Agency: Commerce, Community and Economic Development

Grants to Named Recipients (AS 37.05.316)

Grant Recipient: Crossroads Medical Center **Federal Tax ID:** 92-0126047

Project Title: **Project Type:** Remodel, Reconstruction and Upgrades

Crossroads Medical Center - Biomass Boiler Project

State Funding Requested: $229,020 **House District:** 6 / C

One-Time Need

Brief Project Description:

Biomass boiler installation.

Funding Plan:

Total Project Cost:	$229,020
Funding Already Secured:	($0)
FY2014 State Funding Request:	($229,020)
Project Deficit:	$0

Funding Details:

None.

Detailed Project Description and Justification:

Crossroads is a faith based community medical center located in Glennallen Alaska. Crossroads is the only provider of 24-hour medical care to the general public in the Copper River Valley.

Fuel costs are dangerously high for the facility and installing a biomass heating system will greatly reduce the cost of operating the facility and increase the sustainability of the center. Doing so helps assure continued medical care for residents and guests to the Copper River Valley.

See attached PDF.

Project Timeline:

FY14-18.

Entity Responsible for the Ongoing Operation and Maintenance of this Project:

Crossroads Medical Center

Grant Recipient Contact Information:

Name:	Joel Medendorp
Title:	CEO
Address:	PO Box 5
	Glennallen, Alaska 99588
Phone Number:	(907)822-5686
Email:	crmc.ceo@gmail.com

Contact Name: Michael Paschall
Contact Number: 907-465-4859

For use by Co-chair Staff Only:

$229,020 Approved

2:01 PM 5/9/2013

Has this project been through a public review process at the local level and is it a community priority? ☐ Yes ☒ No

Contact Name: Michael Paschall
Contact Number: 907-465-4859

For use by Co-chair Staff Only:

2:01 PM 5/9/2013

Pre-Feasibility Study

Heating with Woody Biomass for the Glenallen, Alaska Cluster

This pre-feasibility assessment considers the potential for heating buildings at DNR Forestry, Cross Road Medical Center, BLM/NPS Campus, PWSCC Glennallen Campus, and Copper River School District with woody biomass from regional forests.

Dalson Energy Inc.

308 G St. Ste 303
Anchorage, Alaska 99501

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Dalson Energy

Contents

Executive Summary

This assessment suggests small-scale heating with woody biomass technically, operationally, and financially feasible in a number of community buildings in the Glenallen, AK, area. Of the projects surveyed, three were found to have financial feasibility; four were found to be operationally and

technically feasible; and two are recommended to proceed to development, with a high degree of technical, operational, and financial viability. The two projects recommended to proceed to development are the Cross Road Medical Center, and NPS Cluster #1.

In general, containerized cordwood heating systems are the most financially attractive of the possible project configurations evaluated, with the lowest capital cost and the lowest wood fuel cost. Pellets are also an option for small-scale heating, although the projects described in this report have marginal economic feasibility. Options for improving project's financial profiles are discussed.

Regional biomass information

Over 1 million acres in the Copper Valley are forested. A number of institutional land owners manage these lands, including the State of Alaska Department of Natural Resources Forestry Division (DNR), US Bureau of Land Management (BLM), and Ahtna, Inc. According to a 2010 DNR timber resource assessment, State lands alone in the Copper Valley hold more than 2 million tons of timber > 5" DBH (diameter at breast height), and over 96,000 acres of pole timber. Non-commercial trees (too small or defective to make sawlogs), including pole timber, is suitable for biomass energy. Concurrent to making timber resources available for biomass energy development, the State of Alaska is undertaking Wildfire Fuels Reduction Projects around Glenallen, McCarthy, Tazlina, Gulkana, and Gakona.

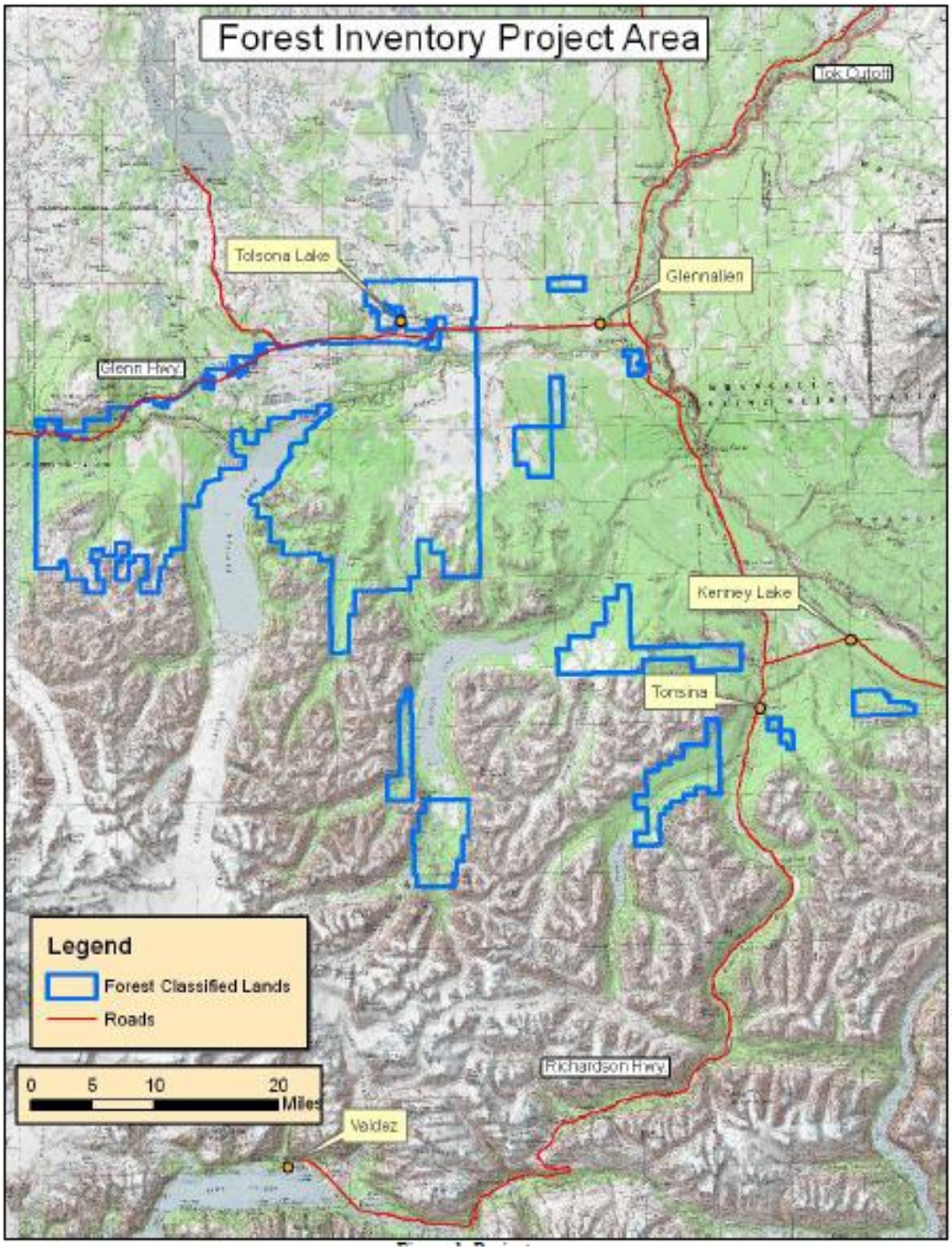

Figure 1: State Land forest inventory map[1].

[1] Hanson, Doug. "Forest Resources on State Forest Lands in the Copper River Basin: A Preliminary Estimate." Alaska Department of Natural Resources – Forestry. March 2010.

The presence of a forest resource is distinct from a wood energy fuel supply. Every energy project needs a fuel plan. That plan could include a harvest contract and/or wood fuel delivery contract, and an operations plan prior to development. Additionally, every project should have a primary and secondary fuel supplier identified prior to investing in a project. Wood fuel supply and contracting is a lynchpin to project success.

Available fuels

Wood chips

There are currently no local commercial manufacturers of woodchips. One initiative, the Glenallen School biomass boiler project, may develop (or catalyze the development of) a chip manufacturing operation if it proceeds to development.

Regal Enterprises produces woodchips for its own use. It operates a small biomass boiler for heating several buildings. Regal Enterprises do not currently plan to sell chips commercially but may be willing to do so if approached with a proposal for a fuel supply contract. Regal Enterprises historically harvested firewood but their future production is unknown at this time.

