

Biomass Energy for Quincy Junior-Senior High School

Quincy, CA

August 2016

Prepared for:



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Biomass Energy for Quincy Junior-Senior High School – Quincy, CA

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1 Project Background

The Sierra Institute for Community and Environment (Sierra Institute), in partnership with High Sierra Community Energy Development Corporation, Inc. (High Sierra), a subsidiary of Wisewood, Inc., successfully applied for funding from the US Department of Agriculture – Forest Service’s Wood Innovations Funding Opportunity grant program in January 2015. The purpose of the grant funding was to further expand the study and development of biomass-fired energy systems in Plumas County, CA. A portion of the funds were dedicated to exploring the feasibility of utilizing biomass fuels at the Quincy Junior-Senior High School campus in Quincy, CA.

Quincy Junior-Senior High is the anchor school in the Plumas Unified School District. Roughly three hundred students currently attend the high school (grades 7-12), out of eighteen hundred students District-wide. The campus is located at 6 Quincy Junction Road in Quincy, California, and is comprised of eight buildings (not including the boiler building) with a total of approximately 100,000 square feet. This study discusses heating options for the entire Quincy Junior-Senior High campus.

2 Existing and Proposed Systems

2.1 Existing System

The Quincy Junior-Senior High School campus is currently heated with two hot water oil-fired boilers (one Cyclotherm 2.51 MMBtu and one Williams and Davis 6.26 MMBtu), which appear to be converted oil-fired steam boilers. The boilers were built in 1949 and 1976, respectively; they are the oldest boilers in the District and are a top priority for replacement among Facilities staff. An approximately 10,000-gallon heating oil tank serves the two boilers.

The campus is heated via three hot water loops served from the mechanical room located in the center of the campus. An approximately 1,000-gallon indirect-fired domestic hot water tank ensures hot water is available on demand. Heat is distributed to rooms by hot water radiators and ceiling-mounted unit heaters. Manual thermostats are used to control each room individually.

2.2 Proposed System

The proposed biomass boiler system for Quincy High School's campus includes the replacement of one existing oil-fired boiler with three small biomass-fired boilers that would operate in parallel to provide a wide range of heat output while maintaining very high efficiency. The second existing oil-fired boiler would be replaced with a propane-fired boiler to act as a backup to the biomass system and assist during peak heat demand.

Although there is an existing silo adjacent to the boiler building, it has not been used for over two decades and has fallen into disrepair. A new silo would be installed in its place to store processed wood chips (or pellets) and would feed the new biomass boiler system. A propane tank would replace the existing oil tank on the far side of the silo.

By utilizing three smaller biomass boilers instead of one larger system, High Sierra expects that the existing boiler building can be retained, rather than requiring new construction. Some modifications would need to be made to the building, which are included in the cost estimate provided below.

3 Energy Model

High Sierra's energy model uses key data inputs such as the existing annual heating energy consumption, an estimate of the efficiency of existing heating sources, and local historical weather data to calculate the heating demand for a given building. The model is used to calculate the optimum biomass boiler size, which is defined as the boiler system that offsets the maximum fossil fuel consumption.

3.1 Heat Demand

To predict the heating load for the proposed system, Plumas Unified School District staff provided High Sierra with billing records of the oil consumption for the entire campus for the period between July 2013–May 2014, November 2014–March 2015, and July 2015–April 2016. The facility consumed an average of 26,273 gallons of heating oil per heating season (September–August) and 893 kWh of electricity (for boiler and controls power only, “ancillary use”). This is equivalent to approximately 3,652 MMBtu per year in energy consumption.

3.2 Boiler Size

High Sierra's preliminary energy model calculated an ideal biomass boiler capacity of 1,535 MBH (450 kW), which would provide 95.9% of heating needs. This is the “optimized” biomass boiler capacity, meaning that the boiler system is intentionally sized to meet less than 100% of heating demand. In the case of Quincy High School, the biomass boiler system would actually be made up of three smaller biomass boilers, each 500 MBH (150 kW). This configuration provides the maximum savings over the life of the system by allowing the three-boiler system to run most efficiently for the highest number of operating hours.

A new secondary 2,500 MBH propane-fired boiler will provide the remaining 4.1% of heating needs, typically during peak periods when the biomass boilers are unable to meet 100% of heat demand. In biomass systems that rely on only one larger boiler, the backup fossil fuel boiler has to supply heat for low heating demands as well, such as during shoulder seasons; in this case, because each biomass boiler is smaller, the biomass system will be able to cover periodic low heating demands, an advantage over a single larger system. The propane-fired backup boiler will also provide full redundancy during planned maintenance on the biomass boilers. The cost of decommissioning the oil tank and both old oil-fired boilers, as well as installing a new propane boiler and tank, is included in the cost estimate.

