Feasibility of Biomass District Energy for Portola, California

Portola, CA

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1 Portola District Energy Overview

1.1 Project History

The idea of utilizing woody biomass to provide thermal heating to facilities in Portola was conceived at the Sierra Institute for Community and Environment (Sierra Institute). The Sierra Institute has been working in Plumas County for almost 20 years to promote a healthy local environment and rural economy by encouraging active participation in natural resource decisions and programs.

To that end, the Sierra Institute applied for and received grant funds from the California Energy Commission (CEC) to create the Plumas Energy Efficiency & Renewable Management Action Plan (PEERMAP). One of the PEERMAP objectives is to create a local biomass network consisting of multiple biomass users (facilities that will adopt biomass as a source of thermal energy) and a plan for a central biomass supply chain utilizing woody renewables from local forest restoration projects.

The Sierra Institute engaged Wisewood, Inc. to conduct several feasibility studies for facilities within Plumas County. To date, these have included Eastern Plumas Health Care (EPHC) and Portola High School (PHS) in Portola, CA; the US Forest Service Supervisor's Office in Quincy, CA; and the US Forest Service's Mt. Hough Ranger District outside of Quincy.

The feasibility studies for both EPHC and PHS reported favorable conditions for utilizing biomass to heat the facilities. Each has a large heating load, ample space for the installation/integration of a biomass system, and an immediate need for system improvements.

Due to their close proximity to each other, this report focuses on the potential for a district energy system that would provide thermal energy to multiple customers in Portola: Eastern Plumas Health Care, Portola High School, and the School District's empty (but still maintained) former Elementary School.

1.2 District Energy Overview

District energy systems can include electricity production, but are more often designed for the local production and distribution of thermal energy. It is a highly efficient means of providing locally generated thermal energy for heating and cooling. District energy systems have two main elements:

1. A central energy plant containing equipment that produces thermal energy in the form of steam or hot water for heating, or chilled water for cooling.

The central plant may also incorporate combined heat and power (CHP) units that produce both electricity and thermal energy.

2. A network of insulated pipes to distribute the thermal energy from the central plant to the facilities.[1]

1.3 The Opportunity

The candidates for biomass conversion in Portola present an opportunity to achieve certain economies of scale by combining the heat loads for both facilities into a single heat production facility. Each facility has proven to be an excellent candidate for biomass, as shown in the feasibility studies previously conducted. By combining their heating needs, a single system could serve both institutions and may create a more efficient and cost-effective system than would be possible with two independent systems.

Many options are available when designing a district heating system. The system can have one owner or many; be located centrally or closer to one entity or another; and have a larger range of appropriate boiler technologies available to choose from. In the case of Portola, administrators at each institution have indicated their desire to simply purchase heat from the plant operator, rather than own and operate it themselves.

The desire for a third party to build, own, and operate the proposed facility presents both opportunities and challenges. An independent third party owner and operator can provide professional management of the system, including financing, fuel procurement agreements, and routine maintenance. This would relieve both EPHC and PHS from any responsibility to maintain the system on a daily basis, further stabilizing their budgets.

At the proposed size of this system, a steady fuel supply should be relatively straightforward to procure, as it will be of a scale conducive to acquiring competitive pricing on the open market, but small enough that it can easily switch from one supplier to another without large disruptions in fuel supply. One challenge may be finding an owner/operator and appropriate funding.

A centrally located district heating plant would also require each facility to maintain only a relatively small-footprint heat exchanger substation assembly on-site, as opposed to a new biomass boiler. Although the boiler and fuel will need a moderate amount of space, both EPHC and PHS will only need to accommodate the hot water supply and return lines at their facilities, as well as some minor electrical control wiring. While EPHC will need to make some internal heat distribution

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[1] *Community Energy: Planning, Development, and Delivery*. International District Energy Association. Michael King. 2012.

conversions (from low pressure steam to hot water) within its building, PHS already uses a hydronic (water-based) heating system that can be directly connected to the proposed biomass system.

Finally, district energy may present a unique opportunity to find funding that may not be otherwise available. After many years of unsustainable fire management practices across the United States, the US Department of Agriculture - Forest Service and other regional environmental groups are providing new and increasing levels of funds to address forest restoration needs. As part of and in conjunction with these initiatives, a number of State-level and private funding sources are increasingly interested in projects focused on innovations that use woody renewable energy sources and that contribute to community and environmental health.

While municipal district energy systems are commonplace across Europe, they are still relatively uncommon in the US. A district energy initiative could provide Portola with a platform from which to seek both public and private funding, as well as attract national attention as a leader in alternative energy strategies.

2 Buildings served

The proposed district energy system to be located in Portola would serve two primary anchor tenants: Eastern Plumas Health Care and Portola High School. The two facilities are approximately a quarter mile apart from each other, across S Gulling Street (see Figure 1, Section 3.5).

Additional public facilities along S Gulling Street in Portola could be considered as future customers, should their heating bills make the cost of connection economically viable. These facilities include the Post Office, City Hall, Library, Courthouse, and pool, and will be discussed only briefly here, as they are not anchor loads and do not currently have heating bills sufficient to support interconnection, a determination primarily based on the estimated cost of installing buried supply and return piping. If the City of Portola can utilize existing Public Works equipment and crews for construction, this determination could change.

2.1 Eastern Plumas Health Care

Eastern Plumas Healthcare (EPHC) is a 9-bed critical access hospital serving the Portola community and surrounding environs. It is a one-story facility, 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.

2.1.1 Existing Heating System

EPHC currently uses steam for heat distribution, relying on dual oil-fired Burnham "Golden Cube" model boilers original to the building, circa 1969. These boilers are each rated at 3,350 MBH input capacity, with an output of 2,318 MBH each, achieving ~70% efficiency. These steam boilers are fired by Gordon-Piatt R10.2-0-50 Burners each rated at 18-30 gallons per hour.

In addition, a single oil-fired Bryan hot water boiler (manufactured in 1999) rated at 1,500 MBH input with a Gordon Platt burner rated at 10.7 gallons per hour 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 2011-2012, EPHC required over 37,000 gallons of fuel oil (diesel) for heat. At rates of $4 per gallon for heating oil, EPHC pays $145,000-150,000 per year for heat; costs were expected to be higher in 2012-2013, and an annual oil cost escalation rate of 5% was used in the financial pro forma based on historical increases.

