Pre-feasibility Assessment for Integration of Biomass Energy Systems

in

Sandpoint High School Sandpoint, Idaho

October 12, 2006

Presented by

CTA Architects Engineers
Nick Salmon

For

United Stated Department of Agriculture
Forest Service
Region One

In partnership with:

Sandpoint School District

Idaho Department of Lands: Fuels For Schools Program

Bitter Root Resource and Conservation Development Area, Incorporated

CTA Project: BIOMSPFA_SNDPNT

Executive Summary

The following assessment was commissioned to determine the technical and economic feasibility of integrating a wood fired heating system in the existing Sandpoint High School located in Sandpoint, Idaho.

The Sandpoint High School is approximately 129,000 SF in size and is heated with one natural gas hot water boiler with approximately a 4.8 mmbtu capacity. Two hot water heaters (500,000 btu each) produce domestic hot water for lavatories and showers. The kitchen facilities use a small electric hot water heater. The facility uses approximately 3,800 dka of natural gas each year at a current delivered cost of $10.00/dka or $38,000 per year.

Energy Analysis:
For the purpose of this investigation it is assumed that 95% of the existing annual natural gas consumption could be offset by the combustion of wood chips or wood pellets in a boiler approximately ½ the size of the natural gas boilers. Modeling energy consumption would establish a more precise wood boiler size for the facility. The wood heating system would be sized to meet approximately 95% of the typical annual heating load of the building, using the existing boilers for additional capacity in peak load conditions, and for future expansion.

Building & Site Constraints:
The main boiler room is located on the west edge of the building adjacent to an access drive. A wood-fired heating system could either be located in an adjacent chip storage/boiler building, or incorporated into the existing boiler room in the form of a wood pellet boiler and exterior pellet storage silo. Wood fuel delivery vehicles would access the chip storage building or pellet silo from the existing access drive. Deliveries should be scheduled to minimize conflicts with other activities on the school campus.

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 Option A.1:

Chip Storage/ Boiler Building:	$100,000
2 mmbtu Wood Heating & Wood Handling System:	$175,000
Stack	$25,000
Mechanical/Electrical within Boiler Building:	$50,000
100 LF of Buried Pipe	$5,000
Boiler Room Integration:	$25,000
Air Quality Permit:	$25,000
Subtotal:	$405,000
Fees, Building Permit, Miscellaneous Expenses:	$60,000
Subtotal:	$465,000
20% Contingency +/-:	$95,000
Subtotal:	$560,000
6% +/- Escalation to bid date (3/2007)	$17,000
Subtotal:	$577,000
6% +/- Escalation to bid date (3/2008)	$35,000
Total:	$612,000

The $700,000 cost of Option A.2 is provided as a sensitivity analysis.

Wood Pellet Options B.1:

60 ton capacity Wood Fuel Silo:	$12,000
2 mmbtu Wood Heating & Wood Handling System:	$150,000
Stack	$25,000
Boiler Room Integration:	$25,000
Air Quality Permit:	$25,000
Subtotal:	$237,000
Fees, Building Permit, Miscellaneous Expenses:	$36,000
Subtotal:	$273,000
20% Contingency +/-:	$55,000
Subtotal:	$328,000
6% +/- Escalation to bid date (3/2007)	$10,000
Subtotal:	$338,000
6% +/- Escalation to bid date (3/2008)	$20,000
Total:	$358,000

The $400,000 cost of Option B.2 is provided as a sensitivity analysis.

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. .

Wood Chip Options:
Option A.1: Appears to achieve positive accumulated cash flow (PAC) in 15 years with a subsidy of $214,200. The project may achieve PAC in 20 years without subsidy. 30 years savings (avoided costs) are approximately $1,000,000.

Option A.2: Appears to achieve positive accumulated cash flow (PAC) in 16 years with a subsidy of $245,000. The project may achieve PAC in 22 years without subsidy. 30 years savings (avoided costs) are approximately $1,000,000.

Wood Pellet Options:
Option B.1: Appears to achieve positive accumulated cash flow (PAC) in 21 years with a subsidy of $125,300. The project may achieve PAC in 26 years without subsidy. 30 years savings (avoided costs) are approximately $400,000.

