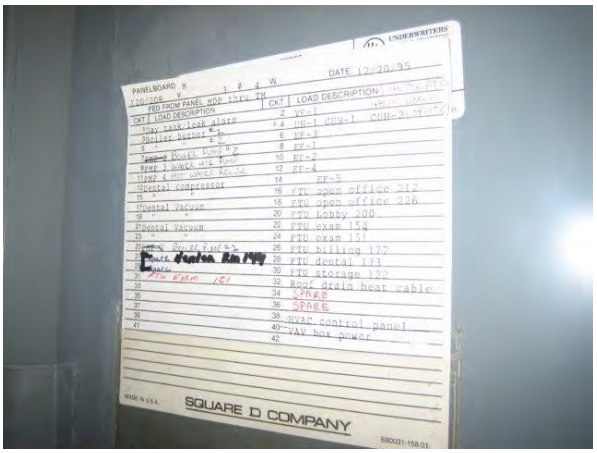
9. Boiler 1

10. Boiler 2

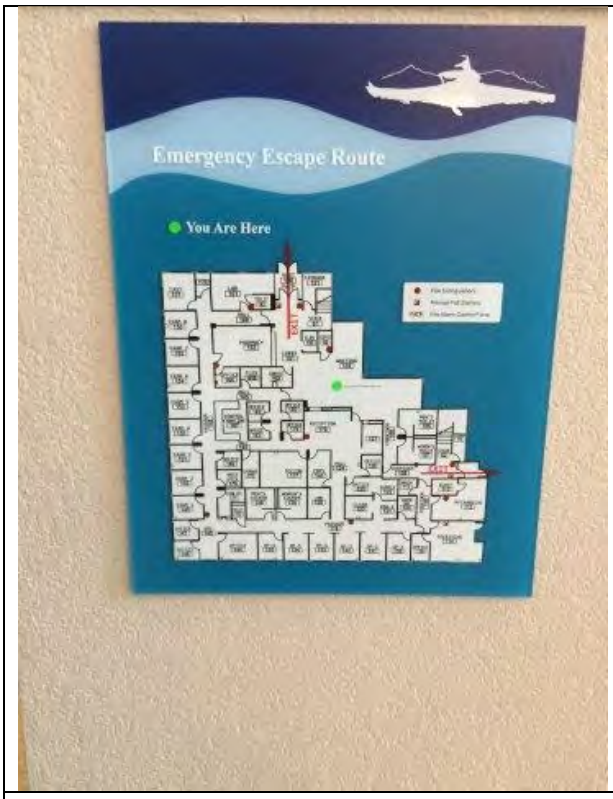
11. Daytank

12. Main Distribution Panel

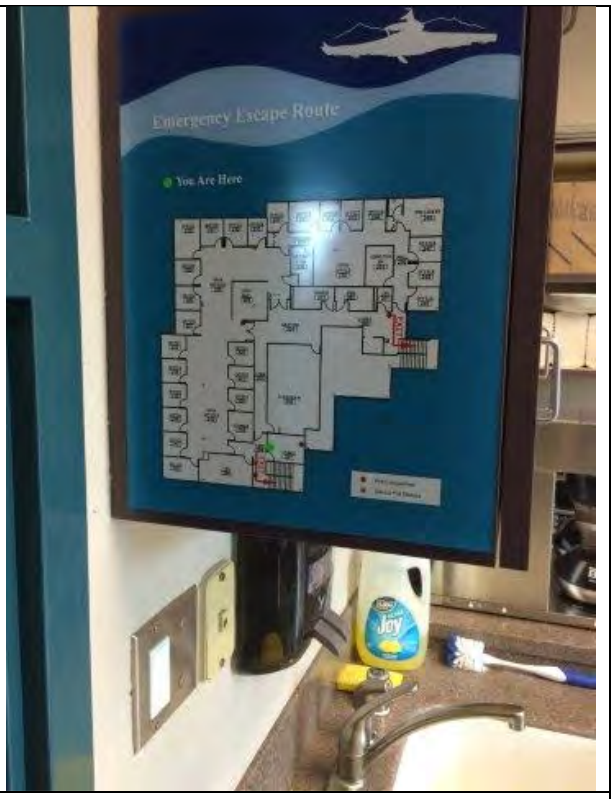
13. Mechanical Rm Electrical Panel



14. Mechanical Rm Panel Circuit Card



15. First Floor Layout



16. Second Floor Layout

17. Indirect Hot Water Heater

CACPLL	
1. West and South elevation of building	2. West and North elevation of building
3. South and East elevation of building	4. East and North elevation of building