Regionally, the Alaska Gateway School District (AGSD) in Tok, AK procures wood chips for the Tok School's biomass boiler project from local sources. A few trailers of chips would satisfy the annual demand of any of the projects considered in this report. The chips supply is considered reliable, and is priced at $60 - $80/ ton FOB Tok, AK. Regional vendors may be available to deliver woodchips in the amounts necessary, until local sources are identified.

Cordwood

Glenallen is located in the Valdez-Cordova Census area, which contains about 10,000 residents. Of 3,914 occupied housing units in this census area, approximately 630 used wood as a primary heat source, according to U.S. Census data. At an average of 5 cords per house, approximately 3,150 cords are used annually in this Census area. There is no way to differentiate between cordwood and pellet wood among the Census data, but pellets are expected to be a small percentage of the total wood fuel heating demand.

Historically, wood is harvested by individual households for personal use. Additionally local businesses harvest and sell firewood, as log-loads or processed cordwood. Local commercial firewood manufacturers include Regal Enterprises and Benston Logging.

Cordwood is also available from regional producers, such as Young's Timber Inc. and Kristian Crozier in Tok, AK.

Commodity prices for cordwood follow:

- Log length -- $1,800/ 10 cords FOB Tok, AK
- Split/ delivered -- $200/ cord FOB Tok, AK

Pellets

Pellets are not produced commercially in the Copper Valley. However, a variety of pellet supplies are accessible:

- Superior Pellets, manufactured in North Pole, AK; delivered in 40 pound bags or bulk. The company plans to acquire a 16 ton auger delivery truck in 2012. Current pellet price is $275/ ton FOB Fairbanks, AK.
- End of the Alcan (Supernaw's), located in Delta Junction, imports pellets from Prince George, Canada. Pellets are palletized in 40 lb. bags, 1 ton per pallet. Pallets are delivered to Delta Junction or Tok. This operator currently distributes about 1,000 tons per year. Each load carries about 25 tons (25 pallets). $330 per ton, FOB Tok.
- Pellets from a variety of suppliers in Anchorage, mostly imported from Lower 48 or Canada.
- Tongass Forest Enterprises, located in Ketchikan, is manufacturing pellets—not currently exporting.

Summary

With regard to woodchips, the viability of any project depends on the ability to reliable obtain chips at a reasonable price. Local woodchip producers are not actively manufacturing chips for sale. Therefore, the viability of any woodchip project depends on new wood chip manufacturing enterprises, or being able to obtain chips from the suppliers of the Alaska Gateway School District in Tok, or another supplier in the area. A primary and secondary source of chips should be developed. Simple chipping equipment and infrastructure could be purchased by a regional organization and made available for lease to entrepreneurs. The preferred chip fuel is 20 – 35% moisture content, and less than 2.5" in size.

With regard to cordwood, the projects discussed herein use about 15 – 30 cords annually. The challenge here is sourcing, not supply. Within the regional biomass market, the additional market demand of 15 – 30 cords will likely have little impact on the commodity pricing. With upcoming wildfire-fuels reduction programs, it appears that more than sufficient volumes of wood should be available for sales, if entrepreneurs engage with agencies (DNR, BLM, Ahtna). Additionally, bulk purchases are available from commercial operators in Tok, Alaska.

Any project proceeding to development should:

A) Negotiate a fuel supply agreement with a local providers of firewood
B) Properly store (deck) wood 6 months – 1 year in advance of the heating season to ensure its dryness. A moisture content of 20%-25% is the range of well-seasoned wood for most combustion systems..

With regard to wood pellets, two existing commercial suppliers are operating in the region: Superior Pellets and End of the Alcan. Currently Superior Pellets has a 16 ton auger truck, but plans to purchase additional delivery vehicles upon negotiation of a fuel supply contract.

Additionally, all pellet projects considered have the potential to charter their own truck from Prince George or other sources, if pellet delivery from End of the Alcan became unavailable.

Economic development

A number of factors yield a favorable market opportunity for woody biomass energy development in the Copper Valley, including high and escalating fossil fuel costs, planned hazardous fuels reduction, and the local labor force.

Economic localization is the term used to describe local benefits gained by locally producing and consuming commodities, especially energy supply and food. Woody biomass in particular can yield savings in heat energy, improved price stability over fossil fuels, locally retained energy dollars, and job creation.

With regard to price stability, although fossil fuels are an input price to biomass fuel harvesting and processing, the biomass price is more inelastic than fossil fuels themselves.

Site Specific Analysis: DNR Forestry

General Description of Opportunity & Challenges

DNR Forestry office in Copper River/ Valdez is a division of the State of Alaska DNR Forestry, which manages forests for multiple uses and the sustained yield of renewable resources on 20 million acres of State land.

The representative of the office, Regional Forester Gary Mullen, is very interested on a biomass heating project for the purpose of stabilizing operating costs and utilizing a renewable resource.

The facility is composed of three existing buildings: the Administration building, Shop, and Pump House. The Administration building has recently been weatherized. A new Operations building, estimated at 2,000 sq. ft, will be constructed in the coming year.

Technology or installation options assessed

Because of the time constraints on limited current staff, only a fully automated system was considered. This is directly based on feedback from DNR-Forestry personnel. The project is too small to accommodate a wood chip boiler. Therefore, a pellet boiler was the only technology considered. The pellets were assumed to be back-hauled using Forestry trucks, at no additional transportation costs to DNR.

Both stand-alone and integrated biomass boiler systems were considered. DNR-personnel preferred the stand-alone option. There is no room within existing buildings to accommodate the biomass plant. The new building, currently in the design phase, has a separate budget that is limited. Therefore, a separate source of funding for the biomass plant was preferred.

Because of the very low volume of fuel usage, a small pellet trough was assumed to be built into the container system. The trough would be made of wood, and could be filled from above by 40 lb bags. A forklift could lift up the pallet of pellets for filling from above.

Alternatively, a metal grain-style silo or small square silo could be employed. The challenge is that a full truck carries 16 – 27 tons of pellets (a full year supply for DNR), but the storage devices for this volume are not easily filled by hand. Because of the low volume of wood fuel usage, and the prospects for using 40 lb. bags of pellets rather than automatic filling, the economic analysis in this report assumes a wooden trough style storage structure built into the containerized boiler system.

One additional note on this project: the DNR site also has a well house that distributes water to the Campus building. This well house is outfitted with a 1.5 kilowatt electric baseboard heater. The well house does not appear to be well insulated. The project design assumes heating this well house with a small heat loop line, offsetting an estimated 4,500 kilowatt-hours per year (20 hours per day of operation, 5 months of winter). The cost of this electricity is $1,485 per year.

Figure 2: Top Left: Location of proposed Operations Building. Top Right: Gravel drive to position boiler unit. Bottom Left: Shop/ Storage building.

Project chart

Building Name **Building Owner** **Contact Information**	Admin, Fire Cache, Water house, Operations (new) DNR Forestry Gary Mullen
Square footage and number of buildings	7,900 sq. ft total (3 buildings). Operations building in design, estimated 1,400 -- 2,200 sq. ft.
Gallons per year, fuel oil #1	estimated 3,600 gallons

PRELIMINARY SITE INVESTIGATION	
What feedback did staff offer on the current heating system?	Has recently completed weatherization on the Admin building, and is considering weatherization of the Shop. Has some money to build a new Operations facility, which will be highly efficient. That building has not yet been designed but will be located north of the Admin building.
What is the staff or building manager's interest in biomass heating?	Seriously interested in automated wood heating. Very ready to install biomass heating plant. Prefers containerized system.
Description of current heating system	Current heating systems are not connected. Office - hydronic fuel oil boiler, 248,000 btu/hr; Shop - unit heater from ceiling (forced air, 185,000 btu); new heating system will be incorporated into new Operations building. Water plant -- 1,500 watt electric baseboard heater heats the water house (5,118 btu/hr).
Available space (within existing structures or space for newly constructed building)	Stand alone boiler system is preferred.
Street access	Excellent street access, about 1/4 mile up driveway from Richardson Hwy. Forestry trucks regularly access the area.
Delivery access	Excellent delivery access to existing gravel driveway.
Fuel storage space	Excellent fuel storage space for proposed pellet system.
Building or site constraints (topography, permitting, historical preservation, etc.)	None.
Options for biomass boiler system (fuel type, technology type, building type)	Given the personnel available, a highly automated system is preferred. At the scale of system required, only pellets are recommended. Bulk pellets are available by the pallet (40 lb bags) or by the truck. With the proposed biomass boiler configuration, the facility should be able to offset 100% of heat demand using 27.5 tons of pellets. Total annual estimated heat requirement is 450 MMBTU.
Estimated boiler size	two (2) 100,000 btu/hr pellet boilers, with cascading control function among them, for a total capacity of 200,000 btu/hr. Boilers should have turn down of 4:1, enabling the facility to meet almost all of its heating needs with pellets.

