Woody Biomass Utilization Assessment

January 2017

In the winter of 2016 Valley County reached out to several partners to effectively utilize a grant awarded to the County by the Idaho Department of Lands in cooperation with the USDA Forest Service.

The Western Competitive Resource Grant entitled "Development Protection in Valley County's Wildland Urban Interface" included an element to assist in Woody Biomass Utilization. The intent is to assist a sagging local timber economy in providing increased value for forest material traditionally considered waste. Increased value of timber products is intended to assist landowners in keeping their ground in forest product production instead of choosing to develop the land for subdivision communities.

Funding Partners

**Valley County**
Gordon L. Cruickshank, Chairman, Board of County Commissioners

**Idaho Department of Lands in cooperation with the USDA Forest Service**
Tyre Holfeltz, Idaho Department of Lands, Community Fire Program Manager

**Statewide Wood Energy Team - Idaho Governor's Office of Energy and Mineral Resources**
Matt Wiggs, Sr. Energy Policy Analyst

**Sustainable Northwest**
Dylan Kruse, Policy Director

**Southwest Idaho Woody Biomass Utilization Partnership**
Rick Brenneman, Coordinator

Project Contributors

**Dylan Kruse** served as co-lead for this project. His responsibilities included general project management and completion of reporting requirements. Dylan is engaged in multiple programs at Sustainable Northwest, including state and federal policy, forest stewardship, and community energy development. He serves as a project partner in the Oregon, Idaho, and Washington State
Wood Energy Teams, as well as co-chair of the Oregon Forest Biomass Working Group. Dylan is also a project manager for the Dry Forest Investment Zone program, which seeks to develop and promote markets for integrated biomass utilization and wood to energy in a 15 county region of Oregon and California experiencing high rates of poverty and unemployment.

The team coordinator for this project is Benjamin Rothfuss Dair, Conservation Finance Fellow at Sustainable Northwest. Ben will serve as liaison to supply assessment leads and project subcontractors in all communications, reporting, and project management matters. Ben is a graduate of the Yale School of Forestry and Environmental Studies and is a candidate for certification as a Chartered Financial Analyst. Prior to Sustainable Northwest, Benjamin conducted market and logistics risk assessments for an international timber investor, wrote feasibility studies on sustainable project finance for WWF Vietnam, and consulted to the Energy and Resources Institute of North America on a turnaround strategy for a tropical hardwood timber operation.

Wallowa Resources Community Solutions Inc. (WRCSI)

Wallowa Resources Community Solutions Inc. (WRCSI) will serve as a project contractor responsible for the majority of technical assessments in this project. Wallowa Resources Community Solutions Inc. is an Oregon-based small business providing professional consulting services in renewable energy and natural resource-based business and economic development. Among the menu of services offered are project feasibility studies and design/build services for farms, ranches, businesses, municipalities, governmental entities, organizations, investor groups, tribes and others. Specifically, WRCSI evaluates the economic, technical and other factors of feasibility of clean distributed generation and biomass heat and boiler conversion solutions, hydropower applications, and solar energy/hot water systems, as well as innovative grid and off-grid applications.

Matt King and Chuck Sarrett are the lead technical resources for WRCSI. Both have previously worked on biomass and bioenergy project development in Idaho. Matt King, consultant at WRCSI and Renewable Energy Solutions LLC, previously worked as Renewables Program Coordinator for Wallowa Resources and has over nine years of experience consulting on renewable energy and conservation agriculture projects. Chuck Sarrett, owner of Full Circle Consulting, has over 33 years of experience as a professional industrial forester and 5 years of experience providing full service forest consulting to the forest industry, governmental agencies, and private timberland owners.

Southwest Idaho Woody Biomass Utilization Partnership

The Southwest Idaho Woody Biomass Utilization Partnership (WBUP) is a public and private partnership, which was initially formed in 2007. Sponsored by the Idaho Department of Commerce, the USDA Rural Development Center, USDA Forest Service S&PF Region 4, and the Adams, Gem, Boise and Valley counties of Idaho, the WBUP is comprised of state and private experts and focuses on effectively utilizing the southwest Idaho forest resources for creation of jobs and entrepreneurial projects for their rural communities. Rick Brenneman is WBUP Coordinator.

Wildfire Prevention Associates

Stephanie Nelson is the project facilitator and is under contract with Valley County to perform services associated with wildfire reduction programs utilizing landowner education, hazard fuels mitigation and development of cooperative policy throughout the fire and forestry community in Valley County.
Acknowledgements

This material is funded in part by the Idaho Department of Lands in cooperation with the USDA Forest Service. MOU between IDL and Valley County to perform work stipulated in the Western Competitive Resource Grant 13COMP-Valley.

This material is funded in part by the U.S. Forest Service through its Statewide Wood Energy Team Program, Cooperative Agreement No. 13-CA-11010000-022, to the Idaho Office of Energy and Mineral Resources.

Nondiscrimination Statement

In accordance with Federal law and U.S. Department of Agriculture Policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability. (Not all prohibited bases apply to all programs.)

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

Disclaimer

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor Sustainable Northwest, nor the Idaho Office of Energy Resources, nor Idaho Department of Lands, nor Valley County, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.
WOODY BIOMASS UTILIZATION ASSESSMENT

Date November 2016

Client Valley County, Idaho

Principal Authors Matt King, Renewable Energy Program Advisor, WR CSI
Chuck Sarrett, Full Circle Consulting
Benjamin Rothfuss Dair, Sustainable Northwest
PREFACE

The Valley County Idaho Commissioners retained WR Community Solutions Inc. (CSI) to examine the feasibility of a Forest Products Campus for woody biomass utilization and economic values. CSI partnered with Sustainable Northwest and the Idaho Woody Biomass Utilization Partnership to complete the study.

The Feasibility Study covers all elements in the contracted Scope of Work, and additional material deemed to be useful to County leaders and project proponents. This study draws from a wood/biomass supply assessment provided to CSI by Valley County and the Idaho Woody Biomass Utilization Partnership.

Specifically:

- Overview of the Forest Products Campus strategy for utilizing woody biomass
- An analysis of the potential markets the biomass campus may serve. The analysis will include identification of regional competition and existing businesses that may influence final decision-making on appropriate product mix.
- Site Evaluation (potential sites, table of site characteristics including existing infrastructure, permitting and environmental considerations, estimates of costs to upgrade sites to useable condition)
- An analysis estimating the startup capital costs that would be necessary to implement a Biomass Campus
- A preliminary analysis of the estimated size and expense required to incorporate a CHP system into the campus
- A summary of any potential federal, state, and local funding opportunities that may reduce the expense of constructing the Biomass Campus
- A summary of any potential federal, state, and local regulatory permits and considerations that will need to be completed in order to construct the biomass campus, as well as any potential regulatory and permitting issues that may hinder the development of the Biomass Campus

The study involved discussions with Valley County elected and volunteer leaders, members of the business community and others, as well as extensive site visits. WR Community Solutions Inc. would like to thank in particular the following individuals and organizations for their assistance during the study: Stephanie Nelson, Wildfire Prevention Associates and Valley County Representative, the Idaho State Wood Energy Team, and the Woody Biomass Utilization Partnership.
1. EXECUTIVE SUMMARY

This analysis examines the viability and potential profitability of a small-diameter forest products campus located in central Valley County Idaho. The campus realizes economic efficiencies by operating a sort-yard to recover higher-value products from the biomass supply. A small enterprise that follows this business cluster approach can realize a more complete utilization of woody biomass inputs, particularly small-diameter logs and fuels-reduction materials, creating local jobs, producing a diversified group timber product lines, and generating energy for local use or export.

Products that could be produced in Valley County include saw logs, posts/poles, packaged/bulk firewood, densified products, wood chips, biomass, landscape products, and others. Preliminary analysis of the market opportunity led to the identification of potential buyers, including Evergreen Forest Products, Parma Post and Pole, Clearwater Paper, and local buyers directly at the Valley Yard.

Utilizing wood products residuals to produce electricity and thermal energy is an integral part of the long-term campus strategy. A combined heat and power (CHP) co-generation facility can directly supply thermal energy to the kiln for drying value-added products and also deliver electricity for the production line. Under Idaho Power’s current rates, the greatest financial benefit would come from a net-metered system of under 100kW capacity.

A pro-forma income statement based on a return-to-log analysis indicates that the campus could operate at a profit of approximately 1% with the above-mentioned product lines if material can be sourced and delivered to the campus at approximately $27/ton or lower. On an annual basis, the campus could convert over 40,000 tons of biomass into value-added products, representing between 4,000 and 10,000 acres of treated forest. Capital costs for log handling & processing equipment, kiln drying & storage, and building improvements total $3.2 million USD. The start-up costs of energy production with a biomass boiler add $1.3 million in capital costs, for a total estimated cost of $4,549,544.

Our recommendation is that Valley County seek an entrepreneur and a suitable supply agreement to ensure the greatest likelihood of success for this project. First and foremost, the project must find a suitable entrepreneur to champion the project. Second, this study should serve as encouragement for local area private timber holders, the U.S. Forest Service, and Idaho Department of Lands to consider supply arrangements that would encourage the success of this business.
# CONTENTS

Preface ........................................................................................................................................... ii
1. Executive Summary ................................................................................................................ iii
2. Introduction ............................................................................................................................. 5
3. Existing Forest Product Initiatives .......................................................................................... 10
4. Current and Projected Timber Supply ..................................................................................... 11
5. Wood Product and Energy Markets Overview ......................................................................... 21
6. Local Market Conditions ........................................................................................................ 23
7. Campus Ownership models .................................................................................................... 26
8. Sort Yard Infrastructure ........................................................................................................... 27
9. Site Analysis ............................................................................................................................ 28
10. Sort Yard Development Stages ............................................................................................ 30
11. Sort Yard Operational Plan .................................................................................................. 32
12. Product Marketing .................................................................................................................. 33
13. Products and Estimated Values ............................................................................................. 34
14. Permits and Approvals .......................................................................................................... 37
15. Income Statement .................................................................................................................. 39
16. Equipment Cost Worksheets ................................................................................................ 39
17. Manpower and wage estimates .............................................................................................. 39
18. Launching a Forest Products Campus ................................................................................... 39
19. Energy Component of the Campus ....................................................................................... 44
20. Estimated Capital Costs ......................................................................................................... 47
21. Recommendation .................................................................................................................. 51
2. **Introduction**

Located in west central Idaho, eighty-eight percent of Valley County is contained in portions of three different National Forests: the Boise, Payette, and Challis. The Frank Church River of No Return Wilderness is also located in Valley County. Just over three percent of Valley County is owned by the State of Idaho. It has more than 75 miles of the Centennial Trail. Valley County’s natural resource economy has historically relied in large part upon the timber industry, however limited supplies of private timber and restrictive government land-use policies have resulted in a dramatic decline of this industry.

USDA Forest Service (2013) reports that Valley County’s timber harvest decreased from 107 MMBF (Scribner) in 1979 to 48 MMBF in 2011 in response to the recession and declines in U.S. housing starts. The southern Idaho counties of Adams, Boise, and Valley have experienced a timber harvest decrease of 146 MMBF (33 percent) since 1990. Virtually all of the decrease can be attributed to sharply declining harvest levels from National Forest lands, which declined by approximately 87 percent since 1990.

Future economic growth in the timber industry is constrained by economic conditions and raw material availability – challenging the County to explore diversification. Diversification could include maximizing best use of forest and biomass resources in new and different ways, and creating new relationships among and between sector partners and stakeholders. These stakeholders and potential partners include the traditional wood products industry, resource agencies, conservationists, and businesses.

Improved utilization of standing timber and woody biomass offers rural communities new economic opportunities and the means to address forest health and wildfire issues. Local markets and outlets for low-value small saw logs and restoration materials help offset the costs of these treatments. New investments in value added processing of small-diameter material and salvaged biomass are critically dependent on a long-term

---

**Table 1. Summary of Ownership**

<table>
<thead>
<tr>
<th>Ownership</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>USFS</td>
<td>88.1%</td>
</tr>
<tr>
<td>Valley County</td>
<td>0.1%</td>
</tr>
<tr>
<td>State of Idaho</td>
<td>3.2%</td>
</tr>
<tr>
<td>Private</td>
<td>8.7%</td>
</tr>
</tbody>
</table>

---

**Figure 1. Map of Valley County and summary of ownership**

- **Area**: 3,733 square miles
  - 2,389,120 acres
- **Population**: 10,103 (2016 Idaho Dept Labor)
- **Ownership**: USFS 88.1%, Valley County 0.1%, State of Idaho 3.2%, Private 8.7%
term and sustainable supply of biomass. A woody biomass campus, including a sort yard and co-located production facilities, creates opportunities to sustain raw material flow and generate increased value from non-saw log volume.