2.1.2 Interconnection Options

Eastern Plumas Health Care currently relies on a combination of steam and hot and chilled water for climate control throughout the facility. Steam from the boilers adjacent to the hospital is used directly in a high-pressure air handler and is converted to hot water in a shell-and-tube heat exchanger before it is distributed throughout the facility. It is Wisewood's recommendation that EPHC convert its high-pressure air handler to utilize hot water instead of steam, as converting this load appears to eliminate the need for steam, allowing for the easiest integration with a biomass district energy system, which would ideally produce hot water. Moreover, the elimination of steam could lower overall maintenance needs for the facility as a whole.

Once EPHC has converted to a hot water distribution system, it will require only a single penetration in one of its exterior walls in order to interconnect piping from the central biomass heating facility with the hot water piping within the building.

2.2 Portola High School

The Portola Junior/Senior High School consists of a one-story campus with multiple buildings, serving approximately 250 students in grades 7-12. The majority of heat for the campus is generated centrally in oil-fired boilers and distributed throughout the school via a hydronic (water-based) heat distribution system, making an ideal candidate to connect to a district energy system.

2.2.1 Existing Heating System

Two boilers provide a large portion of the heat for the Portola campus, and the majority of the heating oil consumed by the school is consumed in the boilers. The two boilers are located in the mechanical room in the southwest corner of the Workshop building. The primary boiler is a Hurst #2 fuel oil (diesel)-fired hot water boiler, circa 2005, with 240 square feet of heating surface area. The Hurst boiler utilizes a Power Flame CR2-OB burner rated at 5.5-17.9 gallons per hour (~2,500 MBH input at high fire). The Power Flame burner appears oversized for the Hurst boiler surface area and therefore likely runs at high fire only during a cold start.

The older (circa 1966) Ray boiler continues to serve as backup, but is used sparingly and is soon to be retired (see Photos 1-4). The Ray boiler was originally commissioned as a steam boiler rated at 2.5 million BTUs per hour input, with 500 square feet of heating surface area. This boiler was later converted to, and currently operates as, a hot water boiler.

The school stores its fuel oil in two 10,000-gallon tanks located at the rear of the school. Its fuel use in 2011-2012 was 22,640 gallons of fuel at a cost of ~$79,500.

Recent fueling has cost the district $3.75 per gallon, which was used as the oil price in the financial pro forma.

2.2.1.1 Main School Building

Heat is delivered to the main school building from the boiler room via buried 4" PEX hot water supply and return piping. It is converted into warm air in air handlers located in an attic mechanical room and distributed by air ducts throughout the interior portions the main school building. In addition, there are multiple air handlers providing zone heat in classrooms. Most of the air handling equipment is circa 1974.

2.2.1.2 Band Building

A separate band building with one large open space and several smaller rooms around its perimeter is heated by five hydronic unit heaters: two in the large space and three additional smaller units in the peripheral rooms. Three additional modular campus buildings are heated with electricity, but were outfitted with stub-ups for hydronic heat from the boiler room when the entire campus piping was upgraded last year to PEX piping. These modular buildings could be converted to hot water heat at any time in the future, potentially further lowering energy costs.

2.2.1.3 Hastings Workshop Building

The workshop building is heated separately because it has a high heat demand due to its dust vacuum system that results in a high rate of air exchange. The shop has its own Hastings #2 fuel oil (diesel) fired furnace using a Gordon Piatt burner rated at 850,000 BTUs per hour output. Wisewood recommends including the Workshop in the biomass heating plan, but some energy efficiency improvements should be made to the building first, such as a more efficient vacuum system and improved insulation and windows. The cost of these improvements was not included in this cost assessment.

2.2.2 Interconnection Options

Portola Junior/Senior High School is an excellent candidate to connect to a biomass-fired district heating system. Its multi-building campus already uses hydronic heat distribution as its primary heating medium, and its remaining electric-heated buildings have been prepared to receive hydronic heat at each building. Because the proposed system would utilize the existing heat distribution network, it would also use the existing thermostats and central temperature controls, requiring virtually no training or behavioral change by school staff. We assume that the best point of interconnection from the planned district energy system to the High School will be in the cafeteria building.

2.3 Old Portola Elementary School

Adjacent to the Junior/Senior High School campus, and between the High School and Hospital, there is a set of buildings that previously housed the Portola Elementary School but now sits vacant. The School District continues to heat these buildings to prevent them from freezing, costing the district approximately an additional $15,000 per year (this number is based on a verbal estimate communicated by the School District to the Sierra Institute). Under the proposed district energy system, these buildings would be connected to the heat loop, further reducing the School District's total heating costs.

3 Boiler Options and Siting

3.1 Fuel Quality

3.1.1 Hog Fuel

Hog fuel is the name given to low-grade wood fuel that is not screened or actively dried beyond that which can occur at the point of grinding or chipping. Hog fuel is readily available from most forest operations and lumber mills. It can be sourced directly from the forest and brought to its point of combustion, or can be stored for long periods of time (depending on moisture content) at a central distribution facility. This makes it an excellent fuel to purchase on the open market, as there are many competitive suppliers available in most forested areas.

Hog fuel is the least expensive woody biomass fuel available, making it an attractive energy source. There are, however, several challenges to utilizing it as a fuel for boilers. Because of its highly variable quality (particle size, moisture content, foreign particles, species mix, etc.), the boiler systems that burn hog fuel must be much more robust than boilers burning a more uniform fuel - such as wood pellets - to avoid fuel handling difficulties and combustion issues such as clinkering (when wood ash melts and fuses together, requiring manual removal).

These more robust boilers have more complexity in order to deal with the highly variable hog fuel, and a correspondingly higher price tag. While the reduced cost of hog fuel over the life of the boiler can offset any increase in capital costs, the initial expenditure needed to fund the system, as well as the additional space needed for equipment and fuel storage, may not be feasible for some projects.

3.1.2 Select Fuel

Select fuel (or “conditioned chip”) is a wood chip that has been, at minimum, screened for a more uniform particle size distribution and managed for moisture content. Because select fuel is either seasoned in the field or actively dried, it is both lighter than hog fuel and contains more available energy per unit weight.