3.3 Fuel Consumption

The selected biomass system would consume “select” wood chips – that is, wood chips that have been partially dried and screened for consistent size. Based on the preliminary energy model, three 500-MBH biomass boilers will consume approximately 243 green tons (20% moisture content) of wood chips per year. This is equivalent to 188 bone dry tons (0% moisture content). The trim propane consumption is calculated to be 1,431 gallons per year. By using woody biomass as the primary fuel, Quincy Junior-Senior High reduce fossil fuel consumption by more than 96%.

High Sierra’s complete energy model for the Quincy Junior-Senior High School campus is included in Appendix A. A representative sample of facility photos are included in Appendix B.

4 Biomass Fuel Supply Assessment

4.1 Fuel Quality

Modern, computer-controlled biomass-fired boilers are available for all levels of thermal outputs, from small-scale systems sized for individual residences to large-scale systems capable of heating entire cities. While all of these systems are able to sustain clean wood combustion by utilizing automatic controls and continuous emissions monitoring, their respective fuel quality requirements are largely dictated by the size of the system. In general, the smaller the system, the narrower the requirements for fuel quality; the larger the system, the broader the fuel types it is able to handle.

The wood fuel quality spectrum is defined by particle size, moisture content, and ash content, and has traditionally been bordered on the high end by premium wood pellets suitable for burning in small pellet boilers and stoves, and on the low end by “hog fuel,” a lightly processed fuel material typically comprised of bark, tops, and limbs from forest activities and other non-marketable woody biomass. To produce hog fuel, pre-commercial woody material generated during forest management activities is chipped or ground up, resulting in a range of particle size, moisture content, and ash content. In contrast, “select” wood chips have been processed to control for particle size and moisture content, and lie on the fuel spectrum between pellets and hog fuel.

High Sierra recommends a boiler system that would utilize select wood chip fuel with a moisture content of not more than 35% (wet basis) and with a particle size of not more than 2”. This system could also be fueled with wood pellets, with some minor modifications made to the fuel infeed system and adjustment to boiler controls. Efforts are currently underway in Plumas County to establish a local grinding and screening operation that would be capable of providing select wood chips for biomass systems such as the one High Sierra recommends for the Quincy Junior-Senior High School. This and other fuel providers would be fully assessed during the next stage of design and engineering.

4.2 Fuel Storage

The proposed biomass boiler system would utilize the existing boiler building, with a new silo to store wood chips in place of the existing silo adjacent to the boiler building. Silos are an economical choice when the fuel source is select wood chips or pellets. They can hold a significant amount of fuel in a compact footprint. The cost estimate for this feasibility study is based on a wood chip silo holding approximately 15 tons of select wood chips, or 35 tons of pellets.

An alternative storage solution is a set of fuel bins. Fuel bins are modified shipping containers or trash hauling bins that are typically transported by roll-off or hook-lift style delivery trucks; the bins would be mounted next to the boiler and feed directly into the fuel conveyance system. Two bins are generally recommended so that one can be swapped out quickly while the other continues to feed the boiler system. Should other biomass boiler systems in the area utilize fuel bins, this could be a reasonable fuel storage solution for Quincy High School. Although the bins hold less than a single silo can, frequent deliveries to other users could make fuel deliveries to the school more economical.

A new, smaller propane tank would replace the existing heating oil tank (estimated at 10,000-gallon capacity) to serve the new propane backup boiler.

4.3 Flue Gas Treatment

Most modern biomass boiler systems feature combustion technology that employs feedback from oxygen and/or temperature sensors in the flue gas stream to optimize the air-to-fuel ratio in the firebox resulting in optimum combustion characteristics, even with varying fuel quality. Due to this combustion control system, a biomass boiler of the size recommended for Quincy Junior-Senior High is not required to have additional flue gas treatment.

5 Project Economics

5.1 Capital Costs

High Sierra estimates the cost of the biomass energy system described in the previous sections to be \$1,530,000. This preliminary number includes full system engineering, procurement, and construction management, as well as 20% contingency on equipment and labor costs. Summaries of total project costs are provided in Appendix C.

More detailed costs of retrofitting Quincy High School will not be known until detailed engineering has been completed and bids from subcontractors have been received.

5.2 Operating Costs

High Sierra compared the existing costs of operating a fossil fuel (oil) system to heat Quincy Junior-Senior High for one year with the proposed biomass energy system. These costs include fuel, labor, and maintenance, and show a stark contrast between the yearly operating costs of fueling with oil versus wood. Assuming a cost of \$80/ton for wood chips, in Year 1 of operations the biomass system could save over \$40,000 from current expenditures.

A full Stabilized Year is included in Appendix D and is summarized in Table 1 below.