This approach is supported by the Idaho Forest Restoration Partnership (IFRP) and other entities. The IFRP describes forest products industry infrastructure is essential to restoring forests, because forest restoration often involves mechanical treatments such as thinning, removing hazardous fuels, or cutting larger trees to restore diversity in tree stand structure or composition. This makes Idaho’s forest products industry an important ally in forest restoration.3

In 2004, Valley County completed the Valley County, Idaho Wildland-Urban Interface4 Wildfire Mitigation Plan with the assistance of many partners. The vision of the plan was to “Institutionalize and promote a countywide wildfire hazard mitigation ethic through leadership, professionalism, and excellence, leading the way to a safe, sustainable Valley County.”5 The Plan emphasized the need for active management of residential, commercial, agricultural, and forest lands in order to reduce the risk of wildfire. On state and federal forest lands in particular, the Plan highlighted the need for large scale treatments within or near to the WUI, with a significant potential biomass supply coming from the treatment activities.

This available biomass may be in the form of traditional saw log material that can be utilized at a standard commercial mill, however much of the material consists of trees too small for traditional milling facilities and of little to no value.6

In the region around Valley County, the volume of wood fiber now standing on the public and private forest lands has been estimated as significantly greater than the target management condition. This abundant small growth is in need of thinning to maintain forest health and reduce fire risks. Lacking strong markets for this material, the treatment costs are prohibitive.

Local communities have struggled along with Idaho’s traditional forest products industry. Numerous forest manufacturing facilities in the county and surrounding region have closed in the last couple of decades, including Boise Cascade Mills in McCall that close in 1977 and Cascade that closed in 2001, representing a loss of more than 150 jobs. Additional mill closures in Gem, Boise, and Adams Counties certainly had a negative effect on logging and transportation jobs in Valley County as well. Concurrently, the volume of timber being removed from National Forest Lands has been significantly reduced. This has led to a build-up of forest fuels that pose a significant wildfire threat to the forest and the communities that lie within it.

During the 2016 fire season, the Pioneer Fire burned nearly 200,000 acres bordering Valley County and was the largest fire of the season on USFS land in the United States.7

---

3 Idaho Forest Restoration Partnership, Nov. 2013
4 Wildland-Urban Interface abbreviated WUI
7 http://inciweb.nwcg.gov/incident/4866/
wildfires across the West have destroyed hundreds of homes, burned millions of acres of forest lands.\textsuperscript{8} These wildfires serve to emphasize the importance of managing fuel loadings, particularly in the WUI (wildland urban interface.) Some manual thinning, piling, and burning of small trees or chipping has occurred on the WUI lands in Valley County, but tight budgets and limited resources restrict the amount of land which can be treated to significantly reduce fire dangers.

Many more acres of the WUI lands could be treated if the small logs from the thinnings and the waste fiber could be sold to offset some of the treatment costs. The few remaining sawmills in the region are small and designed to process traditional saw logs, which are often supplied by the surrounding private lands and the IDL (Idaho Dept. of Lands.) Efforts have been made in the past to site a medium to large wood fired electrical co-generation plant in Boise County adjacent to Valley County, but have failed due to a number of factors including low natural gas prices, the lack of other energy incentives such as “green power” subsidies, and a lack of access to fuel supply located on USFS lands\textsuperscript{9}.

This analysis models and develops a small log forest products campus which will take advantage of synergies available through the development of a number of different production lines co-located with a single log sort yard. The specific product lines within the model align with site-specific supply and market characteristics in Valley County and the surrounding region. The general concept is similar to a campus that was developed and is currently operating in Wallowa County, Oregon at an old sawmill site near the City of Wallowa.

The forest products campus model design can adapt to future expansion if the USFS increases its management activity and market conditions improve. The initial scale is driven by the existing wood supply available at appropriate price points from existing stewardship and restoration projects.

Timing of this study is opportune. Traditional timber industry businesses have been hit hard. In their \textit{2016 Wood Products Industry Forecast}\textsuperscript{10}, researchers at the Idaho Forest, Wildlife and Range Experiment Station noted that although Idaho’s forest industry provided 12 thousand jobs and 2.72 billion in sales (2015), the industry faces significant challenges including market demand and pricing, lack of an appropriately skilled workforce, and in particular supply challenges related to the lack of the timber supply coming from USFS Forest Lands. Innovation in forest management and product development is needed to sustain this sector of Idaho’s economy, including developing opportunities to supply the industry from USFS timber sales.

\textsuperscript{8} https://www.nifc.gov/fireInfo/nfn.htm
\textsuperscript{9} Boise County Woody Biomass Feasibility, McKinstry, March 1, 2011, Funded by a USDA Rural Development
\textsuperscript{10} Idaho’s Forest Products Industry Current Conditions and 2016 Forecast. Idaho Forest, Wildlife and Range Experiment Station, University of Idaho. Station Bulletin 103, January 2016
THE “FOREST PRODUCTS CAMPUS” MODEL

This analysis examines the viability and potential profitability of a small log, i.e. a log that cannot generate a long saw log for traditional timber processing, forest products campus centered around a single log sort yard. This “campus” approach is sometimes described as a forest “business cluster” approach.

Co-location of processing facilities that result in shorter haul distances, and improved raw material utilization rates, is the single most important strategy for reducing costs of biomass utilization from hazardous fuel reduction projects. This cost reduction is critical to generating value and jobs from low-value woody biomass. This proximity is, in fact, the single most important strategy for reducing costs of woody biomass utilization\(^{11}\).

A forest products campus relies upon a group of product lines which allow the business to capture the maximum amount of value from any individual log, while driving efficiency by limiting feedstock costs. For biomass-based small businesses, lower costs can be realized by more complete utilization of a woody biomass input stream, particularly small-diameter logs and hazardous fuels reduction materials.

A sort yard with multiple product lines provides a commercial market for various dimensions and species of locally harvested forest logs. Utilizing byproducts from fuels reduction projects is a critical aspect of national wildfire planning because it provides a means to offset some of the costs and increase acres associated with fire mitigation and forest health treatments.

Various organizational, tactical and market factors must be considered in the Campus design, many of which are unique to each site.

This approach has been demonstrated successfully in various timbered areas of the US and Canada which share similar challenges and opportunities to Valley County. An example in Wallowa County, Oregon, is Integrated Biomass Resources (IBR) near Wallowa. As much flexibility as possible was designed into the Wallowa facility to allow for potential future expansion while scaling to match the existing economic wood supply available from private lands and some small stewardship contracts on USFS lands.\(^{12}\)

SORT YARD DEFINED

Definition: A woody biomass sort yard is a collection point or location for aggregating, sorting, consolidating, processing and distributing biomass for various purposes.

This biomass material is generated by forest practices such as harvest, thinning and salvage; from fuels reduction and forest restoration projects; and from other sources.

The Sort Yard (SY) is an opportunity-driven response to a potential economic opportunity. The sort yard provides both a service and a product for on-campus product lines, and others


\(^{12}\) For more information on the Wallowa County model, please refer to the publication titled “Design Benefits of Wallowa County’s Integrated Biomass Energy Campus” included with the reference material.
industry businesses, in the form of sorted, sized input materials. Raw materials could include bark, chips, poles, stems and branches and fire salvage and hazardous fuel treatments. Sorting these materials for higher-value uses is necessary for campus businesses. In this sense, the Sort Yard becomes the heart of the Campus.

A woody biomass sort yard is a collection point or location for accepting biomass, and for sorting, consolidating, processing and distributing this material for various markets and purposes. A sort yard is a business, which in turn can be an integral part of the value chain for other businesses when compared to traditional woods-to-processor delivery.

A campus Sort Yard would conduct the economic and technical operations of receiving, handling, and distributing woody biomass into various product lines. The product lines include short saw logs and post and pole logs that can then be shipped to area mills, wood pellets firewood, chips, and energy. The sort yard allows for any of the material coming into the mill to be prioritized for the best value and sorted into the various product lines depending on the nature of the log and the current market conditions.

Various factors affect the organization and operation of a successful sort yard, including biomass sourcing; facility site selection and equipment; biomass collection, concentration and distribution; biomass handling, sorting and economic considerations; business planning; marketing and distribution; financial factors13; managerial and labor skills; contractual agreements between various participants; and other factors.

A Sort Yard has the potential to create savings on log loads, lower operating costs, and improved cash flow. The Sort Yard could create economic drivers for hazardous fuels reduction efforts and other beneficial activities in the forests, by augmenting regional businesses appetites for woody biomass used in value-added processing. The added benefit is increasing the volume produced of useful products, jobs, and tax revenues.

Typically, landowners and forest harvest contractors are reluctant or unable to sort material in the woods to meet the needs of small companies. A sort yard will allow for all non-saw log material to be piled and shipped at low cost from the woods to a central sorting and merchandizing facility. This is material that would otherwise be left standing or cut and burned in slash pile because of the relative cost-to-value compared to saw logs to bring that material from the woods. No unusual logging or trucking equipment is required to harvest and transport this material. This facility could vastly improve the cost to supply the various campus product lines with raw material.

For example, at current production levels of 25,000-30,000 green tons per year, the IBR Sort Yard in Wallowa could handle 500,000-600,000 green tons of woody biomass within the first 20 years of operation, representing over 50,000 acres of forest treated. The actually number of treated acres will likely be an order of magnitude higher, as IBR anticipates increasing

---

production levels, and the current stewardship contracts have yielded an unusually high tonnage per acre.

The Campus model has the potential to enhance biomass utilization in Valley County by (a) improving the operational efficiency of Campus production (b) improving the bottom-line of campus products via raw material cost savings, especially those utilizing low-value material (c) increasing Campus revenues from high-value material which can be sold to traditional timber producers. Siting the project in Valley County captures production efficiencies through decreased haul costs for low value material and ensures that a majority of value generation and job creation remains within the County.

3. Existing Forest Product Initiatives

Like much of the Pacific Northwest, Valley County and the North Idaho region have experienced closures of primary forest products businesses over the past couple of decades. Sawmills, plywood mills, and other wood product facilities were common in Valley County and many rural Idaho communities prior to mid-90’s when fundamental shifts in national forest management policy and market changes forced the closure of many operations. A 2016 study by the University of Idaho notes that the utilization rate of existing mills is low compared to capacity.14

At the time of this study, there are no active forest products mills in Valley County, the closest operational mill being Evergreen Forest Products in Tamarack, just outside the County. Boise Cascade operated the last mill in Valley County up until 2002 when the operation closed down permanently and production was shifted to their facility in La Grande, Oregon. Capacity of the regional lumber mills is well below the recommended harvest levels to address forest health issues on timberlands across the region. The County is losing the opportunity to provide local jobs in the wood processing industries.

Lacking local processing capacity, most logs and other forest products generated from forest lands in Valley County are being trucked to facilities outside the County. The cost of transporting timber out of the County reduces the returns to forest landowners and contractors and can reduce the margins of profits from managing low-value timber to impractical levels. This exacerbates the problem of returning the WUI lands to a healthy and fire safe condition. Creating a market for small diameter logs can create additional opportunities for fire mitigation and forest restoration beyond the traditional saw-log market.

An extensive study was completed by McKinstry Company in 2011 to assess the feasibility of building a biomass energy production facility. The study looked at the possibility of constructing a 2-3 megawatt power plant in Horseshoe Bend, Idaho City, or Garden Valley, all relatively close to Valley County. The facility would have certainly provided a market for forest biomass sourced from Valley County had it been constructed. Unfortunately, a number of factors including current low natural gas prices and the lack of bio-energy incentives have put the plan on hold indefinitely.

4. CURRENT AND PROJECTED TIMBER SUPPLY

This summary describes biomass supply in Valley County, Idaho, and discusses the risks and challenges associated with securing a long-term supply. This summary is based on a detailed biomass supply assessment already completed by researchers at the University of Idaho (Cook and O’Laughlin) in January 2011. Summary tables are presented throughout the text and the complete datasets are available online.

PRINCIPLES OF A GENERAL SUPPLY ASSESSMENT

A biomass supply assessment considers theoretical, technical, and economic constraints on available material. A comprehensive supply assessment should also identify land ownership, timber stocking, and cost of supply agreements in order to provide project planners with the necessary information to make investment decisions.

- Theoretical: Describes the ultimate resource potential based on calculations of all existing biomass, with no constraints on access or cost-effectiveness.
- Technical: Limits the theoretical resource potential by accounting for terrain limitations, land use and environmental considerations, collection inefficiencies, and other technical and social constraints, including public/private land sources, permits and approvals for harvest/haul, etc.
- Economic: Economic parameters are applied to the technical resource potential, which results in a subset of the technical potential along with an estimate of the cost of biomass resources either at the field or forest edge. The final outcome of this type of assessment is a supply curve ($/ton) and costs of logistics.