Drying can be achieved passively by allowing time for the wood to sit outside during the summer where it can reach a moisture content under 35% (wet basis) or less. Active drying by applying heat to the wood can reduce moisture to as low as 0%, but also requires additional equipment and energy to achieve these levels, making it a more expensive method.

Select fuel is advantageous over hog fuel for several reasons. Because of its significantly lower moisture contents, select fuel burns more efficiently in a biomass boiler system. Because it contains less water, it can be more cost-effective to transport. Select fuel is also generally more uniform in size than hog fuel, reducing the likelihood of mechanical error in the fuel handling system of the boiler. This can translate to reduced maintenance costs and a longer life of fuel handling equipment components.

3.2 Wood Boiler Technology

3.2.1 Modern Wood Boiler Technology

Small-scale wood boiler technology has seen significant development in the past thirty years, primarily in Europe, but also in the USA. Some of the commonalities that exist among all of these modern boilers are the following:

- Phased combustion (primary and secondary combustion chambers and independent air supply)
- Combustion air preheating
- Combustion chamber designs that allow long residence time in a secondary combustion chamber for complete burnout of all combustion gases
- Well-insulated combustion chamber to help maintain high combustion temperatures
- Oxygen sensor and/or thermocouples and electronic controllers that automatically modulate the air/fuel ratio according to the oxygen content and temperature of the flue gas
- Forced combustion air supply to control firing rate as well as induced draft to maintain negative pressure in the combustion chamber
- Ash drop-out systems in the primary combustion chamber as well as automatic ash removal
- Moving grate (optionally water cooled) systems for difficult fuels (those with high moisture and ash content)

All modern wood boilers utilize some of these characteristics to generate clean, automated heat from wood.

3.2.2 Capacity

To serve the two anchor tenants, EPHC and PHS (as well as the old Elementary School facility), Wisewood calculated that a boiler of approximately 1,600 MBH (approximately 78% of peak heat demand) would cover 94% of total thermal energy needs. This means that the existing fossil fuel boilers at each facility would meet 6% of heat demand, on average; most of this demand is represented on extremely cold ("peak") days and during "shoulder" seasons, when outside temperatures are still cool, but heat is only required for a few hours in the morning or evening. During these times, fossil fuel boilers can be a more efficient heat source, as they can fire up and down within minutes, whereas biomass boiler systems require significantly longer warm-up periods.

A large thermal energy storage tank (hot water tank) can further reduce the need for fossil energy consumption and can improve overall wood boiler performance by isolating the wood boiler from fluctuations in demand that could cause the boiler to cycle excessively, allowing for longer, more efficient burn cycles that charge the buffer tank. The buffer tank then responds to short-duration heating demand.

3.2.3 Fuel Handling

Options for storing and handling wood chips onsite include: 1) a concrete bunker attached to the boiler building; and 2) portable metal bins designed to both store and feed wood chips. Within the concrete bunker, the floor of the fuel storage area would have a low-speed hydraulic scraper system that pushes the wood fuel toward the stoker system. To stoke the boiler with either fuel handling system, the fuel would drop into a large auger, drag chain conveyor or hydraulic ram feed into a metering bin, and then into the boiler furnace.

3.3 Flue Gas Treatment

3.3.1 Multi-cyclone

After passing through the secondary combustion phase and exchanging its heat to the boiler water through the three-pass heat exchanger, the flue gas enters a multi-cyclone array that drops out the majority of any fly ash particles that remain in the flue gas stream. When operated with clean dry fuel, most modern biomass boiler systems can achieve particulate emission levels at or below 100 mg/m^3, which is considered a low level of emissions. This level of flue gas treatment is sufficient in most air quality jurisdictions for boilers of the size proposed.

3.3.2 Electrostatic Precipitator

If additional flue gas treatment is required, an electrostatic precipitator (ESP) could be added that will remove over 90% of the remaining particulate matter in the flue gas stream. Due to air quality concerns in Portola, Wisewood included an ESP in the conceptual design and cost estimate. The inclusion of an ESP in the system could further reduce the already low particulate emissions to a level of approximately 10-20 mg/m^3, which is considered to be a very low emission rate.

The added cost of the ESP (approximately $310,000) would cover the cost of the ESP equipment itself, the additional electrical power and control requirements, and the additional costs associated with the larger concrete pad needed to support the ESP housing, which has a footprint equal to that of the biomass boiler itself. The inclusion of the ESP should only be considered after consulting with local and State air quality authorities, and after the final choice of boiler technology has been decided upon (which is in large part a function of fuel source). If a consistent source of clean, dry wood chips can be guaranteed, emissions levels approaching 20 mg/

m^3 may be achievable without the ESP. Thus an ESP should only be considered on an “as needed” basis.

3.4 Siting Needs

A district energy facility will need approximately 30 x 60 feet of space for its building, fuel storage, and vehicle access (not including the optional ESP system). Approximately half of this footprint will be comprised of fuel storage in the form of a concrete bunker or fuel bin storage area, as described above. The other half will house the boiler, controls, and other auxiliary equipment. When fuel trucks arrive, they will need easy access to approach the boiler facility, unload their contents, and exit.

3.5 Available Space

3.5.1 Eastern Plumas Health Care Property

EPHC has expressed their willingness to provide a parcel of land (via lease) to place the boiler system on their property. To serve the Hospital and School, the ideal location for this proposal would be along the access road, due south of the Hospital, at the northwest corner of the athletic fields (see Figure 1 below). This site would allow easy access by fuel trucks, keep any noise associated with fueling or maintenance far away from the facilities, and keep trenching costs to a minimum.

Figure 1. Map of the proposed District Energy system. DE plant and heat distribution piping shown in red. Facilities to be served shown in orange. From North to South: Eastern Plumas Health Care, old Portola Elementary School, and Portola Junior/Senior High School.

3.5.2 Portola School District Property

Another possible location for the facility is on the land immediately across S Gulling Street from the EPHC property. This space, owned by the School District, would also provide an ideal location for the District Energy system. It has ready access for fueling and maintenance, would minimize trenching costs, and would keep any associated noise away from all active facilities.

