Feasibility Assessment for Biomass Heating Systems
Russian Mission, Alaska

FINAL REPORT – 9/4/2014

COFFMAN ENGINEERS

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

Tony SlatonBarker, PE,
David Nicolai, PE and
Lee Bolling, CEA, CEM

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Abbreviations

ACF	Accumulated Cash Flow
AEA	Alaska Energy Authority
AFUE	Annual Fuel Utilization Efficiency
AHU	Air Handling Unit
ARCH	Architectural
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
CMU	Concrete Masonry Unit
ΔT	Delta T (Temperature Differential)
Eff	Efficiency
EUI	Energy Utilization Index
F	Fahrenheit
ft	Feet
GPM	Gallons Per Minute
HP	Horsepower
HVAC	Heating, Ventilating, and Air-Conditioning
in	Inch(es)
kBTU	One Thousand BTUs
kWh	Kilowatt-Hour
MBH	Thousand BTUs per Hour
MECH	Mechanical
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 to determine the technical and economic viability of biomass heating systems at the Tribal Office, City Office and Community Center in Russian Mission, Alaska. Two options were evaluated in this study and differ only in the construction method of a central plant building. Both options utilize a central plant that will deliver heat through buried hydronic piping to each building. Both options utilize one Garn cord wood boiler system to offset heating oil consumption of all three buildings.

Option A – A GarnPak central plant will house the Garn boiler system. The GarnPak is a pre-constructed conex that contains the Garn boiler and other system components that is shipped to the site.

Option B – A detached central plant building will house the Garn boiler system. The detached building will be constructed using local labor.

The results of the economic evaluation are shown below. The proposed biomass systems in both options are economically justified at this time, due to the fact that the benefit to cost ratios are greater than 1.0. The major economic driver for these projects is the high cost of heating oil combined with the relatively low cost of cord wood.

Economic Analysis Results	Option A	Option B
Project Capital Cost	$375,679	$313,802
Present Value of Project Benefits (20 year life)	$1,136,389	$1,136,389
Present Value of Operating Costs (20 year life)	$452,213	$452,213
Benefit / Cost Ratio of Project (20 year life)	1.82	2.18
Net Present Value (20 year life)	$308,497	$370,374
Year Accumulated Cash Flow is Net Positive	First Year	First Year
Year Accumulated Cash Flow > Project Capital Cost	13 years	11 years
Simple Payback	15.3 years	12.8 years

Table 1 – Economic Evaluation Summary

II. Introduction

A preliminary feasibility assessment was completed to determine the technical and economic viability of biomass heating systems for the City Office, Tribal Office, and Community Center in Russian Mission, AK. The location of the building is shown in Figures 1 and 2.

Fig. 1 – Russian Mission, Alaska – Google Maps

Fig. 2 – Russian Mission Buildings Site – AlaskaMapped.org

III. Preliminary Site Investigation

Data and records for the buildings are not complete. All dates, quantities, and additional data is approximated.

Building Descriptions

The City of Russian Mission Office Building is a 1,120 SF single story building that was constructed in approximately 1972. The main part of the building is the hall, and an addition to the building contains offices for the city administrators. It is used by 5 office staff during the work week from 9am-12pm and 1pm-5pm. It is typically used 35 hours per week. No energy audit has been conducted at the building.

The Tribal Office of Russian Mission is a building very similar to the City Office building. It is also 1,120 SF and built in 1972. It is divided into 8 rooms. Most are used as offices, and one room is used as a community room. It is used by 7 office staff during the work week from 9am-12pm and 1pm-5pm. It is typically used 35 hours per week. No energy audit has been conducted at the building.

The Community Center Building is a 9,600 SF single story building that was constructed in 1985. The main part of the building is the gymnasium. There is a storage room and the mechanical room connected to the gymnasium. It is used by community members from 6 to 8 months of the year (September to April) for 20 days per month. It is available for community meetings and also a gathering space for community youth. Occupancy varies with each event.

Existing Heating System

The City Office Building is heated by a Weil McClain 68 series boiler, model P-468V-WT, with a firing rate of 1.25 GPH. The boiler is located in a mechanical closet, with an exterior wall. The building is single heating zone. All of the mechanical equipment was installed with the boiler 15 years ago. The combustion efficiency of the fuel oil boiler is 80%. There is no routine maintenance of the boiler, and it is in working order.

One 300 gal heating oil tank serves the boiler and is located to the north side of the City Office Building. No spill containment is present around the tank. Fuel in the tanks is used for heating only.

The Tribal Office is heated with a Crown Boiler, model BDS-092 WC, with a firing rate of 0.75 GPH. The boiler is located in a mechanical closet, with an exterior wall. The building is a single heating zone. All of the mechanical equipment was installed with the boiler 15 years ago. The combustion efficiency of the boiler is 80%. There is no routine maintenance of the boiler, and it is in working order.

One 300 gal heating oil tank serves the boiler and is located along the east face of the building. Fuel in the tanks is used for heating only.

The Community Center is heated with a Unitary Products furnace model P+LBX16F12001, with a firing rate of 1 GPH. The furnace is located in the mechanical room, with an exterior wall. The building is a single heating zone. The furnace was installed 10 years ago, and is in operating condition. The combustion efficiency of the furnace is 80%.

Additionally, the gym is provided with a Burnham V-76-T boiler, capable of a firing rate of 1.9 GPH. However, the boiler is disconnected from the building's hydronic system, which is currently abandoned-in-place. The Burnham boiler is 20 years old, and is not currently functional.

The City retains the services of a heating mechanic who can repair heating systems at each facility as needed.

Domestic Hot Water

No domestic hot water service is provided for the City Office, Tribal Office, or Community Center. The Tribal Office and Community Center do not have any domestic water heating equipment. The City Office has a domestic hot water heater that is disconnected and abandoned-in-place due to the expense of providing fuel for hot water.

