Preliminary Feasibility Study of Biomass Heat for Eastern Plumas Health Care

Portola, California

October 27, 2012

Presented to:

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Introduction

Eastern Plumas Health Care (EPHC) is a 9-bed critical access hospital located in Portola, CA, less than 50 miles from both Truckee, CA, and Reno, NV. It is a one-story building, serving 10,000 local residents and thousands of summer visitors. The building is heated with oil-fired boilers and heating costs have been rising steadily for the hospital. There is an abundance of woody biomass fuel in the region, making biomass a viable alternative to provide heat to the facility.

Existing Heating System

The EPHC currently uses steam for heat distribution, relying on dual oil-fired Burnham "Golden Cube" model boilers original to the building. These boilers are each rated at 3,350 MBH input capacity, with an output of 2,318 MBH each, achieving ~70% efficiency. The steam boilers are fired by Gordon-Piatt R10.2-0-50 Burners, rated at 18-30 GPH each. In addition, a single oil-fired Bryan hot water boiler rated at 1,500 MBH input (manufactured in 1999) with 10.7 GPH Gordon Platt burner provides additional heat and hot water to the health care complex. The total annual oil bill for heating the hospital has been steadily climbing as rates increase. In 2011, EPHC required over 37,000 gallons of fuel oil (diesel) for heat. At current rates of $4 per gallon for heating oil, EPHC pays $145,000-150,000 per year for heat; costs are expected to be higher in 2012 and an annual oil cost escalation rate of 5% was used in the financial pro forma.

If a biomass boiler system is installed, the two existing Burnham boilers could provide a backup heating system. However, given their poor condition, the installation of one new oil-fired steam boiler to provide backup and to cover the peaks and low-load periods not covered by the biomass system is advised and the cost for a basic oil-fired unit ($100,000) is included in the proforma as an added cost of the biomass boiler installation. This would allow one of the old oil boilers to be retired. If the hospital chooses to continue solely with oil heat, they would need to replace both of the existing Burnham boilers soon, and we include a cost of $200,000 in year 2 of the proforma to cover the cost of replacing the existing oil-fired boilers. No detailed cost assessment of the replacement cost of the existing oil-fired boilers was conducted, so this number may not accurately reflect costs.

Site Considerations

The EPHC appears to have a good site for a stand-alone biomass boiler system at the rear of the hospital in the vicinity of the existing oil boiler shed. Some clearing of land may be required to construct the biomass system, but the available space available on site appears sufficient for a variety of biomass system configurations while maintaining access for emergency vehicles and fuel trucks.

Technology Assessed

Given that forestry residuals are available from multiple sources near EPHC, we assessed a boiler system fueled by wood chips. The assessment assumed a state-of-the-art biomass boiler system that incorporates full automation of all major functions, including automatic ignition, continuously unattended operation, and automatic de-ashing. The boiler system assessed would also include the components required for consistent low emissions levels with variable quality fuels, including: an oxygen sensor and flue gas temperature sensor-based combustion control; distinct primary and secondary combustion zones; and flue gas recirculation. To be certain the system will pass the most stringent emissions standards, the system assessed includes a flue gas cleaning system based on an electro-static precipitator (ESP). This component adds considerable cost (~$200,000, including equipment, additional slab and building area) but may be required by environmental permitting authorities, so was included in project costs to be conservative. Although more expensive than wood pellet boilers, the advent of small-scale fully-automated wood chip boilers that can take advantage of <4" wood chip fuel would allow EPHC to utilize the lowest cost and most abundant local fuels available, and would ensure flexible fuel sourcing over the service lifetime of the system (>30 years). The cost estimate underlying this assessment is based on the installation of a modern, high efficiency boiler with a proven track record of cleanliness, requiring minimal work to maintain or adjust when fuel conditions change.