Table 1 Stabilized Year 1 operating cost comparison between existing and biomass heating systems (rounded to the nearest \$100)

Existing Heating Systems		Biomass Energy Costs	
Propane	\$68,000	Wood Fuel	\$19,400
Electricity	\$700	Electricity	\$2,100
Operations & Maintenance	\$2,000	Trim Fuel - Propane	\$2,200
		Operations & Maintenance	\$6,800
Total	\$70,700	Total	\$30,500

5.3 Lifetime Costs

The operating costs shown in Table 1 above are representative of Year 1 of operations, after which costs would escalate. High Sierra used an escalator of 4% for propane fuel, which is commensurate with long term increases in the fossil fuel market. Electricity, wood fuel, and labor costs were modeled with a 2% escalator. The effects of these escalators can be seen in the 25-year lifetime economic pro forma included in Appendix E. A snapshot comparison is shown in Table 2 below,

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where operating costs of the existing oil system increase by 150% over 25 years, while the already lower biomass operating costs increase by only about 65%, resulting in potential cost savings over the life of the system of over \$1.9 million.

Table 2 Summary comparison of lifetime costs between existing and biomass heating systems (rounded to the nearest \$100)

	Year 1 Cost	Year 25 Cost	Cumulative Operating Cost (25 years)
Propane System	\$70,700	\$178,700	\$2,919,600
Biomass System	\$30,500	\$51,100	\$998,300
Biomass System Savings	\$40,200	\$127,600	\$1,921,400

5.4 Simple Payback

Simple payback, which does not take into account price escalators over the life of the system, is often used to justify the economic viability of capital improvement projects when the capital outlay will result in an operational savings. When the capital expense (\$1,530,000) is divided by the estimated Year 1 savings (\$40,200), the result is a simple payback of approximately 38 years.

The two oil-fired boilers at Quincy Junior-Senior High School are slated to be replaced with a modern heating system as soon as funding is identified. Portola High School made a comparable switch from two old oil boilers to three new propane boilers for approximately \$800,000, including additional renovations to the mechanical room. By avoiding the need to replace both boilers with new fossil fuel systems and incorporating a single new propane boiler into the proposed biomass system, this \$800,000 estimate becomes an avoided cost, making the simple payback closer to 18 years.

There are several funding opportunities available that may reduce the capital costs of the project. These include grants, low-interest loans, and tax credit programs available through various state and federal agencies.

6 Next Steps and Conclusion

6.1 Identify Project Funding

Construction-ready engineering for this project is estimated to cost approximately \$165,000, including mechanical, structural, electrical, and architectural. This budget would encompass the new biomass system and its propane backup boiler.

There are various funding options available at the State and Federal level to assist with the costs of both project design and construction funding, often for up to 50-80% of total costs (with the remaining 20-50% of costs coming from the grantee in the form of matching funds and/or in-kind time). These competitive processes are an excellent opportunity for facilities to leverage limited internal funds and take advantage of alternative energy incentive programs. Current funding sources that may have available funds for projects of this type include the USDA-Forest Service, the California Energy Commission, and the Sierra Nevada Conservancy.

6.2 Detailed Design and Engineering

Detailed design and engineering will include work from all the major design disciplines. Mechanical engineering will include: detailed boiler equipment specifications; detailed boiler building layout; fuel feed system selection and integration with boiler system controls; detailed design of hydronic circuits with equipment specifications; detailed design of hydronic interconnection with existing building HVAC systems; and control strategy design and equipment specifications.

In addition to power and control wiring of mechanical equipment, an electrical engineer will address controls and monitoring. A structural engineer will address the modifications needed on the existing boiler building to accommodate the proposed biomass system, as well as the foundation needs for a new fuel silo.

A more detailed cost estimate will be generated during the design and engineering phase, which will refine system needs and determine specific interconnection requirements with each hot water loop.

A switch to biomass may represent an ideal time for the school district to consider upgrading additional aspects of the mechanical and heat distribution systems at the school. During the upgrade to biomass energy, it would make sense to also consider upgrading the controls system to further improve occupant comfort and energy efficiency. While a complete analysis of the controls system is beyond the scope of this study, such an effort could be undertaken during detailed design and the recommendations made during that process could be implemented in tandem with the upgrade to biomass heat.

6.3 Conclusion

The existing oil-fired boilers at Quincy Junior-Senior High School are the oldest in the School District, and are due to be replaced as soon as funding is available. In addition to this impending expense, estimated at \$800,000 based on a similar project at the Portola High School, the campus has high enough heating costs to make conversion to a biomass-fired heating system feasible and attractive compared to likely fossil fuel alternatives. Such a biomass system would create a market for locally produced woody material that supports efforts to improve forest health in the surrounding landscape, rather than relying on imported fossil fuels while exporting community dollars.

