Pre-Feasibility Assessment for Integration of Biomass Energy Systems

Proposed Libby Aquatic Center Libby, Montana

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Presented by

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For

United Stated Department of Agriculture
Forest Service
Region One

In partnership with:

Libby Aquatic Center
Bitter Root Resource and Conservation Development Area, Incorporated

CTA Project: BIOMASPFA-LBYSP

Executive Summary

The following assessment was commissioned to determine the technical and economic feasibility of integrating a wood chip heating system or wood pellet heating system in the proposed Libby Aquatic Center in Libby, Montana. This assessment is funded through the Bitter Root RC&D, as part of the Fuels for Schools program.

The proposed facility includes a 3,295 SF lap pool and 5,582 SF activity pool adjacent to the existing city hall building. The two pools would contain approximately 213,000 gallons of water. The proposed lap pool would be located under a permanent tent in order to extend potential days of operation.

It is assumed that the facility would be heated with either a fuel oil boiler or propane boiler. At this point in time a detailed energy analysis has not been conducted. CTA has contacted the operator of the Bitterroot Aquatic Center in Hamilton, Montana and determined that annual natural gas consumption is approximately 1,700 decatherms (dka). The Bitterroot Aquatic Center is not entirely similar in configuration to the proposed Libby Aquatic Center, but is a reasonable comparison to the proposed facility. The six-month period of operation of the Bitterroot Aquatic Center from April-September consumes approximately 1,000 dka.

CTA also contacted Frank Eagle of Pacific Pools in Seattle, WA, and determined that the Libby Aquatic Center is likely to use a 500,000 btu boiler to heat the lap pool and a 750,000 btu boiler to heat the activity pool.

For the purpose of this assessment, the six-month 1,000 dka average for the Bitterroot Aquatic Center was adjusted to 1,400 dka due to the projected size of the proposed Libby Aquatic Center.

Two wood fuel sources (chips and pellets) and two fossil fuel sources (fuel oil and propane) were examined for this report. Two system sizes were also considered (100% wood fuel and 90% wood fuel). The 100% wood fuel option assumes that the wood fuel system would be capable of meeting 100% of the peak pool water heating requirement. This option reduces the total project cost by the estimated displaced cost ($50,000) of a fuel oil or propane boiler that would have been purchased for the project. The 90% option assumes that the wood fuel system would be capable of meeting 90% of the typical annual consumption with an additional fuel oil or propane boiler combined to meet the peak demand for the facility. In this scenario, the displaced cost of the fuel oil or propane boiler and boiler room is not taken since the additional fossil fuel boiler would be provided.

The current site plan does not readily accommodate large wood chip or wood pellet delivery vehicles. If wood chips were to be delivered to the site, the vehicles might access the courtyard space between the proposed pool clubhouse and existing city hall building. Wood pellet deliveries could use the same space, or potentially use a pneumatic system located on the delivery vehicle to convey the pellets from the delivery vehicle parked on the adjacent street. In any case, deliveries could be timed to minimize impacts on the pool and the city hall facilities.

If a wood chip system were to be constructed, the chips would be delivered to a storage bin capable of heating the pool for about a week. In order to keep the construction costs down, the storage bin capacity is likely to be smaller than a typical 25-ton chip van load. Wood pellets would be stored in a 25-30 ton silo adjacent to the facility and connected directly to a pellet burner in the boiler room via a flexible auger.

The total project costs including integration and contingency are estimated as follows:

Wood Chip Options:
Option A.1: 100% peak capacity wood chip heating plant compared to fuel oil ($300,000).
Option A.2: 100% peak capacity wood chip heating plant compared to propane ($300,000).

Option A.3: 90% typical annual load wood chip heating plant with fuel oil boiler for peak load compared to fuel oil ($350,000).
Option A.4: 90% typical annual load wood chip heating plant with propane boiler for peak load compared to propane ($350,000).

The projected total project cost of the wood chip options presented is based upon the contracted cost of the Thompson Falls School District wood chip project in Thompson Falls, Montana (assuming that significant savings could be realized by integrating the wood heating system into the proposed pool clubhouse and that the chip storage bin would not be capable of receiving 25 ton loads).

