Pre-Feasibility Assessment for Integration of Biomass Energy Systems

in

Saint Maries School District
Saint Maries, Idaho

January 30, 2006

Presented by

CTA Architects Engineers
Dan Stevenson

For

United Stated Department of Agriculture
Forest Service
Region One

In partnership with:

Saint Maries School District

Bitter Root Resource and Conservation Development Area, Incorporated
Idaho Division of Forestry

CTA Project: BIOMASPFA-STMARIES

Executive Summary

The following assessment was commissioned to determine the technical and economic feasibility of integrating a biomass heating system with three existing facilities at the Saint Maries School District located in Saint Maries, Idaho. This assessment is funded through the USDA Forest Service, Region One, as part of the Fuels for Schools program. The field investigation took place on August 19, 2004. Revised fuel costs and fuel volumes were provided on January 30, 2006.

Field investigation identified the following information:

The elementary school is a two-story brick building with full basement, originally constructed in 1928, with a classroom and cafeteria addition in 1988. The addition is wood or metal studs construction with EIFS exterior. Overall size of the entire facility is 48,000 square feet. Based on a review of the pre-feasibility assessment form, the site has potential as a biomass project. The original boiler room sits within a paved courtyard formed by the original school and the 1988 addition. The boiler room within the addition is adjacent to a paved access drive. The 2.1 mmbtu steam boiler in the original school is located in a large boiler room with an adjacent coal bin. The 1988 addition contains a 446,000 BTU hot water boiler. The project would require that the original boiler and new boiler be interconnected and that a chip receiving door & bin be constructed adjacent to the former coal bin.

Two options were explored:

Option A.1 – Automated Wood Chip Plant, 1928 Elementary School Only
Construct an automated wood chip receiving unit, south of the original boiler room. The heating plant would include a 1.0 MMBTUH steam boiler and related equipment and would use the adjacent coal bin for chip storage. This option provides heat for the majority of the school and assumes that the existing boilers would be used as back up.

Option A.1.1 – Automated Wood Chip Plant, 1928 Elementary School Only Fuel Oil @ $2.50/gallon

Option A.2 – Automated Wood Chip Plant, 1928 & 1988 Elementary School Only
Construct an automated wood chip receiving unit, south of the original boiler room. The heating plant would include a 1.0 MMBTUH steam boiler and related equipment and would use the adjacent coal bin for chip storage. This option provides heat for the majority of the school and assumes that the existing boilers would be used as back up. A heat exchanger would be required to tie the steam boiler to the hot water boiler with approximately 250 linear feet of hot water supply and return piping.

Option A.2.1 – Automated Wood Chip Plant, 1928 & 1988 Elementary School Only @ $2.50/gallon

Estimated Costs

The total project costs including integration, contingency and escalation are estimated as noted below.

Option A.1 (1928 Elementary Only)

Chip Receiving Door/Bin:	$50,000
Wood Heating & Wood Handling System:	$175,000
Boiler Room Integration:	$50,000
Fees, Building Permit, Miscellaneous Expenses:	$30,000
Air Quality Permit:	$25,000
Subtotal:	$330,000
20% Contingency:	$70,000
Total:	$400,000

Option A.2 (1928 & 1988 Elementary Only)

Chip Receiving Door/Bin:	$50,000
Wood Heating & Wood Handling System:	$175,000
Boiler Room Integration:	$50,000
Tie-In to 1988 boiler:	$100,000
Fees, Building Permit, Miscellaneous Expenses:	$40,000
Air Quality Permit:	$25,000
Subtotal:	$440,000
20% Contingency:	$85,000
Total:	$525,000

Biomass boiler system budget estimates are based upon recent biomass assessments and project costs for completed systems.

Results of Evaluation

The cash flow analysis assumes fuel oil at $2.00/gallon, wood chips at a price of $35 per green ton. Options A.1.1 & A.2.1 assume fuel oil at $2.50/gallon. The price and source of wood fuels should be confirmed.

Wood Chip Options:

Option A.1: Appears to achieve positive accumulated cash flow (PAC) in 11 years with a subsidy of $250,000. The project may achieve PAC in 22 years without subsidy. 30 years savings may be more than $600,000.

Option A.1.1: Appears to achieve positive accumulated cash flow (PAC) in 13 years with a subsidy of $250,000. The project may achieve PAC in 21 years without subsidy. 30 years savings may be more than $800,000.