Building Envelope

The City Office building is a 2"x6" stick-frame typical of 1970's era construction in rural Alaska. The office addition is the same age as the original building construction. It is estimated that the walls have R-19 fiberglass batt insulation and the metal hot roof has R-25 fiberglass batt insulation. The windows are double pane. Only the main entrance has an arctic entry. The secondary door is not provided with an arctic entry, but is kept locked from the exterior at all times.

The City Office and Tribal Office buildings are very similar in construction. The major difference between the two buildings is that the Tribal Office does not have an addition – in all other respects, the two buildings are identical.

The Community Center is a 2" x 8" stick-frame building, constructed in 1985. It is estimated that the walls have R-30 fiberglass batt insulation and the metal hot roof has R-30 fiberglass batt insulation. The few windows remaining (most are boarded up) are double pane windows. The main entrance has an arctic entry. The secondary door is not provided with an arctic entry, and is kept locked at all times.

Available Space

There is no available space inside the buildings for a wood heating system. Both the City Office and the Tribal Office have full usage of the interior spaces, and the mechanical closet in each building is not large enough for a wood boiler system.

While the Community Center has some indoor space available, usage of the building for a wood boiler system central equipment would not be recommended. The state of the building is in disrepair, and has a history of being broken into and vandalized.

Building a dedicated building would allow for new, secure facility with ample room. There is space available on the site for a detached wood boiler building. Additionally, placing a wood boiler system in a central plant would allow all three buildings to connect to the same system. This would require buried arctic pipe between the buildings. The site's buildings are approximately a triangle, with Tribal Office about 30 feet away from the City Office, and the Community Center is located approximately 100 feet away from the other two buildings.

Street Access and Fuel Storage

The site is situated on a dirt pad cleared from a hillside, with access only by dirt road. Vehicles can easily access the site, and the central clearing on the site. There is adequate space in the center of the pad for a wood boiler building and a wood storage shed.

Building or Site constraints

The site is flat with no significant site constraints. There were no wetlands or signs of historical structures observed.

Biomass System Integration

A wood boiler system would be able to integrate easily with the Tribal Office and City Office, since both already utilize hydronic heating systems. Additionally, in the Community Center, the abandoned-in-place hydronic piping and heating systems could be refurbished and connected to the wood boiler heating system.

Biomass System Options

The most viable option for biomass resource is cord wood, as it is available locally in the Russian Mission area. Wood chips and wood pellets were considered, but were considered not to be viable due to the expense of shipping to Russian Mission since there is no local supplier of either type of wood fuel. Chips and pellets can only be shipped to Russian Mission in two ways: 1) flown in by plane or 2) shipped by barge from port of origin to Dutch Harbor, then from Dutch Harbor to Russian Mission on a river-capable barge. Due to these expensive shipping issues, it was determined that a cord wood boiler system would be the most viable option for wood heating at the building.

Two options were evaluated in this study: GarnPak Central Plant and Detached Central Plant Building.

Option A - A GarnPak cord wood boiler system is used for this option. A GarnPak, or Garn-in-the-box, is a pre-constructed connex that contains one Garn cord wood boiler. The GarnPak would be located in the available central space on the dirt pad, and would deliver heat to the Tribal Office, City Office, and Community Center via buried and pre-insulated hydronic piping.

The Garn boiler would deliver heat to a heat exchanger inside the GarnPak connex, which would transfer heat to a buried 50% propylene glycol distribution loop. This loop would deliver heat via buried arctic pipe to heat exchangers in each building. This second heat exchanger would transfer heat to each building's existing hydronic system. To accommodate the new piping systems, an arctic pipe connection doghouse will be built on each building. This involves constructing a small, insulated enclosure on the side of the building with enough room for the arctic pipe to terminate, and piping elbows to turn into the building.

For these buildings, one Garn WHS 2000 is recommended (325,000 BTU/hr output on a 3 hour batch fire). This size Garn will supply approximately 62% of the design heat load during the coldest day of the year. The remaining heat will come from the existing building's oil fired heating systems.

An outdoor temperature bin data analysis for the Russian Mission region was completed to determine the annual energy utilization of the wood boiler system. Based on this analysis, even though one Garn WHS-2000 will only provide 62% of the buildings' peak design load, it will provide 96% of the building's

heat on an annual basis. The existing oil fired heating systems will be used during the coldest days of the year to supplement heat. This strategy of installing a smaller biomass system can help reduce project costs and still allows for a large heating oil offset, resulting in a more cost effective project.

Option B – Option B is identical to Option A, except that a detached building is constructed instead of purchasing the pre-constructed GarnPak. The detached central plant building would be constructed using local labor. The same garn boiler as in option A would be installed in this central plant. The energy and cost savings for both options will be identical.

IV. Energy Consumption and Costs

Wood Energy

The gross energy content of a cord of wood varies depending on tree species and moisture content. Black spruce, white spruce and birch at 20% moisture content have respective gross energy contents of 15.9 MMBTU/Cord, 18.1 MMBTU/cord and 23.6 MMBTU/cord, according to the UAF Cooperative Extension. Wet or greenwood has higher moisture contents and require additional heat to evaporate moisture before the wood can burn. Thus, wood with higher moisture contents will have lower energy contents. Seasoned or dry wood will typically have 20% moisture content. For this study, cord wood was estimated to have 16.0 MMBTU/cord. This is a conservative estimate based on the fact that the community has access to both spruce and birch. To determine the delivered $/MMBTU of the biomass system, a 75% overall efficiency for the Garn boiler system was assumed. This is based on manufacturer documentation and typical operational issues which do not allow firing 100% of the time.

Energy Costs

The high price of fuel oil is the main economic driver for the use of lower cost biomass heating. Fuel oil is shipped into Russian Mission by barge, and currently costs $5.80/gal. For this study, the energy content of fuel oil is based on 134,000 BTU/gal, according to the UAF Cooperative Extension.