Wood Pellet Options:
Option B.1: 100% peak capacity wood pellet heating plant compared to fuel oil ($200,000).
Option B.2: 100% peak capacity wood pellet heating plant compared to propane ($200,000).

Option B.3: 90% typical annual load wood pellet heating plant with fuel oil boiler for peak load compared to fuel oil ($250,000).
Option B.4: 90% typical annual load wood pellet heating plant with propane boiler for peak load compared to propane ($250,000).

The projected total project cost of the wood pellet options presented is based upon the projected cost of the Walter Morrison Elementary School pellet project in Troy, Montana (assuming two pellet boilers would be purchased to meet the projected capacity).

Results of Evaluation

The cash flow analysis assumes fuel oil at $1.90/gallon, propane at $1.40/gallon, wood chips at a price of $35 per green ton and a pellet fuel price of $85 per ton.

Wood Chip Options:
Option A.1: Appears to achieve a $4,000 positive accumulated cash flow (PAC) in 10 years with a subsidy of $150,000. The project may achieve PAC in 17 years without subsidy. 30 years savings may be more than $700,000.

Option A.2: Appears to achieve a $1,000 positive accumulated cash flow (PAC) in 10 years with a subsidy of $150,000. The project may achieve PAC in 17 years without subsidy. 30 years savings may be more than $700,000.

Option A.3: Appears to achieve a $17,000 positive accumulated cash flow (PAC) in 13 years with a subsidy of $175,000. The project may achieve PAC in 21 years without subsidy. 30 years savings may be more than $600,000.

Option A.4: Appears to achieve a $14,000 positive accumulated cash flow (PAC) in 12 years with a subsidy of $175,000. The project may achieve PAC in 21 years without subsidy. 30 years savings may be more than $600,000.

Wood Pellet Options:

Option B.1: Appears to achieve a $32,000 positive accumulated cash flow (PAC) in 10 years with a subsidy of $100,000. The project may achieve PAC in 15 years without subsidy. 30 years savings may be more than $600,000.

Option B.2: Appears to achieve a $29,000 positive accumulated cash flow (PAC) in 10 years with a subsidy of $100,000. The project may achieve PAC in 15 years without subsidy. 30 years savings may be more than $600,000.

Option B.3: Appears to achieve an $18,000 positive accumulated cash flow (PAC) in 12 years with a subsidy of $125,000. The project may achieve PAC in 19 years without subsidy. 30 years savings may be more than $500,000.

Option B.4: Appears to achieve a $14,000 positive accumulated cash flow (PAC) in 12 years with a subsidy of $125,000. The project may achieve PAC in 19 years without subsidy. 30 years savings may be more than $500,000.

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.

The sensitivity analysis provided above suggests that the Libby Aquatics Center appears to be a good candidate for the use of a wood biomass heating system. 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.

Libby Aquatic Center-B.1 100% Wood Pellets-Fuel Oil

Libby, Montana

Date(Revision Date): June 24, 2005
Analyst: CTA-Architects Engineers- Nick Salmon

EXISTING CONDITIONS					**Notes:**
Existing Fuel Type:	**Fuel Oil**	**Propane**	**Natural Gas**		Fuel type highlighted
Current Annual Fuel Cost:	$1.90	$1.40	$9.30		Current year average $/gallon or $/dka
3-year Annual Average Fuel Usage:	11,550	15,500	1,400		3-year year average gallon or dka
Annual Heating Costs:	$21,945	$21,700	$13,020		Chart will automatically convert
ENERGY CONVERSION (to 1 mmbtu, or 1 dka)					
Current Annual Fuel Volume (dka):	1,601,869,500	1,402,781,000	1,400,000,000		Chart will automatically convert
Assumed efficiency of existing heating system (%):	70%	80%	80%		
Net Annual Fuel Usage (dka):	1,121,308,650	1,122,224,800	1,120,000,000		Chart will automatically convert

WOOD FUEL COST	**Wood Chips**	**Wood Pellets**	
$/ton:	$35.00	$85.00	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	160	98	=Net Annual Fuel Usage/10.8 or 16.4 mmbtu/Assumed efficiency of wood heating system