SUPPLY AREA (WOOD BASKET)

Although the wood basket available to the facilities in Valley County may include most of West Central Idaho and the adjacent counties, it is more reasonable to assume the primary wood basket is centered in and around Valley County itself. The expense of transporting low value timber over long distances coupled with competing facilities outside of Valley County limits the reach of the proposed facility. These conditions provide both advantages and disadvantages: the wood basket is constrained by hauling costs however the significant volume of timber in Valley County can be most economically delivered to a local facility compared to other existing competitor’s locations. Additionally, utilizing the local timber supply helps center the economic benefits and job creation of the campus on Valley County.

FEEDSTOCK SOURCES

Woody biomass can be obtained from a variety of feedstock sources including private, state, and federal forest lands, from short rotation tree crops (fast growing poplars, etc.), and biomass crops. At present production levels, Agroforestry and biomass crops are not sufficient to factor into reliable or adequate biomass supplies.
Figure 2. Theoretical biomass supply within 50-mile radius of two potential campus sites in Valley County.
The proposed biomass campus sort yard will require unprocessed virgin sources for value-added products. Additional feedstock sources could otherwise include municipal solid wastes including wood chipped by Valley County such as tree trimmings, construction wastes, etc. However, even considering a tipping fee, these sources are not considered because the cost of handling outweighs their value for a small operation. These sources might be more relevant if a larger biomass energy facility is built on the campus or in the region, or if a small biomass energy facility located at the facility requires supplemental feedstock beyond what is created at the campus.

**Theoretical supply: Biomass in the United States**

The theoretically available biomass supply includes all sustainably harvestable material from public and private lands, as well as agricultural residues and other waste. The National Renewable Energy Laboratory (NREL) publishes county-level estimates of solid biomass resources by county.\(^{15}\) NREL’s definition of biomass includes “logging residues and other removable material left after carrying out silviculture operations and site conversions... Other removals are the unutilized wood volume of trees cut or otherwise killed by cultural operations (e.g., pre-commercial thinnings) or land-clearings to non-forest uses.”\(^{16}\)

**Figure 3. Forest Biomass Resources by County**\(^{17}\)

\(^{15}\) [http://www.nrel.gov/gis/biomass.html](http://www.nrel.gov/gis/biomass.html)

\(^{16}\) Source: USDA, Forest Service’s Timber Product Output database, 2012.

According to the 2014 estimate, Valley County could produce 50 to 100 thousand tons per year of crop residues, forest and primary mill residues, secondary mill residues, and urban wood waste. Neighboring Idaho County has a potential of 250-500 thousand tons per year, due in part to its relatively larger size (3,733 mi² vs. 8,503 mi²). If only forest residues are considered, this number drops to 25 to 50 thousand tons per year in both Valley and Idaho County.

**Biomass in Idaho State**

Thinning for hazard-fuel reduction could supply significant quantities of material. The state of Idaho ranks third, behind California and Montana, in terms of the total volume of material that could be removed under a simulated thinning regime (Table 1). The cost curve for biomass reflects a relatively favorable cost-volume relationship, with the available biomass maximized at under $30/bdt (Figure 4). Idaho’s forests would supply far more cost-effective biomass compared with states like Arizona and Colorado, which have a different species mix and operating costs.

Table 1. Volume of material removed under a simulated uneven-age hazard-fuel thinning regime by timberland ownership type

<table>
<thead>
<tr>
<th>State</th>
<th>Private</th>
<th>National Forest</th>
<th>Other Federal</th>
<th>State and Local</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>50</td>
<td>65.1</td>
<td>0.6</td>
<td>1.7</td>
<td>117.4</td>
</tr>
<tr>
<td>Montana</td>
<td>14.8</td>
<td>38.2</td>
<td>3.2</td>
<td>2.6</td>
<td>58.9</td>
</tr>
<tr>
<td>Idaho</td>
<td>13.2</td>
<td>35.7</td>
<td>3.5</td>
<td>5.3</td>
<td>57.7</td>
</tr>
<tr>
<td>Oregon</td>
<td>16.3</td>
<td>28.3</td>
<td>8.4</td>
<td>2.1</td>
<td>55.1</td>
</tr>
<tr>
<td>Washington</td>
<td>12.8</td>
<td>18.4</td>
<td>1.1</td>
<td>6.4</td>
<td>38.8</td>
</tr>
<tr>
<td>Colorado</td>
<td>5.9</td>
<td>8.9</td>
<td>2.4</td>
<td>0.2</td>
<td>17.4</td>
</tr>
<tr>
<td>New Mexico</td>
<td>3.3</td>
<td>10.7</td>
<td>0</td>
<td>1.1</td>
<td>15</td>
</tr>
<tr>
<td>Arizona</td>
<td>2</td>
<td>6.9</td>
<td>0</td>
<td>0</td>
<td>8.9</td>
</tr>
<tr>
<td>Wyoming</td>
<td>2.3</td>
<td>3.1</td>
<td>1.8</td>
<td>0.1</td>
<td>7.3</td>
</tr>
<tr>
<td>Utah</td>
<td>1.6</td>
<td>3.9</td>
<td>0.3</td>
<td>1.1</td>
<td>6.9</td>
</tr>
<tr>
<td>South Dakota</td>
<td>0</td>
<td>1.1</td>
<td>0</td>
<td>0</td>
<td>1.1</td>
</tr>
<tr>
<td>Nevada</td>
<td>0.2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>122.3</strong></td>
<td><strong>220.2</strong></td>
<td><strong>21.3</strong></td>
<td><strong>20.8</strong></td>
<td><strong>384.6</strong></td>
</tr>
</tbody>
</table>

BIOMASS IN VALLEY COUNTY

The feedstock supply area (‘wood basket’) for Valley County includes forests in neighboring counties such as the Boise National Forest in Boise County and the Payette National Forest in Idaho County. The area of any given facility’s wood basket is generally limited by haul costs, which can rapidly consume any profits from timber, chips, and other material utilization. A Beck Group (2015) study of small-diameter wood utilization in Eastern Oregon found haul costs of $16/bdt for 25 miles increasing to $48/bdt for 100 miles. A 2015 study of biomass for bioenergy in eastern Idaho assumed transportation costs generated based on an estimated cost of $80/hour for operation of a standard 25-ton chip van, with five hours of loading and transportation time factored into the final delivered price.

A preliminary biomass feasibility study in support of a wood heat conversion of municipal and public buildings in McCall found that sufficient wood chips or commercial-grade pellets could be made available to run a 2.9 MMBtu/hr biomass boiler (380 bdt/yr). The study’s author commented, “The National Forest System in particular provides a great biomass resource for this location with approximately 650,000 acres of overstocked land having accessible slopes in a non-reserved category within 40 miles of McCall.”

---


Table 2. Total mass of woody biomass in bone dry tons available from several sources within a 50 mile radius of the either proposed site.\(^{22}\)

<table>
<thead>
<tr>
<th>Woody Biomass Source</th>
<th>Estimated Total (1000 BDT)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Treatment Activities (1), Private Lands</td>
<td>3.0 to 9.1</td>
<td>Most of this material is not profitable at this time and would require subsidy to encourage residue removal.</td>
</tr>
<tr>
<td>Fuel Treatment Activities (1), Public Lands</td>
<td>46.0 to 138.1</td>
<td>--</td>
</tr>
<tr>
<td>Available Logging Slash Private Lands</td>
<td>36</td>
<td>--</td>
</tr>
<tr>
<td>Available Logging Slash Public Lands</td>
<td>103.8</td>
<td>--</td>
</tr>
<tr>
<td>Forest Products Manufacturing Residue (2)</td>
<td>(~13)</td>
<td>8 wood products manufacturers within 50 miles of McCall. The largest uses a significant portion in a 6 MW plant (3)</td>
</tr>
<tr>
<td>Land-filled Urban Wood Waste</td>
<td>(~0)</td>
<td>Relatively little, cost of collection would be too high. Currently being hauled to regional landfill.</td>
</tr>
<tr>
<td>Agricultural Byproducts</td>
<td>(~0)</td>
<td>Very little available and high cost of collection</td>
</tr>
</tbody>
</table>

(1) Includes forest management activities to reduce fire potential, such as biomass thinning and collection of timber harvest residues

(2) Industrial wood products residue within 50 miles of McCall totals approximately 25,750 green tons or approximately half this at 50% moisture content wet basis.

**Sources – Public/Private Lands Breakdown**

Total biomass may be limited by stocking levels, species age class, management planning, or other cost constraints. Importantly, legal restrictions on harvest planning (NEPA) drive the ultimate availability, or lack thereof, on public lands. Research from the Forest Service shows that “Southern Idaho’s most dramatic harvest decreases occurred in the southwestern counties...

---

\(^{22}\) Source: “Preliminary Biomass Feasibility Study, Payette National Forest – Krassel Yeard, McCall, Idaho”, prepared by Craig Hustwit, James Baker, Dean Graham, National Energy Technology Laboratory, prepared for William L. Perry, Supervising Civil Engineer, Payette National Forest, March 2011
of Adams, Boise, and Valley, where timber harvest has decreased by 146 MMBF (33 percent) since 1990.”

Figure 5. Idaho’s timber harvest by ownership, 1947 through 2013 (sources: Bureau of Business and Economic Research, The University of Montana-Missoula; USDA Forest Service Region One, Missoula, Montana).

State lands administered by the Idaho Department of Lands (IDL) could offer a more predictable supply. Planned sales for July 1, 2016 to June 30, 2017 in the Payette Lakes Supervisory Area include 1,449 acres for a total of 90,560 tons (16,000 MBF). This is compared with 2,031 acres, 97,628 tons (16,000 MBF) in the Payette Lakes Supervisory Area from July 1, 2015 to June 30, 2016. Prescribed operations include activities across a range of costs, including skyline logging, and ground-based equipment.

Biomass cost curves shown in Figure 6. suggest that an increased price for biomass will only drive increased availability from public lands hazard-fuels reduction. Table 3 shows the calculated biomass available in Valley County and its surrounding five neighbors. The authors

25 Timber sales are advertised for four weeks in a newspaper in the county where the sale is located, and are sold at public auction. In addition to publication in the county newspaper, the advertisement is also posted to the Idaho Department of Lands timber sales website at: https://apps.idl.idaho.gov/timbersale/Search.aspx
Contact: Scott Corkill, (208) 634-7125, Payette Lakes
555 Deinhard Lane McCall, ID 83638
note that “biomass removal is a byproduct, or secondary output, of other forest management objectives including forest health treatment, fire hazard reduction work, or the treatment of fuels after logging (see Cook and O’Laughlin 2011, Appendix B, p. 9). Of these, Boise County and Idaho County are the most likely to offer suitable material in the necessary quantities.

Table 3. Forest Biomass Supply at $10/bone-dry-ton (Cook and O’Laughlin 2011)²⁶

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>FIRE HAZARD THINNING</th>
<th>LOGGING RESIDUE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PUBLIC</td>
<td>PRIVATE</td>
<td>PRIVATE LAND THINNING</td>
</tr>
<tr>
<td>Boise</td>
<td>647</td>
<td>34</td>
<td>-</td>
</tr>
<tr>
<td>Gem</td>
<td>-</td>
<td>34</td>
<td>-</td>
</tr>
<tr>
<td>Idaho</td>
<td>-</td>
<td>1,969</td>
<td>4,394</td>
</tr>
<tr>
<td>Payette</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Valley</td>
<td>2,365</td>
<td>168</td>
<td>359</td>
</tr>
<tr>
<td>Washington</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>12,686</td>
<td>4,389</td>
<td>19,058</td>
</tr>
</tbody>
</table>

Figure 6. Biomass cost curves for Valley County at prices ranging from $10-40/bdt. Based on Cook and O’Laughlin 2011.

Supply Challenges

The biomass supply assessment results from Skog et al. (2008) and Cook and O’Laughlin (2011) must be interpreted with caution, due to numerous assumptions that may not apply to the present circumstances. For example, stumpage cost was assumed to be $2/odt on private land and $0 on public land, with the cost for wood removals estimated using the FRCS models on

each FIA forest plot. Roadside chipping cost was assumed at $8/dry ton. The main stem of trees greater than 7” DBH was not used for biofuels, but instead assumed to be sold for sawtimber to subsidize the cost of removing tops and branches. In many ways, this treatment is consistent with the approach of an integrated woody biomass campus, making the Skog et al. studies an appropriate high-level perspective to inform more detailed analysis.

**Supply Agreement**

A facility needs to be able to sign supply agreements in order to secure financing for capital investments. The uncertainty surrounding NEPA planning on public lands makes it almost impossible for public lands alone to support an investment-grade business plan. Public lands may be able to offer cost-competitive timber sales on a year-to-year basis, however this kind of variability is not “bankable,” i.e. would not satisfy commercial lending underwriting criteria for capital investments. One approach could be to ramp up with material from private lands and then secure a 10-year stewardship contract in order to expand operations. A significant volume of biomass could be available from private lands at a price ranging from $10-40/bdt.