Wood is sold in Russian Mission by the cord. The current rate for a delivered cord of wood in Russian Mission is $250.

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. As shown below, cord wood is less than half the cost of fuel oil based on the $/MMBTU delivered to the building heat load.

Fuel Type	Units	Gross BTU/unit	System Efficiency	$/unit	Delivered $/MMBTU
Cord Wood	cords	16,000,000	75%	$250	$20.83
Fuel Oil	gal	134,000	80%	$5.80	$54.10
Electricity	kWh	3,413	99%	$0.62	$183.49

Table 2 – Energy Comparison

Existing Fuel Oil Consumption

Existing heating oil records were not available for the three buildings in this study. The Village estimates that the three buildings currently use approximately 5,000 gallons annually. However, at this time the Community Center is only partially used because of high heating costs. If a lower cost fuel, such as cord wood is used, then the Community Center is anticipated to use a greater amount of thermal energy to fully heat the building. To account for this, the heating oil consumption was estimated for each building assuming full occupancy and use. Heating oil consumption was estimated based on the average Energy Utilization Index for eleven buildings in the Calista Region as published in "A White Paper on Energy Use in Alaska's Public Facilities" by the Alaska Housing Finance Corporation in 2012. Based on this study the average Energy Utilization Index for heating oil in the Russian Mission region is 94,554 BTU/SF. Heating oil estimated based on this 2012 study are shown below. The total heating oil cost for all three Village buildings is estimated to be $48,457 annually.

Building Name	Fuel Type	Avg. Annual Consumption	Net MMBTU/yr	Annual Fuel Cost
City Office	Fuel Oil	790 gal	84.7	$4,584
Tribal Office	Fuel Oil	790 gal	84.7	$4,584
Community Center	Fuel Oil	6,774 gal	726.2	$39,289
Total	Fuel Oil	8,355 gal	895.6	$48,457

Table 3 – Existing Fuel Oil Consumption

Biomass System Consumption

It is estimated that the proposed biomass system for both options will offset 95% of heating oil consumption for the buildings. The remaining 5% of the heat for the building will come from the existing heating oil-fired boilers or furnaces. The proposed biomass system would have a total annual energy cost of $21,778, to serve the three Village buildings. This annual energy cost includes wood and fuel oil costs, as well as the cost of the additional electricity required to operate the biomass heating system. It is estimated that 3,285 kWh annually will be required to operate the system pumps required by the Garn system. The energy consumption and energy costs will be identical for both options.

Option	Fuel Type	% Heating Source	Net MMBTU/yr	Annual Consumption	Energy Cost	Total Energy Cost
Option A and B	Cord Wood	95%	850.8	70.9 cords	$17,726	$22,185
	Fuel Oil	5%	44.8	418 gal	$2,423	
	Electricity	N/A	N/A	3,285 kWh	$2,037	

Table 4 – Proposed Biomass System Fuel Consumption

V. Preliminary Cost Estimating

An estimate of probable costs was completed for each option. The costs are based on a similar GarnPak system, installed in 2012, which Coffman designed for Thorne Bay, Alaska. The estimate includes general conditions and overhead and profit for the general contractor. A 10% remote factor was used to account for increased shipping and installation costs in Russian Mission. Project and Construction Management was estimated at 5%. Engineering design and permitting was estimated at 15% and a 10% contingency was used. It is assumed that local labor is used to construct the detached central plant building in Option B.

Option A - GarnPak Central Plant			
Category	**Description**		**Cost**
Site Work	NFS Fill	$	4,000
	Site Grading	$	1,500
	Traffic Protection	$	500
	Subtotal	**$**	**6,000**
Mechanical Utilities	Trench & Backfill	$	4,500
	Buried Piping	$	10,000
	Piping Allowance	$	8,000
	Building Connections	$	9,000
	Subtotal	**$**	**31,500**
Electrical Utilities	Service Entrance	$	7,000
	Conduit and Wiring	$	7,000
	Fire Allowance	$	3,000
	Electrical Allowance	$	12,000
	Subtotal	**$**	**29,000**
Wood Boiler and Boiler Bldg	GarnPak Unit	$	120,000
	Installation	$	6,000
		$	**126,000**
Interior Mechanical & Electrical	HXs, Piping & Materials	$	20,000
	Subtotal	**$**	**20,000**
Subtotal Material and Installation Cost		**$**	**212,500**
General Conditions	10%	$	21,250
	Subtotal	**$**	**233,750**
Overhead and Profit	10%	$	23,375
	Subtotal	**$**	**257,125**
Remote Factor	10%	$	25,713
	Subtotal	**$**	**282,838**
Project and Construction Management	5%	$	14,142
		$	**296,979**
Design Fees and Permitting	15%	$	44,547
	Subtotal	**$**	**341,526**
Contingency	10%	$	34,153
Total Project Cost		**$**	**375,679**

Table 5 – Option A - Estimate of Probable Cost

Option B – Detached Central Plant Building			
Category	**Description**		**Cost**
Site Work	NFS Fill	$	4,000
	Site Grading	$	1,500
	Traffic Protection	$	500
	Subtotal	**$**	**6,000**
Mechanical Utilities	Trench & Backfill	$	4,500
	Buried Piping	$	10,000
	Piping Allowance	$	8,000
	Building Connections	$	9,000
	Subtotal	**$**	**31,500**
Electrical Utilities	Service Entrance	$	7,000
	Conduit and Wiring	$	7,000
	Fire Allowance	$	3,000
	Electrical Allowance	$	12,000
	Subtotal	**$**	**29,000**
Wood Boiler and Boiler Bldg	Detached Boiler Building	$	60,000
	Garn Boiler and Appurtenances	$	25,000
	Installation	$	6,000
		$	**91,000**
Interior Mechanical & Electrical	HXs, Piping & Materials	$	20,000
	Subtotal	**$**	**20,000**
Subtotal Material and Installation Cost		**$**	**177,500**
General Conditions	10%	$	17,750
	Subtotal	**$**	**195,250**
Overhead and Profit	10%	$	19,525
	Subtotal	**$**	**214,775**
Remote Factor	10%	$	21,478
	Subtotal	**$**	**236,253**
Project and Construction Management	5%	$	11,813
		$	**248,065**
Design Fees and Permitting	15%	$	37,210
	Subtotal	**$**	**285,275**
Contingency	10%	$	28,527
Total Project Cost		**$**	**313,802**

Table 6 – Option B - Estimate of Probable Cost

VI. Economic Analysis

The following assumptions were used to complete the economic analysis for the proposed biomass system at the Russian Mission site.