4 Project Economics

4.1 Wood Fuel Demand

The total annual fuel needs for a biomass District Energy system are estimated to be 680 tons of wood chip fuel. At an estimated $50/ton delivered and a moisture content of 35%, the total annual wood fuel cost would be ~$34,000, exclusive of operating and maintenance (O&M) costs and the remaining low load and peak load propane consumption, estimated at 5,500 gallons.

4.2 Construction Costs

The total estimated cost of constructing a 1,600 MBH biomass boiler system and 2,000 feet of district heating pipe is $3,272,727. This number includes all construction costs, project development fees, construction administration, permitting, and startup and commissioning of the system. This also includes an optional electrostatic precipitator (ESP) to minimize the amount of particulate matter released into the air in consideration of Portola's status as a Non-Attainment Area.

Of this amount, the major equipment costs are $1,349,600, which includes: a 1,600 MBH biomass boiler; electrostatic precipitator; trenched piping to Eastern Plumas Health Care; and trenched piping to Portola High School (as well as the old Elementary School). Major equipment accounts for 41.2% of the total project budget.

4.3 Operations and Maintenance

The 1,600 MBH biomass boiler is estimated to cover 94% of the facilities' total heating needs. The boiler system is projected to reduce the combined heating oil expenditures of all three facilities from approximately $254,000 to approximately $33,800 for wood fuel, $13,300 for remaining heating oil needs (during peak and shoulder heating seasons), and $4,300 for electricity to run the boiler, for a combined new heating fuel cost of $51,500. This represents a reduction in total heating fuel costs of 80%.

Annual operations and maintenance costs are estimated to be $33,600, including all labor, maintenance, lease fees, taxes, any administrative costs such as legal and accounting, and a reserve fund for any major equipment replacements needed throughout the life of the boiler (such as the refractory).

The total operations and maintenance budget is estimated at $85,000 annually (fueling and O&M combined). This results in approximately $169,000 ($254,000 less $85,000) of free net cash flow from operations of the biomass boiler to finance the construction of the system.

The full economic analysis and financial pro forma can be found in Appendix C.

4.4 Ownership Options

The proposed Portola District Energy (PDE) system would sell thermal energy (in the form of hot water) to its customers (EPHC and PHS) that would be delivered via underground, insulated pipes. At each facility, a small metering substation would be installed to measure the total amount of thermal energy consumed by each building. The owner of PDE would then bill each customer according to a predetermined rate schedule for the energy (BTUs) used in any given month.

Under this arrangement, a third-party owner of the PDE system would be responsible for all fueling, maintenance, and operations of the system components up to and including the metering substations. They would maintain a lease agreement with the owner of the property chosen to place the biomass system (currently recommended as a lower portion of the EPHC grounds that is central to all facilities under consideration) for the life of the system.

The final owner/operator of PDE may not and need not be the same entity that develops the system. Various financing options available allow for the possibility that one company may take on the construction risk of the project and sell the project to another entity as a “turn-key” system upon its successful startup and commissioning. Depending upon which interested parties decide to take on the construction of the project and when, long-term ownership may become more attractive to non-construction firms that could take on the project after it has been fully developed and all costs are known.

4.5 Project Finance

Wisewood has identified several possible avenues for project finance. Because of the high up-front capital costs, an initial incentive would enhance the project’s financial viability and returns to potential investors. Two promising programs could offer Portola District Energy grant assistance of up to 35%.

The California Energy Commission (CEC) offers grants to help fund energy efficiency and renewable energy projects. Based on the funds available in recent CEC program offerings that target Community Energy systems, the PDE project could qualify for up to approximately $1.6 million in grants. The Wisewood financial model indicates that approximately $1.2 million (or ~35%) in grant funds would be required to lower the simple payback from 19.3 years to 12.5 years and therefore be economically viable to the right mix of investors. In the model, these grant dollars would be leveraged to secure a loan for the balance of construction costs (approximately $2.1 million).

Another program, the Federal New Markets Tax Credit (NMTC), aims to provide financial incentives in qualified geographic areas that are in need of economic revitalization based on a set of economic indicators defined by the US Treasury. Large investors can take advantage of Federal tax incentives and pass along a portion of the savings to projects spurring investment in disadvantaged areas. The NMTC is a complex funding mechanism that requires extensive legal and accounting work to be implemented. Because of these transaction costs, most interested financers prefer to bundle several projects together into one larger package, thus reducing the per unit professional fees through economies of scale. PDE is an excellent candidate for the NMTC program, assuming it can join a larger bundle of projects to be financed concurrently. If utilized, the NMTC program could assist with up to approximately 35% of project costs, or $1.2 million for PDE.

If one of the programs described above could be utilized to provide at least 35% subsidy, the Portola District Energy project could be attractive to certain long-term investors. The current Wisewood financial model assumes that the remaining 65% of project costs could be financed through a loan with an interest rate of 6% and a 20-year fixed repayment term.

4.6 Cost to the Customer

Under the proposed third-party ownership model, the customers of the system (EPHC and PHS) would purchase thermal energy from the owner of PDE. They would have no maintenance or operations responsibility for any of the biomass equipment, but would need to maintain their heating distribution systems within their respective facilities to properly accept and distribute the heat for the life of the system.

The current Wisewood financial model analysis pegs costs in Year 1 to match the customers' current heating costs ($254,850 combined). This cost would increase annually at a set price escalator (currently 2.0% in the financial pro forma). The advantage of this model to the thermal energy customers over their continued use of heating oil is that their heating costs would be known for the life of the system, as opposed to the volatilely-priced heating oil, which, on average, has escalated at more than 5.8% annually, and which Wisewood models, conservatively, at 3.5%.

By Year 30, the projected cost savings of biomass over heating oil are calculated to increase to over $238,000. Over the 30-year life of the system, this means that customers can expect to save a combined $2.8 million. For critical Portola institutions such as Eastern Plumas Health Care and Portola Junior/Senior High

School, these savings could translate directly into additional services provided to the community.

5 Conclusion

The opportunity to connect Eastern Plumas Health Care and Portola Junior/Senior High School together via a district energy system is an innovative concept, and one that needs to be considered within the broader context of the economic development goals for Portola and Plumas County before it can be declared either feasible or desirable.