Given the operational savings expected from implementation of a biomass system, this project warrants further investigation and design to fully understand the school's interconnection requirements. The funding mechanisms discussed above for both engineering and construction may provide enough assistance to convert the school campus to biomass in the near future, which would further support the regional push toward utilization of a local, abundant natural resource to meet the heating needs of this critical institution.

High Sierra recommends that the Plumas Unified School District strongly consider applying for funding through the USDA – Forest Service's Wood Innovations Funding Opportunity, typically announced in October each year and due the following January. Traditionally, this grant program has funded the full design and engineering of biomass projects so they are construction-ready, and it provides an excellent opportunity for school districts to leverage their dollars by providing a relatively small match (either cash and/or in-kind time) to unlock federal funds. High Sierra has worked with several organizations to successfully apply to the Wood Innovations Funding Opportunity in the past, and is available to assist the Plumas Unified School District in assembling an application this year.

Appendix A

Energy Model

Quincy High School

Proposed System Analysis



Location Quincy, CA
Client Contact Lisa Cavin
Date 8/17/16

Proposed System Biomass Boiler Installation
Proposed System Output (MBH) 1,535
Proposed System Fuel Type Wood Chips

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

Fuel Prices		Conversion Factors		Current System Consumption		
Heating oil cost (\$/gal)	\$2.59	Energy of heating oil [Btu/gal]	139,000	Heating oil use [gal/yr]	26,273	
Propane cost (\$/gal)	\$1.51	Energy of propane [Btu/gal]	92,000	Heating oil cost (\$/yr)	\$60,290	
Electricity demand cost (\$/kW)	\$16.92	Energy per kWh [Btu/kWh]	3,412	Propane use [gal/yr]	0	
Electricity cost (\$/kWh)	\$0.12	Moisture of biomass [% MC WB]	20%	Propane cost (\$/yr)	\$0	
Biomass fuel cost (\$/ton)	\$80.00	Energy of bone dry wood [Btu/ton]	16,400,000	Heating electricity use [kWh/yr]	0	
		Energy of actual biomass [Btu/ton]	12,731,840	Heating electricity cost (\$/yr)	\$0	
				Total energy input [MMBtu/yr]	3,652	
Current System Values						
Boiler efficiency	75%	Heating device nameplate, [MBH]	8,755	Operating hours per day	10	
Max. electrical demand [kW]	2.66	Boiler output, low-fire [MBH]	876	Energy consumption [MMBtu/HHD]	0.54	
Average electrical demand [kW]	0.24	Average boiler output [MBH]	778	Existing heat input [MMBtu/HHD]	0.41	
Proposed Biomass Boiler Specifications		Proposed Trim Boiler Specifications		Proposed System Values		
Fuel type	Wood Chips	Fuel type	Propane	Total load carried by wood, as %	95.9%	
Boiler output, high-fire [MBH]	1,535	Boiler output, high-fire [MBH]	2,500	Operating hours per year	3,038	
Boiler output, low-fire* [MBH]	192	Boiler output, low-fire [MBH]	313	Biomass boiler output [% of peak]	68%	
Max. electrical demand [kW]	4.5	Max. electrical demand [kW]	1.5			
Average electrical demand [kW]	2.3	Average electrical demand [kW]	0.19			
Boiler efficiency	85%	Boiler efficiency	85%			
Proposed Biomass Boiler Consumption and Cost		Proposed Trim Boiler Consumption and Cost		Proposed Totals		
Wood fuel consumption [tons/yr]	243	Propane consumption [gals/yr]	1,431	Total fuel consumption [MMBtu/yr]	3,222	
Wood fuel cost (\$/yr)	\$19,420	Propane cost (\$/yr)	\$2,161	Total fuel cost (\$/yr)	\$21,581	
Electrical consumption [kWh/yr]	6,928	Electrical consumption [kWh/yr]	570	Total electrical consumption [kWh/yr]	7,497	
Electrical energy cost (\$/yr)	\$831	Electrical use charge (\$/yr)	\$68	Total electrical use charge (\$/yr)	\$900	
Electrical demand charge (\$/yr)	\$914	Electrical demand charge (\$/yr)	\$305	Total electrical demand charge (\$/yr)	\$1,218	
Month	Heating Degree Days [HDD]	Current gross fossil energy consumption [MMBtu]	Current net space heat energy input [MMBtu]	Projected biomass boiler gross energy consumption [MMBtu]	Projected trim boiler energy consumption [MMBtu]	Projected wood fuel use [tons]
September	267	145	109	123	5	9.7
October	612	333	250	282	12	22.2
November	799	435	326	368	16	28.9
December	1,213	661	496	559	24	43.9
January	993	541	406	458	20	36.0
February	754	411	308	348	15	27.3
March	720	392	294	332	14	26.1
April	547	298	224	252	11	19.8
May	324	176	132	149	6	11.7
June	227	124	93	105	4	8.2
July	99	54	40	46	2	3.6
August	149	81	61	69	3	5.4
Yearly Total	6,704	3,652	2,739	3,091	132	243