While much of the private forest lands in the region are rather small, there does exist one significant piece of former Boise Cascade industrial timber lands that is currently owned by DF Development LLC. The tree farm is approximately 172,000 acres, and the manager has expressed interest in engaging in a supply agreement with the proposed project for pre-commercial thinning material. A theoretical estimate of the possible contribution of supply from the DF Development lands is detailed here, although it is not based on any specific familiarity with the lands, rather a general knowledge of past management history. The DF land managers or local consulting foresters should be able to provide a more precise estimate as time allows.

Using the following assumptions about the property:

- 172,000 total acres, 155,000 managed timber acres excluding meadows, rims, riparian areas
- Average timber productivity of 50 cubic feet per acre per year (from state taxation estimates)
- Extensive management and timber cutting of merchantable saw timber over the last 30 years
- Much of the existing timber inventory is likely in small size classes.
- An average weight of solid wood of 40 lbs. per cubic foot

Based on the above assumptions the estimate of timber growth in tons per year:

\[
155,000 \text{ (ac.)} \times 50 \text{ (cu. ft.)} \times 40 \text{ (lbs.)} / 2000 \text{ lbs./ton} = 155,000 \text{ tons}
\]

To estimate the volume of small diameter wood that might be available on the property the average volume of larger diameter saw logs being removed needs to be subtracted from the total tonnage. A general estimate 10 to 15 million board feet of saw logs being removed annually and therefore approximately 55,000 to 80,000 tons are in the form of saw
logs. Subtracting that from the potential growth would leave something in the neighborhood of **75,000 to 100,000 tons** in small diameter wood.

It is likely that not all of the tonnage of small diameter wood would be available at an economic cost to the biomass campus, although this illustrates the large potential of the DF Development lands to provide small logs to the facility.

**LOGISTICS**

Increased traffic through scenic and residential could be partially mitigated in part by the choice of site location at the Weed Department Site, given the lack of home sites in the immediate proximity relative to the County Road Yard Site. In either case, material sourced from the Boise National Forest would travel from South to North along logging roads and highway 55, potentially contributing to increased traffic along scenic portions of the Payette between Banks and Cascade. In contrast, material traveling from North to South must pass through McCall and Lake Fork, potentially raising concern among residents of the resort town.

**FIRES**

The Pioneer Fire (July-October 2016) in the Boise National Forest burned an area of 188,404 acres east-northeast of Pioneerville. The fire appears to have spared the triangle between Pioneerville, Placerville, and Garden Valley\(^{27}\) that may potentially offer biomass removal contract opportunities with the Forest Service. Conflicting opinions about salvage logging following a fire mean that attempts to remove logs from the area burned by the Pioneer Fire could end up tangled in litigation with environmental groups. The hardpan soils following a wildfire create conditions very sensitive to erosion and permanent damage from skidders and other log handling equipment.

**CONCLUSION**

The theoretically available supply could easily provide enough raw materials for the operation of an integrated biomass campus in Valley County. However, the technically and economically recoverable supply will need to be calculated using updated land ownership, forest inventory, and harvest cost data in order to provide a supply assessment that can stand up to the scrutiny of investor due diligence and bank underwriting criteria. Ultimately, the development of the campus is most likely to occur if the project developer can secure a 10-year supply agreement with a private timberland owner.

5. **Wood Product and Energy Markets Overview**

National and global market forces drive regional demand for wood and wood products, with policies and incentives providing additional support to specific projects. Overall, consumption and production of forest products are correlated with the economic activity of the U.S. as a whole. Key market indicators include U.S global market share, housing starts, currency exchange rates, and others. Policies that support woody biomass utilization and energy production include federal and state incentive and grant programs.

**National Markets for Timber and Forest Products**

Demand for timber changes in response to the interaction of business cycles, interest rates, and housing starts. The Fed did not raise rates at their September 2016 meeting, although the divided vote suggests that a number of committee members support raising benchmark rates. Economic indicators remain positive but uninspiring, with inflation (0.8% for the 12 months ending July 2016), unemployment (4.9% in August 2016), and gross domestic product growth (1.1% Q1-Q2 2016) showing improvement since the financial crisis.

New home construction drives demand for timber, with housing starts increasing 4.8% from May to June 2016, for a seasonally adjusted rate of 1.189 million according to data released by the Commerce Department. Continued growth is expected to 2020, when Trading Economics forecasts 1.280 million per year. This remains below the historical average of 1.5 million per year from 1960 to 2000. Economists disagree about whether the US housing sector will recover to this historical level. The Freddie Mac Multi Indicator Market Index (MiMi), which includes home purchase applications and other indicators of mortgage rates, repayment and household income, shows a stable housing market nationwide, with Oregon, Montana and Colorado approaching their historical benchmark index values.

A 2011 study by researchers at the University of Oregon found a positive correlation between the Oregon wood fuel price and U.S. wood pulp, softwood timber, and energy sources such as electricity, gas, coal and oil, but not with U.S. log or lumber exports. The study found a negative correlation between Oregon wood fuel price and U.S. housing starts and softwood lumber. The study authors had access to several paid databases (Forest2Markets & Random Lengths) that are beyond the scope of this report.

---

30 [http://www.bls.gov/news.release/emplsir0.htm](http://www.bls.gov/news.release/emplsir0.htm)
31 [http://www.bea.gov/newsreleases/national/gdp/gdpprincip.htm](http://www.bea.gov/newsreleases/national/gdp/gdpprincip.htm)
33 [http://www.tradingeconomics.com/united-states/housing-starts/forecast](http://www.tradingeconomics.com/united-states/housing-starts/forecast)
36 [https://scholarsbank.uoregon.edu/xmlui/bitstream/handle/1794/19032/WP_32.pdf?sequence=1](https://scholarsbank.uoregon.edu/xmlui/bitstream/handle/1794/19032/WP_32.pdf?sequence=1)
INTERNATIONAL MARKETS FOR TIMBER AND FOREST PRODUCTS

Forest Service research shows that the U.S. share of the global roundwood market declined from its peak of 28% in 1998 to 20% in 2013. The globalization of timber markets combined with the long-term trend towards substitution of pulp and paper products with electronics and plastics suggests that the U.S. is unlikely to recapture market share.

The Campbell Group reports that US softwood lumber imports rose 43 percent year-over-year in Q1 2016, with imports from Canada making up 10.04 out of 10.51 million m³. US lumber exports dipped to 124.02 million board feet in April 2016, with reductions in exports to China due to a slowdown in the Chinese economy. Wood Resources International’s Q2 2016 market update suggests that Canada’s declining exports to China instead found buyers in the US market.

The USD/CAD exchange rate influences log prices in the Pacific Northwest by effectively decreasing the cost of Canadian timber relative to U.S. supply. The Royal Bank of Canada reports a stable USD/CAD exchange rate of 1 USD to 1.30 CAD in Q1 & Q2 2016, with a forecast of a slight increase to 1.36 in Q3 2016 and 2017 forecast value returning to 1.30. This suggests that Canadian imports will remain relatively less expensive when compared to US production.

BIOENERGY AND RENEWABLES MARKETS

Advances in drilling technology unlocked a global supply glut of oil and gas, driving down prices to historic lows and stabilizing energy costs in the medium-term. The 2016 Brent Spot price of $36.84/barrel (2015 USD) has translated into lower energy costs across the country. With natural gas at Henry Hub costing $2.62/mmBTU (2015 USD), many utilities are investing in high efficiency natural gas turbines for electricity production to replace their aging coal generation infrastructure.

Renewable energy generated from intermittent renewables Bloomberg New Energy Finance projects that “The levelised costs of generation per MWh for onshore wind will fall 41% by 2040, and solar photovoltaics by 60%, making these two technologies the cheapest ways of producing electricity in many countries during the 2020s and in most of the world in the 2030s.” The majority of renewable energy produced in Idaho (excluding conventional hydropower) comes from large-scale wind generation sited around the Snake River. With the 2016 extension of the Production Tax Credit (PTC), we can expect to see continued wind energy development in the region.

Due to the low cost of power, wood use for bioenergy is most economical in traditional applications of combined heat and power systems, such as at large sawmills where a electricity offsets the facility’s load and waste heat powers drying kilns for wood products. “Forisk analysis

38 Email Newsletter. June 2016.
40 http://www.eia.gov/ Accessed 9/7/16
suggests wood use for viable bioenergy projects in the U.S. will be 77.7 million tons per year by 2025.\textsuperscript{41} However, the overall utilized capacity of biomass cogeneration plants in the Pacific Northwest and California has decreased in the last twenty years due to mill closures (Oregon, Washington, Idaho) and rollback of subsidies and public support (California).

Wood pellet manufacturers serve a higher end, primarily export market. The EU heat and power markets drive global demand for wood pellets. Hawkins Wright projects the EU’s demand for wood pellets will increase at a CAGR of 11% between 2015 and 2019.\textsuperscript{42} Due to the EU’s Renewable Energy Directive (RED), the region accounted for 85% of the world’s 25 million metric tons (Mt) of wood pellet trade in 2013. The US International Trade Commission reports that over three quarters of the US wood pellet capacity is located in the US South, and that in 2013, 2.9 million Mt were shipped to the EU, accounting for 98% of wood pellet exports.

In contrast, Asian markets could be a destination for exports from the US West Coast. Both South Korea and Japan have set renewable power targets (10% by 2022, and 25-35% by 2030 respectively), and are expected to increase imports of wood pellets from Canada, Southeast Asia, and the United States.\textsuperscript{43} On balance, the 2015 labor disputes at West Coast Ports (Los Angeles and Portland)\textsuperscript{44} and the 2016 bankruptcy of global shipping giant Hanjin\textsuperscript{45} suggest that international logistics are unlikely to be straightforward or suitable for small-scale operations.

Idaho has seven pellet production facilities listed in the online directory by Biomass Magazine, with a combined production capacity of 448,600 short tons per year.\textsuperscript{46} The Rocky Canyon Pellet Company facility in Grangeville, Idaho, had an annual production capacity of 10,000 tons, but the production facility burned in 2014.\textsuperscript{47} It appears that the facility is currently still in production and managers may be contacted via their website.

6. **Local Market Conditions**

Delivered prices vary by location and species, with prices in central Idaho influenced by regional supply and international commodity prices. The Campbell Group notes an upswing in US West Coast Douglas-fir and Canadian spruce-pine-fir in Interior British Columbia, with prices above 350-380 2014$/MBF.\textsuperscript{48}

**Saw Log Markets**

Since the proposed Valley County biomass campus would not utilize and process saw logs, but re-sell them, the benchmark price for saw logs would be whatever the local mills pay less the

\textsuperscript{41} http://forisk.com/product/forisk-research-quarterly-frq/ Q3 2016
\textsuperscript{43} https://www.usitc.gov/publications/332/wood_pellets_id-039_final.pdf January 2015
\textsuperscript{44} http://www.wsj.com/articles/shipping-growth-slows-at-u-s-east-coast-ports-1439923808
\textsuperscript{46} http://biomassmagazine.com/plants/listplants/pellet/US/
\textsuperscript{47} http://www.idahocountyfreepress.com/news/2014/au ag/06/it-went-quick-fire-destroys-pellet-production-faci/
\textsuperscript{48} Email Newsletter. June 2016.
haul-by trucking rates. Using the current price of small saw logs at Evergreen Forest Products of $44/ton less the haul differential of approximately $7.25 per ton, Valley would need to pay $27/ton to be competitive for the small saw log component.

Pulp log values would be the primary benchmark for pricing of remaining material to be processed at the Sort Yard. Current delivered prices for pulp logs throughout the Northwest are weak due to light demand for whole log chips and adequate supplies of residual chips from sawmills. Current pulp log prices as of October 2016 in Lewiston Idaho are approximately $85 per bone dry ton. To be competitive with regional whole log chippers, the Valley Yard would need to pay around $27 per ton for logs originating in Valley County.

Although it will not be considered in the income statement for this analysis, there is a great potential to purchase logs at a considerably lower rate when delivered into the sort yard. This is achieved by modification of the in-the-woods logging systems, increasing the logger’s efficiency and volume recovery. Experience in Northeast Oregon by some of the larger mechanically based loggers has shown that 20-30% savings on the harvesting costs for small logs can be achieved. This savings is realized through reduced processing of the logs on the landing; leaving the small saw logs attached to the tops and elimination of sorting by species.

The Campus Model is optimized when smaller trees (generally 12” diameter breast height and smaller) are cut and skidded whole to the landing. At the landing the processor would only cut a saw log from the tree if it yielded a long log (>33’) to the minimum sawmill top diameter. All short logs would remain attached to the tree. The tree with the short log attached would be minimally processed to remove the limbs out to the minimum top size the sort yard would accept (estimated 3” diameter.) The tree would then be loaded onto a conventional long log truck and sent to the sort yard unsorted by species. Likewise this would allow the tops from larger trees to be sent to the sort yard as well. The overall result is less residual slash on the logging job.