5. Electrical Meter

6. Electrical Panel – No available breaker spaces

7. Boiler

8. Zone Manifolds

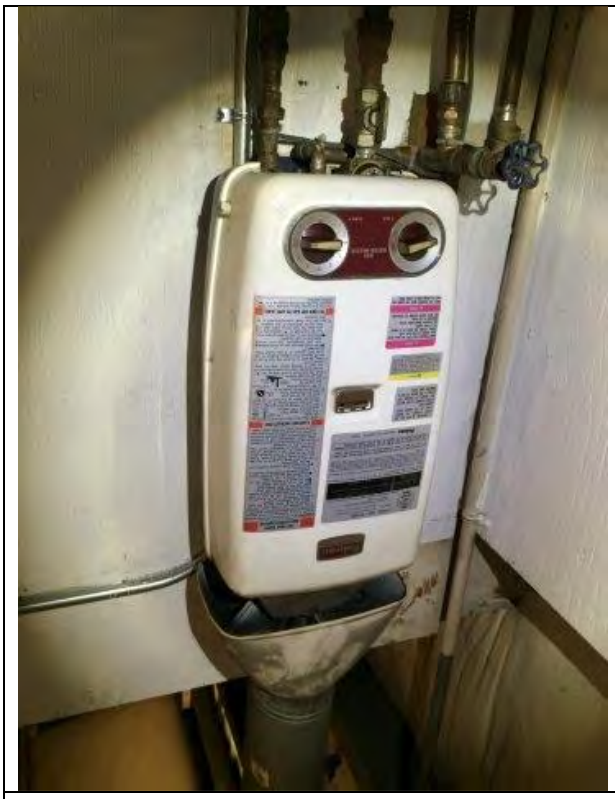
9. Air Handler

10. Electrical Service Entry

11. Electric Water Heater

12. Fuel Oil Tank

Anderson Construction Warehouse	
1. North and West elevation of building	2. North and East elevation of building
3. East and South elevation of building	4. South and West elevation of building



5. Tankless Water Heater

6. Electrical Panel

7. Waste Oil Heater

8. Electrical Meters

9. Electrical Panel	10. Electrical Service Entry

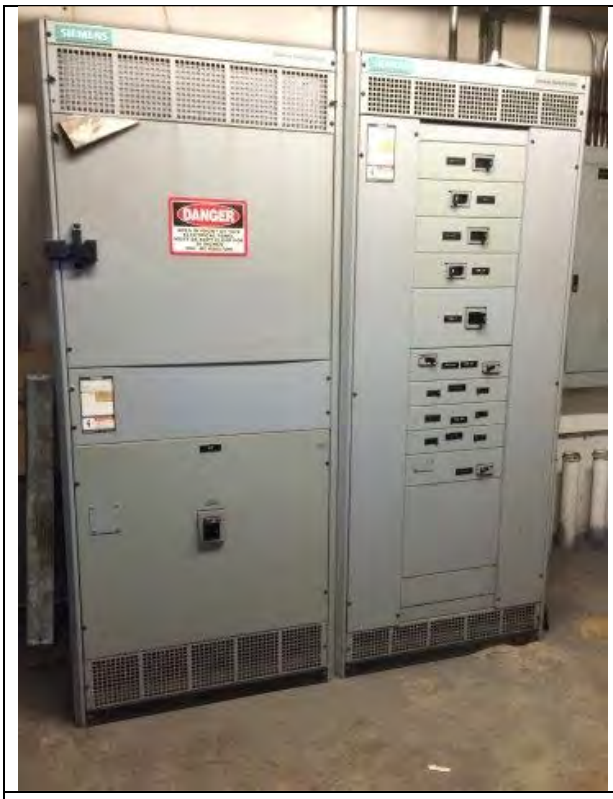
A/C Building	
1. North and West elevation of building	2. West and Partial South elevation of building

3. South and East elevation of building

4. Partial East and Partial North elevation of building

5. Boiler 1

6. Boiler 2

	
7. Main Distribution Panel	8. Oil-Fired Water Heater
9. Aboveground Oil Storage Tank	

Appendix B
Economic Analysis Spreadsheet

KANA Main Building
Kodiak, AK

Economic Analysis Results	
Project Capital Cost	($328,343)
Present Value of Project Benefits (20 year life)	$769,269
Present Value of Operating Costs (20 year life)	($364,387)
Benefit / Cost Ratio of Project (20 year life)	1.23
Net Present Value (20 year life)	$76,538.88
Year Accumulated Cash Flow is Net Positive	First Year
Year Accumulated Cash Flow > Project Capital Cost	18 years
Simple Payback = Total Project Cost / First Year Cost Savings	21.9 years

Inflation Rates	
Discount Rate for Net Present Value Analysis	3%
Wood Fuel Escalation Rate	3%
Fossil Fuel Escalation Rate	5%
Electricity Escalation Rate	3%
O&M Escalation Rate	2%