Preliminary Cost Estimating

Initial investment: DNR Forestry

Biomass System	
Size	(2) 109,000 btu/hr
System Rating -- Btu/hr	218,000
Buffer tank	475 gal.

	footnote		*notes*
Building and Equipment Costs (B&E) $			
Fuel Storage Building (V-storage installed in fabricated building)	A	$ 10,000	
Pre-Fabricated Boiler System			
Base price	C	$ 180,000	Based on quote from viable suppliers.
Boiler shipping to hub city	B	$ 10,000	
Local delivery	B	$ 2,000	
Plumbing and electrical	C	$ 7,000	
Site Prep	C	$ 3,000	Forestry will construct gravel pad
Installation	C	$ 6,000	
District loop & building integration	D	$ 88,000	Forestry will trench.
Subtotal-B&E Costs		***$ 306,000***	
Contingency -- 20%		***$ 61,200***	
Grand Total		**$ 367,200**	
Soft Costs $			
Project Management	C	$ 29,376	8% B&E
A/E Design Services	C	$ 33,048	9% of B&E, because of district loop
Fire Marshall Plan Review			incl'd in design
Equipment Commissioning and Training	C		incl'd with purchase
Construction Management	C	$ 29,376	8% B&E
Subtotal -- Soft Costs		**$ 91,800**	
Recommended Project Budget -- Design and Construction Costs		**$ 459,000**	

footnote	
A	Square bulk silo or pre-fabricated building with V-shaped storage trough, built of wood into container. Waterproof hatch. Fill from above.
B	Estimated based on quotes from viable suppliers
C	Estimate
D	$15,000 per building integration (4 buildings). $35/ft for duel insulated pex pipe. 800 ft.

Economic Analysis

AEA B/C Model_DNR

	Project Description	
	Community	Glennallen
	Nearest Fuel Community	Tok
11	Region	Rural
	RE Technology	Woody biomass heat
	Project ID	
	Applicant Name	DNR Forestry
	Project Title	Glennallen DNR Wood Heat
	Category	

Results	
NPV Benefits	$207,135
NPV Capital Costs	$459,000
B/C Ratio	0.45
NPV Net Benefit	($251,865)

Low	$ 300
Med	$ 330
High	$ 400

Performance	Unit	Value
Displaced Electricity	kWh per year	4,500
Displaced Electricity	total lifetime kWh	4,500
Displaced Petroleum Fuel	gallons per year	3,600
Displaced Petroleum Fuel	total lifetime gallons	90,000
Displaced Natural Gas	mmBtu per year	-
Displaced Natural Gas	total lifetime mmBtu	-
Avoided CO2	tonnes per year	37
Avoided CO2	total lifetime tonnes	914

	Proposed System	Unit	Value
1	Capital Costs	$	$ 459,000
2	Project Start	year	2013
3	Project Life	years	25
	Displaced Electric	kWh per year	4,500
4	Displaced Heat	gallons displaced per year	3,600
	Displaced Transportation	gallons displaced per year	0.00
10	Renewable Generation O&M	$ per BTU	
	Electric Capacity	kW	0
	Electric Capacity Factor	%	0
	Heating Capacity	Btu/hr.	218,000
	Heating Capacity Factor	%	86

General perspective of project viability, and recommended next steps

Due to relatively low fuel oil consumption, this project has marginal economic feasibility. However, it has all the attributes of a project that will thrive operationally: motivated and capable staff, appropriate technology for available fuels and operating requirements, and simple building interconnections. This project will demonstrate the viability of small-scale biomass heating to a variety of commercial and municipal buildings.

Because of uncertainty regarding new building loads, and the potential to adjust the Shop heat load as additional weatherization measures are undertaken, the recommended project technology are two highly modulating wood pellet boilers. These boilers will probably offset 100% of the fuel oil demand of the facility.

Usually AEA recommends funding for projects with a Benefit/ Cost ratio greater than 1.0. This project is markedly lower than that, and is unlikely to move forward if AEA Renewable Energy Grant funds are the only sources of funding.

Creative project development will need to be undertaken for this project to move forward. Such development could include:

- Partner with the neighboring heat consumer, DOT, for a district heating system serving both agencies. This project would likely be able to be financed by grants or even private third parties
- Attempt to establish the value of the project apart from financial value, such as the value of monitoring, the value of purchasing regionally manufactured wood fuels, etc, to obtain grant monies
- Negotiate lower pellet prices for a long term wood fuel contract and/or partnering with another pellet consumer to negotiate lower prices through bulk purchasing

This project is recommended to prove the concept of small-scale wood heating. It is also believed that the facility staff would be very interested in record-keeping for the purpose of building models of biomass heating in interior Alaska.

Site Specific Analysis: Cross Road Medical Center

General Description of Opportunity & Challenges

Cross Road Medical Center (CRMC) is a not-for-profit Christian Community Health Center serving the residents of South Central Alaska. Since 1956, CRMC has been the only MD level provider of health care for an area nearly the size of West Virginia.

CEO Joel Medendorp and CFO Kevin Dorsey have been highly engaged in exploring the possibility of a wood energy project, with the primary goal being reducing costs. Mr. Medendorp also supports local

economic development via local wood harvests, and proposed allowing patients to offset healthcare bills with cordwood.

The facility appears to be well maintained and had a dedicated maintenance staff, who participated in all discussions regarding biomass heating.

The facility is comprised of three buildings: the Ambulance Garage and Clinic, which are heated by a single hydronic boiler system located in the Ambulance Garage, and the Admin building, which is heated by a separate hydronic boiler.

Technology or installation options assessed

The heat load of the facility accommodates a cordwood or pellet boiler. Both containerized and new building construction options were considered. Due to Mr. Medendorp's desire to construct a new ambulance bay, Dalson Energy recommends an addition onto the existing ambulance garage for congruency with the existing structure. One bay would be used for the boiler equipment and fuel trailer; the other would be used for trucks and other equipment. Both bays would be heated.

Figure 3: Above Left: Head Maintenance Manager Tim Sloma and CEO Joel Medendorp in front of the Clinic. Above Right: Foreground is existing boiler building and area for new biomass boiler installation. Background is Clinic. Below: Foreground Admin building, background is Clinic.

Project chart

Building Name **Building Owner** **Contact Information**	Administration building, Clinic, Garage (3) Cross Road Medical Center (non profit) Joel Medendorp, Kevin Dorsey
Square footage	21,640 sq. ft. Total. (Admin is 2,700 square feet; Clinic is 17,640 sq. ft; Garage is 1,300 sq. ft.)
Gallons per year, fuel oil #1	7,675 gallons

PRELIMINARY SITE INVESTIGATION	
What feedback did staff offer on the current heating system?	Goal to reduce cost. Interested in potential trade for cordwood in exchange for medical bills.
What is the staff or building manager's interest in biomass heating?	Very positive interest. Reduce costs. Willing to hire. Keep existing system as back up. Potential to use some hazardous fuels on the property in the biomass system for a few years of operation.
Description of current heating system	Garage and clinic are open 24/7. Admin operates as an office. The Garage and Clinic are heated by a single hydronic heating system, located in the garage, using about 6,000 gallons per year. The Admin building is heated by a single hydronic boiler, located on the Northwest corner of the building.
Available space (within existing structures or space for newly constructed building)	200 acres on site. Only 50 acres are developed.
Street access	Excellent acess to Glenn Hwy.
Delivery access	Excellent.
Fuel storage space	Excellent, with "day bin" space adequate, as well as long term storage on the "back 40."
Building or site constraints (topography, permitting, historical preservation, etc.)	These three buildings are within 130' of each other.
Options for biomass boiler system (fuel type, technology type, building type)	Cordwood option preferred for local fuel utilization, economic development, and potential to trade for medical bills. Total MMBTU is 959 per year. To offset 80% of the load, about 38 cords of firewood would be required. Cordwood system of about 350,000 btu/hr is recommended. A GarnPac would serve this load well. System would be located on East side of Garage. A boiler plus new vehicle bay could be added. Trailer with cordwood could be backed into the Garage, then removed and reloaded when necessary.
Estimated Boiler Size	350,000 btu/hr cordwood