Project Viability and Recommendations

The preliminary cost assessment conducted as part of this feasibility study indicate that a wood chip boiler providing heat to the EPHC delivered as a turn-key project, including site preparation and light demolition, construction of a boiler building of a similar specification to the existing oil boiler shed, modern biomass boiler unit, all required mechanical equipment, including ESP flue gas cleaning, HVAC interconnections to the existing heat distribution system and all installation labor could be achieved with a budget of approximately ~$1.19M, including 10% contingency. This system would cover approximately 85% of the hospital's heating needs with the remaining 15% provided by the existing or new oil boiler(s).

It is recommended that the new boiler system utilize forestry and mill residuals available near the facility. Wood chips, sawdust, and shavings are the lowest cost and most abundant sources of local wood fuel. The ability to handle coarse (<4") high moisture (<50% moisture content (MC)) wood fuel will allow a diversity of fuel sources to help the hospital maintain low fuel costs while enabling access to multiple fuel vendors should any one supplier be unable to provide fuel for a period of time. The system assessed is designed for wet wood chips and would be able to accept forestry residuals directly from harvest sites. The total annual fuel needs for EPHC are estimated to be approximately 400 tons of wood chip fuel. At an estimated $50/ton delivered and a moisture content of 50%, the total annual wood fuel cost would be ~$20,000, exclusive of operating and maintenance (O&M) costs and the

remaining low load and peak load propane consumption, estimated at ~5,500 gallons.

With regards to fuel handling, we recommend that a set of removable hook-lift fuel bins be utilized for fuel transport and storage, rather than a large, concrete bunker type fuel storage facility. The cost estimate provided is based on this type of system. The use of fuel bins with self-contained reclaim equipment would provide easy access to all fuel handling components for simplified maintenance, and most importantly, would keep installation costs down.

Comprehensive engineering will be needed to determine the exact configuration and final cost of the biomass energy system, how the biomass system will connect into the existing facility heating system, and what structural, mechanical, and electrical requirements must be met. It is recommended that this scope of work be included in an Engineering, Procurement and Construction (EPC) contract to an experience biomass energy construction and engineering firm for turnkey delivery of the proposed system.

Conclusion

Eastern Plumas Health Care is an ideal candidate for biomass energy. Its high oil heating bills, the volatility of the oil market, round-the-clock heating needs, and physical layout are all significant factors that favor integrating a biomass energy system into the facility. In the long term, the most cost effective biomass heating solution for EPHC is a wood chip-fueled boiler located adjacent to the main hospital building providing heat via the existing underground steam piping. By utilizing the low cost wood chip fuels in the area, this configuration would reduce fuel oil costs by approximately 85% and reduce overall heating costs by approximately ~70% annually, generating more than enough savings to finance the cost of installation. When the 30 year estimated operational lifespan of the boiler is taken into account, the project yields a 30 year Net Present Value (5% discount rate) of $2.0 million, and a 30 year non-adjusted Cumulative Cash Flow of $5.9 million, indicating the project is a good investment.

Eastern Plumas Health Care

Heat Load Estimator and Wood Boiler System Sizing Tool

Project Eastern Plumas Health Care
Location Portola, CA
Contact Tom Hayes
Date 10/23/12

Boiler Option Wood Chip Boiler (C.1)
System Output (MBH) 1400
Fuel Type Forestry Residuals
Workbook Version 3.2.2

Contact Andrew Haden
Phone (503) 706-6187
Email andrew@wisewood.us

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Portland, OR 97214

Years of HDD data	1	**Description:**	Fahrenheit-based heating degree days for a base temperature of 65F
Years of energy use data	1	**Station:**	Portola, CA (120.47W,39.82N)
Fuel type	Heating Oil	**Station ID:**	KCAPORT02

Heating Oil Consumption	2011	2010	2009	Year 4	Year 5
Heating Oil (Diesel)	37,341	0	0	0	0