* Low-fire output includes the use of a 1,000-gallon thermal storage to increase effective boiler turndown

Net fossil energy savings [MMBtu/yr] 3,520

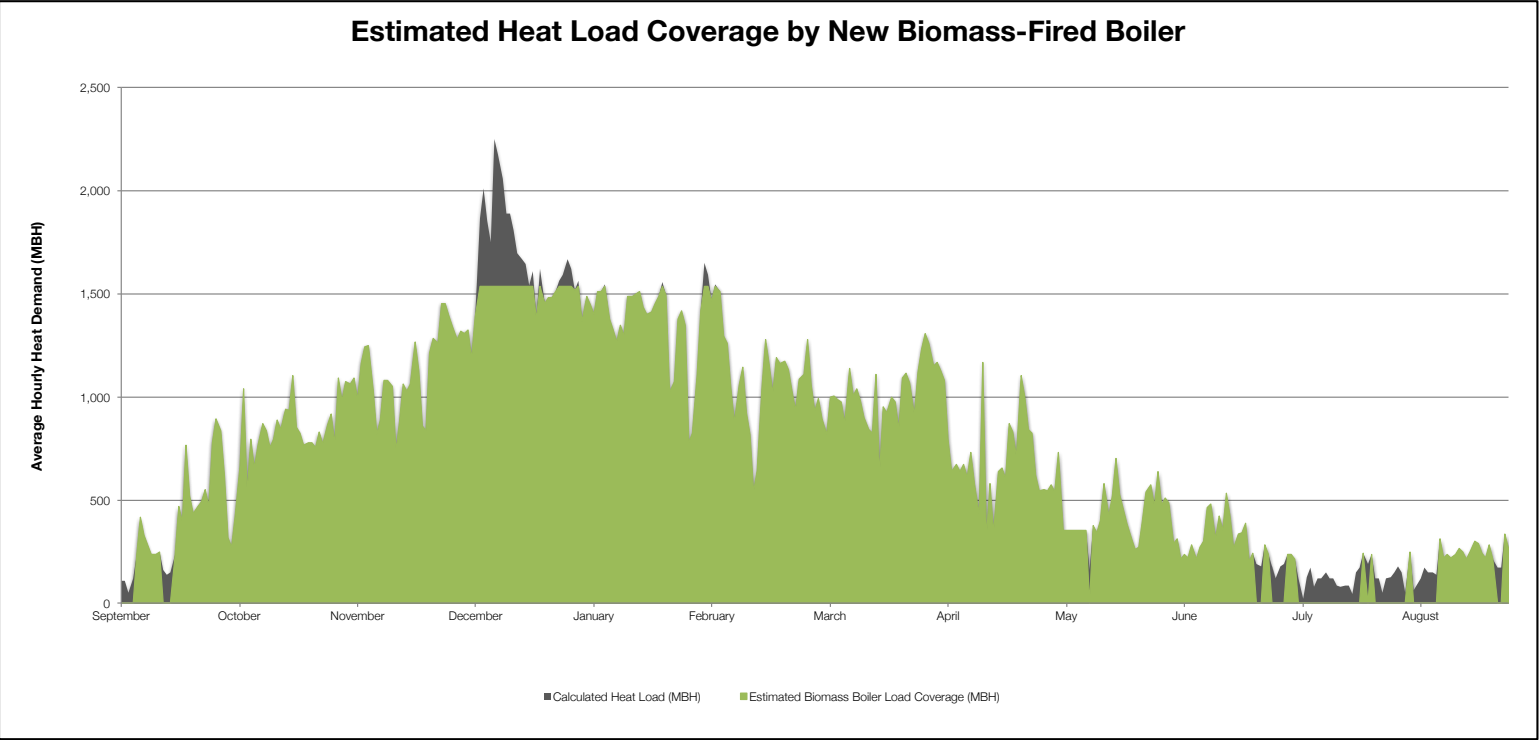
Quincy High School

Proposed System Analysis

Location Quincy, CA
Client Contact Lisa Cavin
Date 8/17/16

Proposed System Biomass Boiler Installation
Proposed System Output (MBH) 1,535
Proposed System Fuel Type Wood Chips