Description	Unit Cost	Heating Source Proportion	Annual Energy Units	Energy Units	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Existing Heating System Operating Costs																								
Existing Heating Oil Consumption	$4.00		8,200	gal	**$32,800**	**$34,440**	**$36,162**	**$37,970**	**$39,869**	**$41,862**	**$43,955**	**$46,153**	**$48,461**	**$50,884**	**$53,428**	**$56,099**	**$58,904**	**$61,849**	**$64,942**	**$68,189**	**$71,598**	**$75,178**	**$78,937**	**$82,884**
Biomass System Operating Costs																								
Pellet Fuel	$200.00	80%	52.0	tons	($10,400)	($10,712)	($11,033)	($11,364)	($11,705)	($12,056)	($12,418)	($12,791)	($13,174)	($13,570)	($13,977)	($14,396)	($14,828)	($15,273)	($15,731)	($16,203)	($16,689)	($17,190)	($17,705)	($18,236)
Fossil Fuel	$4.00	20%	1,640	gal	($6,560)	($6,888)	($7,232)	($7,594)	($7,974)	($8,372)	($8,791)	($9,231)	($9,692)	($10,177)	($10,686)	($11,220)	($11,781)	($12,370)	($12,988)	($13,638)	($14,320)	($15,036)	($15,787)	($16,577)
Additional Electricity	$0.15		250	kWh	($38)	($39)	($40)	($41)	($42)	($43)	($45)	($46)	($48)	($49)	($50)	($52)	($53)	($55)	($57)	($58)	($60)	($62)	($64)	($66)
Operation and Maintenance Costs					($400)	($408)	($416)	($424)	($433)	($442)	($450)	($459)	($469)	($478)	($488)	($497)	($507)	($517)	($528)	($538)	($549)	($560)	($571)	($583)
Additional Operation and Maintenance Costs for first 2 years					($400)	($408)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Operating Costs					**($17,798)**	**($18,455)**	**($18,722)**	**($19,424)**	**($20,154)**	**($20,914)**	**($21,704)**	**($22,527)**	**($23,383)**	**($24,273)**	**($25,200)**	**($26,165)**	**($27,169)**	**($28,215)**	**($29,304)**	**($30,437)**	**($31,618)**	**($32,847)**	**($34,128)**	**($35,462)**
Annual Operating Cost Savings					$15,003	$15,985	$17,440	$18,546	$19,714	$20,948	$22,251	$23,626	$25,078	$26,610	$28,227	$29,934	$31,735	$33,634	$35,638	$37,751	$39,980	$42,331	$44,809	$47,422
Accumulated Cash Flow					$15,003	$30,988	$48,428	$66,974	$86,689	$107,637	$129,888	$153,514	$178,592	$205,202	$233,429	$263,363	$295,098	$328,732	$364,370	$402,121	$442,102	$484,433	$529,242	$576,664
Net Present Value					**($313,777.47)**	**($298,709.72)**	**($282,749.38)**	**($266,271.26)**	**($249,265.44)**	**($231,721.76)**	**($213,630)**	**($194,979)**	**($175,759)**	**($155,959)**	**($135,567)**	**($114,571)**	**($92,962)**	**($70,726)**	**($47,851)**	**($24,325)**	**($137)**	**$24,728**	**$50,282**	**$76,539**

CACPLL Building
Kodiak, AK

Economic Analysis Results	
Project Capital Cost	($106,791)
Present Value of Project Benefits (20 year life)	$243,915
Present Value of Operating Costs (20 year life)	($119,511)
Benefit / Cost Ratio of Project (20 year life)	1.16
Net Present Value (20 year life)	$17,613.02
Year Accumulated Cash Flow is Net Positive	First Year
Year Accumulated Cash Flow > Project Capital Cost	Year 15
Simple Payback = Total Project Cost / First Year Cost Savings	24.9 years

Inflation Rates	
Discount Rate for Net Present Value Analysis	3%
Wood Fuel Escalation Rate	3%
Fossil Fuel Escalation Rate	5%
Electricity Escalation Rate	3%
O&M Escalation Rate	2%

Description	Unit Cost	Heating Source Proportion	Annual Energy Units	Energy Units	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Existing Heating System Operating Costs																								
Existing Heating Oil Consumption	$4.00		2,600	gal	**$10,400**	**$10,920**	**$11,466**	**$12,039**	**$12,641**	**$13,273**	**$13,937**	**$14,634**	**$15,366**	**$16,134**	**$16,941**	**$17,788**	**$18,677**	**$19,611**	**$20,591**	**$21,621**	**$22,702**	**$23,837**	**$25,029**	**$26,280**
Biomass System Operating Costs																								
Pellet Fuel	$200.00	80%	16.0	tons	($3,200)	($3,296)	($3,395)	($3,497)	($3,602)	($3,710)	($3,821)	($3,936)	($4,054)	($4,175)	($4,301)	($4,430)	($4,562)	($4,699)	($4,840)	($4,985)	($5,135)	($5,289)	($5,448)	($5,611)
Fossil Fuel	$4.00	20%	520	gal	($2,080)	($2,184)	($2,293)	($2,408)	($2,528)	($2,655)	($2,787)	($2,927)	($3,073)	($3,227)	($3,388)	($3,558)	($3,735)	($3,922)	($4,118)	($4,324)	($4,540)	($4,767)	($5,006)	($5,256)
Additional Electricity	$0.15		250	kWh	($38)	($39)	($40)	($41)	($42)	($43)	($45)	($46)	($48)	($49)	($50)	($52)	($53)	($55)	($57)	($58)	($60)	($62)	($64)	($66)
Operation and Maintenance Costs					($400)	($408)	($416)	($424)	($433)	($442)	($450)	($459)	($469)	($478)	($488)	($497)	($507)	($517)	($528)	($538)	($549)	($560)	($571)	($583)
Additional Operation and Maintenance Costs for first 2 years					($400)	($408)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Operating Costs					**($6,118)**	**($6,335)**	**($6,144)**	**($6,370)**	**($6,605)**	**($6,849)**	**($7,104)**	**($7,368)**	**($7,643)**	**($7,929)**	**($8,227)**	**($8,536)**	**($8,859)**	**($9,194)**	**($9,543)**	**($9,906)**	**($10,285)**	**($10,679)**	**($11,089)**	**($11,516)**
Annual Operating Cost Savings					$4,283	$4,585	$5,322	$5,669	$6,036	$6,424	$6,833	$7,266	$7,723	$8,205	$8,714	$9,251	$9,818	$10,417	$11,048	$11,714	$12,417	$13,158	$13,940	$14,765
Accumulated Cash Flow					$4,283	$8,868	$14,190	$19,859	$25,895	$32,319	$39,153	$46,418	$54,141	$62,346	$71,060	$80,311	$90,129	$100,546	$111,594	$123,309	$135,726	$148,884	$162,824	$177,589
Net Present Value					**($102,633.23)**	**($98,311.08)**	**($93,440.72)**	**($88,403.66)**	**($83,196.77)**	**($77,816.88)**	**($72,261)**	**($66,525)**	**($60,606)**	**($54,501)**	**($48,206)**	**($41,717)**	**($35,032)**	**($28,145)**	**($21,053)**	**($13,753)**	**($6,241)**	**$1,488**	**$9,438**	**$17,613**