Option B.1.1: Appears to achieve positive accumulated cash flow (PAC) in 22 years with a subsidy of $140,000. The project may achieve PAC in 27 years without subsidy. 30 years savings (avoided costs) are approximately $350,000.

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 School District 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 Sandpoint High School appears to be a good candidate for the use of a wood chip heating system and a fair candidate for a wood pellet heating system. Modeling the energy use would establish the appropriate size and energy savings associated with the boiler. 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 High School- A.1 Chips

Sandpoint, Idaho

Date(Revision Date): October 12, 2006
Analyst: CTA-Architects Engineers- Nick Salmon

EXISTING CONDITIONS	Fuel Oil	Propane	Natural Gas	Notes:
Existing Fuel Type:				Fuel type highlighted
Current Annual Fuel Cost:	$2.50	$1.50	$10.00	Current year average $/gallon or $/dka
3-year Annual Average Fuel Usage:	0	0	3,800	3-year year average gallon or dka
Annual Heating Costs:	$0	$0	$38,000	Chart will automatically convert
ENERGY CONVERSION (to 1 mmbtu, or 1 dka)				
Current Annual Fuel Volume (btu):	0	0	3,800,000,000	Chart will automatically convert
Assumed efficiency of existing heating system (%):	70%	80%	80%	
Net Annual Fuel Usage (btu):	0	0	3,040,000,000	Chart will automatically convert

WOOD FUEL COST	Wood Chips	Wood Pellets	
$/ton:	$20.00	$125.00	Modify for local conditions
Assumed efficiency of wood heating system (%):	65%	70%	
PROJECTED FUEL USAGE			
Assumed btu content of wood fuel	5400	8200	
Tons of wood fuel to create net equivalent of 100% annual heating load	433	265	=Net Annual Fuel Usage/10.8 or 16.4 mmbtu/Assumed efficiency of wood heating system

Project Capital Cost	**-$612,000**		nearest $50,000
Project Financing Information			
Percent Financed	**65%**		
Amount Financed	-$397,800		
Amount of Grants	$214,200		35% FFS grant
Interest Rate	5.00%		Modify for local conditions
Term	10		
Annual Finance Cost (years)	-$51,517		
Simple Payback: Total Project Cost/Year One Operating Cost Savings:		-24 (years)	Represents a quick look at project viability
Inflation Factors			
O&M Inflation Rate	3%		Change in this location only
Current Fuel Inflation Rate	4%		Change in this location only
Wood Fuel Inflation Rate	2%		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		3800	dka	$38,000	$54,086	$56,249	$80,060	$118,509
Displaced Operation and Maintenance Costs					$500	$652	$672	$877	$1,178
Biomass System Operating Costs									
Wood Fuel ($/ton, delivered to boiler site, btu/lb) (95% of total heat rqmnt)	$20.00	95%	433	tons	$8,228	$9,833	$10,030	$11,987	$14,612
Small load existing fuel (5% of total heat rqmnt)	$10.00	5%	3800	dka	$1,900	$2,704	$2,812	$4,003	$5,925
Operation and Maintenance Costs					$2,500	$3,262	$3,360	$4,384	$5,891
Annual Operating Cost Savings					***$25,872***	***$38,939***	***$40,719***	***$60,564***	***$93,259***
Financed Project Costs - Principal and Interest					*(51,517)*	*(51,517)*			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					*(25,645)*	*(12,578)*	***40,719***	***60,564***	***93,259***
Cumulative Cash Flow					*(25,645)*	*(194,770)*	*(154,051)*	***306,162***	***1,080,555***

Sandpoint High School- A.2 Chips

Sandpoint, Idaho

Date(Revision Date): October 12, 2006
Analyst: CTA-Architects Engineers- Nick Salmon

EXISTING CONDITIONS	Fuel Oil	Propane	Natural Gas	Notes:
Existing Fuel Type:				Fuel type highlighted
Current Annual Fuel Cost:	$2.50	$1.50	$10.00	Current year average $/gallon or $/dka
3-year Annual Average Fuel Usage:	0	0	3,800	Projected gas consumption with future expansion
Annual Heating Costs:	$0	$0	$38,000	Chart will automatically convert
ENERGY CONVERSION (to 1 mmbtu, or 1 dka)				
Current Annual Fuel Volume (btu):	0	0	3,800,000,000	Chart will automatically convert
Assumed efficiency of existing heating system (%):	70%	80%	80%	
Net Annual Fuel Usage (btu):	0	0	3,040,000,000	Chart will automatically convert