Given that the heating loads of the prospective anchor customers are significant and that they are located close together geographically, a District Energy project in Portola is physically feasible. However, financial feasibility of such a project will depend on many variables. A key metric for evaluating the financial feasibility of any project is something called "simple payback." This is a relatively basic metric that divides total upfront capital costs by annual cash flow from operations to determine how many years it will take to recover the upfront investment. The project as currently estimated has a simple payback of approximately 19 years. Wisewood believes that this figure needs to be closer to 12 years in order to increase the chances of securing market based project financing.

One way to reduce the simple payback of this project from approximately 19 years to 12 years would be to secure an upfront project cost subsidy in the amount of roughly 35% from either grants or tax credit programs. Other key variables that will affect financial feasibility are both sources and prices for long-term project debt and equity. In order to engage in structured project finance, it is essential to isolate the annual net operating costs and revenues of a biomass District Energy system. Wisewood has completed this essential analysis as part of this report (see Appendix C for Financial Pro Forma).

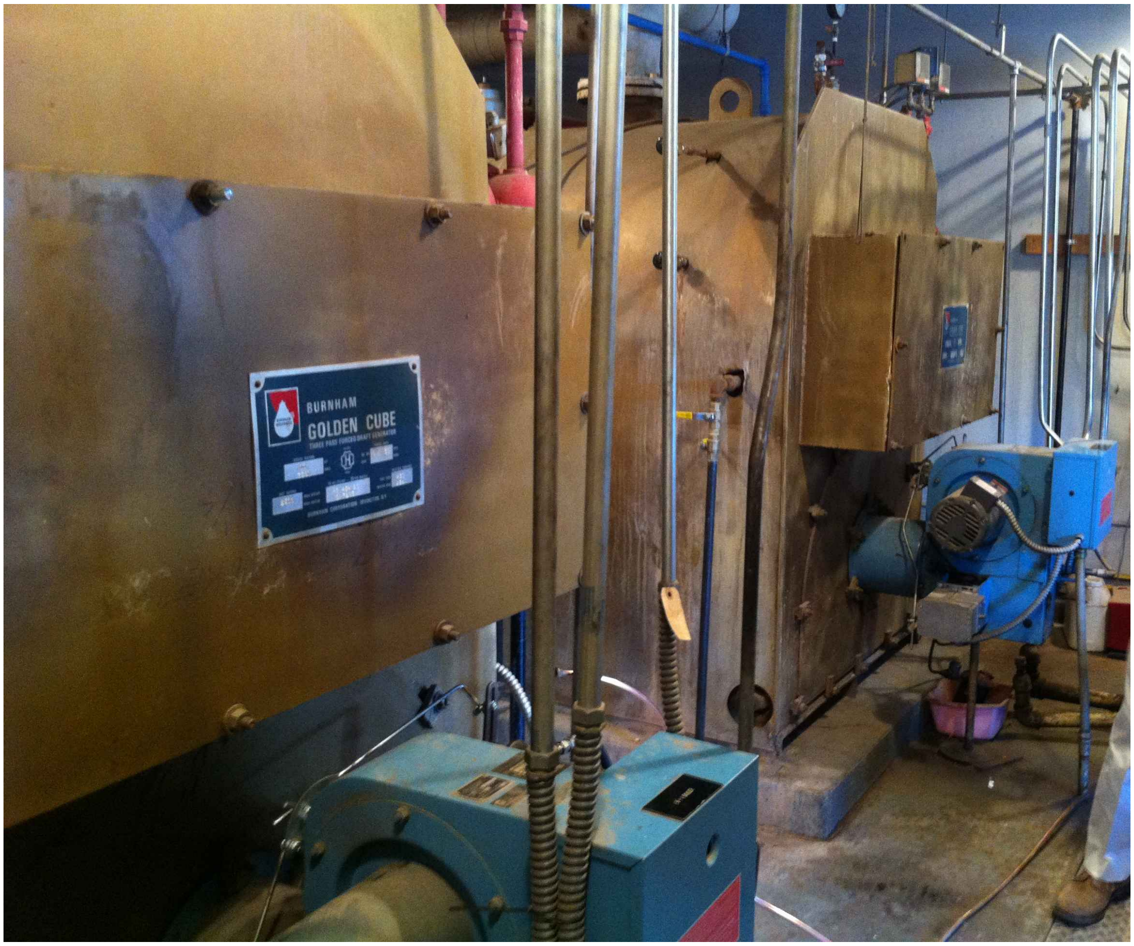
If the PDE system is built, it could be expanded to cover additional buildings in Portola, such as the cluster of public buildings on S Gulling Street (discussed briefly in Section 2) at a future date, should community interest and/or energy prices suggest that this option makes economic sense. Alternatively, if individual biomass boiler systems are constructed at each facility (as discussed in the previously completed feasibility studies for the respective facilities), it could be more difficult for the community to pursue a District Energy system in the future, given that one or more of the key anchor tenants (EPHC and PHS) would already be using biomass individually.

The question of whether a District Energy project is feasible thus becomes one of immediate economic imperative in contrast to long-range strategic vision for the economic development of Portola and Plumas County in relation to its natural resource base. Implementing a biomass heating system at either facility as a stand-alone project could serve the immediate goals (lowered heating costs and a shift to renewable, local fuel) of either facility. However, the long-term potential to utilize more local biomass as a replacement to fossil fuels could be greatly and positively impacted by the installation of a District Energy project between EPHC and PHS, as it would set the stage for future expansion. A District Energy project could also be a compelling catalyst and market signal to the rest of Plumas County and the State of California in regards to the forward-thinking community leadership of the City and County, along with the economic viability of future District Energy biomass systems in the region.