Anderson Construction Warehouse
Kodiak, AK

Economic Analysis Results	
Project Capital Cost	($106,791)
Present Value of Project Benefits (20 year life)	$281,440
Present Value of Operating Costs (20 year life)	($138,666)
Benefit / Cost Ratio of Project (20 year life)	1.34
Net Present Value (20 year life)	$35,982.80
Year Accumulated Cash Flow is Net Positive	First Year
Year Accumulated Cash Flow > Project Capital Cost	11 years
Simple Payback = Total Project Cost / First Year Cost Savings	21.5 years

Inflation Rates	
Discount Rate for Net Present Value Analysis	3%
Wood Fuel Escalation Rate	3%
Fossil Fuel Escalation Rate	5%
Electricity Escalation Rate	3%
O&M Escalation Rate	2%

Description	Unit Cost	Heating Source Proportion	Annual Energy Units	Energy Units	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Existing Heating System Operating Costs																								
Existing Heating Oil Consumption	$4.00		3,000	gal	**$12,000**	**$12,600**	**$13,230**	**$13,892**	**$14,586**	**$15,315**	**$16,081**	**$16,885**	**$17,729**	**$18,616**	**$19,547**	**$20,524**	**$21,550**	**$22,628**	**$23,759**	**$24,947**	**$26,194**	**$27,504**	**$28,879**	**$30,323**
Biomass System Operating Costs																								
Pellet Fuel	$200.00	80%	19.0	tons	($3,800)	($3,914)	($4,031)	($4,152)	($4,277)	($4,405)	($4,537)	($4,674)	($4,814)	($4,958)	($5,107)	($5,260)	($5,418)	($5,580)	($5,748)	($5,920)	($6,098)	($6,281)	($6,469)	($6,663)
Fossil Fuel	$4.00	20%	600	gal	($2,400)	($2,520)	($2,646)	($2,778)	($2,917)	($3,063)	($3,216)	($3,377)	($3,546)	($3,723)	($3,909)	($4,105)	($4,310)	($4,526)	($4,752)	($4,989)	($5,239)	($5,501)	($5,776)	($6,065)
Additional Electricity	$0.15		250	kWh	($38)	($39)	($40)	($41)	($42)	($43)	($45)	($46)	($48)	($49)	($50)	($52)	($53)	($55)	($57)	($58)	($60)	($62)	($64)	($66)
Operation and Maintenance Costs					($400)	($408)	($416)	($424)	($433)	($442)	($450)	($459)	($469)	($478)	($488)	($497)	($507)	($517)	($528)	($538)	($549)	($560)	($571)	($583)
Additional Operation and Maintenance Costs for first 2 years					($400)	($408)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Operating Costs					**($7,038)**	**($7,289)**	**($7,133)**	**($7,396)**	**($7,669)**	**($7,953)**	**($8,249)**	**($8,556)**	**($8,876)**	**($9,208)**	**($9,554)**	**($9,914)**	**($10,289)**	**($10,678)**	**($11,084)**	**($11,506)**	**($11,946)**	**($12,404)**	**($12,880)**	**($13,376)**
Annual Operating Cost Savings					$4,963	$5,311	$6,097	$6,495	$6,917	$7,362	$7,832	$8,329	$8,854	$9,408	$9,993	$10,610	$11,262	$11,949	$12,675	$13,441	$14,248	$15,100	$15,999	$16,947
Accumulated Cash Flow					$4,963	$10,274	$16,371	$22,866	$29,783	$37,145	$44,977	$53,306	$62,160	$71,567	$81,560	$92,170	$103,431	$115,381	$128,056	$141,496	$155,745	$170,845	$186,844	$203,791
Net Present Value					**($101,973.04)**	**($96,966.56)**	**($91,387.27)**	**($85,616.21)**	**($79,649.77)**	**($73,484.25)**	**($67,116)**	**($60,541)**	**($53,755)**	**($46,755)**	**($39,536)**	**($32,095)**	**($24,426)**	**($16,526)**	**($8,391)**	**($15)**	**$8,606**	**$17,476**	**$26,600**	**$35,983**