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%

Table 7 – Inflation rates

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 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 2013 studies.

O&M Costs

Non-fuel related operations and maintenance costs (O&M) were estimated at $1,000 per year. This estimate is consistent with AEA's O&M estimates used for projects utilizing Garn cord wood boilers. For only the first two years of service, an additional $1,000 per year was added to account for maintenance staff getting used to operating the new system. It must be noted that the cost to handle, store, and batch fire cord wood is not included in this study. It is assumed that this labor will be provided by Village staff.

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.

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. $$Simple\ Payback = \frac{Installed\ Cost\ of\ ECM}{First\ Year\ Energy\ Savings\ of\ ECM}$$
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.

Economic Term	Description
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 to provide 85% of the building's heat. It also includes the heating oil required for the existing oil-fired boilers to provide the remaining 15% of heat to the building.
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 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.

Table 8 – Economic Definitions

Results

The economic analysis was completed for both options in order to determine the simple payback, benefit to cost ratio, and net present value of the proposed biomass system.

Option A - The results of the proposed GarnPak cord wood boiler system are shown below. The GarnPak would be located in the available space on a gravel and would deliver heat to the Tribal Office, City Office and Community Center via buried hydronic piping. The proposed GarnPak system has a benefit to cost ratio of 1.82 over the 20 year study period, and is considered economically just. Any project with a benefit to cost ratio above 1.0 is considered economically justified. The major economic driver for this project is the high cost of heating oil combined with the relatively low cost of cord wood.

Option A – GarnPak Central Plant	
Project Capital Cost	$375,679
Present Value of Project Benefits (20 year life)	$1,136,389
Present Value of Operating Costs (20 year life)	$452,213
Benefit / Cost Ratio of Project (20 year life)	1.82
Net Present Value (20 year life)	$308,497
Year Accumulated Cash Flow is Net Positive	First Year
Year Accumulated Cash Flow > Project Capital Cost	13 years
Simple Payback	15.3 years

Table 9 – Option A - Economic Analysis Results

Option B - The results of the proposed detached central plant building cord wood boiler system are shown below. The central plant building would be located in the same location as Option A. The proposed central plant building system has a benefit to cost ratio of 2.18 over the 20 year study period, and is considered economically just. Any project with a benefit to cost ratio above 1.0 is considered economically justified.

Option A – Detached Central Plant Building	
Project Capital Cost	$313,802
Present Value of Project Benefits (20 year life)	$1,136,389
Present Value of Operating Costs (20 year life)	$452,213
Benefit / Cost Ratio of Project (20 year life)	2.18
Net Present Value (20 year life)	$370,374
Year Accumulated Cash Flow is Net Positive	First Year
Year Accumulated Cash Flow > Project Capital Cost	11 years
Simple Payback	12.8 years

Table 10 – Option B - Economic Analysis Results

Sensitivity Analysis

A sensitivity analysis was completed for each option to show how changing heating oil costs and wood costs affect the B/C ratios of the projects. The B/C ratios greater than 1.0 are economically justified and are highlighted in green. B/C ratios less than one are not economically justified and are highlighted in red. Current cost components for Russian Mission are highlighted in blue. As the price of heating oil goes up the project becomes economically more attractive.

Option A - B/C Ratios		Wood Cost ($/cord)			
		$200/cord	$250/cord	$300/cord	$350/cord
Heating Oil Cost ($/gal)	$4.00/gal	1.10	0.92	0.73	0.55
	$5.00/gal	1.61	1.42	1.24	1.05
	$5.80/gal	2.01	1.82	1.64	1.45
	$6.00/gal	2.11	1.92	1.74	1.55

Table 11 – Option A - Sensitivity Analysis

Option B - B/C Ratios		Wood Cost ($/cord)			
		$200/cord	$250/cord	$300/cord	$350/cord
Heating Oil Cost ($/gal)	$4.00/gal	1.32	1.10	0.88	0.66
	$5.00/gal	1.92	1.70	1.48	1.26
	$5.80/gal	2.40	2.18	1.96	1.74
	$6.00/gal	2.52	2.30	2.08	1.86

Table 12 – Option B - Sensitivity Analysis

VII. Forest Resource and Fuel Availability Assessments

Forest Resource Assessments

Fuel availability assessments were not available for the Russian Mission area. During the site visit it was found that the land around Russian Mission is densely forested. A variety of landowners and land managers control resources surrounding Russian Mission. These include the local village corporation, the United States Forest Service, and the United States Fish and Wildlife Service, in addition to private landowners.

It is important to note that if more than 40 acres per year or 50 cords of wood are collected per year, the harvesting is classified as a commercial operation. Since this project anticipates using 70 cords of wood a year, the commercial harvesting practices outlined in the Forest Resources and Practices Act will need to be followed. The Forest Resource and Practices Act protects the water and habitat within the harvesting site and applies to state, federal, and native corporation land. If less than 40 cords of wood are used per year, the use is considered as a personal use and a commercial permit is not required.

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). The recent Garn boiler systems installed in Alaska have not needed or obtained 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 villages 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.

In the Yukon River community studied, the community's wood supply and demand are isolated from outside markets. 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. 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.