Heating Oil cost, $/gal.	$4.00	Annual Heating Oil use, gal.	37341	Anticipated building efficient gains	0%
Wood fuel cost, $/ton	$50.00	Operating hours/day	24	Calculated heat load (Gal./HHD)	5.09
MC, wet weight basis	50%	Wood Boiler Eff.	85%	Estimated reduction in Heating Oil use	85%
Energy of Heating Oil, Btu/gal, LHV	125000	Existing Boiler Eff.	70%	Boiler output, high-fire (MBH)	955
Energy of Wood, mmBtu/ton, LHV	8.2			Boiler output, low-fire (MBH)	341
Heating Oil cost, $/mmBtu	$32.00			Efficiency corrected fuel cost, $/mmBtu	$45.71

Current Estimated Energy Use

Month	Heat Demand [HDD]	Current Est. Heating Oil Use [gal/mo]	Percent of annual use	Heat input [MMBtu]		Estimated Current Heating Oil Bill
August	238	1,211	3%	106	$	4,845.03
September	524	2,663	7%	233	$	10,652.56
October	900	4,579	12%	401	$	18,317.92
November	1039	5,286	14%	462	$	21,142.32
December	990	5,036	13%	441	$	20,145.24
January	924	4,701	13%	411	$	18,802.22
February	926	4,711	13%	412	$	18,842.92
March	699	3,555	10%	311	$	14,219.69
April	442	2,246	6%	197	$	8,983.96
May	330	1,677	4%	147	$	6,708.97
June	168	855	2%	75	$	3,420.62
July	161	821	2%	72	$	3,284.28
Yearly Total, or Avg,	7340	37,341	100%	3267	$	149,365.74

Projected Energy Use

Projected wood fuel use, [tons]	Projected Heating Oil use, [gal]
13.0	177
28.5	390
49.1	671
56.6	774
54.0	738
50.4	689
50.5	690
38.1	521
24.1	329
18.0	246
9.2	125
8.8	120
400.1	5470

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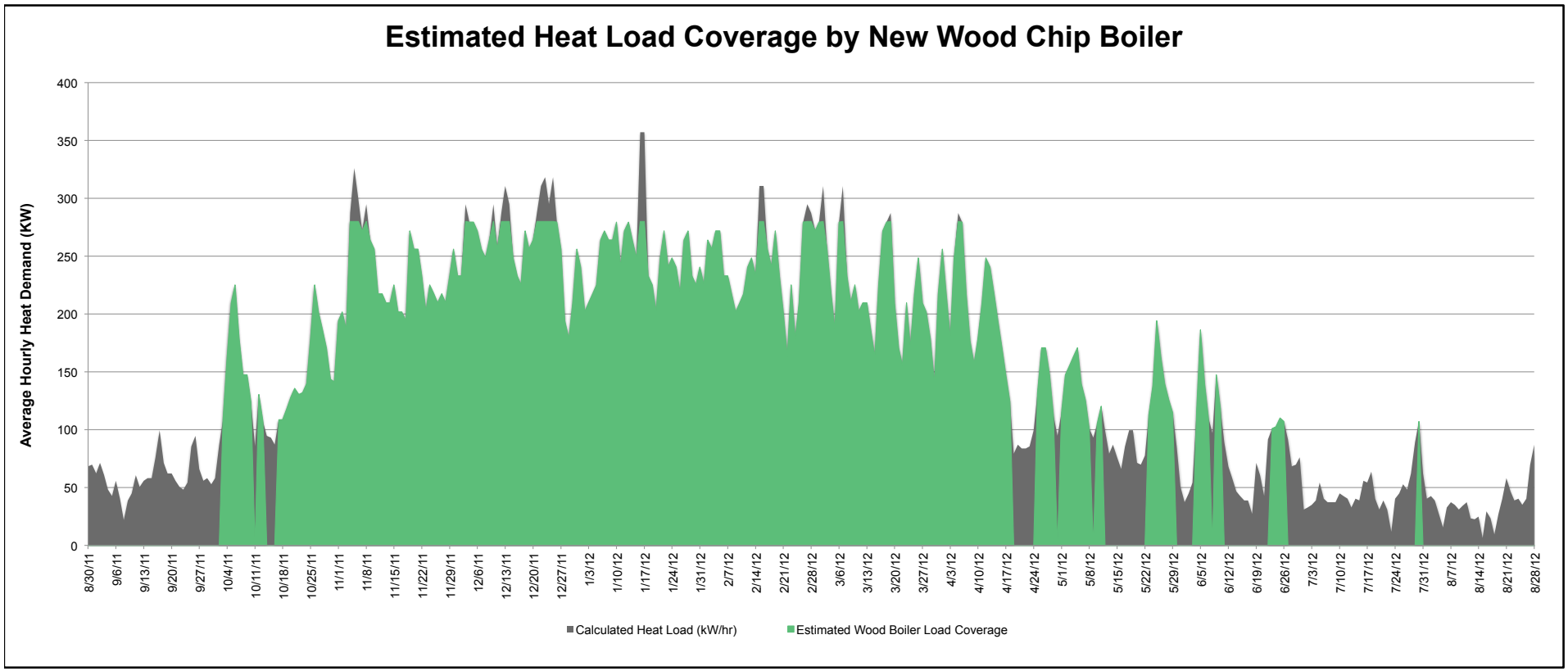