Project Capital Cost	**-$200,000**		
			nearest $50,000

Project Financing Information	
Percent Financed	**50%**
Amount Financed	-$100,000
Amount of Grants	$100,000
Interest Rate	4.16%
Term	10
Annual Finance Cost (years)	-$12,427
Simple Payback: Total Project Cost/Year One Operating Cost Savings:	-16 (years)

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	3%

Cash flow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source	Heating Units	Year 1	Year 10	Year 11	Year 20	Year 30
Existing Heating System Operating Costs									
Displaced heating costs	$1.90		11550	gallons	$21,945	$31,235	$32,484	$46,235	$68,439
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 rqmnt)	$85.00	100%	98	tons	$8,293	$10,820	$11,145	$14,541	$19,542
Small load existing fuel (0% of total heat rqmnt)	$2.09	0%	11550	gallons	$0	$0	$0	$0	$0
Operation and Maintenance Costs					$1,500	$1,957	$2,016	$2,630	$3,535
Annual Operating Cost Savings					***$12,652***	***$19,110***	***$19,995***	***$29,940***	***$46,540***
Financed Project Costs - Principal and Interest					***(12,427)***	***(12,427)***			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					***225***	***6,682***	***19,995***	***29,940***	***46,540***
Cumulative Cash Flow					***225***	***32,669***	***52,664***	***279,507***	***664,406***

Libby Aquatic Center-A.1 100% Wood Chips-Fuel Oil

Libby, Montana

Date(Revision Date): June 24, 2005
Analyst: CTA-Architects Engineers- Nick Salmon

EXISTING CONDITIONS					**Notes:**
Existing Fuel Type:	**Fuel Oil**	**Propane**	**Natural Gas**		Fuel type highlighted
Current Annual Fuel Cost:	$1.90	$1.40	$9.30		Current year average $/gallon or $/dka
3-year Annual Average Fuel Usage:	11,550	15,500	1,400		3-year year average gallon or dka
Annual Heating Costs:	$21,945	$21,700	$13,020		Chart will automatically convert
ENERGY CONVERSION (to 1 mmbtu, or 1 dka)					
Current Annual Fuel Volume (dka):	1,601,869,500	1,402,781,000	1,400,000,000		Chart will automatically convert
Assumed efficiency of existing heating system (%):	70%	80%	80%		
Net Annual Fuel Usage (dka):	1,121,308,650	1,122,224,800	1,120,000,000		Chart will automatically convert

WOOD FUEL COST	**Wood Chips**	**Wood Pellets**	
$/ton:	$35.00	$85.00	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	160	98	=Net Annual Fuel Usage/10.8 or 16.4 mmbtu/Assumed efficiency of wood heating system

Project Capital Cost	**-$300,000**		
			nearest $50,000

Project Financing Information	
Percent Financed	**50%**
Amount Financed	-$150,000
Amount of Grants	$150,000
Interest Rate	4.16%
Term	10
Annual Finance Cost (years)	-$18,641
Simple Payback: Total Project Cost/Year One Operating Cost Savings:	-20 (years)

Modified 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%

Cash flow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source	Heating Units	Year 1	Year 10	Year 11	Year 20	Year 30
Existing Heating System Operating Costs									
Displaced heating costs	$1.90		11550	gallons	$21,945	$31,235	$32,484	$46,235	$68,439
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 rqmnt)	$35.00	100%	160	tons	$5,591	$6,681	$6,815	$8,144	$9,928
Small load existing fuel (0% of total heat rqmnt)	$2.09	0%	11550	gallons	$0	$0	$0	$0	$0
Operation and Maintenance Costs					$1,500	$1,957	$2,016	$2,630	$3,535
Annual Operating Cost Savings					***$15,354***	***$23,249***	***$24,325***	***$36,337***	***$56,154***
Financed Project Costs - Principal and Interest					***(18,641)***	***(18,641)***			
Displaced System Replacement Costs (year one only)									
Net Annual Cash Flow					***(3,287)***	***4,607***	***24,325***	***36,337***	***56,154***
Cumulative Cash Flow					***(3,287)***	***4,383***	***28,708***	***304,361***	***769,997***