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



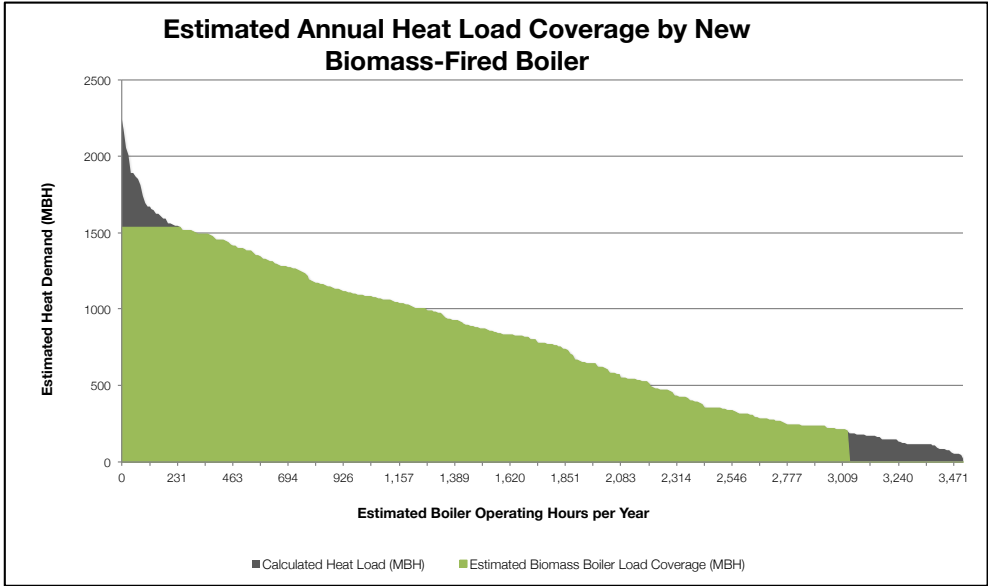
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Boiler Output [MBH]	Fossil Fuel Displaced
100	12.7%
200	24.4%
300	34.7%
400	43.8%
500	52.1%
600	59.8%
700	66.7%
800	73.3%
900	79.0%
1,000	83.5%
1,100	87.4%
1,200	90.2%
1,300	92.7%
1,400	94.5%
1,500	95.7%
1,600	96.4%
1,700	96.4%
1,800	96.5%
1,900	95.8%
2,000	95.3%
2,100	95.3%
2,200	94.8%
2,300	94.5%
2,400	94.3%
2,500	94.0%

Appendix B

Site and Facility Photos



Photo 1 The Quincy High School campus has eight buildings, not including the boiler building, which is shown in red with the existing silo and oil tank



Photo 2 Existing boiler building (silo and oil tank to right)



Photo 3 Existing silo and oil tank (boiler building to left)



Photo 4 Existing boilers: 1976 Williams & Davis (left) and 1949 Cyclotherm (right)



Photo 5 Cyclotherm boiler nameplate

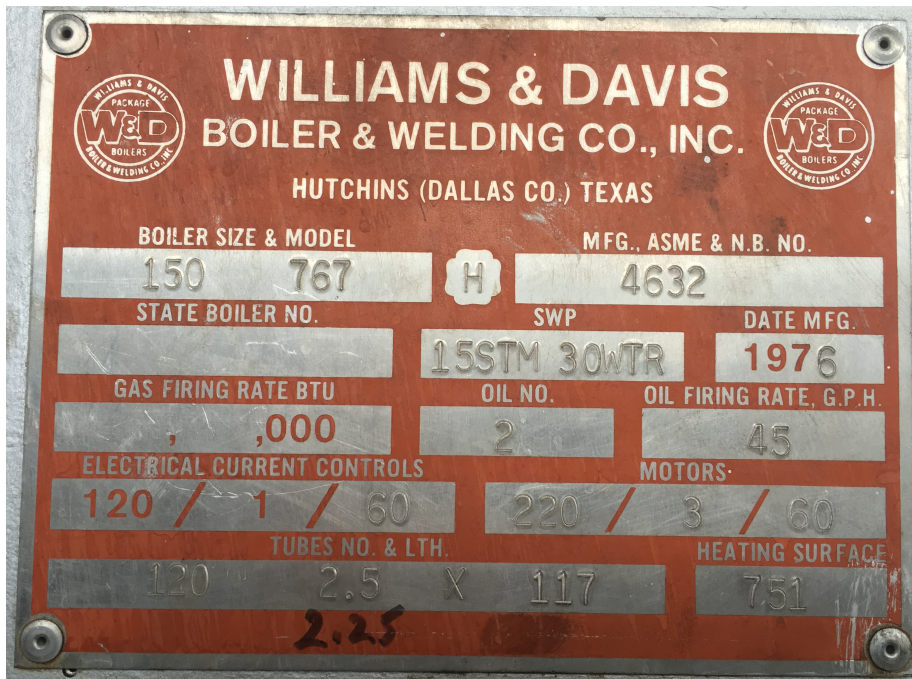


Photo 6 Williams & Davis boiler nameplate



Photo 7 Existing hot water buffer tank



Photo 8 Existing 10,000-gallon heating oil tank



Photo 9 Existing silo that would be replaced

Appendix C

Summary Capital Cost Estimate

Quincy High School

Proposed Boiler Cost Summary



Location Quincy, CA
Client Contact Lisa Cavin
Date 8/17/16

Proposed System Biomass Boiler Installation
Proposed System Output (MBH) 1,535
Proposed System Fuel Type Wood Chips