Eastern Plumas Health Care

Proforma Project Financial Statement

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Email andrew@wisewood.us

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DEBT SERVICE		
Total Installation Cost	$	1,190,000
Grants	$	-
Total Project Cost	$	1,190,000
Debt Leverage		70.0%
Project Equity		30.0%
Loan Amount	$	833,000
Amount of Equity	$	357,000
Annual Rate		5.0%
Term (Years)		15.00

FUEL COSTS	Heating Oil	Wood	Electricity
Unit	(mmBtu)	(mmBtu)	(kWhr)
Cost per unit	$32.00	$6.10	$0.12
Escalation Rate	5.0%	2.0%	3.0%

O&M COSTS	Labor		Electricity
Labor (hrs/wk)	2	Operating hours	6000
$/hr	$30	Max output kW (thermal)	400
Wk/yr	40	Average output kW (thermal)	228
Total/yr	$2,400	Max. electrical draw	10
Ann. increase	2%	Average draw (kWhr)	5.7
		Annual use (kWhr)	34163
		Annual cost	$4,100

30 YR ACCUMULATED CASH FLOW	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 15	Year 20	Year 30
EXISTING HEATING SYSTEM OPERATING COSTS													
Oil Boiler Replacment Cost	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Projected Heating Oil Cost	$ 149,366	$ 156,834	$ 164,676	$ 172,910	$ 181,555	$ 190,633	$ 200,164	$ 210,173	$ 220,681	$ 231,715	$ 295,734	$ 377,440	$ 614,810
O&M Cost	$ 3,000	$ 3,060	$ 3,121	$ 3,184	$ 3,247	$ 3,312	$ 3,378	$ 3,446	$ 3,515	$ 3,585	$ 3,958	$ 4,370	$ 5,328
TOTAL	**$ 149,366**	**$ 356,834**	**$ 164,676**	**$ 172,910**	**$ 181,555**	**$ 190,633**	**$ 200,164**	**$ 210,173**	**$ 220,681**	**$ 231,715**	**$ 268,239**	**$ 377,440**	**$ 614,810**
PROPOSED HEATING SYSTEM OPERATING COSTS													
New Oil Boiler (Peak and Low Load)	$ 100,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Heating Oil Fuel Cost (Peak and Low Load)	$ 21,878	$ 22,972	$ 24,121	$ 25,327	$ 26,593	$ 27,923	$ 29,319	$ 30,785	$ 32,324	$ 33,940	$ 43,317	$ 55,285	$ 90,054
Wood Fuel Cost	$ 20,006	$ 20,406	$ 20,814	$ 21,230	$ 21,655	$ 22,088	$ 22,530	$ 22,980	$ 23,440	$ 23,909	$ 26,397	$ 29,144	$ 35,527
O&M Cost	$ 2,400	$ 2,448	$ 2,497	$ 2,547	$ 2,598	$ 2,650	$ 2,703	$ 2,757	$ 2,812	$ 2,868	$ 3,167	$ 3,496	$ 4,262