Due to the limited wood fuel demand, large financial obligations and operating complexities, it is unlikely that the Yukon River community in this study will be able to manufacture pellets. However, some communities may be able to manufacture bricks or fire logs made from pressed wood material. These products can substitute for cordwood in woodstoves and boilers, while reducing supply pressure on larger diameter trees that are generally preferred for cordwood.

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, washeterias, 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. The Alaska Department of Environmental Conservation has issued nuisance abatement orders for air pollution for outdoor wood boilers in Fairbanks. Fairbanks is ranked number four on Time Magazine's list of most air polluted cities in America. 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, Garns 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 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. The automated fuel handling requirements for bulk fuel systems are not cost-effective for small and medium sized structures due to higher maintenance costs and complexities. Due to these reasons, a bulk fuel boiler system is not recommended for small rural communities in Alaska with limited financial and human resources.

Grants

There are many grant opportunities for biomass work state, federal, and local for feasibility studies, design and construction. If a project if determined to be 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

City Office

1. South and West elevation

2. South and West Elevation of Addition

3. South and East elevation

4. North Elevation

5. Site entrance. Community Center on left. View to North from same point as image 6.

6. Site Entrance. City Office on left, Tribal Office on left behind storage connex. View to South from same point as image 5.

7. Fuel tank in service

8. Decommissioned Water Heater

9. Boiler.

10. Boiler Burner

11. Electrical Service Mast

12. Electrical Panel

Tribal Office

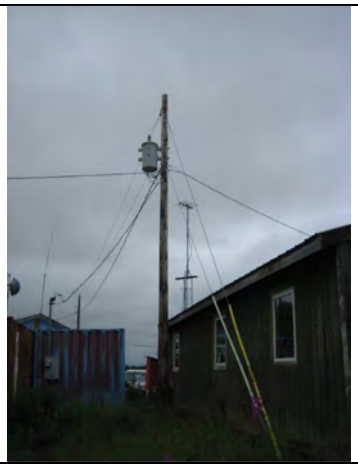
1. East Elevation and Main Entrance. Fuel tank visible on left.

2. East and North Elevations

3. East and South elevations

4. West and South Elevations

5. West and North Elevations



6. Electrical transformer for all 3 buildings

7. Electrical Service Mast and Meter	8. Boiler
9. Boiler Burner	10. Central Pad location for Wood Boiler (connexes can be moved)
11. Electrical Panel	

Community Center

1. East Elevation 1

2. East Elevation 2

3. East and North Elevations, Main Entrance

4. West and South Elevations

5. South Elevation 1

6. South Elevation 2 and Fuel Tank

7. Electrical Service Mast and Meter

8. Electrical Panel

9. Furnace, with edge of boiler in foreground

10. Furnace Burner

11. Decommissioned Boiler

12. Interior looking South toward Furnace Room

Appendix B
Economic Analysis Spreadsheet

Option A - Russian Mission Central Plant
Russian Mission, Alaska

Economic Analysis Results	
Project Capital Cost	($375,679)
Present Value of Project Benefits (20 year life)	$1,136,389
Present Value of Operating Costs (20 year life)	($452,213)
Benefit / Cost Ratio of Project (20 year life)	1.82
Net Present Value (20 year life)	$308,497
Year Accumulated Cash Flow is Net Positive	First Year
Year Accumulated Cash Flow > Project Capital Cost	12 years
Simple Payback = Total Project Cost / First Year Cost Savings	15.3 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	$5.80		8,354	gal	**$48,453**	**$50,876**	**$53,420**	**$56,091**	**$58,895**	**$61,840**	**$64,932**	**$68,179**	**$71,587**	**$75,167**	**$78,925**	**$82,871**	**$87,015**	**$91,366**	**$95,934**	**$100,731**	**$105,767**	**$111,056**	**$116,608**	**$122,439**
Biomass System Operating Costs																								
Wood Pellet Fuel (Delivered to site)	$250.00	96%	71.6	cords	($17,900)	($18,437)	($18,990)	($19,560)	($20,147)	($20,751)	($21,374)	($22,015)	($22,675)	($23,355)	($24,056)	($24,778)	($25,521)	($26,287)	($27,075)	($27,888)	($28,724)	($29,586)	($30,474)	($31,388)
Fossil Fuel	$5.80	4%	334	gal	($1,937)	($2,034)	($2,136)	($2,243)	($2,355)	($2,472)	($2,596)	($2,726)	($2,862)	($3,005)	($3,155)	($3,313)	($3,479)	($3,653)	($3,836)	($4,027)	($4,229)	($4,440)	($4,662)	($4,895)
Additional Electricity	$0.62		3,285	kWh	($2,037)	($2,098)	($2,161)	($2,226)	($2,292)	($2,361)	($2,432)	($2,505)	($2,580)	($2,657)	($2,737)	($2,819)	($2,904)	($2,991)	($3,081)	($3,173)	($3,268)	($3,366)	($3,467)	($3,571)
Operation and Maintenance Costs					($1,000)	($1,020)	($1,040)	($1,061)	($1,082)	($1,104)	($1,126)	($1,149)	($1,172)	($1,195)	($1,219)	($1,243)	($1,268)	($1,294)	($1,319)	($1,346)	($1,373)	($1,400)	($1,428)	($1,457)
Additional Operation and Maintenance Costs for first 2 years					($1,000)	($1,020)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Operating Costs					**($23,874)**	**($24,609)**	**($24,327)**	**($25,089)**	**($25,876)**	**($26,689)**	**($27,528)**	**($28,394)**	**($29,289)**	**($30,213)**	**($31,168)**	**($32,154)**	**($33,172)**	**($34,224)**	**($35,311)**	**($36,434)**	**($37,594)**	**($38,793)**	**($40,031)**	**($41,311)**
Annual Operating Cost Savings					$24,579	$26,267	$29,093	$31,002	$33,019	$35,151	$37,404	$39,784	$42,298	$44,954	$47,757	$50,718	$53,843	$57,142	$60,623	$64,297	$68,173	$72,263	$76,577	$81,128
Accumulated Cash Flow					$24,579	$50,846	$79,939	$110,940	$143,960	$179,111	$216,515	$256,300	$298,598	$343,552	$391,309	$442,027	$495,870	$553,011	$613,634	$677,931	$746,104	$818,367	$894,944	$976,072
Net Present Value					**($351,816)**	**($327,056)**	**($300,433)**	**($272,888)**	**($244,406)**	**($214,967)**	**($184,554)**	**($153,148)**	**($120,729)**	**($87,280)**	**($52,779)**	**($17,206)**	**$19,458**	**$57,235**	**$96,147**	**$136,215**	**$177,461**	**$219,907**	**$263,578**	**$308,497**