Contact Andrew Haden
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Item Description	Est. Hours	Install Equipment	Install Materials	Install Labor	Line Total	% Total Project
Construction Costs						
Civil/Structural	40	\$ -	\$ 4,000	\$ 5,000	\$ 114,000	7.4%
Mechanical Installation	1,480	\$ 2,000	\$ 360,000	\$ 224,000	\$ 587,000	38.3%
Electrical	320	\$ -	\$ 20,000	\$ 40,000	\$ 60,000	3.9%
Permitting					\$ 4,000	0.3%
Miscellaneous					\$ 30,000	2.0%
Contingency and Unlisted Items					\$ 238,000	15.6%
Subtotal Direct Costs	1,840	\$ 2,000	\$ 384,000	\$ 269,000	\$ 1,032,000	67.5%
General Contractor Costs					\$ 206,000	81.0%
Subtotal Construction Costs					\$ 1,239,000	81.0%
Engineering, Procurement and Construction Management Costs						
Engineering, Procurement and Construction Mgmt.					\$ 291,000	19.0%
Subtotal Development Costs					\$ 291,000	19.0%
Total Project Costs					\$ 1,530,000	100%

Labor Rates	\$/Hour
Mechanical contractor	\$ 125
Electrician	\$ 125
Engineering and Project Management	\$ 150
Finance and Accounting	\$ 200

Appendix D

Stabilized Year Operating Costs

Quincy High School

Stabilized Year



Location Quincy, CA
Client Contact Lisa Cavin
Date 8/17/16

Proposed System Biomass Boiler Installation
Proposed System Output (MBH) 1,535
Proposed System Fuel Type Wood Chips

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Item	Total
Existing Fossil Fuel Heating System Operating Cost	
Heating Oil Fuel	
Current heating oil consumption	26,273 gallons/year
Current heating oil cost	\$ 2.59 per gallon
Subtotal:	\$ 68,039
Electricity	
Current ancillary electrical use	833 kWh per year
Current ancillary electrical demand	2.66152 kW
Electricity cost	\$ 0.12 per kWh
Electrical demand cost	\$ 16.92 per kW
Subtotal:	\$ 688
Maintenance	
Maintenance labor	\$ 1,000 per year
Maintenance parts	\$ 1,000 per year
Subtotal:	\$ 2,000
Existing Boiler Cost, Total	\$ 70,727
Proposed Biomass Energy System Operating and Maintenance Cost	
Wood Fuel	
Wood use	243 tons per year
Wood fuel cost	\$ 80 per ton
Subtotal:	\$ 19,420
Electricity to Run Boiler	
Total electrical consumption	7,497 kWh
Total electrical use charge	\$ 900 per year
Total electrical demand charge	\$ 1,218 per year
Subtotal:	\$ 2,118
Trim Fuel - Propane	
Propane use (peak and low load)	1,431 gallons
Propane cost	\$ 1.51 per gallon
Subtotal:	\$ 2,161
New Biomass System Fuel Cost, Total	\$ 23,699

Ash Disposal			
Ash container removal		12 intervals	
Labor for ash container removal	\$	75 per interval	
Ash disposal fee	\$	30 per interval	
Subtotal:			\$ 1,260
Weekly Maintenance			
Weekly boiler checklist		40 weeks	
Labor cost	\$	50 per week	
Subtotal:			\$ 2,000
Monthly Maintenance			
Monthly boiler checklist		12 months	
Labor cost	\$	50 per month	
Boiler water treatment	\$	50 per month	
Subtotal:			\$ 1,200
Remote Monitoring			
Remote monitoring		12 months per year	
Static IP and Internet connection	\$	60 per month	
Subtotal:			\$ 720
Wood Fuel Handling & Delivery			
Handling and transportation		243 tons per year	
Tons per delivery container		20 tons per load	
Fuel deliveries needed		12 loads per year	
Cost to load container	\$	45 per load	
Delivery segments (one way trip)		2 per delivery	
Total delivery segments		24 segments	
Transportation cost	\$	45 per segment	
Subtotal:			\$ 1,639
New Biomass System Cost, Total			\$ 30,517

*The Stabilized Year budget shown above does not account for any possible cost of personnel to manage fuel procurement.