Preliminary Cost Estimating

Initial investment: Clinic, Option #1

Biomass System	
Rating -- Btu/hr	350,000
Btu stored	415,000

	footnote			*notes*
Building and Equipment Costs (B&E) $				
Fuel storage facility (gated gravel facility + trailer)	A	$	1,500	
Boilers				
Base price	B	$	30,000	
Shipping to Tok	C	$	10,000	
Shipping to Glennallen	C	$	2,000	
Boiler Building	D	$	67,200	12' x 40'
Plumbing and electrical	C	$	40,000	
Installation	C	$	20,000	
District loop & building integration	E	$	20,150	
Subtotal-B&E Costs		***$***	***190,850***	
Contingency -- 20%		***$***	***38,170***	
Grand Total		**$**	**229,020**	
Soft Costs $				
Project Management		$	18,322	8% of B&E
A/E Design Services		$	27,482	12% of B&E
Fire Marshall Plan Review				included in design
Equipment Commissioning and Training	C	$	4,000	
Construction Management		$	18,322	8% of B&E
Subtotal -- Soft Costs		**$**	**68,126**	
Recommended Project Budget -- Design and Construction		**$**	**297,146**	

footnote	
A	Long term storage at Shop/ Storage area
B	Based on quotes from viable suppliers
C	Estimate
D	$140/ sq ft
E	$15,000 per building integration (1 building). $35/ft for duel insulated pex pipe. $600 for trenching 130 feet.

Economic Analysis

AEA B/C Model_Clinic

	Project Description	
	Community	Glennallen
	Nearest Fuel Community	Tok
11	Region	Rural
	RE Technology	Woody biomass heat
	Project ID	
	Applicant Name	Crossroad Medical Center
	Project Title	Glennallen Crossroads Medical Wood Heat -- New Construction
	Category	

Results	
NPV Benefits	$414,108
NPV Capital Costs	$297,146
B/C Ratio	1.39
NPV Net Benefit	$116,962

Low	$ 175
Med	$ 200
High	$ 300

Performance	Unit	Value
Displaced Electricity	kWh per year	-
Displaced Electricity	total lifetime kWh	-
Displaced Petroleum Fuel	gallons per year	6,140
Displaced Petroleum Fuel	total lifetime gallons	191,875
Displaced Natural Gas	mmBtu per year	-
Displaced Natural Gas	total lifetime mmBtu	-
Avoided CO2	tonnes per year	62
Avoided CO2	total lifetime tonnes	1,948

	Proposed System	Unit	Value
1	Capital Costs	$	$ 297,146
2	Project Start	year	2013
3	Project Life	years	25
	Displaced Electric	kWh per year	-
4	Displaced Heat	gallons displaced per year	6,140
	Displaced Transportation	gallons displaced per year	0.00
10	Renewable Generation O&M	$ per BTU	
	Electric Capacity	kW	0
	Electric Capacity Factor	%	0
	Heating Capacity	Btu/hr.	350,000
	Heating Capacity Factor	%	86

General perspective of project viability, and recommended next steps

This project has strong economic and operational feasibility. It has all the attributes of a project that will thrive operationally: motivated and capable staff, appropriate technology for available fuels and operating requirements, and simple building interconnections. This project will demonstrate the viability of small-scale biomass heating to a variety of commercial and municipal buildings using cordwood.

This project also underlines an essential aspect of heating with wood in places like Glenallen: ultimately, heating with wood is about thriving rural communities. This project will result in cost savings and economic development to the region, as well as a few happy patients who are able to offset health care costs with cordwood.

This project is highly recommended to prove the concept of small-scale wood heating with cordwood. It is also believed that the facility staff would be very interested in record-keeping for the purpose of building models of biomass heating in interior Alaska.

Site Specific Analysis: Community Chapel

General Description of Opportunity & Challenges

The Glennallen Community Chapel is a community building used for Church services and community events, such as weddings.

Pastor Nathan Winer expressed interest in a cordwood heating system for its potential to reduce utility costs and provide reliable heat. However, he stressed that the Chapel would need to hire someone to stoke the boiler.

Technology or installation options assessed

Because of the relatively low fuel oil consumption, the only options considered were cordwood and pellet heating systems. Because the Chapel staff preferred local resource utilization and manual stoking, the option recommended is cordwood.

Figure 4: Left -- Pastor Nathan Winer with his Church. Right: West side of the Church, where the biomass boiler unit would be positioned.

Project chart

Building Name	Glennallen Community Chapel
Building Owner	Glennallen Community Chapel
Contact Information	James Fields (owner) 907 320 0334; also Nathan Winer (pastor) 907 822-3499
Square footage and number of buildings	10,000 sq ft; 1 bldg
Gallons per year, fuel oil #1	2,800 gallons

PRELIMINARY SITE INVESTIGATION	
What feedback did staff offer on the current heating system?	Would need to hire staff. Not afraid of cordwood system. Would like to use local resources.
What is the staff or building manager's interest in biomass heating?	Lowering cost
Description of current heating system	Two (2) hydronic fuel oil boilers, 152,000 btu/hr each. Maintenance is completed by the landlord. The leasee calls when there are problems. Some leaking on boilers and stacks. There may be the possibility to lower cost through improved insulation.
Available space (within existing structures or space for newly constructed building)	There is no space within the structure but there is adequate space for the boiler and fuel storage in the parking lot on the West side of the building (approximately 20' x 60'). The parking lot is used for weddings, so some aesthetic consideration of the boiler building exterior is advised.
Street access	Excellent
Delivery access	Excellent
Fuel storage space	Excellent, with additional space via clearing land on property. Approximately 3 -- 4 acres is owned by the Church.
Building or site constraints (topography, permitting, historical preservation, etc.)	used for weddings; other than that it is a parking lot
Options for biomass boiler system (fuel type, technology type, building type)	Preference for cordwood; concern about price and availability
Estimated Boiler Size	120,000 btu/hr cordwood boiler

Initial investment: Chapel

Biomass System	
Rating -- Btu/hr	120,000
Btu stored	160,000

	footnote			*notes*
Building and Equipment Costs (B&E) $				
Fuel Storage Building (fabricated building, gravel pad, $27/sf)	A	$	9,720	(18 cds @ 20 sq. ft. / cd.)
Pre-Fabricated Boiler System				
Base price	C	$	93,000	
Shipping to Tok	C	$	20,000	
Delivery to Glennallen	C	$	3,000	
Plumbing and electrical	C	$	2,500	
Site Prep	C	$	4,500	
Installation	C	$	6,000	
Subtotal-B&E Costs		***$***	***138,720***	
Contingency -- 20%		***$***	***27,744***	
Grand Total		**$**	**166,464**	
Soft Costs $				
Project Management	C	$	13,317	8% of B&E
A/E Design Services	C	$	9,988	6% of B&E
Fire Marshall Plan Review	C			pre-approved
Equipment Commissioning and Training	C	$	4,000	
Construction Management	C	$	13,317	8% B&E
Subtotal -- Soft Costs		**$**	**40,622**	

Recommended Project Budget -- Design and Construction Costs	**$**	**207,086**

footnote	
A	Long term storage at back field
B	Based on quotes from viable suppliers
C	Estimate

Economic Analysis

AEA B/C Model_Chapel

	Project Description	
	Community	Glennallen
	Nearest Fuel Community	Tok
11	Region	Rural
	RE Technology	Woody biomass heat
	Project ID	
	Applicant Name	Community Chapel
	Project Title	Glennallen Community Chapel Wood Heat
	Category	

Results	
NPV Benefits	$46,459
NPV Capital Costs	$207,086
B/C Ratio	0.22
NPV Net Benefit	($160,627)

Low	$ 175
Med	$ 200
High	$ 300

Performance	Unit	Value
Displaced Electricity	kWh per year	-
Displaced Electricity	total lifetime kWh	-
Displaced Petroleum Fuel	gallons per year	2,240
Displaced Petroleum Fuel	total lifetime gallons	60,000
Displaced Natural Gas	mmBtu per year	-
Displaced Natural Gas	total lifetime mmBtu	-
Avoided CO2	tonnes per year	23
Avoided CO2	total lifetime tonnes	609

	Proposed System	Unit	Value
1	Capital Costs	$	$ 207,086
2	Project Start	year	2013
3	Project Life	years	25
	Displaced Electric	kWh per year	-
4	Displaced Heat	gallons displaced per year	2,240
	Displaced Transportation	gallons displaced per year	0.00
10	Renewable Generation O&M	$ per BTU	0.000029
	Electric Capacity	kW	0
	Electric Capacity Factor	%	0
	Heating Capacity	Btu/hr.	120,000
	Heating Capacity Factor	%	86

General perspective of project viability, and recommended next steps

Technically, a new biomass boiler unit has strong viability. It could sit directly adjacent to the existing boiler room and easily tie in. However, there is some concern about the capacity of maintenance. The existing boiler room is under-maintained and potentially dangerous, and the building tenant did not demonstrate significant interest in biomass heating. The building owners are interested, but it is not clear what level of involvement they would have in operating the unit.