Due to the short and small saw logs left attached to the stem, the estimated overall tonnage of wood delivered to the sort yard is estimated at approximately 10% in the form of saw logs and 90% in fiber to be utilized at the small wood campus.

As loggers adapt to this system of logging, the cost of logs should actually go down as they find it less expensive to deliver to the small wood campus / sort yard than to traditional facilities which require higher levels of processing and sorting. Estimated savings in Northeast Oregon are from $5 - $6 per ton. If even a portion of that flows back to the yard in the form of lower log costs, the overall income statement would improve considerably.

POST AND POLE MARKET

Hops (Humulus lupulus) cultivation for craft beer production is at an all-time high in the United States due to increased demand for craft beer and supply constraints in traditional growing regions such as southern Germany. Hops production increased 11% 2014-2015 in Oregon, Washington, and Idaho, with a 26% increase in Idaho alone, for a total harvest of 78.8 million
pounds in 2015.\textsuperscript{49} Idaho’s harvested area increased from 3,743 to 4,863 acres 2014-2015, with a total value of production increasing from 18.8 million to 30.8 million USD. Idaho’s potato-growing regions can also support hops cultivation due to the suitability of soils.\textsuperscript{50} The USDA reports a 17\% increase in hop acreage 2015-2016, with Idaho growers accounting for 5,971 acres strung for harvest – the greatest area since 1915.

According to a rough estimate, this increase from 4,863 acres to 5,971 acres could have stimulated demand for around 77,000 20-foot poles. Hops require 20 ft-tall poles and trellises. WSU cost estimate calculations from 2010 suggest 60 field poles and 10 anchor poles per 1.1 acres of land (required for 1 acre of hops), for a cost of $15/$23.50 pole respectively.\textsuperscript{51} This suggests transactions of $260,000 in anchor poles and $997,000 in field poles in 2016 alone.

UMT’s Idaho Wood Product Directory lists 1 hop pole distributor, Panhandle Forest Products in Priest River, with sales between $1-5 million/year.\textsuperscript{52} Parma Post and Pole is also a large supplier of pole material throughout the Treasure Valley, with plans to scale up production through the installation of a new mill in Seneca, Oregon.\textsuperscript{53}

\textbf{FIREWOOD MARKET}

In 2015, the EPA released more stringent requirements for residential wood stoves and pellet-based heat.\textsuperscript{54} Idaho DEQ supports EPA-rated wood stoves in an effort to cut air pollution.\textsuperscript{55} Residents can take a residential tax deduction for 40\% of the installed cost of a system in the first year and amortize an additional 20\% over the following 3 years. Fireplaces are not considered woodstoves.\textsuperscript{56} A minority of households in Valley County use firewood for heating, although anecdotal accounts of firewood removal from slash piles from restoration and logging operations on private and public indicate that a significant local market may exist.\textsuperscript{57}

\textbf{FIBER AND ENERGY BIOMASS MARKET}

Currently, there is little local market for fiber, although there is a market demand for paper chips at Clearwater Paper, and for hog fuel at Evergreen Forest Products. The demand for energy chips appears to be extremely limited at this time, although it is possible that this may change through the development of additional biomass boiler thermal projects at institutional buildings around Valley County. The lack of natural gas and the high cost of fuel oil, propane, or electricity for heating may make the conversion to biomass boilers economically feasible.

\textsuperscript{49} \url{http://usda.mannlib.cornell.edu/usda/current/hops/hops-12-17-2015.pdf}
\textsuperscript{50} \url{https://en.wikipedia.org/wiki/Hops}
\textsuperscript{51} \url{http://cru.cahe.wsu.edu/CEPublications/FS028E/FS028E.pdf}
\textsuperscript{52} \url{http://www.mmis.umt.edu/id/detail.asp?facilitycode=2649}
\textsuperscript{53} Personal Communication, Mike Sterling, Parma Post and Pole, August 2016
\textsuperscript{54} \url{https://www.federalregister.gov/documents/2015/03/16/2015-03733/standards-of-performance-for-new-residential-wood-heaters-new-residential-hydronic-heaters-and}
\textsuperscript{55} \url{http://www.deq.idaho.gov/air-quality/burning/}
\textsuperscript{56} \url{http://www.deq.idaho.gov/air-quality/burning/woodstoves/replacements-and-tax-deductions/}
\textsuperscript{57} Personal Communication, Colin Chambers, DF Development, November 2016
7. **Campus Ownership Models**

This study considered two options for the organization and governance of the biomass campus. Of the two, the preferred option is to have all the product lines operated under one business, thereby eliminating the additional workload of managing contractual relationships and partnerships. However, if the county cannot find the appropriate entrepreneur to take on the entire business, an alliance structure provides a viable option.

In both cases the campus uses a scalable production model which positions it to start with easily accessible biomass supplies from WUI lands and a conservative customer base. The model expands as supply and demand builds, and new opportunities are identified.

**Biomass Campus Operated by a Single Entity (Preferred Option)**

In this scenario, the sort yard, various product lines, and energy production is all operated and managed by a single entity. The campus manager or a designated log buyer will source raw materials as needed to supply the various product lines. Single ownership allows for greater flexibility between production lines, allowing the campus to quickly adapt production to market conditions. By eliminating the need to manage the alliance partners, the work load for the campus manager is decreased, allowing the campus to focus on doing its operations. The main drawback to this model relates to the difficulty of finding a single entrepreneur willing to take on the risk of operating the entire campus.

**Biomass Campus Operated as an Alliance**

A biomass campus alliance consists of multiple independent business that produce distinct product lines operating in partnership with the sort yard. If the biomass campus is to be operated as an alliance, it is essential to integrate the sort yard and the various businesses. In this case, the purpose of the sort yard is to provide the campus and/or collocated businesses with sorted/value added woody biomass that fulfills their needs for logs or pre-processed materials while operating in a safe, reliable, efficient and environmentally sound manner. The Sort yard takes delivery of unsorted and differentiated logs from harvesting and thinning operations; sorts the logs based on their individual “highest and best use”; and then sells the sorted material to co-located forest product enterprises or other customers; for a profit.

One significant factor in managing the sort yard will be the assessment of logs coming into the yard and then moving on to the co-located businesses. Material needs to be measured in order to quantify delivery, which can involve various metrics such as piece counts for post and pole or weight for firewood. Additionally, material quality will have to be assessed in order to ensure that businesses are getting product that suits their needs. It will be the responsibility of the sort yard to manage this monitoring and to create contracts with the businesses that explicitly reference their quality and quantity requirements.

One important consideration with the Alliance model lies in the management of the raw material sourcing. Either an independent sort yard operator or the Producer Alliance as a whole can be responsible for purchasing concessions and getting raw material into the yard. In
the case of independent sort yard operator sourcing the raw materials, co-located business could enter into a supply contract with the sort yard to provide certain volumes of pre-sorted small logs or biomass over a given period of time. Alternatively, if the Alliance handles the purchase of concessions and the sourcing of raw material, the sort yard would still process the logs, thereby providing the advantage of reduced logging rates (as discussed elsewhere in the report), and would charge the co-located business a small processing fee. In this case, the sort yard would profit from the reduced logging rates as well as the residuals from the supply chain, such as hog fuel or chips that could be sold elsewhere.

8. **Sort Yard Infrastructure**

The purpose of the Sort Yard is to provide regional customers and product lines with sorted/value added woody biomass that fulfills their needs for logs or pre-processed materials while operating in a safe, reliable, efficient and environmentally sound manner. It takes delivery of unsorted and differentiated logs from harvesting and thinning operations; sorts the logs based on their individual “highest and best use”; stores these materials as necessary; and then sell the sorted material to co-located value adding forest products industries or other customers; for a profit.

A number of factors influence the operational efficiency of log yards:

- Distance logs need to be moved within the yard. Generally shorter distances equal lower costs.
- Size of loads transported by handling equipment. Generally larger loads equal lower costs.
- Traffic flow. Avoiding situations causing one operation to delay while another passes.
- Adequate room for unloading, sorting, decking and processing logs.
- Number of times logs are handled in the yard. Less handling equals less breakage and lower costs.
- Yard base and surface contour. All-weather rocked yards and roads improve machine efficiency and reduce machine maintenance costs. Level and solid surfaces also lead to reduced fuel consumption.
- Adequate room to separate decked raw materials for fire protection. In example, it is important to keep ground wood and hog fuel located away from decked logs due to fire considerations. Storage of ground wood in overhead bins and moving it to markets as quickly as possible is desirable.
9. **SITE ANALYSIS**

Several sites were examined for their potential for a biomass campus, although only two appeared to be suitable, both on County-owned land: the County Road Yard and County Weed Department location. Other sites lacked infrastructure and were owned by private parties that would likely require that the land be purchased upon creation of the business, which could impede efforts to get the business started.

Between the two County sites, each has their own advantages and disadvantages, although the two sites are generally quite similar. The decision on which site to develop will be dependent on the County’s future plans for the sites and the willingness to eventually sell the land to the potential Campus business, as well as considerations regarding the increased industrial activity that would result from the Campus. The following is a brief listing of the infrastructure advantages and disadvantages for each site. This is not a complete listing but highlights some of the major considerations.

**Table 4. Sites and Considerations**

<table>
<thead>
<tr>
<th>SITE NAME</th>
<th>COUNTY ROAD YARD</th>
<th>COUNTY WEED DEPARTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS Location</td>
<td>44.835405, -116.067979</td>
<td>44.481671, -115.988883</td>
</tr>
<tr>
<td>Physical Address</td>
<td>36 East Lake Fork Road, McCall, ID 83638</td>
<td>55 Gold Dust Rd, Cascade, ID 83611</td>
</tr>
<tr>
<td>Zoning</td>
<td>Multiple Use</td>
<td>Multiple Use</td>
</tr>
<tr>
<td>Existing Infrastructure</td>
<td>County Buildings Currently in Use</td>
<td>County Buildings Currently in Use</td>
</tr>
<tr>
<td>Existing Uses</td>
<td>County Road Department Gravel Pit, County Vehicle Storage</td>
<td>County Weed Department Offices, Vehicle and Chemical Storage</td>
</tr>
<tr>
<td>Total Available Acreage</td>
<td>Approximately 30, not including adjacent site with 80 available</td>
<td>Approximately 20, not including adjacent site with 100+ available</td>
</tr>
<tr>
<td>Freight Access</td>
<td>Good, via HWY 55, although trucks must run near new neighborhood</td>
<td>Good, via HWY 55, no neighboring homes</td>
</tr>
<tr>
<td>Permitting Considerations</td>
<td>Noise and Air Quality due to immediate proximity to new housing development</td>
<td>No concerns</td>
</tr>
<tr>
<td>Other Site Considerations</td>
<td>May be needed for additional gravel sourcing for road building</td>
<td>Site will require significant leveling</td>
</tr>
<tr>
<td>Utilities</td>
<td>Power and Water Available</td>
<td>Power and Water Available</td>
</tr>
</tbody>
</table>
Figure 7. Satellite image of the Valley County Road Yard in Lake Fork. The town of Lake Fork and Hwy 55 can be seen towards the left of the image. The sites are outlined in red, the west (left) side is currently in use and the east (right) side is additional unused County Land. The adjacent housing developments can be seen to the south and east of the sites.

Figure 8. Satellite image of the Valley County Weed Department in Cascade. Hwy 55 can be seen towards the left of the image. The sites are outlined in red, the east (right) side is currently in use by the County and the west (left) side is additional private land where the County sources gravel that the project could potentially use.
To accommodate the projected needs of the facility it is recommended that a minimum of 4 acres be set aside for log storage. Based on maximum 45 foot wide decks stacked 12 foot high, approximately 3,000 tons could be stored on each acre. Assuming a spring break up period of approximately 3 months when deliveries from the woods would be minimal, this would provide the space needed to carry the operation through to the resumption of logging activities. An additional 2 to 3 acres would also be needed for log truck unloading, sorting, processing, and reloading. This could also provide for some additional overflow storage area if needed. Either site has enough room for log storage and processing facilities.

Incoming and outgoing log trucks would enter and exit through the primary access road at either site. A truck weight scale and trailer loader should be located near the entrance of the yard to eliminate congestion in the log handling and decking areas that would be located closer to the facilities.

Both Valley County sites are suitable for a biomass campus. Determination of the preferred site should be discussed among Valley County Commissioners with the following considerations in mind. First and foremost, any Campus business will likely begin operation with a lease agreement with the County, potentially with the option to purchase the land in the future should the project entrepreneur or the County require it. As such, the County should decide what land it may want to dispose of for sale to the business. Additionally, the County should consider its own future plans for the sites, including additional gravel removal, expansion of the Weed Department facilities, or other potential County activities and ensure that a Biomass Campus does not impede plans for future use.

10. Sort Yard Development Stages

Initially a cut-to-length type of processor could be used to merchandise the saw logs and sort by species and product type in the yard. Saw logs for resale would be sorted to one side and moved to a reload/decking area nearby. The remaining logs would be sorted to the opposite side to be decked for use within the Campus. Logs to be decked would be moved to the decking area by the rubber-tired front-end loader.

