

***Pre-feasibility Assessment for
Integration of Biomass Energy Systems***

in

***USDA Sandpoint District Office
Sandpoint, Idaho***

October 12, 2006

Presented by

***CTA Architects Engineers
Nick Salmon***

For

United States Department of Agriculture
Forest Service
Region One

In partnership with:

USDA Sandpoint District Office

Idaho Department of Lands: Fuels For Schools Program

Bitter Root Resource and Conservation Development Area, Incorporated

Executive Summary

The following assessment was commissioned to determine the technical and economic feasibility of integrating a wood fired heating system in the proposed USDA District Office to be located in Sandpoint, Idaho.

The USDA District Office is proposed to be approximately 13,000 SF in size and would be conventionally heated with small natural gas hot water boilers, heat pumps or gas furnaces. Domestic hot water needs are expected to be minimal and may be accommodated with a small natural gas or electric hot water heater. The annual degree days is not known, but the annual degree days in Coeur d' Alene is approximately 2,100 DD. If the facility required 5-10 btu's per square foot per degree day, the facility would use 140-280 dka of natural gas in a typical year. Natural gas is currently available in the Sandpoint area for approximately \$10/dka.

Energy Analysis:

For the purpose of this investigation it is assumed that 100% of the annual natural gas consumption could be offset by the combustion of wood chips or wood pellets in a boiler or wood furnace. At this point in time it is assumed that a boiler or furnace would have an output capacity of less than 400,000 btu. As the design of the facility proceeds, modeling energy consumption will establish a more precise wood boiler or furnace size for the facility.

Building & Site Constraints:

The site plan for the facility has not yet been developed, and should accommodate large delivery vehicles and provide exterior access to the boiler room. Deliveries would be scheduled to minimize conflicts with other activities at the facility. An alternative approach to the project would shift the site of the wood fired heating system to the adjacent Sandpoint High School and distributing heat to the Regional Office with approximately 750 linear feet of buried heating supply and return pipe.

Air Quality Permits:

Air quality permit requirements in the State of Idaho should be reviewed in greater detail. It is likely the State will require air quality permits and emissions modeling.

Estimated Costs:

The total project costs including integration, contingency and escalation are estimated as noted below. Each wood fuel type includes the current and projected natural gas consumption as a sensitivity analysis.

Wood Chip Options:

A.1 Freestanding Container

Packaged wood heating system:	\$166,500
Displaced natural gas boiler or furnace cost	(\$30,000)
Foundation, Crane	\$0
Mechanical/Electrical Integration	\$0
Subtotal:	\$136,500
Fees, Building Permit, Miscellaneous Expenses:	\$0
Subtotal:	\$136,500
20% Contingency +/-:	<u>\$27,500</u>
Total:	\$164,000

Items identified as "zero" above would be incorporated into general construction activities.

A.2 Central Plant Located in the Sandpoint High School

Wood heating system:	\$0
1500 LF of Buried Pipe	\$75,000
Mechanical/Electrical Integration:	\$0
Subtotal:	\$75,000
Fees, Building Permit, Miscellaneous Expenses:	\$0
Subtotal:	\$75,000
20% Contingency +/-:	\$15,000
Total:	\$90,000

Items identified as "zero" above would be incorporated into general construction activities, or provided by the Sandpoint High School project.

Wood Pellet Options:

B.1 Pellet Boiler Within Proposed Building

Wood heating system:	\$26,000
Wood pellet silo	\$5,000
Displaced natural gas heating system cost	(\$30,000)
Mechanical/Electrical Integration:	\$0
Subtotal:	\$1,000
Fees, Building Permit, Miscellaneous Expenses:	\$0
Subtotal:	\$1,000
20% Contingency +/-:	\$200
Total:	\$1,200

Items identified as "zero" above would be incorporated into general construction activities.