Site Specific Analysis: Prince William Sound Community College

General Description of Opportunity & Challenges

Prince William Sound Community College is an extension office of the main campus located in Valdez, Alaska. The College offers a variety of accredited courses and community training courses, such as emergency response.

Technology or installation options assessed

The college has only two full-time staff, and no maintenance personnel. Because of the availability of current staff, only a fully automated system was considered. This is directly based on feedback from the Community College personnel. The project is too small to accommodate a wood chip boiler. Therefore, a pellet boiler was the only technology considered.

Because of the very low volume of fuel usage, a small pellet trough was assumed to be built into the container system. The trough would be made of wood, and could be filled from above by 40 lb bags. A forklift could lift up the pallet of pellets for filling from above.

Alternatively, a metal grain-style silo or small square silo could be employed. The challenge is that a full truck carries 16 – 27 tons of pellets (nearly a full year supply for the College), but the storage devices for this volume are not easily filled by hand. Because of the low volume of wood fuel usage, and the prospects for using 40 lb. bags of pellets rather than automatic filling, the economic analysis in this report assumes a wooden trough style storage structure built into the containerized boiler system.

Figure 5: Left: Face of Prince William Sound Community College. Right: East side of the facility, where the biomass boiler facility would be positioned.

Project chart

Building Name	Glennallen Campus Buildings
Building Owner	Prince William Sound Community College
Contact Information	James Fields, 907 320 0334
Square footage and number of buildings	5,780 square feet total
Gallons per year, fuel oil #1	4,500 gallons

PRELIMINARY SITE INVESTIGATION	
What feedback did staff offer on the current heating system?	This building is leased by University of Alaska Anchorage via Prince William Sound Community College. The building is owned and maintained by Homestead Enterprise. The Community College staff call Homestead Enterprise when there is a problem. There is no on-site maintenance staff. Both owners of Homestead Enterprise are in the construction and supply business, with extensive knowledge of boilers, plumbing, mechanical maintenance.
What is the staff or building manager's interest in biomass heating?	Staff of the Community College hope to avoid lease fuel surcharge clauses as a result of stable fuel costs.
Description of current heating system	Single hydronic boiler, 266 MBH Burnham. Very old and appears to be leaky and potentially dangerous. Stack also shows residues.
Available space (within existing structures or space for newly constructed building)	Very adequate space immediately outside boiler room on the East side of the building in the gravel drive.
Street access	Excellent.
Delivery access	Excellent.
Fuel storage space	Excellent.
Building or site constraints (topography, permitting, historical preservation, etc.)	none
Options for biomass boiler system (fuel type, technology type, building type)	Because there is no existing maintenance staff, a highly automated heat system is preferred. At the scale of of the facility, pellets appear to be the preferred option. Peak load is about 260,000 btu/hr. Recommended biomass size is about 150,000 btu/hr. About 31 tons of pellets needed per year.
Boiler size	164,000 btu/hr pellet boiler

Preliminary Cost Estimating

Initial investment: Price William Sound Community College

Biomass System	
System Rating -- Btu/hr	164,000 btu/hr
Buffer tank	380 gal.

	footnote		*notes*
Building and Equipment Costs (B&E) $			
Pellet storage structure	A	$ 10,000	
Pre-Fabricated Boiler System			
Base price	B	$ 186,000	
Shipping to Tok	C	$ 10,000	
Local delivery	C	$ 2,000	
Plumbing and electrical	C	$ 2,500	
Site Prep	C	$ 4,500	
Installation	C	$ 6,000	
Subtotal-B&E Costs		***$ 221,000***	
Contingency -- 20%		***$ 44,200***	
Grand Total		**$ 265,200**	
Soft Costs $			
Project Management	C	$ 21,216	8% of B&E
A/E Design Services	C	$ 15,912	6% of B&E
Fire Marshall Plan Review			pre-approved
Equipment Commissioning and Training	C	$ 4,000	
Construction Management	C	$ 21,216	8% B&E
Subtotal -- Soft Costs		**$ 62,344**	
Recommended Project Budget -- Design and Construction Costs		**$ 327,544**	

footnote	
A	Square bulk silo or pre-fabricated building with V-shaped storage trough, built of wood into container. Waterproof hatch. Fill from above.
B	Based on quotes from viable suppliers
C	Estimate

Economic Analysis

AEA B/C Model_PWS Community College

	Project Description	
	Community	Glennallen
	Nearest Fuel Community	Tok
11	Region	Rural
	RE Technology	Woody biomass heat
	Project ID	
	Applicant Name	Prince William Sound Community Collge
	Project Title	Glennallen Community College Wood Heat
	Category	

Results	
NPV Benefits	$184,520
NPV Capital Costs	$327,544
B/C Ratio	0.56
NPV Net Benefit	($143,024)

Low	$	300
Med	$	330
High	$	400

Performance	Unit	Value
Displaced Electricity	kWh per year	-
Displaced Electricity	total lifetime kWh	-
Displaced Petroleum Fuel	gallons per year	4,050
Displaced Petroleum Fuel	total lifetime gallons	112,500
Displaced Natural Gas	mmBtu per year	-
Displaced Natural Gas	total lifetime mmBtu	-
Avoided CO2	tonnes per year	41
Avoided CO2	total lifetime tonnes	1,142

	Proposed System	Unit	Value
1	Capital Costs	$	$ 327,544
2	Project Start	year	2013
3	Project Life	years	25
	Displaced Electric	kWh per year	-
4	Displaced Heat	gallons displaced per year	4,050
	Displaced Transportation	gallons displaced per year	0.00
10	Renewable Generation O&M	$ per BTU	
	Electric Capacity	kW	0
	Electric Capacity Factor	%	0
	Heating Capacity	Btu/hr.	150,000
	Heating Capacity Factor	%	86

General perspective of project viability, and recommended next steps

Technically, a new biomass boiler unit has strong viability. It could sit directly adjacent to the existing boiler room and easily tie in. However, there is some concern about the capacity of the tenant for maintenance. The existing boiler room is under-maintained and potentially dangerous, and the building owner did not demonstrate interest in biomass heating. A pellet boiler could be viable in terms of its low maintenance requirements, and the possibility of a local contractor servicing several local pellet boilers.

Site Specific Analysis: Chistochina School

General Description of Opportunity & Challenges

The Chistochina School building no longer operates as a School, due to low enrollment. However, the School is still State property. Currently, the School is being leased by George Drinkwater of Cheesh'na Tribal Council. It will be used for a variety of community activities, such as community education and recreational activities. The School has provided a letter explaining the closure. It is currently leased to the contractor that is building a new clinic.

The building was recommended for consideration because the utility costs inhibit the ability of the tribe to use it as a community center, according to the application.

Technology or installation options assessed

There are no maintenance personnel, or even full time staff. Because of the availability of current staff, only a fully automated system was considered. This is directly based on feedback from the Community College personnel. The project is too small to accommodate a wood chip boiler. Therefore, a pellet boiler was the only technology considered.