Electrical Cost	$ 4,100	$ 4,223	$ 4,349	$ 4,480	$ 4,614	$ 4,752	$ 4,895	$ 5,042	$ 5,193	$ 5,349	$ 6,201	$ 7,189	$ 9,661
TOTAL	**$ 148,383**	**$ 50,048**	**$ 51,781**	**$ 53,584**	**$ 55,460**	**$ 57,413**	**$ 59,446**	**$ 61,564**	**$ 63,769**	**$ 66,066**	**$ 79,082**	**$ 95,115**	**$ 139,504**
PROJECT RELATED DEBT													
Beginning Principal Balance	$ 833,000	$ 794,397	$ 753,864	$ 711,304	$ 666,616	$ 619,693	$ 570,425	$ 518,693	$ 464,375	$ 407,340	$ 76,432	$ -	$ -
Principal Repayments	$ (38,603)	$ (40,533)	$ (42,560)	$ (44,688)	$ (46,922)	$ (49,268)	$ (51,732)	$ (54,318)	$ (57,034)	$ (59,886)	$ (76,432)	$ -	$ -
Interest Payments	$ (41,650)	$ (39,720)	$ (37,693)	$ (35,565)	$ (33,331)	$ (30,985)	$ (28,521)	$ (25,935)	$ (23,219)	$ (20,367)	$ (3,822)	$ -	$ -
Ending Principal Balance	$ 794,397	$ 753,864	$ 711,304	$ 666,616	$ 619,693	$ 570,425	$ 518,693	$ 464,375	$ 407,340	$ 347,454	$ 0	$ -	$ -
TOTAL DEBT PAYMENT	**$ 80,253**	**$ 80,253**	**$ 80,253**	**$ 80,253**	**$ 80,253**	**$ 80,253**	**$ 80,253**	**$ 80,253**	**$ 80,253**	**$ 80,253**	**$ 80,253**	**$ -**	**$ -**
ANNUAL OPERATING COST SAVINGS (LOSS)	**$ (79,271)**	**$ 226,532**	**$ 32,642**	**$ 39,073**	**$ 45,842**	**$ 52,967**	**$ 60,465**	**$ 68,356**	**$ 76,659**	**$ 85,396**	**$ 136,399**	**$ 282,325**	**$ 475,306**
Cash Investment (equity)	$ (357,000)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Income (cost savings)	$ (79,271)	$ 226,532	$ 32,642	$ 39,073	$ 45,842	$ 52,967	$ 60,465	$ 68,356	$ 76,659	$ 85,396	$ 136,399	$ 282,325	$ 475,306
Net Cash Flow	**$ (436,271)**	**$ 226,532**	**$ 32,642**	**$ 39,073**	**$ 45,842**	**$ 52,967**	**$ 60,465**	**$ 68,356**	**$ 76,659**	**$ 85,396**	**$ 136,399**	**$ 282,325**	**$ 475,306**
ACCUMULATED CASH FLOW	$ (436,271)	$ (209,738)	$ (177,097)	$ (138,024)	$ (92,182)	$ (39,215)	$ 21,250	$ 89,605	$ 166,264	$ 251,660	$ 826,482	$ 2,100,143	$ 5,905,332

Net Present Value (NPV)

NPV Discount Rate	5.0%	10 YR NPV	15 YR NPV	20 YR NPV	30 YR NPV
		$ 116,839	$ 419,700	$ 947,464	$ 2,031,966