B.2 Pellet Furnace Within Proposed Building

Wood heating system:	\$16,000
Wood pellet silo	\$5,000
Displaced natural gas heating system cost	(\$12,500)
Mechanical/Electrical Integration:	\$0
Subtotal:	\$8,500
Fees, Building Permit, Miscellaneous Expenses:	\$0
Subtotal:	\$8,500
20% Contingency +/-:	\$2,000
Total:	\$10,500

Items identified as "zero" above would be incorporated into general construction activities.

Results of Evaluation

The cash flow analysis assumes delivered natural gas costs of \$10.00/dka, wood chips at a locally delivered price of \$20 per green ton and a pellet fuel price of \$125 per ton delivered from the Lignetics Pellet Mill in Sandpoint, Idaho. As noted above, the specific natural gas consumption associated with the facility is not known.

Wood Chip Options:

Option A.1: Appears to achieve positive accumulated cash flow (PAC) in 1 year with a subsidy of \$164,000. The project does not achieve PAC in 30 years without subsidy. 30 years savings (avoided costs) are approximately \$40,000.

Option A.2: Appears to achieve positive accumulated cash flow (PAC) in 1 year with a subsidy of \$90,000. The project does not achieve PAC in 30 years without subsidy. 30 years savings (avoided costs) are approximately \$90,000.

Wood Pellet Options:

Option B.1: Appears to achieve positive accumulated cash flow (PAC) in 1 year with a subsidy of \$1,200. The project may achieve PAC in 9 years without subsidy. 30 years savings (avoided costs) are approximately \$22,000.

Option B.2: Appears to achieve positive accumulated cash flow (PAC) in 16 years with a subsidy of \$10,500. The project may achieve PAC in 19 years without subsidy. 30 years savings (avoided costs) are approximately \$45,000.

Accumulated cash flow is the primary evaluation measure that is implemented in this report and is similar to simple payback with the exception that accumulated cash flow takes the cost of financing and fuel escalation into account. For many building owners, a positive accumulated cash flow of about 10 years maximum is considered necessary for implementation. Positive accumulated cash flow in year one indicates a strong project. Positive accumulated cash flow in year 20 or more indicates a challenged project.

Project Funding:

Facility managers could consider a grant from the US Forest Service/Idaho Department of Lands "Fuels For Schools" Program. The grant may support 35% of the total project costs (up to \$400,000) including required integration costs, but not upgrades to heat distribution. The grant requires that 50% of the wood fuel be derived from forest thinning projects on private, state, tribal or federal lands for the first two years of the project.

The project might be of interest local rural electric cooperatives. Rural electric cooperatives have the ability to provide a portion of the project financing through the Rural Economic Development Loan and Grant (REDLG) program.

The USDA could enter into a performance contracts for the project. Companies such as Siemens, McKinstry, Johnson Controls and Chevron have expressed an interest in participating in funding projects of all sizes across the state. This allows the facility owner to pay for the project entirely from the guaranteed energy savings, and to minimize the project funds required to initiate the project.

Next Steps:

The USDA Sandpoint District Office appears to be a fair candidate for the use of a wood pellet heating system. Modeling the energy use would establish the appropriate size and energy savings associated with the boiler or furnace. It is recommended that a detailed energy analysis and cost estimate be developed to refine the project economics before requesting grant support from the Fuels For Schools program.

Sandpoint USDA District Office A.1 Chips- Container

Sandpoint, Idaho

Date(Revision Date): October 12, 2006

Analyst: CTA-Architects Engineers- Nick Salmon

EXISTING CONDITIONS

Existing Fuel Type:

Current Annual Fuel Cost:

3-year Annual Average Fuel Usage:

Annual Heating Costs:

Fuel Oil	Propane	Natural Gas
\$2.50	\$1.50	\$10.00
0	0	140
\$0	\$0	\$1,400

Notes:

Fuel type highlighted
Current year average \$/gallon or \$/dka
3-year year average gallon or dka
Chart will automatically convert

ENERGY CONVERSION (to 1 mmbtu, or 1 dka)

Current Annual Fuel Volume (btu):

Assumed efficiency of existing heating system (%):

Net Annual Fuel Usage (btu):