Option A.2: Appears to achieve positive accumulated cash flow (PAC) in 13 years with a subsidy of $250,000. The project may achieve PAC in 21 years without subsidy. 30 years savings may be more than $900,000.

Option A.2.1: Appears to achieve positive accumulated cash flow (PAC) in 13 years with a subsidy of $250,000. The project may achieve PAC in 19 years without subsidy. 30 years savings may be more than $1,100,000.

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.

Project Funding:

The School District could consider a 50% grant from the US Forest Service/State of Idaho "Fuels For Schools" Program. The grant supports 50% of the total project costs 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 School District may chose to raise the remaining funds for the project using a Maintenance Levy.

The school could review the project with local rural electric cooperatives. Rural electric cooperatives have the ability to provide a portion of the project financing through the Rural Economic Develop Loan and Grant (REDLG) program.

The School District might choose to enter into 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 school to pay for the project entirely from the guaranteed energy savings, and to minimize the project funds required to initiate the project.

St. Maries School District
A.1 Chips: 1928 Elementary Only

St. Maries, Idaho

Date(Revision Date): January 30, 2006
Analyst: CTA-Architects Engineers- Nick Salmon

Existing Boiler I

2.1 mmbtu 1928 Building (steam)
0.446 mmbtu 1988 Addition (hot water)
2.546 mmbtu Combined Capacity
0.068403028 Existing Facility Utilization Factor

Proposed Boiler

1.0 mmbtu Proposed Capacity
0.156738699 Proposed Facility Utilization Factor

EXISTING CONDITIONS

	Fuel Oil	Propane	Notes:
Existing Fuel Type:			Fuel type highlighted
Current Annual Fuel Cost:	$2.00	$1.30	Current year average $/gallon or $/dka
3-year Annual Average Fuel Usage:	11,000	0	
Annual Heating Costs:	$22,000	$0	Chart will automatically convert

ENERGY CONVERSION (to 1 mmbtu, or 1 dka)

Current Annual Fuel Volume (btu):	1,525,590,000	0	Chart will automatically convert
Assumed efficiency of existing heating system (%):	70%	80%	
Net Annual Fuel Usage (btu):	1,067,913,000	0	Chart will automatically convert

WOOD FUEL COST

	Chips: Fuel	Chips: Propane	
$/ton:	$35.00	$35.00	Modify for local conditions
Assumed efficiency of wood heating system (%):	70%	70%	

PROJECTED FUEL USAGE

Assumed btu content of wood fuel	5400	5400	
Tons of wood fuel to create net equivalent of 100% annual heating load	141	0	=Net Annual Fuel Usage/10.8 mmbtu/Assumed efficiency of wood heating system

Total Project Cost	**-$400,000**	nearest $50,000

Project Financing Information		
Percent Financed	38%	
Amount Financed	-$150,000	
Amount of Grants	$250,000	
Interest Rate	4.60%	Modify for local conditions
Term	10	
Annual Finance Cost (years)	-$19,050	
Simple Payback: Total Project Cost/Year One Operating Cost Savings:	-28 (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	3%	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	$2.00		11,000	gal	$22,000	$31,313	$32,565	$46,351	$68,610
Displaced Operation and Maintenance Costs					$500	$652	$672	$877	$1,178
Biomass System Operating Costs									
Wood Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)									
	$35.00	90%	141	tons	$4,450	$5,806	$5,980	$7,802	$10,486
Small load existing fuel (10% of total heat rqmnt)	$2.00	10%	11,000	gal	$2,200	$3,131	$3,257	$4,635	$6,861
Operation and Maintenance Costs					$1,500	$1,957	$2,016	$2,630	$3,535
Annual Operating Cost Savings					***$14,350***	***$21,071***	***$21,985***	***$32,160***	***$48,907***
Financed Project Costs - Principal and Interest					*(19,050)*	*(19,050)*			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					*(4,700)*	***2,021***	***21,985***	***32,160***	***48,907***
Cumulative Cash Flow					*(4,700)*	*(10,107)*	***11,878***	***257,818***	***665,859***

St. Maries School District
A.1.1 Chips: 1928 Elementary Only
St. Maries, Idaho

Date(Revision Date): January 30, 2006
Analyst: CTA-Architects Engineers- Nick Salmon

Existing Boiler I
2.1 mmbtu 1928 Building (steam)
0.446 mmbtu 1988 Addition (hot water)
2.546 mmbtu Combined Capacity
0.068403028 Existing Facility Utilization Factor