Project chart

Building Name	Chistochina school
Building Owner	Copper River School District
Contact Information	George Drinkwater, Lessee. Michael Johnson, Superintendent
Square footage	5,604 square feet, 1 building

PRELIMINARY SITE INVESTIGATION	
What feedback did staff offer on the current heating system?	School is closed as a result of low enrollment (<10 students). George Drinkwater of Cheesh'na Tribal Council leased the school property for uses to be determined, but it could include community education and recreational activities.
What is the staff or building manager's interest in biomass heating?	Superintendent provided letter explaining school closure. Lessee is interested in automated heating system (woodchip, puck or pellet-fired system) for reduced cost.
Description of current heating system	#1 fuel oil-fired boiler system
Available space (within existing structures or space for newly constructed building)	Limited space inside buildings. Open space around school building is available; 5,640 square feet
Street access	Good access from paved roads
Delivery access	Good access for trucks or delivery vehicles
Fuel storage space	Good space for storage buildings or silo
Building or site constraints (topography, permitting, historical preservation, etc.)	None identified
Options for biomass boiler system (fuel type, technology type, building type)	Pellet boiler with external storage silo, or other automated system most appropriate
Estimated boiler size	120,000 btu/hr pellet

Preliminary Cost Estimating

Initial investment: Chistochina School

Biomass System	
System Rating -- Btu/hr	120,000
Buffer tank	350 gal.

	footnote			*notes*
Building and Equipment Costs (B&E) $				
Pellet storage structure	A	$	10,000	
Pre-Fabricated Boiler System				
Base price	B	$	186,000	
Shipping to Tok	C	$	10,000	
Local delivery	C	$	2,000	
Plumbing and electrical	C	$	2,500	
Site Prep	C	$	4,500	
Installation	C	$	6,000	
Subtotal-B&E Costs		***$***	***221,000***	
Contingency -- 20%		***$***	***44,200***	
Grand Total		**$**	**265,200**	
Soft Costs $				
Project Management	C	$	21,216	8% of B&E
A/E Design Services	C	$	15,912	6% of B&E
Fire Marshall Plan Review				pre-approved
Equipment Commissioning and Training	C	$	4,000	
Construction Management	C	$	21,216	8% B&E
Subtotal -- Soft Costs		**$**	**62,344**	
Recommended Project Budget -- Design and Construction Costs		**$**	**327,544**	

footnote	
	Square bulk silo or pre-fabricated building with V-shaped storage trough, built of wood into container.
A	Waterproof hatch. Fill from above.
B	Estimated from quotes from viable suppliers
C	Estimate

Economic Analysis

AEA B/C Model_Chistochina School

	Project Description	
	Community	Glennallen
	Nearest Fuel Community	Tok
11	Region	Rural
	RE Technology	Woody biomass heat
	Project ID	
	Applicant Name	Chistochina School
	Project Title	Chistochina School Wood Heat
	Category	

Results	
NPV Benefits	$34,673
NPV Capital Costs	$327,544
B/C Ratio	0.11
NPV Net Benefit	($292,871)

Low	$ 290
Med	$ 330
High	$ 400

Performance	Unit	Value
Displaced Electricity	kWh per year	-
Displaced Electricity	total lifetime kWh	-
Displaced Petroleum Fuel	gallons per year	2,400
Displaced Petroleum Fuel	total lifetime gallons	60,000
Displaced Natural Gas	mmBtu per year	-
Displaced Natural Gas	total lifetime mmBtu	-
Avoided CO2	tonnes per year	24
Avoided CO2	total lifetime tonnes	609

	Proposed System	Unit	Value
1	Capital Costs	$	$ 327,544
2	Project Start	year	2013
3	Project Life	years	25
	Displaced Electric	kWh per year	-
4	Displaced Heat	gallons displaced per year	1,920
	Displaced Transportation	gallons displaced per year	0.00
10	Renewable Generation O&M	$ per BTU	
	Electric Capacity	kW	0
	Electric Capacity Factor	%	0
	Heating Capacity	Btu/hr.	120,000
	Heating Capacity Factor	%	86

Life Cycle Cost Analysis

Life Cycle Costs of Project Alternatives	
District:	Copper Valley
School:	Chistochina School Wood Pellet Boiler
Project:	Chistochina School Wood Pellet Boiler
Project No.	NA
Study Period:	20
Discount Rate:	3.50%

	Alternative #1 (low)	Alternative #2 (high)
Initial Investment Cost	$ 327,544	$ 400,000
O&M and Repair Cost	$ 7,500	$ 9,320
Replacement Cost	$ 74,247	$ 150,000
Residual Value	$ 50,000	$ 90,000
Total Life Cycle Cost	$ 459,291	$ 649,320
GSF of Project	5,604	5,604
Initial Cost/ GSF	$ 58.45	$ 71.38
LCC/ GSF	$ 81.96	$ 115.87

General perspective of project viability, and recommended next steps

The uncertain future usage of the Chistochina school building makes it an unlikely candidate for a grant-funded biomass project, at least until the community usage is determined.

Site Specific Analysis: BLM NPS Campus

General Description of Opportunity & Challenges

This site is shared among the Bureau of Land Management (BLM) and National Park Service (NPS). The agencies have an interagency agreement that allows them to share space and some resources at this Campus. Decisions affecting both entities would be subject to dual approval from both the Glennallen Field Office Manager (BLM) and the Wrangell St. Elias Superintendent (NPS).

There are multiple challenges to a successful project here. Besides interagency coordination, there is also the challenge of motivation as a result of high turnover. Also, it is not clear how available or amenable maintenance staff would be to operation of the project, although the head maintenance

personnel of BLM has operated a wood boiler in the past. However, the existing facilities appear well-maintained.

Technology or installation options assessed

Three Clusters were identified. BLM Cluster #1 contains the Old Admin, Rec, and New Admin buildings, all of which are managed by BLM. NPS Cluster #1 contains the NPS garages, and NPS Cluster #2 contains NPS housing A & B.

Due to the heat load and interest of BLM Forester Ben Seifert, and the comfort of existing maintenance staff with cordwood heating systems, a cordwood option was considered for Cluster 1. This Cluster could also be heated by pellets.

Figure 6: Cluster 1: from Left to Right: New Admin, Rec, and Old Admin Building. Truck access to proposed boiler facility is pictured on the right.

NPS Cluster #1, comprised of NPS shop buildings, has a load that could be accommodated by either a cordwood or a biomass pellet system. However, the Maintenance Supervisor, who has operated an outdoor cordwood boiler, preferred local resource utilization through a cordwood system. Therefore, a cordwood system was considered for NPS Cluster #2.

Project chart BLM/ NPS

Building Name **Building Owner** **Contact Information**	BLM Cluster Glennallen Bureau of Land Management Ben Seifert
Square Footage	20,000 total (8 buildings). Three Clusters evaluated: Cluster 1: Old Admin, Rec, and New Admin buildings (BLM) Cluster 2: Park service garages (NPS) Cluster 3: Park service housing (NPS)
Gallons per year	Cluster 1: 4,400 Cluster 2: 6,038 Cluster 3: 5,488
PRELIMINARY SITE INVESTIGATION	
What feedback did staff offer on the current heating system?	BLM local staff is unsure of the support for biomass conversion project support, especially if the local staff would need to be pulled off their existing workloads to be involved in the development of the project. Suggestion was that a performance contract or ESCO model development might be a more welcome option for them. There is also some difficulty in coordinating multiple agencies. All existing systems operate reliably and appear to be well-maintained.
What is the staff or building manager's interest in biomass heating?	NPS and BLM staff support local resource utilization, lower carbon footprint fuel (less transportation) and economic development through using cordwood.
Description of current heating system	Cluster 1: The buildings in this Cluster have hydronic boiler systems, amounting to a total of 321 MBH boiler capacity. These buildings use about 4,400 gallons of fuel oil per year. Cluster 2: The buildings in this Cluster have a hydronic and a forced air furnace heating system, both heated by fuel oil. A water house here is heated by propane. Cluster 3: The 2vhousing units in this Cluster have 2 hydronic boilers each.
Available space (within existing structures or space for newly constructed building)	Cluster 1: Good access on the North corner of the Old Admin Building. The lot would have to be developed but is already clear and has road access. Cluster 2: No space within the existing building. Cluster 3: No space within existing building.
Street access	Cluster 1: Good. Cluster 2: Good Cluster 3: Good
Delivery access	Cluster 1: Good. Cluster 2: Good Cluster 3: Good
Fuel storage space	Cluster 1: Adequate space on site or available in the "back 40". Cluster 2: Adequate space on site. Cluster 3: Space would need to be created, but there appears to be plenty of room.
Building or site constraints (topography, permitting, historical preservation, etc.)	No building or site constraints, except interagency agreement where necessary.
Options for biomass boiler system (fuel type, technology type, building type)	Loads would justify a cordwood or pellet heating system. Cluster 1: Up to 28 cords to wood or 34 tons of pellets Cluster 2: Up to 38 cords to wood or 46 tons of pellets Cluster 3: Up to 34 cords of wood or 42 tons of pellets
Estimated boiler size:	Cluster 1: 200,000 btu/hr Cluster 2: 300,000 btu/hr Cluster 3: 250,000 btu/hr