WOOD FUEL COST	Wood Chips	Wood Pellets	
$/ton:	$20.00	$125.00	Modify for local conditions
Assumed efficiency of wood heating system (%):	65%	70%	
PROJECTED FUEL USAGE			
Assumed btu content of wood fuel	5400	8200	
Tons of wood fuel to create net equivalent of 100% annual heating load	433	265	=Net Annual Fuel Usage/10.8 or 16.4 mmbtu/Assumed efficiency of wood heating system

Project Capital Cost	**-$700,000**		nearest $50,000
Project Financing Information			
Percent Financed	**65%**		
Amount Financed	-$455,000		
Amount of Grants	$245,000		35% FFS grant
Interest Rate	5.00%		Modify for local conditions
Term	10		
Annual Finance Cost (years)	-$58,925		
Simple Payback: Total Project Cost/Year One Operating Cost Savings:		-27 (years)	Represents a quick look at project viability
Inflation Factors			
O&M Inflation Rate	3%		Change in this location only
Current Fuel Inflation Rate	4%		Change in this location only
Wood Fuel Inflation Rate	2%		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		3800	dka	$38,000	$54,086	$56,249	$80,060	$118,509
Displaced Operation and Maintenance Costs					$500	$652	$672	$877	$1,178
Biomass System Operating Costs									
Wood Fuel ($/ton, delivered to boiler site, btu/lb) (95% of total heat rqmnt)	$20.00	95%	433	tons	$8,228	$9,833	$10,030	$11,987	$14,612
Small load existing fuel (5% of total heat rqmnt)	$10.00	5%	3800	dka	$1,900	$2,704	$2,812	$4,003	$5,925
Operation and Maintenance Costs					$2,500	$3,262	$3,360	$4,384	$5,891
Annual Operating Cost Savings					***$25,872***	***$38,939***	***$40,719***	***$60,564***	***$93,259***
Financed Project Costs - Principal and Interest					*(58,925)*	*(58,925)*			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					*(33,053)*	*(19,986)*	***40,719***	***60,564***	***93,259***
Cumulative Cash Flow					*(33,053)*	*(268,847)*	*(228,127)*	***232,085***	***1,006,479***

Sandpoint High School- B.1 Chips

Sandpoint, Idaho

Date(Revision Date): October 12, 2006
Analyst: CTA-Architects Engineers- Nick Salmon

EXISTING CONDITIONS	Fuel Oil	Propane	Natural Gas	Notes:
Existing Fuel Type:				Fuel type highlighted
Current Annual Fuel Cost:	$2.50	$1.50	$10.00	Current year average $/gallon or $/dka
3-year Annual Average Fuel Usage:	0	0	3,800	3-year year average gallon or dka
Annual Heating Costs:	$0	$0	$38,000	Chart will automatically convert
ENERGY CONVERSION (to 1 mmbtu, or 1 dka)				
Current Annual Fuel Volume (btu):	0	0	3,800,000,000	Chart will automatically convert
Assumed efficiency of existing heating system (%):	70%	80%	80%	
Net Annual Fuel Usage (btu):	0	0	3,040,000,000	Chart will automatically convert

WOOD FUEL COST	Wood Chips	Wood Pellets	
$/ton:	$20.00	$125.00	Modify for local conditions
Assumed efficiency of wood heating system (%):	65%	70%	
PROJECTED FUEL USAGE			
Assumed btu content of wood fuel	5400	8200	
Tons of wood fuel to create net equivalent of 100% annual heating load	433	265	=Net Annual Fuel Usage/10.8 or 16.4 mmbtu/Assumed efficiency of wood heating system