Future construction of a stationary log utilization cut-off system and sort line would generate increased operational efficiencies relative to the cut-to-length type of processor. The primary cut-off saw should be set in front of the de-barker to merchandise and sort short saw logs for re-sale, and to reduce damage to the saw logs in reloading and shipping. Downstream of the de-barker, a series of sort bins for the pole and firewood operation could be established as well as a chipper and hog fuel grinder. Logs from the pole and firewood sort bins could be moved by a rubber tired front end loader to the respective machine centers for processing. Alternatively, a conveyor system could move the logs to the machine centers with surge capacity built in.

The hydraulic log loader would reload logs on outgoing trucks, sort, and deck logs. To minimize breakage the loader would also be used to break down decks for the rubber tired front-end loader to transport to the processor.
Electronic truck scales with a deck long enough to weigh the longest anticipated load (typically long log trucks with pups) should be installed near the yard entrance. Drivers would self-weigh both coming in and going out of the yard. The weigh ticket should identify the date, time, source, load receipt number, truck, and weights of the load. Gross, tare, and net weight should all be reported. One copy of the weigh ticket should be left at a collection box at the scale and the truck should retain one copy for his records.

Initially the hydraulic log loader could load empty log trailers onto the trucks, but eventually for better efficiency, a trailer loader for the loading of log truck trailers should be installed nearby.
11. SORT YARD OPERATIONAL PLAN

The following plan for operation of the sort yard is typical for log yards in the Northwest, which would be familiar to truck drivers, operators, and sellers. Procedures and safety rules being consistent with other log yards would provide for safer and more efficient operation.

RECEIVING.

The receiving process would begin as a truck enters the yard and is weighed. On a multi-part weigh ticket there should be entries for time, date, source, truck identifier, load receipt number, gross weight, tare weight, and final net weight. A copy of the trip ticket or load receipt should be attached to the load. Whenever possible, the sellers’ own trip ticket should be used and the load accounted for by his unique trip ticket number. If a seller does not have his own trip tickets, the yard should assign numbered multi-part tickets to the seller prior to delivery.

Prior to unloading of the load by the load operator, the truck driver would present to the loader operator a copy of the load receipt. The loader operator would have a current list of valid purchase agreements to verify that the load is to be unloaded. Upon verification, the load would be unloaded and moved to the processor area or decked as needed.

Upon weighing out the truck driver would deposit a copy of the final weight ticket in a box at the scale. This ticket would have the final tare weight from which the net could be calculated or printed depending on the automation of the system. Each day the weigh tickets would be collected by the accountant and compared to the corresponding load receipt collected by the loader operator. The accountant would then make payment based on the contracted rates. Payment should be made to the seller at a minimum on a monthly basis or bi-monthly if possible.

MEASURING.

Each load would be weighed and the net weight would be the basis of all payment. Only in special circumstances would any load be scaled using board foot or cubic foot scaling rules. Examples might be if a USFS sale required it or if the yard and processors needed data to establish yields. Particularly in the beginning it would be helpful to verify yields from various load types.

DECKING.

As feasible, logs should be processed as quickly as possible after entering the yard. In some instances it might be advantageous to deck logs for extended periods for reasons such as providing inventory to carry through the spring break up period. It may also be advantageous to let certain products air dry for a period also, such as for the firewood processor. Saw logs should be moved out of the yard as soon as possible to prevent downgrade and to improve cash flow. Generally, with the size of equipment being proposed, the average deck height would rarely exceed 8 feet. Higher deck heights also increase breakage and should be avoided.
PROCESSING.

As discussed earlier, the initial stage of processing could be handled by a mobile cut-to-length type processor. The front-end loader would deliver unprocessed logs to the processor which would process and sort the logs, while maximizing saw logs and higher value products. The front-end loader would remove the processed logs to be decked for storage, sent to the facilities for use, or reloaded for outside sale.

SHIPPING.

Logs to be shipped out of the yard to outside users could be loaded by the front-end loader or by the hydraulic log loader. As much as possible, the yard should utilize back hauls to improve trucking efficiency and lower haul costs. In certain instances a truck could drop an incoming load at the yard and pick up a back haul to another yard at the same time. This might require the use of “hayracks” to back haul short logs or other equipment such as pre-loaded trailers.

12. PRODUCT MARKETING

The financial viability of the small wood campus / sort yard will rest heavily on strong relationships with primary customers for the different product lines. An estimated 15% of the total tonnage of wood going through the yard would be sold to regional large industrial users in the form of saw logs and post and pole material, with the potential for more depending on the raw material coming into the yard from restoration thinning. Over time that could change with the possible development of additional industry on the campus, however it will be important to maintain good relationships with those large industrial customers. It would be helpful to set up longer term supply contracts with traditional mills if possible to guarantee a market for the wood, such as saw logs or hog fuels not processed at the facility. The operations manager will play the primary role in developing these relationships and doing additional marketing.

Equally important would be the marketing efforts and relationships developed to sell the non-industrial products such as firewood, poles, and other products. Sales of these value-added products produces the highest margins for the facility since the material sold to the industrial customers will be driven by prevailing commodity prices. Local markets for these products will reduce shipping costs and create the potential for local customer loyalty. In addition, partnerships and co-operatives with other producers would allow products to be sold and distributed under established brand names, allowing access to larger markets and contracts.
13. **PRODUCTS AND ESTIMATED VALUES**

Products that could be produced at the small wood campus in Valley include saw logs, posts/poles, packaged/bulk firewood, densified products, wood chips, biomass, landscape products and others. The following is a brief discussion of each of the product types identified and the potential for each.

The initial product range should be selected based on the strength of market opportunity, the relative profitability of each product versus the capital expenditure required, and the suitability of the available raw material to meet the product specifications. Preliminary analysis of these factors has led to the selection of the following products as good candidates for Valley. As with all markets, the values shown are a snapshot in time and represent prices available in June 2012.

- **Small Saw Logs** – estimated $44/ton @ Evergreen Forest Products, less a haul cost of $7.25/ton from Cascade to Tamarack, ID
- **Post and Pole Material** – $55/ton @ Parma Post and Pole in Parma Idaho, less a haul cost of $18.75/ton
- **0.75 cubic foot firewood bundle** – estimated $1.60 per bundle (f.o.b. Valley Yard), sold to local markets.
- **Bulk Firewood** – Estimated at $180 a cord, sold to local markets.
- **Wood Pulp Chips** – Estimated at $85/Bone Dry Ton @ Clearwater Paper less a haul cost of $55/ton
- **Wood hog fuel** - $8 per green ton @ Evergreen Forest Products, less a haul cost of $2.8/ton
- **Wood hog fuel for Energy Use** – Value Estimated at $25/ton when used internally for boiler/cogen feedstock
- **Densified wood pellets** - $165 per ton (f.o.b. Valley Yard), sold to local markets

### SAW LOGS

The model for the integrated campus provides the opportunity to recover small saw logs that often could not be recovered otherwise in the woods. Trees are delivered tree length or as long as possible and then processed at the campus. Small saw logs can then be efficiently processed and removed to be re-sold or sawn. A large part of the efficiency of the overall operation is achieved through tree-length logging with no sorting by species required of the logger. 

Evergreen Forest Products, as well as mills in the Treasure Valley, have expressed interest in buying any short saw logs that could be produced by the Campus.

### POSTS AND POLES

Currently, there exists significant capacity in Post and Pole manufacturing in SE Idaho at Parma Post and Pole (PPP). At the same time, PPP has struggled to access enough material to adequately supply their production facility in Parma, Idaho. Given long standing challenges regarding their supply, PPP has a strong interested in purchasing any suitable post and pole material from the plant at a estimated $58/ton, well above the current value of saw logs in the
region. The Campus will likely benefit from selling any suitable post and pole material that can be sorted out from the Campus feedstock to Parma.

PACKAGED FIREWOOD

Currently there are four large producers and several small producers of pre-packaged firewood bundles in the Northwest. The market for this wood extends outside the Northwest to areas in California, the Southwest, and into the Mid-West. The regional market seems to be saturated at this time, although the local market could provide a small portion of production. Based on the 3/4 cubic foot package this translates to approximately $270 per cord. With good marketing, it is possible that the Campus could sell bundles in the region to various retail outlets, although these partnerships will need to be cultivated and managed well.

BULK FIREWOOD

The Campus could sell bulk firewood to local customers. It is difficult to estimate the current volume of firewood being used in Valley County for household heating, although a significant portion of households, estimated at over 20%, rely on firewood for their domestic heating needs. It should be noted however that selling bulk firewood may displace local small-scale firewood cutters and businesses from the market.

WOOD PELLETS OR OTHER DENSIFIED WOOD PRODUCTS

Demand is steady and growing for high quality wood pellets and other densified products such as briquettes, pucks, and bricks. In the past few years there have been numerous new wood pellet facilities built throughout the Pacific Northwest. Generally, plants have been able to successfully operate using both mill waste and small logs as feedstock. In discussion with the managers of various facilities they have emphasized the need to produce high quality pellets to be successful in the market. The primary factors relating to high quality are species mix, ash content, and moisture content. Each of these can be controlled well in the integrated campus design as stems can be sorted and de-barked prior to processing and extra heat from a biomass boiler can be used to dry material. Production of larger densified products such as briquettes and bricks has the additional advantage of being able to burn in traditional wood stoves and other commercial applications.

WOOD CHIPS

Currently, Clearwater Paper in Lewiston purchases most of the pulp chips produced in the region. The Campus would have the potential to sell some chips to Clearwater, although the haul distance dampens the profit potential, especially in the current chip market. Should market conditions change, the Campus would be able to shift production and increase sales to Clearwater.

BIOMASS

Currently the market for the commercial sale of biomass/hog fuel is very limited due to the extremely low prices for natural gas, which is the primary competitor to biomass. Clearwater Paper is accepting hog fuel at its Lewiston facility but the price is so low that returns to the
producer are typically zero to negative. Some development of biofuel heating could be encouraged in the area particularly in larger commercial buildings and schools. We have discussed the possibility of institutional buildings in Valley County converting to biomass for heating, although there are no current plans to develop new biomass projects in Valley County. The Campus would use a portion of the hog fuel produced on-site to operate the energy project, representing a significant avoided cost though avoiding the use of fossil fuels or electricity for thermal energy for wood processing.

**LANDSCAPE PRODUCTS**

In addition to the above-mentioned product lines, bark, chips, shavings and hog fuel can all be used in landscaping products and Valley County’s location near the potential markets of the Treasure Valley as well as the local market. The Campus may consider a bulk facility for sales to local landscaping firms serving Valley County. The market potential is likely well below the potential volumes of the other product lines however, and was not considered as part of the business model for this study.

**ANIMAL BEDDING**

Animal Bedding from shavings could also be a potential product line for the Campus, and the equipment for pellet production allows for production and packaging of bedding. The Campus may consider marketing to regional farm and ranch stores or directly to area hobby farmers around Valley County. The market potential is likely well below the potential volumes of the other product lines however, and was not considered as part of the business model for this study.
14. PERMITS AND APPROVALS

The project could be expected to require a number of approvals and clearances, with procedures and time lines associated with each. Based on information gathered during this study, no critical environmental or other permitting issues have been identified that should prevent construction and operation of the system.

Among the permits and approvals are submission and acceptance of an Idaho Department of Environmental Quality air quality Permit to Construct; relevant Valley County and city codes, permits and inspections for construction, plumbing, electrical, etc., and potential boiler inspection. Depending upon the funding sources if the project moves to development, additional approvals, permits and clearances may be required. For example, federal funds could trigger the need for a NEPA review.

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

The project will need to apply for a “Permit to Construct” (PTC) from the Idaho Department of Environmental Quality (DEQ) to build the biomass cogeneration facility. The permit will document that the project will not cause or significantly contribute to any violation of the National Ambient Air Quality Standards. The permit is based upon the system size, emissions profile, efficiency and other technology parameters, as well as extent of emissions associated with an installation.

The process enables the DEQ to determine whether the size and type of biomass technology, and the associated construction and operations, will produce regulated emissions/pollutants of a type or volume of concern to the department. The application includes information about the technology, control equipment, and emissions profiles as provided by the manufacturer, as well as detailed maps and other information. No work at the site should occur until authorized by DEQ.

The primary NEPA and permitting issue with a biomass heating system is the combustion emissions. Air emissions from a biomass system depend on the system design and fuel characteristics. The following table\(^58\) shows typical emissions for a biomass heating system (based on CHIPTEC gasifier data) operating on 40% moisture content pine. If necessary, emissions controls systems can be used to reduce particulate matter (PM) and oxides of nitrogen (NOx) emissions. Sulfur emissions are completely dependent on the sulfur content of the biomass, which is usually very low.