A/C Building
Kodiak, AK

Economic Analysis Results	
Project Capital Cost	($234,303)
Present Value of Project Benefits (20 year life)	$938,133
Present Value of Operating Costs (20 year life)	($440,879)
Benefit / Cost Ratio of Project (20 year life)	2.12
Net Present Value (20 year life)	$262,951.62
Year Accumulated Cash Flow is Net Positive	First Year
Year Accumulated Cash Flow > Project Capital Cost	Year 10
Simple Payback = Total Project Cost / First Year Cost Savings	12.6 years

Inflation Rates	
Discount Rate for Net Present Value Analysis	3%
Wood Fuel Escalation Rate	3%
Fossil Fuel Escalation Rate	5%
Electricity Escalation Rate	3%
O&M Escalation Rate	2%

Description	Unit Cost	Heating Source Proportion	Annual Energy Units	Energy Units	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Existing Heating System Operating Costs																								
Existing Heating Oil Consumption	$4.00		10,000	gal	**$40,000**	**$42,000**	**$44,100**	**$46,305**	**$48,620**	**$51,051**	**$53,604**	**$56,284**	**$59,098**	**$62,053**	**$65,156**	**$68,414**	**$71,834**	**$75,426**	**$79,197**	**$83,157**	**$87,315**	**$91,681**	**$96,265**	**$101,078**
Biomass System Operating Costs																								
Pellet Fuel	$200.00	80%	63.0	tons	($12,600)	($12,978)	($13,367)	($13,768)	($14,181)	($14,607)	($15,045)	($15,496)	($15,961)	($16,440)	($16,933)	($17,441)	($17,965)	($18,504)	($19,059)	($19,630)	($20,219)	($20,826)	($21,451)	($22,094)
Fossil Fuel	$4.00	20%	2,000	gal	($8,000)	($8,400)	($8,820)	($9,261)	($9,724)	($10,210)	($10,721)	($11,257)	($11,820)	($12,411)	($13,031)	($13,683)	($14,367)	($15,085)	($15,839)	($16,631)	($17,463)	($18,336)	($19,253)	($20,216)
Additional Electricity	$0.15		250	kWh	($38)	($39)	($40)	($41)	($42)	($43)	($45)	($46)	($48)	($49)	($50)	($52)	($53)	($55)	($57)	($58)	($60)	($62)	($64)	($66)
Operation and Maintenance Costs					($400)	($408)	($416)	($424)	($433)	($442)	($450)	($459)	($469)	($478)	($488)	($497)	($507)	($517)	($528)	($538)	($549)	($560)	($571)	($583)
Additional Operation and Maintenance Costs for first 2 years					($400)	($408)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Operating Costs					**($21,438)**	**($22,233)**	**($22,643)**	**($23,495)**	**($24,381)**	**($25,302)**	**($26,261)**	**($27,259)**	**($28,297)**	**($29,378)**	**($30,502)**	**($31,673)**	**($32,892)**	**($34,161)**	**($35,483)**	**($36,859)**	**($38,292)**	**($39,784)**	**($41,339)**	**($42,958)**
Annual Operating Cost Savings					$18,563	$19,767	$21,457	$22,810	$24,240	$25,749	$27,343	$29,025	$30,801	$32,675	$34,653	$36,740	$38,942	$41,265	$43,715	$46,299	$49,023	$51,897	$54,926	$58,120
Accumulated Cash Flow					$18,563	$38,330	$59,787	$82,597	$106,836	$132,585	$159,928	$188,953	$219,755	$252,430	$287,083	$323,823	$362,765	$404,030	$447,745	$494,043	$543,067	$594,963	$649,889	$708,009
Net Present Value					**($216,281.16)**	**($197,648.51)**	**($178,012.57)**	**($157,746.02)**	**($136,836.72)**	**($115,272.30)**	**($93,040)**	**($70,127)**	**($46,521)**	**($22,207)**	**$2,827**	**$28,596**	**$55,113**	**$82,394**	**$110,453**	**$139,305**	**$168,965**	**$199,449**	**$230,772**	**$262,952**

Appendix C
AWEDTG Field Data Sheet

ALASKA WOOD ENERGY DEVELOPMENT TASK GROUP (AWEDTG)

PRE-FEASIBILITY ASSESSMENT **FIELD DATA SHEET**

APPLICANT:	Kodiak Area Native Association		
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): Consortia of Kodiak Area Tribes		
Contact Name:	Tyler Kornelis and Jeff Hansell		
Mailing Address:	3449 Rezanof Drive		
City:	Kodiak		
State:	AK	**Zip Code:**	99615
Office phone:	(907) 486-1393	**Cell phone:**	( )
Fax:	(907) 486-9898		
Email:	tyler.kornelis@kanaweb.org; jeff.hansell@kanaweb.org		