0	0	140,000,000
70%	80%	90%
0	0	126,000,000

Chart will automatically convert

Chart will automatically convert

WOOD FUEL COST

\$/ton:

Assumed efficiency of wood heating system (%):

Wood Chips Wood Pellets

\$20.00

\$125.00

65%

70%

5400

8200

18

11 =Net Annual Fuel Usage/10.8 or 16.4 mmbtu/Assumed efficiency of wood heating system

PROJECTED FUEL USAGE

Assumed btu content of wood fuel

Tons of wood fuel to create net equivalent of 100% annual heating load

(300 LF of buried HW pipe from HS)

Project Capital Cost	-\$164,000
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Project Financing Information	
Percent Financed	0%
Amount Financed	\$0
Amount of Grants	\$164,000
Interest Rate	5.00%
Term	10
Annual Finance Cost (years)	\$0
Simple Payback: Total Project Cost/Year One Operating Cost Savings:	-303 (years)

Maximum FFS grant

Modify for local conditions

Represents a quick look at project viability

Inflation Factors	
O&M Inflation Rate	3%
Current Fuel Inflation Rate	4%
Wood Fuel Inflation Rate	2%

Change in this location only

Change in this location only

Change in this location only

Cash flow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 1	Year 10	Year 11	Year 20	Year 30
Existing Heating System Operating Costs									
Displaced heating costs	\$10.00		140	dka	\$1,400	\$1,993	\$2,072	\$2,950	\$4,366
Displaced Operation and Maintenance Costs					\$500	\$652	\$672	\$877	\$1,178
Biomass System Operating Costs									
Wood Fuel (\$/ton, delivered to boiler site, btu/lb) (100% of total heat reqmnt)	\$20.00	100%	18	tons	\$359	\$429	\$438	\$523	\$637
Small load existing fuel (0% of total heat reqmnt)	\$10.00	0%	140	dka	\$0	\$0	\$0	\$0	\$0
Operation and Maintenance Costs					\$1,000	\$1,305	\$1,344	\$1,754	\$2,357
Annual Operating Cost Savings					\$541	\$911	\$963	\$1,550	\$2,550
Financed Project Costs - Principal and Interest					0	0			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					541	911	963	1,550	2,550
Cumulative Cash Flow					541	7,146	8,109	19,532	40,168

Sandpoint USDA District Office A.2 Chips- link to SHS

Sandpoint, Idaho

Date(Revision Date): October 12, 2006

Analyst: CTA-Architects Engineers- Nick Salmon

EXISTING CONDITIONS

Existing Fuel Type:

Current Annual Fuel Cost:

3-year Annual Average Fuel Usage:

Annual Heating Costs:

Fuel Oil	Propane	Natural Gas
\$2.50	\$1.50	\$10.00
0	0	280
\$0	\$0	\$2,800

Notes:

Fuel type highlighted

Current year average \$/gallon or \$/dka

Projected gas consumption with future expansion

Chart will automatically convert

ENERGY CONVERSION (to 1 mmbtu, or 1 dka)

Current Annual Fuel Volume (btu):

Assumed efficiency of existing heating system (%):

Net Annual Fuel Usage (btu):

0	0	280,000,000
70%	80%	90%
0	0	252,000,000

Chart will automatically convert

Chart will automatically convert

WOOD FUEL COST

\$/ton:

Assumed efficiency of wood heating system (%):

Wood Chips Wood Pellets

\$20.00

\$125.00

65%

70%

Modify for local conditions

PROJECTED FUEL USAGE

Assumed btu content of wood fuel

Tons of wood fuel to create net equivalent of 100% annual heating load

5400

8200

36

22 =Net Annual Fuel Usage/10.8 or 16.4 mmbtu/Assumed efficiency of wood heating system

Project Capital Cost **-\$90,000**

(300 LF of buried HW pipe from HS)

Project Financing Information

Percent Financed 0%

Amount Financed \$0

Amount of Grants \$90,000

Interest Rate 5.00%

Term 10

Annual Finance Cost (years) \$0

Simple Payback: Total Project Cost/Year One Operating Cost Savings:

-57 (years)

Maximum FFS grant

Modify for local conditions

Represents a quick look at project viability

Inflation Factors

O&M Inflation Rate 3%

Current Fuel Inflation Rate 4%

Wood Fuel Inflation Rate 2%

Change in this location only

Change in this location only

Change in this location only

Cash flow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 1	Year 10	Year 11	Year 20	Year 30
Existing Heating System Operating Costs									
Displaced heating costs	\$10.00		280	dka	\$2,800	\$3,985	\$4,145	\$5,899	\$8,732
Displaced Operation and Maintenance Costs					\$500	\$652	\$672	\$877	\$1,178
Biomass System Operating Costs									
Wood Fuel (\$/ton, delivered to boiler site, btu/lb) (100% of total heat reqmnt)	\$20.00	100%	36	tons	\$718	\$858	\$875	\$1,046	\$1,275
Small load existing fuel (0% of total heat reqmnt)	\$10.00	0%	280	dka	\$0	\$0	\$0	\$0	\$0
Operation and Maintenance Costs					\$1,000	\$1,305	\$1,344	\$1,754	\$2,357
Annual Operating Cost Savings					\$1,582	\$2,475	\$2,598	\$3,977	\$6,279
Financed Project Costs - Principal and Interest					0	0			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					1,582	2,475	2,598	3,977	6,279
Cumulative Cash Flow					1,582	20,024	22,621	52,499	104,124

Sandpoint USDA District Office B.1 Pellets- Boiler

Sandpoint, Idaho

Date(Revision Date): October 12, 2006

Analyst: CTA-Architects Engineers- Nick Salmon

EXISTING CONDITIONS

Existing Fuel Type:

Current Annual Fuel Cost:

3-year Annual Average Fuel Usage:

Annual Heating Costs:

Fuel Oil	Propane	Natural Gas
\$2.50	\$1.50	\$10.00
0	0	140
\$0	\$0	\$1,400
0	0	140,000,000
70%	80%	90%
0	0	126,000,000

Notes:

Fuel type highlighted
 Current year average \$/gallon or \$/dka
 3-year year average gallon or dka
 Chart will automatically convert

ENERGY CONVERSION (to 1 mmbtu, or 1 dka)

Current Annual Fuel Volume (btu):

Assumed efficiency of existing heating system (%):

Net Annual Fuel Usage (btu):

Chart will automatically convert

Chart will automatically convert

WOOD FUEL COST

\$/ton:

Assumed efficiency of wood heating system (%):

Wood Chips Wood Pellets

\$20.00 \$125.00

65% 70%

Modify for local conditions

5400 8200

18 11

=Net Annual Fuel Usage/10.8 or 16.4 mmbtu/Assumed efficiency of wood heating system

PROJECTED FUEL USAGE

Assumed btu content of wood fuel

Tons of wood fuel to create net equivalent of 100% annual heating load

(HSTarm Boiler & Silo= \$30,000 minus \$20,000 displaced cost)

Project Capital Cost **-\$1,200**

Project Financing Information

Percent Financed 0%

Amount Financed \$0

Amount of Grants \$1,200

Interest Rate 5.00%

Term 10

Annual Finance Cost (years) \$0

Simple Payback: Total Project Cost/Year One Operating Cost Savings:

-43 (years)