Project Capital Cost	**-$358,000**		nearest $50,000
Project Financing Information			
Percent Financed	**65%**		
Amount Financed	-$232,700		
Amount of Grants	$125,300		35% FFS grant
Interest Rate	5.00%		Modify for local conditions
Term	10		
Annual Finance Cost (years)	-$30,136		
Simple Payback: Total Project Cost/Year One Operating Cost Savings:		-98 (years)	Represents a quick look at project viability
Inflation Factors			
O&M Inflation Rate	3%		Change in this location only
Current Fuel Inflation Rate	4%		Change in this location only
Wood Fuel Inflation Rate	2%		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		3800	dka	$38,000	$54,086	$56,249	$80,060	$118,509
Displaced Operation and Maintenance Costs					$500	$652	$672	$877	$1,178
Biomass System Operating Costs									
Wood Fuel ($/ton, delivered to boiler site, btu/lb) (95% of total heat rqmnt)	$125.00	95%	265	tons	$31,446	$37,581	$38,332	$45,811	$55,843
Small load existing fuel (5% of total heat rqmnt)	$10.00	5%	3800	dka	$1,900	$2,704	$2,812	$4,003	$5,925
Operation and Maintenance Costs					$1,500	$1,957	$2,016	$2,630	$3,535
Annual Operating Cost Savings					***$3,654***	***$12,496***	***$13,760***	***$28,493***	***$54,384***
Financed Project Costs - Principal and Interest					*(30,136)*	*(30,136)*			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					*(26,482)*	*(17,640)*	***13,760***	***28,493***	***54,384***
Cumulative Cash Flow					*(26,482)*	*(223,725)*	*(209,965)*	*(17,294)*	***400,030***

Sandpoint High School- B.2 Chips

Sandpoint, Idaho

Date(Revision Date): October 12, 2006
Analyst: CTA-Architects Engineers- Nick Salmon

EXISTING CONDITIONS	Fuel Oil	Propane	Natural Gas	Notes:
Existing Fuel Type:				Fuel type highlighted
Current Annual Fuel Cost:	$2.50	$1.50	$10.00	Current year average $/gallon or $/dka
3-year Annual Average Fuel Usage:	0	0	3,800	Projected gas consumption with future expansion
Annual Heating Costs:	$0	$0	$38,000	Chart will automatically convert
ENERGY CONVERSION (to 1 mmbtu, or 1 dka)				
Current Annual Fuel Volume (btu):	0	0	3,800,000,000	Chart will automatically convert
Assumed efficiency of existing heating system (%):	70%	80%	80%	
Net Annual Fuel Usage (btu):	0	0	3,040,000,000	Chart will automatically convert

WOOD FUEL COST	Wood Chips	Wood Pellets	
$/ton:	$20.00	$125.00	Modify for local conditions
Assumed efficiency of wood heating system (%):	65%	70%	
PROJECTED FUEL USAGE			
Assumed btu content of wood fuel	5400	8200	
Tons of wood fuel to create net equivalent of 100% annual heating load	433	265	=Net Annual Fuel Usage/10.8 or 16.4 mmbtu/Assumed efficiency of wood heating system

Project Capital Cost	**-$400,000**		nearest $50,000
Project Financing Information			
Percent Financed	**65%**		
Amount Financed	-$260,000		
Amount of Grants	$140,000		35% FFS grant
Interest Rate	5.00%		Modify for local conditions
Term	10		
Annual Finance Cost (years)	-$33,671		
Simple Payback: Total Project Cost/Year One Operating Cost Savings:		-109 (years)	Represents a quick look at project viability
Inflation Factors			
O&M Inflation Rate	3%		Change in this location only
Current Fuel Inflation Rate	4%		Change in this location only
Wood Fuel Inflation Rate	2%		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		3800	dka	$38,000	$54,086	$56,249	$80,060	$118,509
Displaced Operation and Maintenance Costs					$500	$652	$672	$877	$1,178
Biomass System Operating Costs									
Wood Fuel ($/ton, delivered to boiler site, btu/lb) (95% of total heat rqmnt)	$125.00	95%	265	tons	$31,446	$37,581	$38,332	$45,811	$55,843
Small load existing fuel (5% of total heat rqmnt)	$10.00	5%	3800	dka	$1,900	$2,704	$2,812	$4,003	$5,925
Operation and Maintenance Costs					$1,500	$1,957	$2,016	$2,630	$3,535
Annual Operating Cost Savings					***$3,654***	***$12,496***	***$13,760***	***$28,493***	***$54,384***
Financed Project Costs - Principal and Interest					*(33,671)*	*(33,671)*			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					*(30,017)*	*(21,175)*	***13,760***	***28,493***	***54,384***
Cumulative Cash Flow					*(30,017)*	*(259,080)*	*(245,320)*	*(52,649)*	***364,675***