Facility Identification/Name:	KANA Main	
Facility Contact Person:	Jeff Hansell	
Facility Contact Telephone:	(907)486-1393	( )
Facility Contact Email:	tyler.kornelis@kanaweb.org; jeff.hansell@kanaweb.org	

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	[ ] Junior High [ ] High 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 en energy audit been conducted?:		If Yes, when? *

OTHER FACILITY (Name: KANA Main)

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

Size of Facility (sq. ft. heated)	18910 sf	Year built/age:	20
Number of floors:	2+mezz	Year(s) renovated:	minor remodel in 2005
Number of bldgs.:	1	Next renovation:	none known at site visit
Frequency of Usage:	daily 8am-5pm	# of Occupants	30 employees, ~2 visitors/business hour
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)

							Heating capacity (Btuh / kWh)	Annual Fuel Consumption	Cost
☒ Hot water boiler:	☐ natural gas	☐ propane	☐ electric	☒ #1 fuel oil	☐ #2 fuel oil		5.5 GPH in, 643 MBH out	8,197gal	$4/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)

☐ 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 678 5.5 gph oil 643mbh

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

Serves entire building, and has sidearm hot water heater

Describe age and general condition of existing equipment:

Approximately 20 years old, in great condition, very well kept

Who performs boiler maintenance? Control Contractors, Inc Describe any current maintenance issues:

none

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

above ceiling

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

Underground oil storage tank

If this fuel is also used for other purposes, please describe:

No other uses

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): sidearm heater next to boiler

Describe on-site fuel storage: number of tanks, size of tanks, location(s) of tanks, condition, spill containment, etc.:
1 x 80-gal DHW tank with sidearm heating element.

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): steel & concrete construction Insulation Value: R-20

Roof type: EPDM Insulation Value: R-30

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 ☐ CO_2 Sensor~~

ELECTRICAL

Utility company that serves the building or community: Kodiak Electric Association

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

Energy source: ☒ hydropower ☒ diesel generator(s) ☒ Other: Pillar Mountain Wind

Electricity rate per kWh: _____ Demand charge: _____ first 300 kWh: 14.98 cents per kWh over 300 kWh: 12.85 cents per kWh

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 in report

WOOD FUEL INFORMATION

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

Who manages local forests? Village Native Corp, Regional Native Corp, State of Alaska, Forest Service, BLM, USF&WS, Other:
_____

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.)?
A bluff to the west of the building prevents improvements and additions in that direction

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

Is the building in proximity to other buildings with biomass potential? If so, Which ones and How close?
CACPLL and Anderson Construction Warehouse across the street.

Can building accommodate a biomass boiler inside, or would an addition for a new boiler be necessary? Where would addition go?
An addition would be required. Ample lawn and room to the north.

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from?
Kodiak Electric, City of Kodiak Public Works

If necessary, can piping be run underground from a central plant to the building? Where would piping enter boiler room?
Piping coming underground from a central plant would enter the boiler room exterior wall at the north end of the building

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? looping
For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot? 3/4" copper tubing, 3.5" square aluminum fins, ~16 fins/ft.
Any other energy using systems (kitchen equipment, lab equipment, pool etc)? Fuel or energy source? Healthcare equipment using electricity on first floor
Any systems that could be added to the boiler system? No
Are heating fuel records available? Yes

PICTURE / VIDEO CHECKLIST

Exterior
Photos will be included in reports

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

APPLICANT:	KODIAK AREA NATIVE ASSOCIATION (KANA)
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): CONSORTIA OF KODIAK AREA TRIBES
Contact Name:	TYLER KORNELIS + JEFF HANSELL
Mailing Address:	3449 REZANOF DR.
City:	KODIAK
State:	AK **Zip Code:** 99615
TYLER ~~**Office phone**~~:	(907)486-1393 JEFF ~~**Cell phone**~~: (907) 486-9886
Fax:	(907) 486-9898
Email:	tyler.kornelis@kanaweb.org ; jeff.hansel@kanaweb.org

Facility Identification/Name:	CACPLL BUILDING - 3484 REZANOF DR. - KODIAK, AK 99615
Facility Contact Person:	JEFF HANSELL
Facility Contact Telephone:	(907) 486 1393 ( )
Facility Contact Email:	JEFF.HANSELL@KANAWEB.ORG

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	[ ] Junior High [ ] High 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 en energy audit been conducted?:		If Yes, when? *

OTHER FACILITY (Name: CACPLL BUILDING)

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

Size of Facility (sq. ft. heated)	10,125	Year built/age:	1997; 17 yrs
Number of floors:	1W/MEZZ	Year(s) renovated:	NONE
Number of bldgs.:	1	Next renovation:	NONE
Frequency of Usage:	DAILY 8am-5pm	# of Occupants	2
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

4.45 GPH IN

HEAT GENERATION (check all that apply)

						Heating capacity (Btuh / kWh)	Annual Fuel Consumption	Cost
☒ Hot water boiler:	☐ natural gas	☐ propane	☐ electric	☒ #1 fuel oil	☐ #2 fuel oil	521 MBH out	2,576 gal	$4.00/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)

- ☒ 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):

1x WEIL MCCAIN 578

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

Hydronic UH for shop side, baseboards for office side

Describe age and general condition of existing equipment:

17 yrs old; good condition

Who performs boiler maintenance? Control Contractors Inc Describe any current maintenance issues:

None. Well kept!