Proposed Boiler
1.0 mmbtu Proposed Capacity
0.156738699 Proposed Facility Utilization Factor

EXISTING CONDITIONS

	Fuel Oil	Propane	Notes:
Existing Fuel Type:			Fuel type highlighted
Current Annual Fuel Cost:	$2.50	$1.30	Current year average $/gallon or $/dka
3-year Annual Average Fuel Usage:	11,000	0	
Annual Heating Costs:	$27,500	$0	Chart will automatically convert

ENERGY CONVERSION (to 1 mmbtu, or 1 dka)

Current Annual Fuel Volume (btu):	1,525,590,000	0	Chart will automatically convert
Assumed efficiency of existing heating system (%):	70%	80%	
Net Annual Fuel Usage (btu):	1,067,913,000	0	Chart will automatically convert

WOOD FUEL COST

	Chips: Fuel	Chips: Propane	
$/ton:	$35.00	$35.00	Modify for local conditions
Assumed efficiency of wood heating system (%):	70%	70%	

PROJECTED FUEL USAGE

Assumed btu content of wood fuel	5400	5400	
Tons of wood fuel to create net equivalent of 100% annual heating load	141	0	=Net Annual Fuel Usage/10.8 mmbtu/Assumed efficiency of wood heating system

Total Project Cost	**-$500,000**	nearest $50,000

Project Financing Information		
Percent Financed	50%	
Amount Financed	-$250,000	
Amount of Grants	$250,000	
Interest Rate	4.60%	Modify for local conditions
Term	10	
Annual Finance Cost (years)	-$31,750	
Simple Payback: Total Project Cost/Year One Operating Cost Savings:	-26 (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	3%	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	$2.50		11,000	gal	$27,500	$39,141	$40,707	$57,938	$85,763
Displaced Operation and Maintenance Costs					$500	$652	$672	$877	$1,178
Biomass System Operating Costs									
Wood Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)									
	$35.00	90%	141	tons	$4,450	$5,806	$5,980	$7,802	$10,486
Small load existing fuel (10% of total heat rqmnt)	$2.50	10%	11,000	gal	$2,750	$3,914	$4,071	$5,794	$8,576
Operation and Maintenance Costs					$1,500	$1,957	$2,016	$2,630	$3,535
Annual Operating Cost Savings					***$19,300***	***$28,116***	***$29,312***	***$42,589***	***$64,344***
Financed Project Costs - Principal and Interest					*(31,750)*	*(31,750)*			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					*(12,450)*	*(3,634)*	***29,312***	***42,589***	***64,344***
Cumulative Cash Flow					*(12,450)*	*(76,391)*	*(47,079)*	***279,505***	***817,765***

St. Maries School District
A.2 Chips: 1928 & 1988 Elementary

St. Maries, Idaho

Date(Revision Date): January 30, 2006
Analyst: CTA-Architects Engineers- Nick Salmon

Existing Boiler I

2.1 mmbtu 1928 Building (steam)
0.446 mmbtu 1988 Addition (hot water)
2.546 mmbtu Combined Capacity
0.099495314 Existing Facility Utilization Factor

Proposed Boiler

1.0 mmbtu Proposed Capacity
0.227983562 Proposed Facility Utilization Factor

EXISTING CONDITIONS

	Fuel Oil	Propane	
Existing Fuel Type:			Notes: Fuel type highlighted
Current Annual Fuel Cost:	$2.00	$1.30	Current year average $/gallon or $/dka
3-year Annual Average Fuel Usage:	16,000	0	
Annual Heating Costs:	$32,000	$0	Chart will automatically convert

ENERGY CONVERSION (to 1 mmbtu, or 1 dka)

Current Annual Fuel Volume (btu):	2,219,040,000	0	Chart will automatically convert
Assumed efficiency of existing heating system (%):	70%	80%	
Net Annual Fuel Usage (btu):	1,553,328,000	0	Chart will automatically convert

WOOD FUEL COST

	Chips: Fuel	Chips: Propane	
$/ton:	$35.00	$35.00	Modify for local conditions
Assumed efficiency of wood heating system (%):	70%	70%	

PROJECTED FUEL USAGE

Assumed btu content of wood fuel	5400	5400	
Tons of wood fuel to create net equivalent of 100% annual heating load	205	0	=Net Annual Fuel Usage/10.8 mmbtu/Assumed efficiency of wood heating system