Option B - Russian Mission Central Plant
Russian Mission, Alaska

Economic Analysis Results	
Project Capital Cost	($313,802)
Present Value of Project Benefits (20 year life)	$1,136,389
Present Value of Operating Costs (20 year life)	($452,213)
Benefit / Cost Ratio of Project (20 year life)	2.18
Net Present Value (20 year life)	$370,374
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	12.8 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	$5.80		8,354	gal	**$48,453**	**$50,876**	**$53,420**	**$56,091**	**$58,895**	**$61,840**	**$64,932**	**$68,179**	**$71,587**	**$75,167**	**$78,925**	**$82,871**	**$87,015**	**$91,366**	**$95,934**	**$100,731**	**$105,767**	**$111,056**	**$116,608**	**$122,439**
Biomass System Operating Costs																								
Wood Pellet Fuel (Delivered to site)	$250.00	96%	71.6	cords	($17,900)	($18,437)	($18,990)	($19,560)	($20,147)	($20,751)	($21,374)	($22,015)	($22,675)	($23,355)	($24,056)	($24,778)	($25,521)	($26,287)	($27,075)	($27,888)	($28,724)	($29,586)	($30,474)	($31,388)
Fossil Fuel	$5.80	4%	334	gal	($1,937)	($2,034)	($2,136)	($2,243)	($2,355)	($2,472)	($2,596)	($2,726)	($2,862)	($3,005)	($3,155)	($3,313)	($3,479)	($3,653)	($3,836)	($4,027)	($4,229)	($4,440)	($4,662)	($4,895)
Additional Electricity	$0.62		3,285	kWh	($2,037)	($2,098)	($2,161)	($2,226)	($2,292)	($2,361)	($2,432)	($2,505)	($2,580)	($2,657)	($2,737)	($2,819)	($2,904)	($2,991)	($3,081)	($3,173)	($3,268)	($3,366)	($3,467)	($3,571)
Operation and Maintenance Costs					($1,000)	($1,020)	($1,040)	($1,061)	($1,082)	($1,104)	($1,126)	($1,149)	($1,172)	($1,195)	($1,219)	($1,243)	($1,268)	($1,294)	($1,319)	($1,346)	($1,373)	($1,400)	($1,428)	($1,457)
Additional Operation and Maintenance Costs for first 2 years					($1,000)	($1,020)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Operating Costs					**($23,874)**	**($24,609)**	**($24,327)**	**($25,089)**	**($25,876)**	**($26,689)**	**($27,528)**	**($28,394)**	**($29,289)**	**($30,213)**	**($31,168)**	**($32,154)**	**($33,172)**	**($34,224)**	**($35,311)**	**($36,434)**	**($37,594)**	**($38,793)**	**($40,031)**	**($41,311)**
Annual Operating Cost Savings					$24,579	$26,267	$29,093	$31,002	$33,019	$35,151	$37,404	$39,784	$42,298	$44,954	$47,757	$50,718	$53,843	$57,142	$60,623	$64,297	$68,173	$72,263	$76,577	$81,128
Accumulated Cash Flow					$24,579	$50,846	$79,939	$110,940	$143,960	$179,111	$216,515	$256,300	$298,598	$343,552	$391,309	$442,027	$495,870	$553,011	$613,634	$677,931	$746,104	$818,367	$894,944	$976,072
Net Present Value					**($289,939)**	**($265,179)**	**($238,556)**	**($211,011)**	**($182,529)**	**($153,090)**	**($122,677)**	**($91,271)**	**($58,852)**	**($25,403)**	**$9,098**	**$44,671**	**$81,335**	**$119,112**	**$158,024**	**$198,092**	**$239,338**	**$281,784**	**$325,455**	**$370,374**

Appendix C
Site Map

Site Plan of Russian Mission Buildings

Appendix D
AWEDTG Field Data Sheet

GYM

ALASKA WOOD ENERGY DEVELOPMENT TASK GROUP (AWEDTG)

PRE-FEASIBILITY ASSESSMENT **FIELD DATA SHEET**

APPLICANT:	CITY OF RUSSIAN		
Eligibility: (check one)	☒ Local government ☐ State agency ☐ Federal agency ☐ School/School District ☐ Federally Recognized Tribe ☐ Regional ANCSA Corp. ☐ Village ANCSA Corp. ☐ Not-for-profit organization ☐ Private Entity that can demonstrate a Public Benefit ☐ Other (describe):		
Contact Name:	AGNES HOUSLER		
Mailing Address:	PO BOX 49		
	S111 MAIN ST		
City:	RUSSIAN MISSION		
State:	AK	**Zip Code:**	99657
Office phone:	(907) 584 5111	**Cell phone:**	(907) 584 2023, Administrator
Fax:	(907) 584 5476		
Email:	RUSSIANMISSIONCITYOF@YAHOO.COM		

Facility Identification/Name:	GYM	
Facility Contact Person:	AGNES HOUSLER	
Facility Contact Telephone:	(907) 584 5111	( )
Facility Contact Email:	RUSSIAN MISSION CITY OF @ YAHOO.COM	