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

shop - exposed office - thru ceiling

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

400 GAL Eco DWT Plus 3. Great condition, no spill containment

If this fuel is also used for other purposes, please describe:

N/A

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: _____

4.5 kW element DHW

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

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

N/A

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): Type-V non-rated, concrete + steel Insulation Value: R-20

Roof type: Metal Insulation Value: R-30

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 ☐ CO_2 Sensor N/A

ELECTRICAL

Utility company that serves the building or community: KODIAK ELECTRIC ASS'N

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

Energy source: ☒ hydropower ☒ diesel generator(s) ☒ Other: WIND, DIESEL, HYDRO

Electricity rate per kWh: <200 14.98 >200 12.85 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:

illegible

WOOD FUEL INFORMATION

FBX

- Wood pellet cost delivered to facility $ 295/ton purchase, $233/ton to chip /ton Viable fuel source? Yes No
- Wood chip cost delivered to facility $_____/ton Viable fuel source? Yes No
- Cord wood cost delivered to facility $ 300 /cord Viable fuel source? Yes No
- Distance to nearest wood pellet and wood chip suppliers? _____
- Can logs or wood fuel be stockpiled on site or at a nearby facility? _____

Who manages local forests? Village Native Corp, Regional Native Corp, State of Alaska, Forest Service, BLM, USF&WS, Other: DNR, COAST GUARD, LOCAL TRIBES

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.)?

~~SLOPES~~, ~~PARKING LOTS~~, ~~PARK~~

What are local soil conditions? Permafrost issues?

ROCK AND SOIL NONE

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

YES- ~~CAPITOL TOWN~~ ANDERSON WAREHOUSE AND KANA HQ

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

ADDITION OR DETACHED CENTRAL PLANT

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

CITY UTILITIES

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? LOOPING

For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot? 3/4", 12 fins/ft

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

Any systems that could be added to the boiler system? DOMESTIC HOT WATER HEATER

Are heating fuel records available?

YES

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)

IN PROGRESS

Wood

How much local wood availability is there?

Will additional wood demand cause issues?

Yes

Where would wood storage and wood drying occur:

create on site

Typical Wind Direction at Storage Area:

SE

Local Wood Species (Birch, Spruce):

alder

Moisture Content of Wood (Wet, dry, MC%):

IN PROGRESS

Domestic Hot Water

Avg DHW Usage (ASHRAE Daily Avg for Office Bldg is 1.0 gal/day):

IN PROGRESS

Logistics

How are construction materials shipped to Village (barge company):

Is there local gravel or fill? How far away?

ALASKA WOOD ENERGY DEVELOPMENT TASK GROUP (AWEDTG)

PRE-FEASIBILITY ASSESSMENT FIELD DATA SHEET

APPLICANT:	KODIAK AREA NATIVE ASSOCIATION (KANA)
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): CONSORTIA OF KODIAK AREA TRIBES
Contact Name:	TYLER KORNELIS + JEFF HANSEL
Mailing Address:	3449 REZANOF DR.
City:	KODIAK
State:	AK **Zip Code:** 99615
TYLER ~~**Office phone:**~~	(907) 486-1393 JEFF **Cell phone:** (907) 486-9886
Fax:	(907) 486-9898
Email:	tyler.kornelis@kanaweb.org ; jeff.hansel@kanaweb.org

Facility Identification/Name:	ANDERSON CONSTRUCTION WAREHOUSE - 3472 REZANOF DR. KODIAK, AK 99615	
Facility Contact Person:	JEFF HANSELL	
Facility Contact Telephone:	(907)	( )
Facility Contact Email:	JEFF.HANSELL@KANAWEB.ORG	

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	[ ] Junior High [ ] High 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 en energy audit been conducted?:		If Yes, when? *

OTHER FACILITY (Name: ANDERSON CONSTRUCTION WAREHOUSE)

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

Size of Facility (sq. ft. heated)	3000	Year built/age:	UNKNOWN
Number of floors:	1	Year(s) renovated:	NONE
Number of bldgs.:	1	Next renovation:	None known at site visit
Frequency of Usage:	Ø	# of Occupants	Ø
Has an energy audit been conducted?	UNKNOWN	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: WASTE OIL HEAT

HEAT GENERATION (check all that apply) WASTE OIL BURNER

							Heating capacity (Btuh / kWh)	Annual Fuel Consumption	Cost
☐ 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: _____						

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):

ENERGYLOGIC

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

WHOLE BUILDING

Describe age and general condition of existing equipment:

UNKNOWN AGE, EQUIPMENT IS IN WORKING ORDER

Who performs boiler maintenance? KANA STAFF Describe any current maintenance issues:

None

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

N/A

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

300 gal waste oil storage tank, WORKING ORDER, NO SPILL CONTAINMENT

If this fuel is also used for other purposes, please describe:

No

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: DIRECT FIRE ON DEMAND

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 bathroom

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

2 tanks

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): Steel + CONCRETE Insulation Value: R-13

Roof type: METAL Insulation Value: R-13

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 N/A

Outside Air/Air Exchange: ☐ HRV ☐ CO_2 Sensor NONE

ELECTRICAL

Utility company that serves the building or community: CEA

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

Energy source: ☒ hydropower ☒ diesel generator(s) ☐ Other: WIND

Electricity rate per kWh: <300 14.98 >300 12.85 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: ✓

WOOD FUEL INFORMATION

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

Who manages local forests? Village Native Corp, Regional Native Corp, State of Alaska, Forest Service, BLM, USF&WS, Other: IN PROGRESS

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

What are local soil conditions? Permafrost issues? Rocky, no permafrost

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

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

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from?
Kodiak Electric, City of Kodiak Public Works

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? N/A
For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot? N/A
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? No N/A
Are heating fuel records available?
yes

PICTURE / VIDEO CHECKLIST

To be included in reports

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

APPLICANT:	KODIAK AREA NATIVE ASSOCIATION (KANA)
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): CONSORTIA OF KODIAK AREA TRIBES
Contact Name:	TYLER KORNELIS + JEFF HANSELL
Mailing Address:	~~340~~ 3449 REZANOF DR.
City:	KODIAK
State:	AK **Zip Code:** 99615
TYLER ~~**Office phone**~~**:**	(907) 486-1393 JEFF ~~**Cell phone**~~**:** (907) 486-9886
Fax:	(907) 486-9898
Email:	tyler.kornelis@kanaweb.org ; jeff.hansell@kanaweb.org

Facility Identification/Name:	KANA "A/C" BUILDING - 111 REZANOF DR., KODIAK, AK 99615	
Facility Contact Person:	JEFF HANSELL	
Facility Contact Telephone:	(907) 486 1393	( )
Facility Contact Email:	tyler.kornelis@kanaweb.org; jeff.hansell@kanaweb.org	

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	[ ] Junior High [ ] High 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 en energy audit been conducted?:		If Yes, when? *

OTHER FACILITY (Name: KANA "A/C" BUILDING)

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

Size of Facility (sq. ft. heated)	40,000	Year built/age:	1964 - 50 yrs.
Number of floors:	2	Year(s) renovated:	2013 - change of use
Number of bldgs.:	1	Next renovation:	unknown
Frequency of Usage:	seldom	# of Occupants	1
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: unit heaters
- ☐ Steam: _____
- ☐ Forced/ducted air
- ☐ Electric heat: ☐ resistance ☐ boiler ☐ heat pump(s)
- ☐ Space heaters

HEAT GENERATION (check all that apply)

							Heating capacity (Btuh / kWh)	Annual Fuel Consumption	Annual Fuel Cost
☒ Hot water boiler:	☐ natural gas	☐ propane	☐ electric	☒ #1 fuel oil	☐ #2 fuel oil		7.5GPH, 886 MBH out	>8,000 gal	$4.00/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)

- ☒ 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):

2x Weil McLain 878, 7.5GPH 886 MBH out

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

Serves entire building.

Describe age and general condition of existing equipment:

Roughly 20 years old. In operating condition.

Who performs boiler maintenance? Scott's Plumbing & Heating Describe any current maintenance issues:

none

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

exposed at ceiling

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

1x 100gal aboveground tank

If this fuel is also used for other purposes, please describe:

domestic hot water

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 boiler room next to boilers

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

Uses same fuel tank previously described

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): Concrete + wood post + beam Insulation Value: R-20

Roof type: EPDM Insulation Value: R-30

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 NONE

Outside Air/Air Exchange: ☐ HRV ☐ CO_2 Sensor NONE

ELECTRICAL

Utility company that serves the building or community: Kotzebue Electric Association

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

Energy source: ☒ hydropower ☒ diesel generator(s) ☒ Other: Pillar Mountain Wind

Electricity rate per kWh: <300 14.98 cents ~~$300~~ 12.85 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 in report

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 $_____/cord Viable fuel source? Yes No
- Distance to nearest wood pellet and wood chip suppliers? _____
- Can logs or wood fuel be stockpiled on site or at a nearby facility? _____

Section in development

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

_____

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.)?

Yes, heavily developed downtown area

What are local soil conditions? Permafrost issues?

Rocky

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

Surrounded by lots of privately owned buildings

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

Inside if remodeled

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

Kodiak Electric, City of Kodiak Public Works

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

No central plant necessary

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? looping
For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot? N/A
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? No current regular use
Are heating fuel records available? Not at this time only recently

PICTURE / VIDEO CHECKLIST

Photos will be included in reports

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)

DAVID NICOLAI
COFFMAN ENGINEERS
WOOD BOILERS PRESENTATION

TUE 9 JUNE 2015
KANA MAIN

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COFFMAN ENGINEERS	project FEDC BIOMASS	by DN	sheet no.
	location Kodiak Community Meeting	date 6/9/15	Job no.
	client	checked	
		date	