Preliminary Cost Estimating: BLM Cluster #1

Biomass System	
Brand and Model #	WHS 1500
Rating -- Btu/hr	200,000
Btu stored	350,000

	footnote			*notes*
Building and Equipment Costs (B&E) $				
Fuel Storage Building (conex or equivalent, gravel pad, chute $30/sf)	A	$	15,120	(28 cds) @ $27 / sq. ft.
Boilers				
Base price	B	$	100,000	
Shipping to hub city	C	$	20,000	
Local delivery	C	$	3,000	
Plumbing and electrical	C	$	2,500	
Installation	C	$	4,500	
Site prep		$	6,000	
District loop & building integration	C	$	53,750	
Subtotal-B&E Costs		***$***	***204,870***	
Contingency -- 20%		***$***	***40,974***	
Grand Total		**$**	**245,844**	
Soft Costs $				
Project Management		$	19,668	8% of B&E
A/E Design Services		$	22,126	9% of B&E, because of district loop
Fire Marshall Plan Review				included in design
Equipment Commissioning and Training	C			included with boiler price
Construction Management		$	19,668	8% of B&E
Subtotal -- Soft Costs		**$**	**61,461**	
Recommended Project Budget -- Design and Construction		**$**	**307,305**	

footnote	
A	A cord occupies 128 cu. ft. If the wood is stacked 6 1/2 feet high, the area required to store the wood is 20 sq. ft per cord.
B	Quote
C	Shipping quoted 7/3/12
D	Estimate

Economic Analysis: BLM Cluster #1

	Project Description	
	Community	Glennallen
	Nearest Fuel Community	Tok
11	Region	Rural
	RE Technology	Woody biomass heat
	Project ID	
	Applicant Name	Bureau of Land Management
	Project Title	BLM Cluster #1 Wood Heat
	Category	

Results	
NPV Benefits	$191,118
NPV Capital Costs	$307,305
B/C Ratio	0.62
NPV Net Benefit	($116,187)

Low	$ 175
Med	$ 200
High	$ 300

Performance	Unit	Value
Displaced Electricity	kWh per year	-
Displaced Electricity	total lifetime kWh	-
Displaced Petroleum Fuel	gallons per year	4,400
Displaced Petroleum Fuel	total lifetime gallons	110,000
Displaced Natural Gas	mmBtu per year	-
Displaced Natural Gas	total lifetime mmBtu	-
Avoided CO2	tonnes per year	45
Avoided CO2	total lifetime tonnes	1,117

	Proposed System	Unit	Value
1	Capital Costs	$	$ 307,305
2	Project Start	year	2013
3	Project Life	years	25
	Displaced Electric	kWh per year	-
4	Displaced Heat	gallons displaced per year	3,520
	Displaced Transportation	gallons displaced per year	0.00
10	Renewable Generation O&M	$ per BTU	
	Electric Capacity	kW	0
	Electric Capacity Factor	%	0
	Heating Capacity	Btu/hr.	200,000
	Heating Capacity Factor	%	86

Preliminary Cost Estimating: NPS Cluster #1

Biomass System	
Rating -- Btu/hr	300,000
Btu stored	375,000

	footnote			*notes*
Building and Equipment Costs (B&E) $				
Fuel Storage Building	A	$	16,200	(30 cds) @ $27 / sq. ft.
Boilers				
Base price	B	$	100,000	
Shipping to hub city	C	$	20,000	
Local delivery	C	$	3,000	
Plumbing and electrical	C	$	2,500	
Installation	C	$	4,500	
Site prep		$	6,000	
District loop & building integration	C	$	33,500	
Subtotal-B&E Costs		***$***	***185,700***	
Contingency -- 20%		***$***	***37,140***	
Grand Total		**$**	**222,840**	
Soft Costs $				
Project Management		$	17,827	8% of B&E
A/E Design Services		$	20,056	9% of B&E, because of district loop
Fire Marshall Plan Review				included in design
Equipment Commissioning and Training	C			included with boiler price
Construction Management		$	17,827	8% of B&E
Subtotal -- Soft Costs		**$**	**55,710**	
Recommended Project Budget -- Design and Construction		**$**	**278,550**	

footnote	
A	A cord occupies 128 cu. ft. If the wood is stacked 6 1/2 feet high, the area required to store the wood is 20 sq. ft per cord.
B	Quote
C	Shipping quoted 7/3/12
D	Estimate

Economic Analysis: NPS Cluster #1

	Project Description	
	Community	Glennallen
	Nearest Fuel Community	Tok
11	Region	Rural
	RE Technology	Woody biomass heat
	Project ID	
	Applicant Name	Bureau of Land Management
	Project Title	NPS Cluster #1 Wood Heat
	Category	

Results	
NPV Benefits	$325,564
NPV Capital Costs	$278,550
B/C Ratio	1.17
NPV Net Benefit	$47,014

Low	$ 175
Med	$ 200
High	$ 300

Performance	Unit	Value
Displaced Electricity	kWh per year	-
Displaced Electricity	total lifetime kWh	-
Displaced Petroleum Fuel	gallons per year	6,003
Displaced Petroleum Fuel	total lifetime gallons	150,075
Displaced Natural Gas	mmBtu per year	-
Displaced Natural Gas	total lifetime mmBtu	-
Avoided CO2	tonnes per year	61
Avoided CO2	total lifetime tonnes	1,523

	Proposed System	Unit	Value
1	Capital Costs	$	$ 278,550
2	Project Start	year	2013
3	Project Life	years	25
	Displaced Electric	kWh per year	-
4	Displaced Heat	gallons displaced per year	4,830
	Displaced Transportation	gallons displaced per year	0.00
10	Renewable Generation O&M	$ per BTU	
	Electric Capacity	kW	0
	Electric Capacity Factor	%	0
	Heating Capacity	Btu/hr.	300,000
	Heating Capacity Factor	%	86

Preliminary Cost Estimating: NPS Cluster #2

Biomass System	
Rating -- Btu/hr	250,000
Btu stored	300,000

	footnote			*notes*
Building and Equipment Costs (B&E) $				
Fuel Storage Building	A	$	15,120	(28 cds) @ $27 / sq. ft.
Boilers				
Base price	B	$	100,000	
Shipping to hub city	C	$	20,000	
Local delivery	C	$	3,000	
Plumbing and electrical	C	$	2,500	
Installation	C	$	4,500	
Site prep		$	6,000	
District loop & building integration	C	$	33,500	
Subtotal-B&E Costs		***$***	***184,620***	
Contingency -- 20%		***$***	***36,924***	
Grand Total		**$**	**221,544**	
Soft Costs $				
Project Management		$	17,724	8% of B&E
A/E Design Services		$	19,939	9% of B&E, because of district loop
Fire Marshall Plan Review				included in design
Equipment Commissioning and Training	C			included with boiler price
Construction Management		$	17,724	8% of B&E
Subtotal -- Soft Costs		**$**	**55,386**	
Recommended Project Budget -- Design and Construction		**$**	**276,930**	

footnote	
A	A cord occupies 128 cu. ft. If the wood is stacked 6 1/2 feet high, the area required to store the wood is 20 sq. ft per cord.
B	Quote
C	Shipping quoted 7/3/12
D	Estimate

Economic Analysis: NPS Cluster #2

	Project Description	
	Community	Glennallen
	Nearest Fuel Community	Tok
11	Region	Rural
	RE Technology	Woody biomass heat
	Project ID	
	Applicant Name	Bureau of Land Management
	Project Title	NPS Cluster #2 Wood Heat
	Category	

Results	
NPV Benefits	$278,014
NPV Capital Costs	$276,930
B/C Ratio	1.00
NPV Net Benefit	$1,084

Low	$ 175
Med	$ 200
High	$ 300

Performance	Unit	Value
Displaced Electricity	kWh per year	-
Displaced Electricity	total lifetime kWh	-
Displaced Petroleum Fuel	gallons per year	5,488
Displaced Petroleum Fuel	total lifetime gallons	137,200
Displaced Natural Gas	mmBtu per year	-
Displaced Natural Gas	total lifetime mmBtu	-
Avoided CO2	tonnes per year	56
Avoided CO2	total lifetime tonnes	1,393

	Proposed System	Unit	Value
1	Capital Costs	$	$ 276,930
2	Project Start	year	2013
3	Project Life	years	25
	Displaced Electric	kWh per year	-
4	Displaced Heat	gallons displaced per year	4,390
	Displaced Transportation	gallons displaced per year	0.00
10	Renewable Generation O&M	$ per BTU	
	Electric Capacity	kW	0
	Electric Capacity Factor	%	0
	Heating Capacity	Btu/hr.	250,000
	Heating Capacity Factor	%	86

Base System	Unit	Value
Diesel Generator O&M	$ per kWh	$ 0.033
Diesel Generation Efficienc	kWh per gallon	

General perspective of project viability, and recommended next steps

BLM Cluster #1, which would be owned and operated by BLM, has a reasonable heat load to accommodate a cordwood or pellet-fired biomass boiler, a motivated project champion, and experienced maintenance personnel to operate the project. However, this project has marginal economic feasibility, and key decision makers at the BLM were not available to discuss the project and did not respond to emails or phone calls.