Appendix A:
Site Photos

Eastern Plumas Health Care

Photo 1. Dual oil-fired Burnham “Golden Cube” model steam boilers, circa 1969



Eastern Plumas Health Care

Photo 2. Name plate for oil-fired Burnham "Golden Cube" model boilers

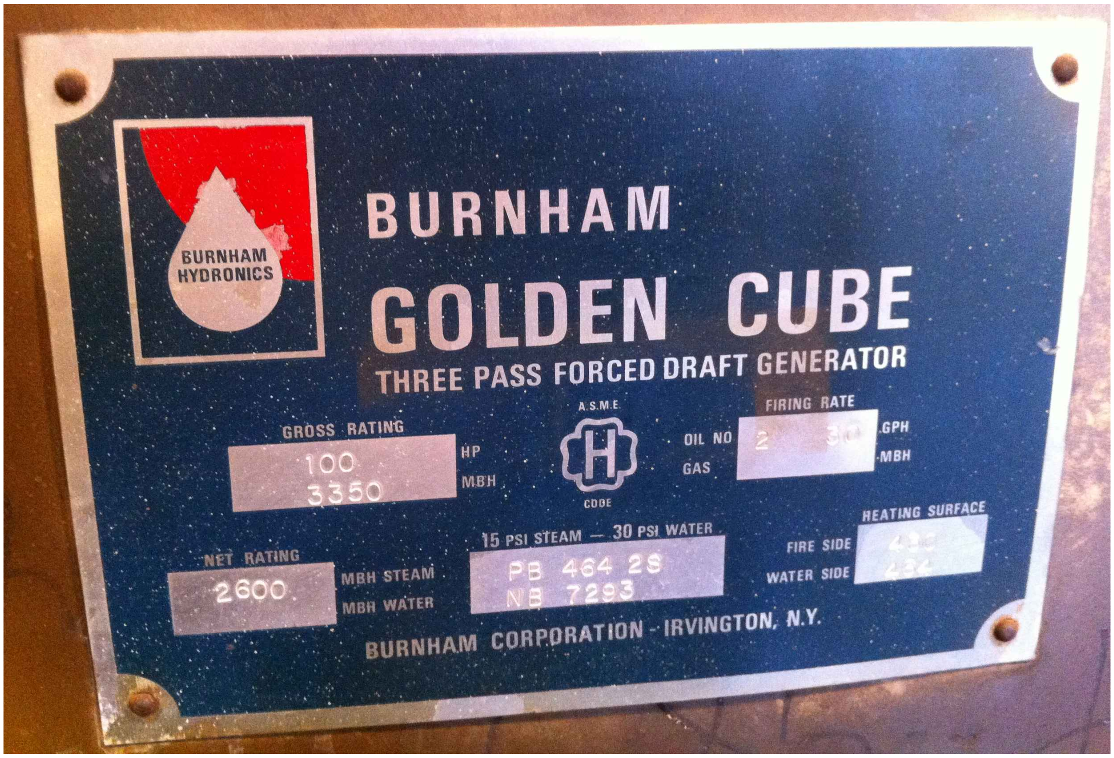
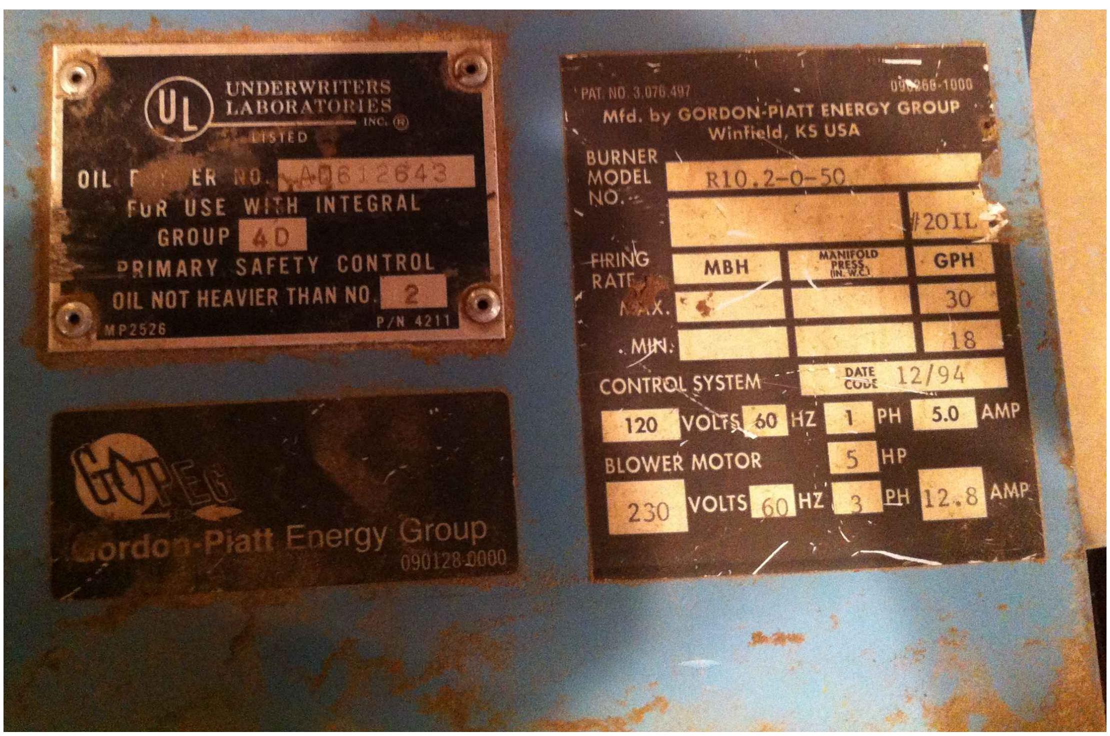
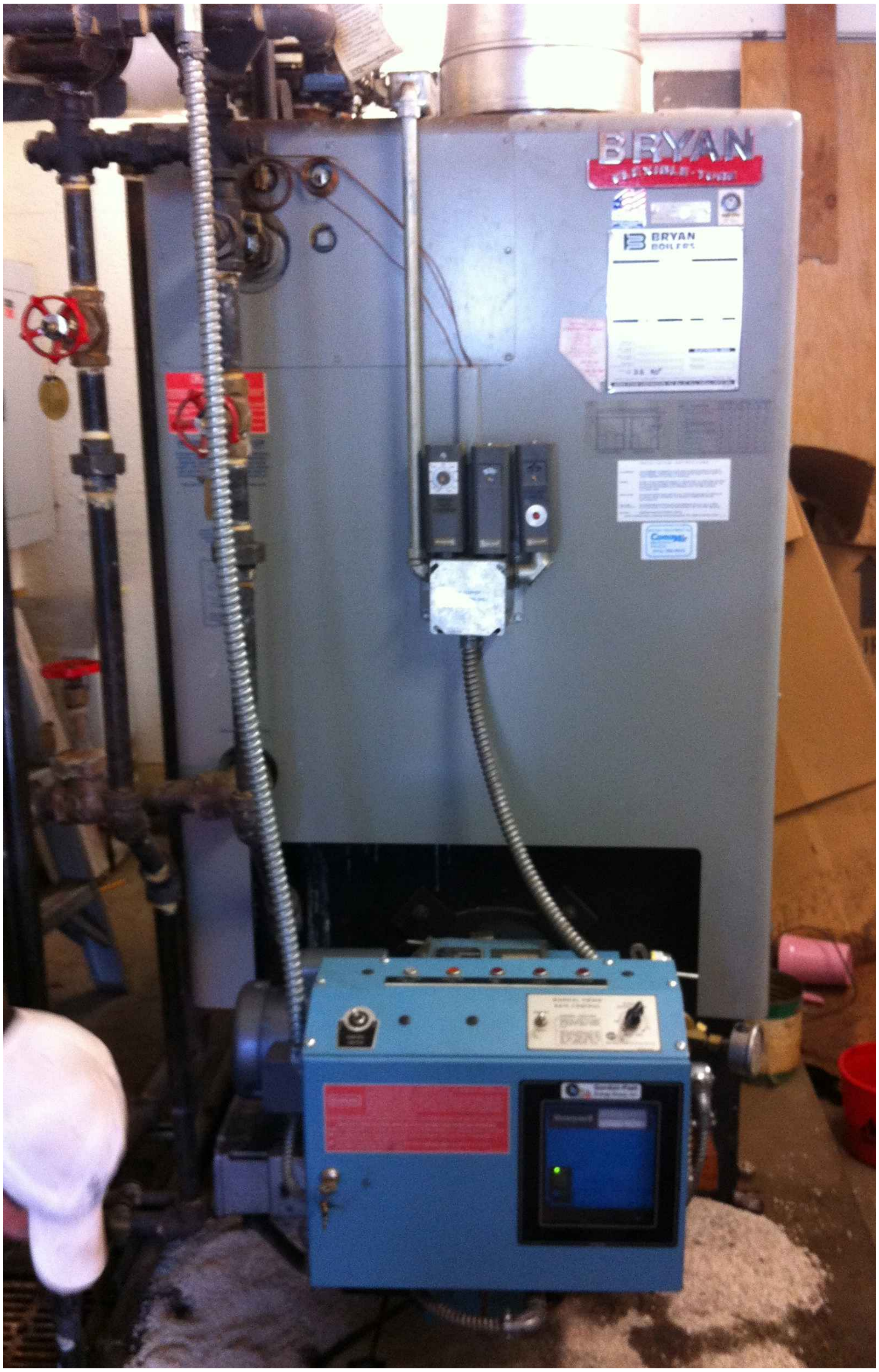