---


Last updated: 08-24-2012
Table 5. Air Emissions for a typical biomass heating system

<table>
<thead>
<tr>
<th>Constituent</th>
<th>PM10</th>
<th>NOx</th>
<th>VOC</th>
<th>CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical biomass system emissions</td>
<td>2.1</td>
<td>2.8</td>
<td>0.6</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Following the PTC, the DEQ will make a ruling regarding whether or not the project will require a Tier 1 operating permit, or if the project is exempt from permitting. Boilers using biomass fuel are not specifically listed in the Rules for the Control of Air Pollution in Idaho - (IDAPA 58.01.01), although the DEQ may qualify biomass fuel as “wood waste,” which would require a Tier 1 Permit for operations. The total cost of permitting is estimated to be $1000 for the PTC, and up to a maximum of $5000 total for the PTC and Tier 1 permit.

LOCAL LAND USE AND ZONING

The proposed project sites are zoned “Multiple Use” by the Valley County. The proposed project is consistent with zoning and land use regulations, although it will need to apply for a Conditional Use Permit. The Fee Schedule for Single Purpose Conditional Use Permit is $50 for commercial properties.

CONSTRUCTION RELATED PERMITS/INSPECTIONS

Several construction-related permits and inspections must be acquired by the contractor if the project moves to development. Among the permits and inspections would be mechanical, structural, plumbing, electrical, and possibly others. Generally the contractor and/or subcontractors (electrician, etc.) apply for these permits within one or two weeks of beginning this pertinent phase of the project, and the contractor schedules inspections.

BOILER INSPECTION

The State of Idaho repealed the Boiler and Pressure Vessel rules on March 29, 2010, and is currently the only state in the country that does not have an inspection and permitting requirement for Boiler and Pressure Vessels. An inspection may be required for insurance purposes, however.

---

59 http://www.co.wallowa.or.us/community_development/land_use_planning/index.html
60 http://www.co.wallowa.or.us/community_development/building_codes/index.html
61 https://dbs.idaho.gov/programs/industrial/faqIS.html
15. **Income Statement**

A *pro forma* income statement using current product values and costs has been developed for the proposed small wood campus/sort yard covering the following product lines: small saw logs, posts and poles, firewood, chips, and hog fuel. The income statement is based on a return to log (RTL) style of analysis. In this type of analysis, the estimated final product selling values are used to calculate backwards through the process to determine how much each product contributes to the value of the logs. That price is then compared to the anticipated price that would have to be paid for the logs in a competitive local log market. The difference represents the income or loss (before taxes, depreciation, etc.) that could be achieved through buying logs at market prices.

The pro forma income statement indicates that the campus could operate at a profit of approximately 1% with the above mentioned product lines.

The income statement is presented in the attached Appendix A.

16. **Equipment Cost Worksheets**

Individual cost worksheets are in the attached Appendix C. The sheets show estimated operating costs for each specific piece of equipment. In the case of rolling stock, all equipment is based on good used equipment prices for machines that are generally about 5 years old. The ownership costs are based on a 5 year depreciation to a 20% salvage value. In the case of stationary equipment, good used equipment prices were also used, however the ownership costs are calculated on 10 year depreciation.

17. **Manpower and Wage Estimates**

For purposes of this analysis, all machine operator, laborer, and clerical staff rates of pay are $15.00 per hour based on typical timber industry pay rates in the region. Payroll loading and benefits are figured at 50%. In addition, there is a single yard manager / log buyer position with an hourly rate of $30.00 per hour plus benefits. As configured, this operation would require approximately 21 people working a single eight hour shift.

18. **Launching a Forest Products Campus**

The campus model – also termed a business cluster approach – is a powerful model for future biomass-based economic and entrepreneurial development in Valley County, given that resource availability is likely to be adequate. The objective of a business cluster is to develop competitive advantages unavailable or most costly to businesses individually. These competitive advantages require that companies are resilient to adapt to changing markets, customers, technologies, prices and other factors. Clusters arise because of economic and innovation drivers – the relationship increases productivity, reduce costs, or provide other
synergies of mutual benefit to co-located businesses. Leaders must help companies identify overlapping interests and new opportunities and to develop shared vision for the future of the cluster.62

“There is growing statistical evidence that clusters play a fundamental role in regional job growth, wages, patenting, and new company formation. At a time when our nation needs to invigorate its competitiveness and lay for the foundations for more sustainable growth, cluster development is one of the key policy agendas that we cannot afford to neglect.” (Michael E. Porter, Harvard Business School Institute for Strategy and Competiveness)

Establishing the Valley Forest Products Campus begins with establishing an “anchor tenant” business with various product lines. Over time, additional new businesses or re-located businesses could be attracted to the site. New businesses, re-locating businesses and these business interrelationships may require slightly different plans and responses. However, a general strategy for moving the campus concept forward is applicable. Moving from a single tenant to an integrated campus cluster or alliance will take time, but initial understanding and planning will provide for this opportunity.

Campus Model

The enhanced competitive advantage of the campus or strategic alliance model has been the subject of extensive research and demonstration. The model has been applied with great success by forest industry in Canada. Spatial proximity is especially beneficial for small and medium sized businesses, but is not enough alone to drive a benefit to participants. The campus approach is a strategic alliance – a joint activity by two or more businesses with the goal of mutual benefit. It recognizes that no successful company exists in isolation and that two or more businesses can contribute particular abilities in order to profit from cooperation with other businesses: each is stronger together and benefit from joint cooperation and relationships with each other. In the forest products model, they gain similar or complimentary benefits along a value chain. Understanding the characteristics of co-located strategic alliances helps in visualizing, communicating and establishing one.

---

62 The Status of and Opportunities for Business Clustering Within the Forest Products Sector in the U.S. (2009).
U.S. Endowment for Forestry and Communities, Inc.
Successful strategic alliances have several characteristics:

- Each partner expects a benefit – added value – for themselves. They anticipate that this added value can be achieved only or more easily through strategic alliance – BENEFITS
- Partners brings strengths, skills, services and/or capabilities (core competencies) to the collaboration – STRENGTHS
- Partners maintain their autonomy – AUTONOMY
- Partners recognize and accept the opportunity for better resource utilization and share a commitment to making their businesses and the alliance successful – COOPERATION and COMMITMENT
- The participants need to be capable of entrepreneurial thinking and action - ENTREPRENEURSHIP
- Leadership by a third party organization or entity is often needed to coordinate initial activities of stakeholders and help cluster businesses identify niche markets, assist with workforce training and development, seek financial resources, improved networking, gain political support for the cluster - LEADERSHIP
- Coordination between cluster members is fundamental to success. Supply and quality of raw materials must be assured and must flow from forest to campus in a reliable manner, which requires close working relationships between logging contractors, value added processors, supply-chain companies and resident businesses alike - COORDINATION.
- Access to inputs and markets is crucial to success. Adequate infrastructure to acquire materials and to supply markets for products and services must exist - INFRASTRUCTURE

Successful forest/biomass business clusters share a common identity and involve businesses which gain access to missing resources and/or knowledge while offering their own to the alliance. Each partner is able to concentrate on their strengths while using the other businesses to supplement the other areas.

It is important to recognize that each business must receive or anticipate benefits to itself from the alliance. In turn, each participant must bring a competency or service of value to partners or access value through cooperation.

Strengths to the cluster may include purchasing, logistics, human resources, organizational structure, business services, production capacity, sales, marketing, customer service, and so on. Each of these areas represents opportunities and costs for the individual partners and the alliance itself.

A 2008 survey of 248 stakeholders (2 or more from each state in the U.S.) was conducted for the 2009 U.S. Endowment for Forestry and Communities Inc. report. Results of that survey (Figure 3 of the 2009 report, page 14) offer useful insights for Valley County. Factors leading to

---

64 The Status Of and Opportunities for Business Clustering Within the Forest Products Sector in the U.S. (2009). U.S. Endowment for Forestry and Communities, Inc.
the successful development of forest business clusters included availability of raw materials, access to product markets and transportation network, labor availability, non-financial support, and private financial and non-financial support.

Figure 6. Importance of selected driving factors for the successful development of a forest business cluster (Strongly Agree = 5, Strongly Disagree = 1)

![Importance of selected driving factors for the successful development of a forest business cluster](image)

The most important factor driving business clustering was the availability of raw materials. Respondents also cited major advantages to forest business clusters with the most prominent being better utilization of raw materials and/or manufacturing, improved cooperation between cluster members, and more effective product marketing through complementarity and cooperation of companies. The report also notes that “concerns were also highlighted around the sense that some clusters are overly dependent on a single source of raw materials (e.g., federal forest) or a single source of funding (e.g., grants). These concerns emphasize the need for balance and sustainable business models” (p. 17).

PLANNING AND OUTREACH COMMUNICATIONS

An important first step in developing the campus is establishing communications and relationships with local and state and federal officials and leaders, as well as prominent forest contractors and industry representatives. These officials and organizational/agency personnel can both assist and hinder project development and add costs, so early and open communications is appropriate. These individuals and offices can also facilitate public acceptance of the project. Many will share a commitment to sustainable forest health and restoration practices and value rural jobs and communities, but may have differing views on how these are best achieved.

Key officials to contact include local/regional/state economic development agencies; state regulatory officials; tax or revenue agencies (who often administer tax credit programs); elected officials including state legislators or representatives; resource agencies (USFS, BLM, State

---

Department of Lands, and so on); energy and transportation service providers (utilities, road dept.); local stakeholders including chamber of commerce, jobs corps, industry representatives and forest contractors, etc.

A clear and well-articulated message about the concept, plans and progress will lay the foundation for supportive community involvement – important when public hearings on permits, zoning and other impacts and benefits are discussed\(^67\).

**FINANCIAL AND TECHNICAL SUPPORT**

Funding and technical support are critical components of business cluster development. It is also important to anticipate questions and concerns and support from allies, possible participants, the community and others.

The 2009 U.S. Endowment for Forestry and Communities, Inc. report on forest products clustering notes, “Entry of new businesses is often limited by needed financial capital. Local, state and federal governments can allocate funding to improve the economic climate for business clustering in the forest sector. Important actions created by additional funding (such as project grants, low interest loans and tax incentives) include start-up assistance to new businesses and incorporation of new technologies. However, other forms are also beneficial. Funding for workforce training workshops, education programs, assistance with research and marketing, and investment in needed infrastructure can also help lower cluster development and operating costs” (p. 12).

Within the legal framework of county operations, various options may be available to Valley County leaders to expedite the Forest Business Campus. These could include outright site purchase and ownership, short term financing; GIS, survey and engineering services; access to business facilitation personnel; contacts and linkages with resources such as institutions and departments; commissioning additional technical support and reports; application for grants or project development assistance as a local government entity; matching funds for grants; and so on.

Counties have used various approaches and tools to examine and establish forest business clusters and projects. These options may or may not be a good fit for Valley County. The Woody Biomass Desk Guide & Toolkit could be a useful reference for this project, see link in footnote\(^68\). Section 6, titled financing a Bioenergy Project, has a concise and useful summary of available resources. Appendix B of this report includes a list of Idaho opportunities. Local and regional agencies and organizations may be willing to commit time, money, in-kind resources, and other technical and financial assets toward realizing the campus.

It is important to note that the menu of incentives, credits, loans and other programs is constantly and shifts rapidly with policy changes, political maneuvering, funding levels, tax laws,

---


and other factors. As noted in the Appendix B, a useful source of information can be found on the internet at www.dsire.org which is the Database for State Incentives for Renewables and Efficiency (DSIRE). State and local economic development authorities also have information on general business incentives.

19. **Energy Component of the Campus**

Utilizing the wood products residuals to produce electricity and thermal energy is an integral part of the long-term campus strategy. While it can increase the overall production, capacity and profitability of the campus, it is a component that may be pursued after the sort yard has been well established and more permanent equipment is in place. It should be considered up-front if the business plan and product lines require process-heat, as a biomass combined heat and power system may be the most cost effective way to deliver the required heat. Otherwise, after the campus has established a relatively stable production line, on-site energy production can be added to generate additional cost savings.

There are two types of energy that the campus uses, electrical and thermal, and both can be produced using residuals, including chips and hog fuel, through a combined heat and power system.

Combined Heat and Power is also termed co-generation. CHP offers the concurrent production and distribution of electricity or mechanical power and useful thermal energy (heating and/or cooling) from a single source of energy. Using both heat and power is considered “distributed generation.”

These efficient systems recover heat that normally would be wasted in an electricity generator, and save the fuel that would otherwise be used to produce heat or steam in a separate unit.

- **CHP outputs**: Heat and electricity (90% useful energy). Minimal waste heat rejection to atmosphere (stack losses and waste heat only 10%).
- Compared to conventional power plant with one output: electricity. In conventional systems waste heat is rejected to atmosphere through cooling towers or body of water. Stack losses and waste heat rejected to atmosphere 70%. Useful energy 30%.