NPS Cluster #1 and #2, which would be owned and operated by NPS, have reasonable heat loads to accommodate a cordwood biomass boiler and and experienced personnel to operate the project. Like BLM Cluster #1, these projects could source firewood from BLM lands. Both projects have reasonable economic feasibility.

Summary of Benefit/ Cost analyses

Dalson Energy would like to note that B/C analyses and the other financial metrics listed below are only one way of calculating the value of a project. A project's likelihood of operational success (in other words, the risk associated with the investment) is another crucial factor. In many cases, a project with lower risk and less attractive financials may be preferable over a project with higher risk and more attractive financials. Additionally, the nascent biomass energy industry in Alaska is still building experience of operational success; projects with marginal economic feasibility may be considered an investment in the industry.

	Estimated System Description (abbreviated)	NPV Benefits	NPV Capital Costs	B/C Ratio
DNR Forestry	Two (2) 100,000 btu pellet boilers, containerized; hand loaded pellets if necessary into fuel hopper	($252,000)	$459,000	0.45
Cross Road Medical Center	350,000 btu cordwood boiler, integrated into new garage bay on existing ambulance garage; trailer for moving cordwood from long term storage to garage bay	$117,000	$297,000	1.39
Community Chapel	120,000 btu cordwood boiler, containerized. Fuel storage in a separate building on site.	($161,000)	$207,000	0.22
Prince William Sound Community College	160,000 btu pellet boiler, containerized. Fuel storage via hopper.	($143,000)	$327,500	0.56
Chistochina School	120,000 btu pellet boiler, containerized. Fuel storage in a separate building on site.	($293,000)	$328,000	0.11
BLM Cluster #1	200,000 btu cordwood boiler, containerized. Fuel storage building in a separate building on site.	($116,000	$307,000	0.62
NPS Cluster #1	300,000 btu cordwood boiler, containerized. Fuel storage building in a separate building on site.	$47,000	$279,000	1.17
NPS Cluster #2	250,000 btu cordwood boiler, containerized. Fuel storage building in a separate building on site.	$1,000	$278,000	1.00

Recommendations and Next Steps

Each candidate facility should examine the proposed capital costs and operational profiles of the projects presented in this report, and approach the Consultant with any concerns or questions.

Facilities with a Benefit/ Cost ratio greater than 1.0 are likely candidates for Alaska Energy Authority's Renewable Energy Fund grant program, Round 6 has a September 24 deadline. Any of these projects could apply for design and construction grants.

Projects with a Benefit/ Cost ratio less than 1.0 are encouraged to look at creative strategies for improving the financial profile of their project. In particular, DNR-Forestry, which has a high probability for operational success, is encouraged to adapt their project profile by exploring a heat loop partnership with DOT.

The most likely candidates for successful projects, in the opinion of the Consultants, are Cross Road Medical Center and the DNR-Forestry Campus. Both of these projects have motivated and capable staff, appropriate technology for available fuels and operating requirements, and simple building interconnections. These facilities are owned and controlled by the organization, rather than being leased from a separate owner. The NPS Clusters may also be successful, but the management team was not available to discuss the opportunity for biomass heating.

About the Consultant

Dalson Energy is a Renewable Energy Consulting and Technology Research firm based in Anchorage, Alaska. Dalson Energy staff and partners have decades of experience in construction project management, project development consulting and renewable energy technology research. Dalson Energy teams with licensed engineers, architects and designers in Alaska, Canada and Lower 48.

Dalson Energy has worked with Alaska Energy Authority, Alaska Center for Energy & Power, University of Alaska Fairbanks, Washington State CTED (Community Trade & Economic Development) and California Energy Commission on biomass energy technology research.

Dalson Energy's President, Thomas Deerfield, has been involved in biomass energy RD&D since 2001, winning grants and managing projects with NREL (National Renewable Energy Labs), USFS (US Forest Service), and CEC (California Energy Commission).

Thomas managed the field-testing of biomass CHP systems, including the first grid-connected biomass gasification CHP system in the U.S. (2007). Thomas coordinated the design and creation of the first prototype Biomass "Boiler in a Box" in Alaska, in 2010. That Garn-based system is now installed in Elim, in the Bering Sea region.

Thomas founded Shasta Energy Group (SEG), a 501c3 nonprofit, and managed wind energy research, biomass energy feasibility studies, energy efficiency for buildings, and hydronic heating system research design and development (RD&D). He also initiated a rural economic development think tank and has engaged his writing skills to assist many other renewable energy project initiatives.

Wynne Auld is a Biomass Energy Specialist with Dalson Energy. She focuses on assessing opportunities for woody biomass heating, and assisting communities in developing wood energy projects. Over the past few years she has supported the business development of integrated biomass energy campuses in Oregon and Idaho, especially related to their energy initiatives. Her efforts have included marketing Campus biomass heating products to major wholesalers and retail buyers, and planning and developing Campus sort yards.

Cross Road Medical Center
Box 5, Glennallen, AK 99588

February 15, 2013

SPECIAL PROJECT REQUEST SELF-SUSTAINABLE URGENT/EMERGENCY MEDICAL SERVICES IN THE COPPER RIVER BASIN

Project Summary: Cross Road Medical Center (CRMC) respectfully requests funds for renovation and improvements to help Cross Road become a self-sustained and quality provider of urgent and emergency medical services to all the residents and visitors (the local Chamber of Commerce reports about a million vehicles drive through our area annually) of the entire Copper River Basin 24 hours a day and 7 days a week.

Need for project: CRMC's main building in Glennallen is tired and the original section was built in the 1950's when energy costs were low. Three additions were constructed that decreased the effectiveness of the building. Simply adding insulation to the ceiling has improved the energy efficiency, but an energy audit showed there are many more opportunities for energy efficiency. Adding a wood burning boiler would make the organization more sustainable by decreasing the energy costs and would help build up local enterprise. We currently have a grass helicopter pad, which can only be used in summer and our emergency entrance from the Glenn Highway is gravel, which causes patients arriving to have to bump over the rough surface before entering our building.

Organizational Information: CRMC is a licensed Federally Qualified Community Health Center (FQHC) and Frontier Extended Stay Clinic (FESC) and has staff on site 24 hrs a day, 7 days a week to take care of entire population of the Copper River Basin for emergency/urgent care, and for primary care during normal business hours. All emergency patients arriving from the Copper River Valley by ambulance come through CRMC to either be medically managed in our Frontier Extended Stay Clinic, or stabilized for transfer by air to Anchorage. We have a strong Board of Directors who are all patients of ours, and who all live in the Copper River Valley area. We also now have a much-improved reputation for quality medicine and community collaboration.

Total Request: $2,001,935

Budget Detail: CRMC has qualified staff in place to carry out the objectives of this request. No funds are allocated for administration. See the budget below for summary and attached documents for details.

Contact: Joel Medendorp, CEO -- cell phone: 907-320-0557

Cross Road Medical Center
Box 5, Glennallen, AK 99588

Budget Summary for Cross Road Medical Center Special Request

BUILDING RENOVATION – improve emergency access and flow: (see "Renovation Concept" note: 3% construction inflation over 3 years added)	$1,674,058
WOOD BOILER – heat with cord wood for sustainability: (see "Pre-Feasibility Wood Heating Results"	229,020
ENERGY AUDIT (total cost effective measures) (see "Comprehensive Energy Audit")	25,257
HELICOPTER PAD – landing pad and pavement:	73,600
TOTAL	$2,001,935