Photo 3. Name plate for Gordon-Piatt oil-burner



Eastern Plumas Health Care

Photo 4. Bryan oil-fired hot water boiler, circa 1999

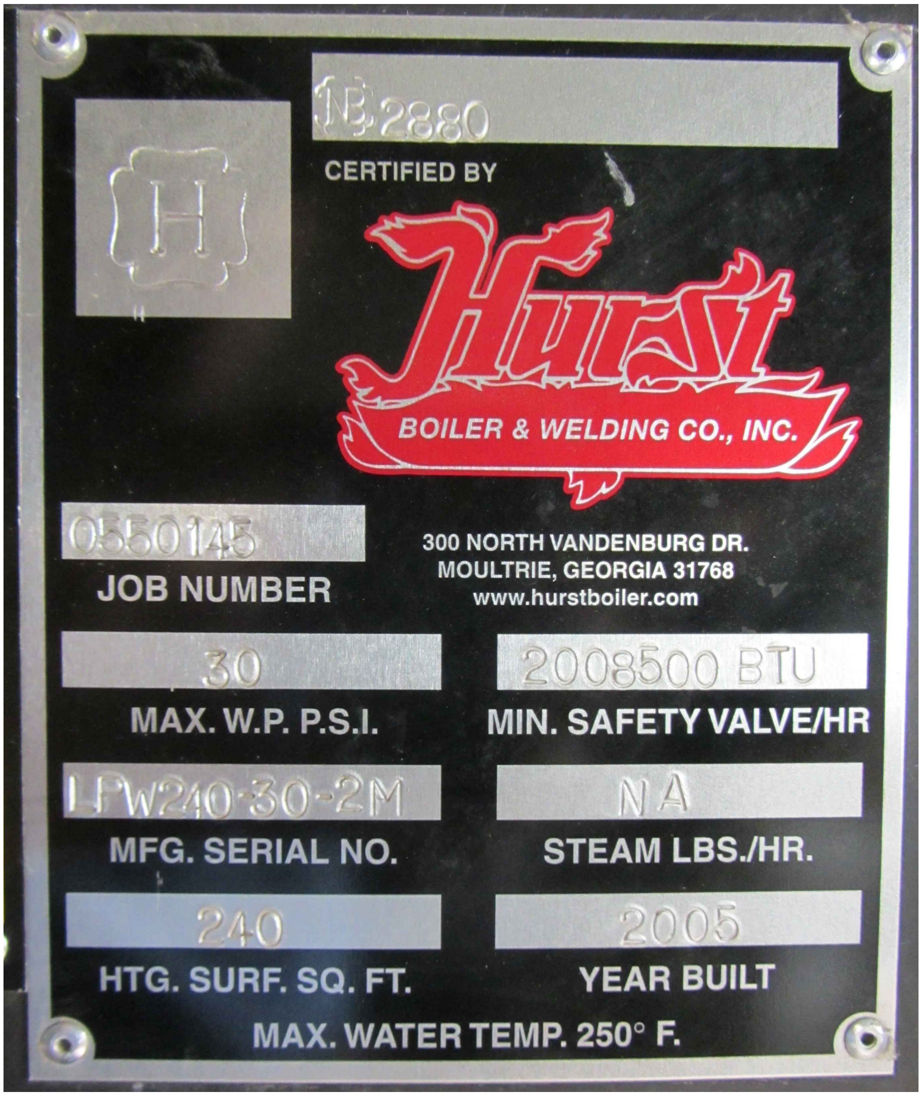


Portola Junior/Senior High School

Photo 5. Hurst oil-fired boiler (2005)