Technical potential for CHP is based on the coincident demand of power and thermal energy at a facility. Power can include both electricity and shaft power, which can be used for mechanical purposes. Thermal demand can include steam, hot water, chilled water, process heat, refrigeration, and dehumidification. A CHP system can be designed to convert waste heat into various forms of thermal energy to meet different facility needs, including heating hot water in the winter and chilling water in the summer.

Economic suitability for CHP at a specific site is based on: current and future fuel costs and utility rates; planned new construction or heating, ventilation, and air conditioning (HVAC) equipment replacement; and the need for power reliability at the site. CHP project economics are greatly affected by utility policies at the local, state, and federal level.
THERMAL GENERATION

Thermal energy generation is achieved by burning biomass in a boiler to produce heat. The heat is captured in a heat exchanger, transferring energy from the flue gases to a thermal medium; typically water. The heat can then be used for process heat or electrical generation.

Advances in boiler technology make these units more attractive. Outdated solid fuel boilers were inefficient, produced unwanted byproducts, and were difficult to operate. Modern boilers have an array of features that make them more efficient, simpler to operate, and much more effective at creating useful energy from biomass fuels.

The typical modern boiler is designed to have multiple stages of combustion, beginning with gasification and leading to combustion. These stages of combustion are controlled through the boiler architecture and several air inputs that provide increasing amounts of air as flue gases rise through the combustion area. The advanced control of air inputs allows for near-complete combustion of the material and a highly efficient machine. Additionally, inclined moving grate systems, where fuel is moved mechanically through the combustion bed, virtually eliminate clinkering and slagging, which vastly increases tolerance for heterogeneous fuels and decreases operator input.

The boiler technology evaluated for this project is commercially available and includes all modern improvements in boiler engineering.

ELECTRICAL GENERATION

There are two main options for electrical generation: steam turbine or Organic Rankine Cycle generators (ORC). Steam turbine systems are typically used at large fossil fuel power plants. Steam is generated from a combustion chamber for the fossil fuel, which then drives a rotary turbine under large amounts of pressure. Steam turbines require complex ancillary systems and come with high capital costs, although they can produce the best thermal to electric efficiency. Organic Rankine Cycle (ORC) systems use low pressure superheated hot water to heat refrigerant in a closed loop system, which drives a screw turbine as it condenses. ORC systems require a thermal sink on the condensing side, called reject heat, and are perfectly suited to cogeneration.

Sale of electricity is usually to the utility or can be used to “net meter” or offset the producer’s electricity costs. The high capital cost and system complexity of steam turbines make them unsuitable for a biomass campus unless electricity markets allow for the sale of biomass electricity at favorable rates.
Table 6. Comparison of steam turbine vs. organic rankine cycle (ORC)

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>STEAM TURBINE</th>
<th>ORC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency (kWth/kWel)</td>
<td>&lt; 35%</td>
<td>&lt; 25%</td>
</tr>
<tr>
<td>Parasitic load</td>
<td>Minimal</td>
<td>Circulation pumps</td>
</tr>
<tr>
<td>Power Generation</td>
<td>2 MW to 100+ MW</td>
<td>35 kW to 7 MW</td>
</tr>
<tr>
<td>Water Treatment</td>
<td>Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>Overall System Complexity</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Service Costs</td>
<td>High, regular major overhauls</td>
<td>Low</td>
</tr>
<tr>
<td>Turbine Speed</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Turndown ratio</td>
<td>40 -45%</td>
<td>10 - 25 %</td>
</tr>
<tr>
<td>Startup Procedure</td>
<td>Complex and Slow</td>
<td>Easy, fast</td>
</tr>
<tr>
<td>Approved Operator 24/7</td>
<td>Yes</td>
<td>No (if boiler is under 250°F)</td>
</tr>
<tr>
<td>Cogeneration Temperature</td>
<td>Steam/High (&gt;400°F)</td>
<td>Superheated Water (&lt;250°F)</td>
</tr>
<tr>
<td>Max Pressure</td>
<td>1000 PSI</td>
<td>200 PSI</td>
</tr>
</tbody>
</table>

Energy Demand at the Campus

Depending upon the final product mix, the campus will have a demand for thermal energy – heat - for wood processing and for space heating. Wood processing will require heat to kiln dry products such as firewood in order to make a higher quality product with added value. Such value added products include pest-free firewood, which requires wood to be heated to an internal temperature of 160 degrees Fahrenheit. Sawdust and chips may also need to be dried for use in densified products or to be sold for thermal projects elsewhere. Additionally, indoor spaces will require some level of thermal energy for space heating that can be provided by the boiler.

The campus will also use a significant amount of electrical energy for the production line, lighting, etc. While it is theoretically possible that a co-generation facility could supply all the power required to operate the campus, it is best to scale the electrical output of the electricity generation to be within allowable net-metering under the local utility, Idaho Power. A net-metering arraignment allows for the greatest financial benefit to the campus because of the kW-hour rate given to net-metering customers.
For commercial/industrial customers, the maximum net-metered production allowable is 100 kilowatts (kW) under Idaho Power’s current net-metering guidelines. Under the net-metering scheme, any power produced by the plant would offset costs on the energy bill on a one-to-one kW basis. In other words, every kW produced would result in a savings of one kW on the utility bill. Idaho Power calculates this offset monthly, and any power supplied to the utility form the campus beyond what the campus uses is credited to the campus and can offset future power use. At the end of the calendar year, any credits remaining on the utility bill will be forfeited to the utility without compensation to the campus. To that end, the co-generation facility should be sized to produce as much power as possible given the anticipated residual fuel supply, but stay within both the maximum allowable net-metering and the anticipated energy use of the campus. This campus design will create a power appetite that will exceed the net-metering maximum, so a facility should be sized to meet 100 kW if possible, although it is important to also consider the amount of residuals available so that the campus avoids having to source fuel beyond what is produced at the campus. Given the anticipated size of the campus in Valley County, and the respective residuals created at 6500 tons/year, the study uses a 65 kW machine as the baseline, with potential room for expansion to 100 kW, should the business grow and create a larger amount of residuals.

Installation of a biomass boiler requires undergoing permitting under both the Idaho Department of Environmental Quality and the United States Department of Energy. The permitting processes can be undertaken concurrently and with significant overlap of materials.

20. Estimated Capital Costs

Combined the total estimated cost of the project as proposed here will be $4,549,544. The estimated capital costs include plant, property, and equipment of $3.3 million for the biomass campus - excluding the cost of land acquisition – as shown in Table 7. Capital costs for the biomass campus, not including the energy component of the project. Further, the biomass cogeneration component of the project is described in Table 8.
Table 7. Capital costs for the biomass campus, not including the energy component of the project.

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used Cat 320 Processor</td>
<td>$100,000.00</td>
</tr>
<tr>
<td>Used Cat 950 front end loader</td>
<td>$120,000.00</td>
</tr>
<tr>
<td>Used Cat 322 hydraulic log loader</td>
<td>$100,000.00</td>
</tr>
<tr>
<td>Used Trailer Loader</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>Used Weigh Scales</td>
<td>$25,000.00</td>
</tr>
<tr>
<td>Used Cord King Firewood Processor</td>
<td>$50,000.00</td>
</tr>
<tr>
<td>Used Firewood Packaging System</td>
<td>$20,000.00</td>
</tr>
<tr>
<td>Used 5000 lb forklift</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>Used Nicholson Chipper</td>
<td>$130,000.00</td>
</tr>
<tr>
<td>Used Williams Hog</td>
<td>$25,000.00</td>
</tr>
<tr>
<td>Used 2 Peerless Chip Bins</td>
<td>$15,000.00</td>
</tr>
<tr>
<td>Used Nicholson 17&quot; ring barker</td>
<td>$130,000.00</td>
</tr>
<tr>
<td>Dry Kilns</td>
<td>$100,000.00</td>
</tr>
<tr>
<td>Firewood building - 10000 sq ft</td>
<td>$200,000.00</td>
</tr>
<tr>
<td>Used Jackson Harvester log shaver</td>
<td>$100,000.00</td>
</tr>
<tr>
<td>Solid Fuel Burner</td>
<td>$143,000.00</td>
</tr>
<tr>
<td>Rotary Drum Dryer</td>
<td>$350,000.00</td>
</tr>
<tr>
<td>Hammer mill</td>
<td>$60,000.00</td>
</tr>
<tr>
<td>Pellet Mill</td>
<td>$315,000.00</td>
</tr>
<tr>
<td>Pellet Cooler</td>
<td>$32,000.00</td>
</tr>
<tr>
<td>Screen shaker</td>
<td>$24,000.00</td>
</tr>
<tr>
<td>Packaging Unit</td>
<td>$80,000.00</td>
</tr>
<tr>
<td>Storage Bin</td>
<td>$24,000.00</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>$168,000.00</td>
</tr>
<tr>
<td>Fork lift</td>
<td>$82,000.00</td>
</tr>
<tr>
<td>Dump truck</td>
<td>$100,000.00</td>
</tr>
<tr>
<td>Pellet mill building - 10000 sq ft</td>
<td>$200,000.00</td>
</tr>
<tr>
<td>Office Building</td>
<td>$75,000.00</td>
</tr>
<tr>
<td>Engineering and Construction</td>
<td>$500,000.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$3,288,000.00</strong></td>
</tr>
</tbody>
</table>
Table 8. Start up costs of the energy component of the project.

<table>
<thead>
<tr>
<th>Biomass boiler with 65 kw ORC estimate</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler &amp; Flue Gas Train</td>
<td></td>
</tr>
<tr>
<td>Biomass boiler package including:</td>
<td>$293,128.00</td>
</tr>
<tr>
<td>Automatic heat exchanger cleaning</td>
<td></td>
</tr>
<tr>
<td>Remote monitoring package</td>
<td></td>
</tr>
<tr>
<td>Multiclone</td>
<td>$6,903.60</td>
</tr>
<tr>
<td>Flues</td>
<td>$5,500.00</td>
</tr>
<tr>
<td>Stack</td>
<td>$5,500.00</td>
</tr>
<tr>
<td>Baghouse</td>
<td></td>
</tr>
<tr>
<td>Cems devices</td>
<td></td>
</tr>
<tr>
<td>Economizer</td>
<td></td>
</tr>
<tr>
<td>Additional shipping</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>Power Generation Equipment</td>
<td></td>
</tr>
<tr>
<td>ORC generator with air cooler</td>
<td>$290,000.00</td>
</tr>
<tr>
<td>Cooling tower</td>
<td></td>
</tr>
<tr>
<td>Cooling water pumps</td>
<td></td>
</tr>
<tr>
<td>Shipping</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>Supplemental Equipment and Building</td>
<td></td>
</tr>
<tr>
<td>Air compressor &amp; dryer</td>
<td>$1,500.00</td>
</tr>
<tr>
<td>Additional ash transportation</td>
<td></td>
</tr>
<tr>
<td>Material storage bin with transport to boiler</td>
<td>$60,000.00</td>
</tr>
<tr>
<td>Maintenance catwalks</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>Shipping</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>Boiler building with foundation (2000 square feet)</td>
<td>$80,000.00</td>
</tr>
<tr>
<td>Exterior building slabs and lean to</td>
<td>$10,000.00</td>
</tr>
<tr>
<td>Equipment and building total</td>
<td>$772,531.60</td>
</tr>
<tr>
<td>Civil/sitework (2%)</td>
<td>$15,450.63</td>
</tr>
<tr>
<td>Mechanical &amp; install (20%)</td>
<td>$154,506.32</td>
</tr>
<tr>
<td>Electrical and controls (20%)</td>
<td>$154,506.32</td>
</tr>
<tr>
<td>Construction total</td>
<td>$1,096,994.87</td>
</tr>
<tr>
<td>Engineering &amp; air permitting (7.5%)</td>
<td>$82,274.62</td>
</tr>
<tr>
<td>Construction management (7.5%)</td>
<td>$82,274.62</td>
</tr>
<tr>
<td>Project total</td>
<td>$1,261,544.10</td>
</tr>
</tbody>
</table>
21. RECOMMENDATION

Valley County has a valuable opportunity to develop a small diameter biomass campus that would create jobs and enhance biomass utilization in the woods, providing benefits in wildfire mitigation, forest restoration, and timber production.

The concept described in this study has a reasonable likelihood of success as long as two major conditions are met moving forward. First and foremost, the project must find a suitable entrepreneur to champion the project. This business requires extensive experience in forestry and the timber industry, a lot of ingenuity, and serious commitment; the chosen entrepreneur must have these characteristics and more. Equally important, the project must ensure the economical availability of supply. This study should serve as encouragement for local area private timber holders, the USFS, and IDL to consider supply arrangements that would encourage the success of this business while mutually benefitting all parties.

Our recommendation is that Valley County pursue both an entrepreneur and a suitable supply arrangement to ensure the greatest likelihood of success for this project.