Total Project Cost	**-$525,000**

Project Financing Information	
Percent Financed	52%
Amount Financed	-$275,000
Amount of Grants	$250,000
Interest Rate	4.60%
Term	10
Annual Finance Cost (years)	-$34,925
Simple Payback: Total Project Cost/Year One Operating Cost Savings:	-25 (years)

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

nearest $50,000

Modify for local conditions

Represents a quick look at project viability

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	$2.00		16,000	gal	$32,000	$45,546	$47,368	$67,419	$99,797
Displaced Operation and Maintenance Costs					$500	$652	$672	$877	$1,178
Biomass System Operating Costs									
Wood Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)									
	$35.00	90%	205	tons	$6,472	$8,445	$8,698	$11,349	$15,252
Small load existing fuel (10% of total heat rqmnt)	$2.00	10%	16,000	gal	$3,200	$4,555	$4,737	$6,742	$9,980
Operation and Maintenance Costs					$1,500	$1,957	$2,016	$2,630	$3,535
Annual Operating Cost Savings					***$21,328***	***$31,242***	***$32,589***	***$47,575***	***$72,208***
Financed Project Costs - Principal and Interest					*(34,925)*	*(34,925)*			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					*(13,597)*	*(3,683)*	***32,589***	***47,575***	***72,208***
Cumulative Cash Flow					*(13,597)*	*(81,650)*	*(49,061)*	***315,062***	***917,988***

St. Maries School District
A.2.1 Chips: 1928 & 1988 Elementary

St. Maries, Idaho

Date(Revision Date): January 30, 2006
Analyst: CTA-Architects Engineers- Nick Salmon

Existing Boiler I

2.1 mmbtu 1928 Building (steam)
0.446 mmbtu 1988 Addition (hot water)
2.546 mmbtu Combined Capacity
0.099495314 Existing Facility Utilization Factor

Proposed Boiler

1.0 mmbtu Proposed Capacity
0.227983562 Proposed Facility Utilization Factor

	Fuel Oil	Propane	Chips: Fuel	Chips: Propane	Notes:
EXISTING CONDITIONS					
Existing Fuel Type:					Fuel type highlighted
Current Annual Fuel Cost:	$2.50	$1.30			Current year average $/gallon or $/dka
3-year Annual Average Fuel Usage:	16,000	0			
Annual Heating Costs:	$40,000	$0			Chart will automatically convert
ENERGY CONVERSION (to 1 mmbtu, or 1 dka)					
Current Annual Fuel Volume (btu):	2,219,040,000	0			Chart will automatically convert
Assumed efficiency of existing heating system (%):	70%	80%			
Net Annual Fuel Usage (btu):	1,553,328,000	0			Chart will automatically convert
WOOD FUEL COST					
$/ton:			$35.00	$35.00	Modify for local conditions
Assumed efficiency of wood heating system (%):			70%	70%	
PROJECTED FUEL USAGE					
Assumed btu content of wood fuel			5400	5400	
Tons of wood fuel to create net equivalent of 100% annual heating load			205	0	=Net Annual Fuel Usage/10.8 mmbtu/Assumed efficiency of wood heating system

Total Project Cost	**-$625,000**	nearest $50,000

Project Financing Information		
Percent Financed	**60%**	
Amount Financed	-$375,000	
Amount of Grants	$250,000	
Interest Rate	4.60%	Modify for local conditions
Term	10	
Annual Finance Cost (years)	-$47,625	
Simple Payback: Total Project Cost/Year One Operating Cost Savings:	-22 (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	3%	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	$2.50		16,000	gal	$40,000	$56,932	$59,210	$84,274	$124,746
Displaced Operation and Maintenance Costs					$500	$652	$672	$877	$1,178
Biomass System Operating Costs									
Wood Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)									
	$35.00	90%	205	tons	$6,472	$8,445	$8,698	$11,349	$15,252
Small load existing fuel (10% of total heat rqmnt)	$2.50	10%	16,000	gal	$4,000	$5,693	$5,921	$8,427	$12,475
Operation and Maintenance Costs					$1,500	$1,957	$2,016	$2,630	$3,535
Annual Operating Cost Savings					***$28,528***	***$41,490***	***$43,247***	***$62,744***	***$94,663***
Financed Project Costs - Principal and Interest					*(47,625)*	*(47,625)*			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					*(19,098)*	*(6,136)*	***43,247***	***62,744***	***94,663***
Cumulative Cash Flow					*(19,098)*	*(120,335)*	*(77,088)*	***404,335***	***1,196,670***