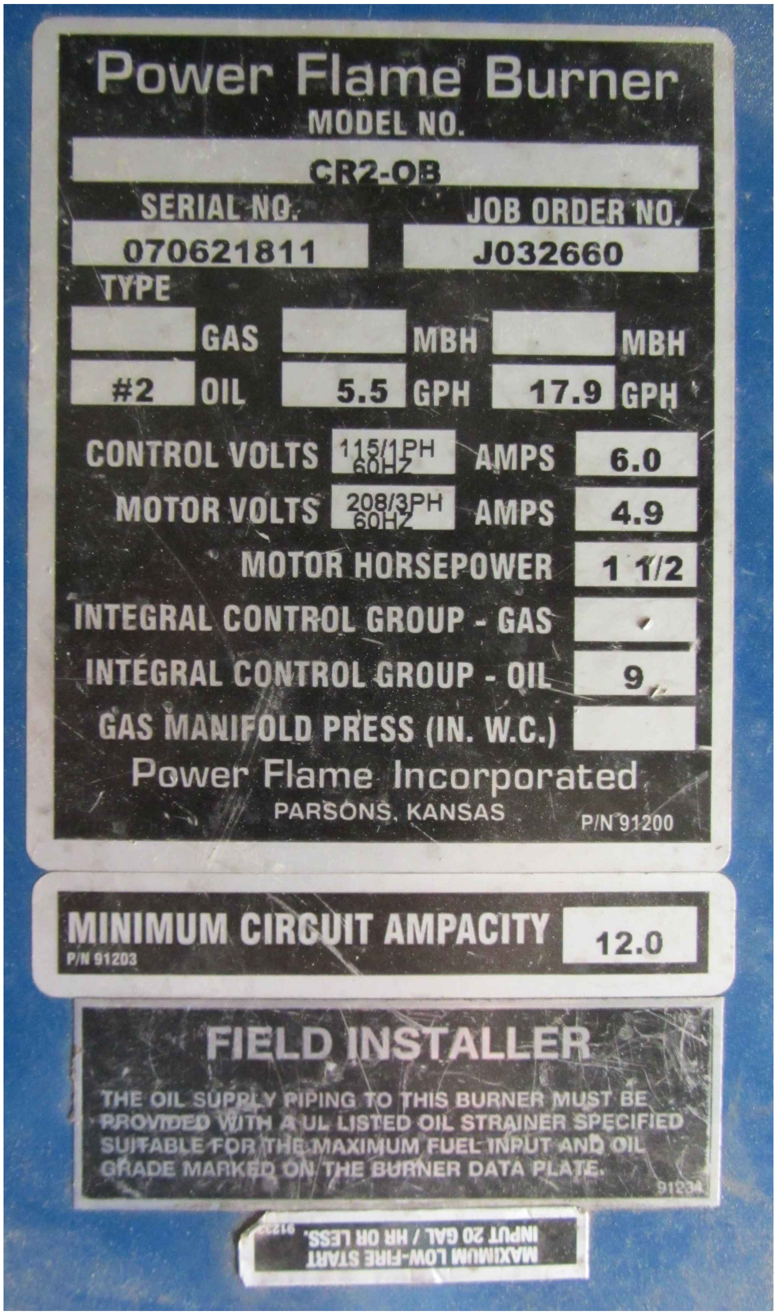
Portola Junior/Senior High School

Photo 6. Nameplate for Hurst boiler



Portola Junior/Senior High School

Photo 7. Nameplate for Power Flame burner on Hurst boiler



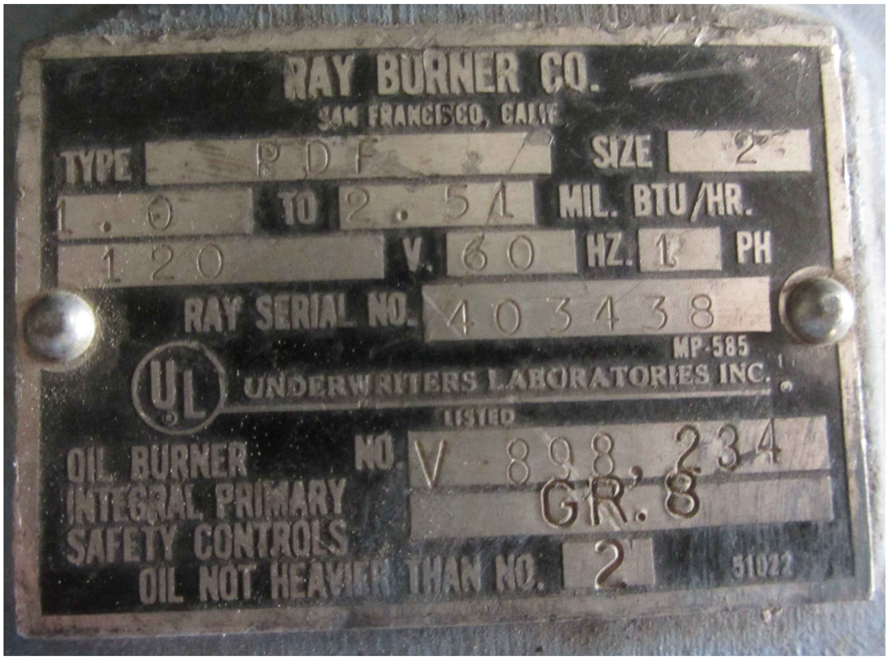
Portola Junior/Senior High School

Photo 8. Ray boiler (1966)

Photo 9. Nameplate for Ray boiler

Portola Junior/Senior High School

Photo 10. Nameplate for Ray burner on Ray boiler



All photos: Wisewood, Inc.

Appendix B:
Energy Model

Appendix C:
Financial Pro Forma