Maximum FFS grant

Modify for local conditions

Represents a quick look at project viability

Inflation Factors

O&M Inflation Rate 3%

Current Fuel Inflation Rate 4%

Wood Fuel Inflation Rate 2%

Change in this location only

Change in this location only

Change in this location only

Cash flow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 1	Year 10	Year 11	Year 20	Year 30
Existing Heating System Operating Costs									
Displaced heating costs	\$10.00		140	dka	\$1,400	\$1,993	\$2,072	\$2,950	\$4,366
Displaced Operation and Maintenance Costs					\$500	\$652	\$672	\$877	\$1,178
Biomass System Operating Costs									
Wood Fuel (\$/ton, delivered to boiler site, btu/lb) (100% of total heat reqmnt)	\$125.00	100%	11	tons	\$1,372	\$1,640	\$1,672	\$1,999	\$2,436
Small load existing fuel (0% of total heat reqmnt)	\$10.00	0%	140	dka	\$0	\$0	\$0	\$0	\$0
Operation and Maintenance Costs					\$500	\$652	\$672	\$877	\$1,178
Annual Operating Cost Savings					\$28	\$353	\$400	\$951	\$1,930
Financed Project Costs - Principal and Interest					0	0			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					28	353	400	951	1,930
Cumulative Cash Flow					28	1,786	2,186	8,355	22,861

Sandpoint USDA District Office B.2 Pellets- Furnace

Sandpoint, Idaho

Date(Revision Date): October 12, 2006

Analyst: CTA-Architects Engineers- Nick Salmon

EXISTING CONDITIONS

Existing Fuel Type:

Current Annual Fuel Cost:

3-year Annual Average Fuel Usage:

Annual Heating Costs:

Fuel Oil	Propane	Natural Gas
\$2.50	\$1.50	\$10.00
0	0	280
\$0	\$0	\$2,800

ENERGY CONVERSION (to 1 mmbtu, or 1 dka)

Current Annual Fuel Volume (btu):

Assumed efficiency of existing heating system (%):

Net Annual Fuel Usage (btu):

Fuel Oil	Propane	Natural Gas
0	0	280,000,000
70%	80%	90%
0	0	252,000,000

Notes:

Fuel type highlighted

Current year average \$/gallon or \$/dka

Projected gas consumption with future expansion

Chart will automatically convert

Chart will automatically convert

Chart will automatically convert

WOOD FUEL COST

\$/ton:

Assumed efficiency of wood heating system (%):

Wood Chips Wood Pellets

\$20.00 \$125.00

65% 70%

Modify for local conditions

5400 8200

36 22

=Net Annual Fuel Usage/10.8 or 16.4 mmbtu/Assumed efficiency of wood heating system

PROJECTED FUEL USAGE

Assumed btu content of wood fuel

Tons of wood fuel to create net equivalent of 100% annual heating load

(HSTarm Boiler & Silo= \$30,000 minus \$20,000 displaced cost)

Project Capital Cost **-\$10,500**

Project Financing Information

Percent Financed	0%
Amount Financed	\$0
Amount of Grants	\$10,500
Interest Rate	5.00%
Term	10
Annual Finance Cost (years)	\$0
Simple Payback: Total Project Cost/Year One Operating Cost Savings:	-187 (years)

Maximum FFS grant

Modify for local conditions

Represents a quick look at project viability

Inflation Factors

O&M Inflation Rate	3%
Current Fuel Inflation Rate	4%
Wood Fuel Inflation Rate	2%

Change in this location only

Change in this location only

Change in this location only

Cash flow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 1	Year 10	Year 11	Year 20	Year 30
Existing Heating System Operating Costs									
Displaced heating costs	\$10.00		280 dka		\$2,800	\$3,985	\$4,145	\$5,899	\$8,732
Displaced Operation and Maintenance Costs					\$500	\$652	\$672	\$877	\$1,178
Biomass System Operating Costs									
Wood Fuel (\$/ton, delivered to boiler site, btu/lb) (100% of total heat reqmnt)	\$125.00	100%	22 tons		\$2,744	\$3,279	\$3,345	\$3,997	\$4,873
Small load existing fuel (0% of total heat reqmnt)	\$10.00	0%	280 dka		\$0	\$0	\$0	\$0	\$0
Operation and Maintenance Costs					\$500	\$652	\$672	\$877	\$1,178
Annual Operating Cost Savings					\$56	\$706	\$800	\$1,902	\$3,859
Financed Project Costs - Principal and Interest					0	0			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					56	706	800	1,902	3,859
Cumulative Cash Flow					56	3,572	4,372	16,709	45,723