

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

in

***Saint Maries School District
Saint Maries, Idaho***

October 12, 2004

Presented by

***CTA Architects Engineers
Dan Stevenson***

For

United States 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.

Field investigation identified the following information:

The existing high school is located on a separate campus north of town and includes an academic building, shop and gymnasium. The academic building is located on a steep hillside and is heated with electric wall units. The gymnasium and shop building are located on a flat site below the academic building and are heated with electric reheat coils and space heat units. The high school complex would require extensive replacement of existing heating systems and underground piping and would not be a good candidate for a biomass heating system. The school should consider reviewing the potential replacement of the existing heating system with a performance contractor.

The existing middle school is located on a separate campus about two block from the elementary school. The site has a significant slope and inadequate remaining space adjacent to or nearby the existing boiler room. A recent gymnasium addition is heated by a separate electric heating system. The school should consider reviewing the potential replacement of the existing heating system with a performance contractor.

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 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 facility be constructed adjacent to the former coal bin.

Option A – Automated Wood Chip Plant

Construct an automated wood chip receiving unit, south of the original boiler room. The heating plant would include a 2.0 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. Estimated cost: \$400,000.

A pellet fuel option was not explored for the following reasons: A. Need to produce steam, B. high cost of fuel (\$100/ton) and C. the very low fuel oil usage documented in the wood chip option.

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

Results of Evaluation

The results of this analysis are summarized below. The cost estimate is representative of the scope of this project. A Cash Flow Analysis is provided at the end of the report. The cash flow analysis assumes availability of green chips at a price of \$35 per green ton.

An Automated Wood Chip Plant achieves a positive accumulated cashflow (PAC) in 10 years with a subsidy of \$367,000 and in greater than 30 years without subsidy.

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. Based on this standard, the amount of project subsidy required to achieve a 10-year PAC was calculated and is indicated above. If the School District choose to further pursue a biomass heating system, it is recommended that each of the options be investigated in further detail.

The approach in analyzing this option has been to remain conservative, yet realistic about the performance of biomass heating plants and the cost of their installation. Due to the preliminary nature of this assessment, it is possible that the construction cost estimates can be reduced as additional information relative to the construction is gathered, favorably affecting the economic analysis.

Other factors should be considered when evaluating the viability of this project. The first is that although the current fuel oil cost is approximately \$7.25/decatherm, fuel contracts have been as high as \$7.50/decatherm. The cash flow analysis assumes a 4% inflation rate in fuel oil costs. Individual years may fluctuate beyond that average. The cost of transporting wood pellet fuel to the site should be considered. Wood chips sell for \$35/ton or \$3.00/decatherm.

Air Quality permits for wood burning devices in the State of Idaho are required and may impact the overall cost of the project.

Saint Maries Biomass Heating Economic Analysis- Wood Chips

Conversion Proforma - 4.6% APR - 10 Year Term

October 12, 2004
 Revision:
 Analyst: Salmon-CTA

Project Capital Cost **-\$400,000**

Project Financing Information	
Percent Financed	8%
Amount Financed	-\$33,000
Amount of Grants	\$367,000
Interest Rate	4.60%
Term	10
Annual Finance Cost (years)	-\$4,191

Escalation factors	
Elec. Escalation factor	1.04
Fuel Oil Escalation factor	1.04
Natural Gas Escalation factor	1.06
Pellet Escalation factor	1.03
Green Chip Escalation factor	1.02
Maint. Escalation factor	1.03

Cashflow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Existing Heating System Operating Costs																			
	\$0.000		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Displaced fuel oil heating costs	\$1.031		10,390	gallons	10,712	11,141	11,586	12,050	12,532	13,033	13,554	14,096	14,660	15,247	15,857	16,491	17,150	17,836	18,550
Displaced Operation and Maintenance Costs					570	587	605	623	642	661	681	701	722	744	766	789	813	837	862
Biomass System Operating Costs																			
Green Chip Fuel (\$/ton, delivered to boiler site, btu/lb) (90% of total heat reqmnt)	\$35.00	90%	166	tons	5,802	5,918	6,036	6,157	6,280	6,406	6,534	6,664	6,798	6,934	7,072	7,214	7,358	7,505	7,655
Small load fuel oil (10% of total heat reqmnt)	\$1.100	10%	1039	gallons	1,143	1,189	1,236	1,286	1,337	1,391	1,446	1,504	1,564	1,627	1,692	1,759	1,830	1,903	1,979
Operation and Maintenance Costs					1,710	1,761	1,814	1,869	1,925	1,982	2,042	2,103	2,166	2,231	2,298	2,367	2,438	2,511	2,587
Annual Operating Cost Savings					2,627	2,860	3,104	3,361	3,631	3,915	4,213	4,526	4,854	5,199	5,560	5,939	6,337	6,754	7,191
Financed Project Costs - Principal and Interest					(4,191)														
Displaced System Replacement Costs																			
Special financing																			
	\$0.00		149		0	0	0	0	0	0	0	0	0	0					
Net Annual Cash Flow					(1,564)	(1,331)	(1,087)	(830)	(560)	(276)	22	335	663	1,008	5,560	5,939	6,337	6,754	7,191
Cumulative Cash Flow					(1,564)	(2,895)	(3,981)	(4,811)	(5,371)	(5,647)	(5,625)	(5,290)	(4,627)	(3,619)	1,942	7,881	14,218	20,972	28,163

Cashflow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
Existing Heating System Operating Costs																			
	\$0.000		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Displaced fuel oil heating costs	\$1.031		10390	gallons	19,292	20,064	20,866	21,701	22,569	23,472	24,410	25,387	26,402	27,458	28,557	29,699	30,887	32,122	33,407
Displaced Operation and Maintenance Costs					888	915	942	970	999	1,029	1,060	1,092	1,125	1,159	1,193	1,229	1,266	1,304	1,343
Biomass System Operating Costs																			
Green Chip Fuel (\$/ton, delivered to boiler site, btu/lb) (90% of total heat reqmnt)	\$35.00	90%	166	tons	7,808	7,965	8,124	8,286	8,452	8,621	8,794	8,970	9,149	9,332	9,519	9,709	9,903	10,101	10,303
Small load fuel oil (10% of total heat reqmnt)	\$1.100	10%	1039	gallons	2,058	2,141	2,226	2,315	2,408	2,504	2,604	2,709	2,817	2,930	3,047	3,169	3,295	3,427	3,564
Operation and Maintenance Costs					2,664	2,744	2,826	2,911	2,998	3,088	3,181	3,277	3,375	3,476	3,580	3,688	3,798	3,912	4,030
Annual Operating Cost Savings					7,649	8,129	8,632	9,158	9,710	10,287	10,892	11,524	12,187	12,879	13,604	14,363	15,156	15,986	16,853
Financed Project Costs - Principal and Interest																			
Displaced System Replacement Costs																			
Special financing																			
	\$0.00																		
Net Annual Cash Flow					7,649	8,129	8,632	9,158	9,710	10,287	10,892	11,524	12,187	12,879	13,604	14,363	15,156	15,986	16,853
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