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:	1985	
Number of floors:		Year(s) renovated:	1992, 2002	
Number of bldgs.:		Next renovation:		
# of Students:		Has en energy audit been conducted?:		If Yes, when? *

OTHER FACILITY (Name: GYM **)**

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)	1600 FT²	Year built/age:	1985
Number of floors:	1	Year(s) renovated:	1992, 2002
Number of bldgs.:	1	Next renovation:	—
Frequency of Usage:	6-8mo, 2xmo, 20 days	# of Occupants	40
Has an energy audit been conducted?	NO	If Yes, when? *	

June 30 to July 1

*** 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

NOTE: BOILERS/UH SYSTEM OFFLINE

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				
☐ 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		1 GPH		
☐ 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): plus

Unitary products P+LBX16F12~~0~~1 S/N LGKP~~0~~ 5186

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

central furnace, serves gym

Describe age and general condition of existing equipment:

Approx 10yrs old, in poor condition

Who performs boiler maintenance? CITY MAINTENANCE Describe any current maintenance issues:

system functions

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

DUCTWORK & PIPING THROUGH CEILING

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

1x 300 GAL aboveground, no containment

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

No

DOMESTIC HOT WATER

N/A

USES OF DOMESTIC HOT WATER
Check all that apply:

- ☐ Lavatories
- ☐ Kitchen
- ☐ Showers
- ☐ Laundry
- ☐ Water treatment
- ☐ Other: _____

TYPE OF SYSTEM
Check all that apply:

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

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

Describe location of water heater(s): _____

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

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): STICK 8" Insulation Value: _____

Roof type: metal Insulation Value: _____

Windows: ☐ single pane ☐ double pane ☐ other: NONE

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

Drawings available: ☐ architectural ☐ mechanical ☐ electrical NO

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

ELECTRICAL

Utility company that serves the building or community: AVEC

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

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

Electricity rate per kWh: 0.30 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: N/A, but photos taken

WOOD FUEL INFORMATION

- Wood pellet cost delivered to facility $_____/ton Viable fuel source? Yes No
- Wood chip cost delivered to facility $_____/ton Viable fuel source? Yes No
- Cord wood cost delivered to facility $ 250 /cord Viable fuel source? Yes No
- Distance to nearest wood pellet and wood chip suppliers? SEATTLE, SEALASKA
- Can logs or wood fuel be stockpiled on site or at a nearby facility? ON SITE

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.)?
CONNEXS TO BE MOVED

What are local soil conditions? Permafrost issues?
GOOD NO

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

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

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from?
AVEC, ARUC- Alaska Rural Utilities Cooperative

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

OTHER INFORMATION

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

Is heat distribution system looping or branching? 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? NO
Any systems that could be added to the boiler system? NO
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 N/A

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) ✓

Wood

How much local wood availability is there?

Lots

Will additional wood demand cause issues?

No

Where would wood storage and wood drying occur:

Need a shed (build it)

Typical Wind Direction at Storage Area:

Local Wood Species (Birch, Spruce):

Evergreens, spruce

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

variable

~~Domestic Hot Water~~

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

Logistics

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

Nenana or Crowley

Is there local gravel or fill? How far away?

no, but under study by Golder & Associates

TRIBAL OFFICE

ALASKA WOOD ENERGY DEVELOPMENT TASK GROUP (AWEDTG)

PRE-FEASIBILITY ASSESSMENT **FIELD DATA SHEET**

APPLICANT:	CITY OF RUSSIAN MISSION		
Eligibility: (check one)	☒ Local government ☐ State agency ☐ Federal agency ☐ School/School District ☐ Federally Recognized Tribe ☐ Regional ANCSA Corp. ☐ Village ANCSA Corp. ☐ Not-for-profit organization ☐ Private Entity that can demonstrate a Public Benefit ☐ Other (describe):		
Contact Name:	AGNES HOUSLER, ADMINISTRATOR		
Mailing Address:	PO BOX 49 S111 MAIN ST		
City:	RUSSIAN MISSION		
State:	AK	**Zip Code:**	99657
Office phone:	(907) 584 5111, 584 5110	**Cell phone:**	(907) 584 2023, administrator
Fax:	(907) 584 5476		
Email:	RUSSIANMISSIONCITYOF@YAHOO.COM		

Facility Identification/Name:	TRIBAL OFFICE	
Facility Contact Person:	AGNES HOUSLER	
Facility Contact Telephone:	(907) 584 5111	(907) 584 5110
Facility Contact Email:	RUSSIAN MISSION CITY OF@YAHOO.COM	

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):	1120	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: TRIBAL OFFICE)

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

Size of Facility (sq. ft. heated)	1120	Year built/age:	42 YRS
Number of floors:	1	Year(s) renovated:	–
Number of bldgs.:	1	Next renovation:	–
Frequency of Usage:	9-12, 1-5, 5d/wk	# of Occupants	7
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		0.75 GPH		
☐ 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 Just 1
- ☐ Pneumatic control system Manufacturer: _____ Approx. Age: _____
- ☐ Direct digital control system Manufacturer: _____ Approx. Age: _____

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

CROWN BDS -092

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

Baseboard around whole bldg

Describe age and general condition of existing equipment:

Who performs boiler maintenance? CITY MAINTENANCE MAN Describe any current maintenance issues:

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

along walls

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

1 x 300 gal

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 x 1
- ☐ Kitchen
- ☐ Showers
- ☐ Laundry
- ☐ Water treatment
- ☐ Other: _____

N/A

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: none

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

Describe location of water heater(s): _____

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

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): 6" stick Insulation Value: _____

Roof type: Metal Insulation Value: _____

Windows: ☐ single pane ☒ double pane ☐ other: _____

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

Drawings available: ☐ architectural ☐ mechanical ☐ electrical NO

Outside Air/Air Exchange: ☐ HRV ☐ CO_2 Sensor No

ELECTRICAL

Utility company that serves the building or community: AVEC

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

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

Electricity rate per kWh: $0.30 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: N/A