Appendix E

25-Year Economic Pro Forma

Quincy High School

25-Year Operating Pro Forma



Location Quincy, CA
Client Contact Lisa Cavin
Date 8/17/16

Proposed System Biomass Boiler Installation
Proposed System Output (MBH) 1,535
Proposed System Fuel Type Wood Chips

*Fossil Fuel Escalator 4.0%
**Wood/Electricity/Labor Escalator 2.0%

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	Year														
	1	2	3	4	5	6	7	8	9	10			15	20	25
Existing Heating System Operating Costs															
Existing Fuel Cost															
Existing Fossil Fuel Cost*	\$ 68,039	\$ 70,760	\$ 73,591	\$ 76,534	\$ 79,596	\$ 82,780	\$ 86,091	\$ 89,534	\$ 93,116	\$ 96,840	\$ 117,821	\$ 143,347	\$ 174,404		
Existing Electricity Cost**	\$ 688	\$ 702	\$ 716	\$ 730	\$ 745	\$ 760	\$ 775	\$ 791	\$ 807	\$ 823	\$ 908	\$ 1,003	\$ 1,107		
Operations and Maintenance															
Operations & Maintenance Cost**	\$ 2,000	\$ 2,040	\$ 2,081	\$ 2,122	\$ 2,165	\$ 2,208	\$ 2,252	\$ 2,297	\$ 2,343	\$ 2,390	\$ 2,639	\$ 2,914	\$ 3,217		
Estimated Oil Boiler Replacement Cost															
Estimated Oil Boiler Replacement Cost	\$ 800,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Total Existing Heating Costs	\$ 870,727	\$ 73,502	\$ 76,388	\$ 79,387	\$ 82,506	\$ 85,748	\$ 89,118	\$ 92,622	\$ 96,266	\$ 100,053	\$ 121,368	\$ 147,264	\$ 178,728		
Proposed Heating System Operating Costs															
Proposed Fuel Cost															
Trim Fuel*	\$ 2,161	\$ 2,247	\$ 2,337	\$ 2,430	\$ 2,528	\$ 2,629	\$ 2,734	\$ 2,843	\$ 2,957	\$ 3,075	\$ 3,742	\$ 4,552	\$ 5,538		
Wood Fuel**	\$ 19,420	\$ 19,809	\$ 20,205	\$ 20,609	\$ 21,021	\$ 21,442	\$ 21,870	\$ 22,308	\$ 22,754	\$ 23,209	\$ 25,625	\$ 28,292	\$ 31,236		
Electricity (Ancillary)**	\$ 2,118	\$ 2,160	\$ 2,203	\$ 2,248	\$ 2,293	\$ 2,338	\$ 2,385	\$ 2,433	\$ 2,481	\$ 2,531	\$ 2,795	\$ 3,085	\$ 3,407		
Subtotal Fuel Costs	\$ 23,699	\$ 24,216	\$ 24,745	\$ 25,287	\$ 25,841	\$ 26,409	\$ 26,989	\$ 27,584	\$ 28,192	\$ 28,815	\$ 32,161	\$ 35,929	\$ 40,181		
Operations and Maintenance															
Parts and Labor**	\$ 6,819	\$ 6,955	\$ 7,094	\$ 7,236	\$ 7,381	\$ 7,528	\$ 7,679	\$ 7,832	\$ 7,989	\$ 8,149	\$ 8,997	\$ 9,933	\$ 10,967		
Subtotal O&M Costs	\$ 6,819	\$ 6,955	\$ 7,094	\$ 7,236	\$ 7,381	\$ 7,528	\$ 7,679	\$ 7,832	\$ 7,989	\$ 8,149	\$ 8,997	\$ 9,933	\$ 10,967		
Total Proposed Heating Costs	\$ 30,517	\$ 31,171	\$ 31,839	\$ 32,523	\$ 33,222	\$ 33,937	\$ 34,668	\$ 35,416	\$ 36,181	\$ 36,964	\$ 41,158	\$ 45,863	\$ 51,148		
Biomass Energy Savings	\$ 840,210	\$ 42,331	\$ 44,548	\$ 46,864	\$ 49,284	\$ 51,811	\$ 54,450	\$ 57,206	\$ 60,084	\$ 63,089	\$ 80,211	\$ 101,401	\$ 127,580		
Cumulative Cash Savings	\$ 840,210	\$ 882,541	\$ 927,090	\$ 973,954	\$ 1,023,238	\$ 1,075,049	\$ 1,129,499	\$ 1,186,705	\$ 1,246,789	\$ 1,309,878	\$ 1,675,222	\$ 2,138,050	\$ 2,721,389		