WOOD FUEL INFORMATION

- Wood pellet cost delivered to facility $_____/ton Viable fuel source? Yes No
- Wood chip cost delivered to facility $_____/ton Viable fuel source? Yes No
- Cord wood cost delivered to facility $ 250 /cord Viable fuel source? Yes No
- Distance to nearest wood pellet and wood chip suppliers? _____
- 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.)?
CONNEXS TO BE MOVED

What are local soil conditions? Permafrost issues? NO

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

Can building accommodate a biomass boiler inside, or would an addition for a new boiler be necessary? Where would addition go?
NO YES

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from?
AVEC, ARUC - Alaska Rural Utilities Cooperative

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

OTHER INFORMATION

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

Is heat distribution system looping or branching?
For baseboard hydronic heat, what is the diameter of the copper tubing? Size of fins? Number of fins per lineal foot? 1"
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 NO
Are heating fuel records available?
YESS

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) ✓

Wood

How much local wood availability is there?

Lots

Will additional wood demand cause issues?

No

Where would wood storage and wood drying occur:

build shed

Typical Wind Direction at Storage Area:

Local Wood Species (Birch, Spruce):

Evergreens, spruce

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

variable

Domestic Hot Water

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

Logistics

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

Nenana or Crowley

Is there local gravel or fill? How far away?

no, but under study by Golder & Associates

CITY OFFICE

ALASKA WOOD ENERGY DEVELOPMENT TASK GROUP (AWEDTG)

PRE-FEASIBILITY ASSESSMENT **FIELD DATA SHEET**

APPLICANT:	City of Russian Mission
Eligibility: (check one)	☑ Local government ☐ State agency ☐ Federal agency ☐ School/School District ☐ Federally Recognized Tribe ☐ Regional ANCSA Corp. ☐ Village ANCSA Corp. ☐ Not-for-profit organization ☐ Private Entity that can demonstrate a Public Benefit ☐ Other (describe):
Contact Name:	Agnes Housler, Administrator
Mailing Address:	Box 49
City:	Russian Mission, Alaska 99657-0049
State:	AK **Zip Code:** 99657
Office phone:	(907) 584-5111 **Cell phone:** (907) 584-2023, Administrator
Fax:	(907) 584-5476
Email:	russianmissioncityofe yahoo.com

Facility Identification/Name:	City office	
Facility Contact Person:	Agnes Housler	
Facility Contact Telephone:	(907) ~~907~~ 584-5111	(907) 584-5476 (fax)
Facility Contact Email:	russianmissioncityofe yahoo.com	

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: CITY OFFICE)

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

Size of Facility (sq. ft. heated)	1120	Year built/age:	42 yrs
Number of floors:	1	Year(s) renovated:	—
Number of bldgs.:	1	Next renovation:	
Frequency of Usage:	9-12, 15, 5dy/wk	# of Occupants	5
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	Annual Fuel Cost
☒ Hot water boiler:	☐ natural gas	☐ propane	☐ electric	☒ #1 fuel oil	☐ #2 fuel oil	1.25 GPH		
☐ 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 McClain 68 model P-468V-WT,

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

CENTRAL EQUIPMENT IN BOILER RM, PERIMETER BASEBOARD THROUGHOUT

Describe age and general condition of existing equipment:

15 yrs, operating

Who performs boiler maintenance? CITY MAINTENANCE Describe any current maintenance issues:

system in acceptable working order

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

along walls

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

1 x 300 gal tank, no containment

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

No

DOMESTIC HOT WATER

N/A

USES OF DOMESTIC HOT WATER
Check all that apply:

- ☐ Lavatories
- ☐ Kitchen
- ☐ Showers
- ☐ Laundry
- ☐ Water treatment
- ☐ Other: _____

TYPE OF SYSTEM
Check all that apply:

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

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

Describe location of water heater(s): _____

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

BUILDING ENVELOPE

Wall type (stick frame, masonry, SIP, etc.): 6" STICK Insulation Value: _____

Roof type: Metal Insulation Value: _____

Windows: ☐ single pane ☒ double pane ☐ other: _____

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

Drawings available: ☐ architectural ☐ mechanical ☐ electrical NO

Outside Air/Air Exchange: ☐ HRV ☐ CO_2 Sensor NO

ELECTRICAL

Utility company that serves the building or community: AVEC

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

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

Electricity rate per kWh: 0.30 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
- Wood chip cost delivered to facility $_____/ton Viable fuel source? Yes No
- Cord wood cost delivered to facility $ 250 /cord Viable fuel source? Yes No
- Distance to nearest wood pellet and wood chip suppliers? SEATTLE; SE ALASKA
- Can logs or wood fuel be stockpiled on site or at a nearby facility? YES

Who manages local forests? Village Native Corp, Regional Native Corp, State of Alaska, Forest Service, BLM, USF&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.)?
CONNEXS need moved

What are local soil conditions? Permafrost issues?
good NO

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

Can building accommodate a biomass boiler inside, or would an addition for a new boiler be necessary? Where would addition go?
NO YES

Where would potential boiler plant or addition utilities (water/sewer/power/etc.) come from?
ARUC - Alaska Rural Utilities Cooperative

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? 1"
Any other energy using systems (kitchen equipment, lab equipment, pool etc)? Fuel or energy source? NO
Any systems that could be added to the boiler system? NO
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) ✓

Wood

How much local wood availability is there?

lots

Will additional wood demand cause issues?

No

Where would wood storage and wood drying occur:

need a shed (build it)

Typical Wind Direction at Storage Area:

Local Wood Species (Birch, Spruce):

Evergreens, spruce

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

variable

~~Domestic Hot Water~~

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

Logistics

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

Nerman or Crowley

Is there local gravel or fill? How far away?

no, but under study by Golder & Associates