Prepared by
WR Community Solutions Inc.
401 NE 1st, Suite A
Enterprise, OR 978282
ph 541.426.4100

www.wallowaresources.org

FEASIBILITY STUDY OF A WOODY-BIOMASS-BASED COMBINED HEAT AND POWER UTILTY AT WIND RIVER BUSINESS PARK IN HEMLOCK, WA

Date	March 2014
Client	Port of Skamania County PO Box 1099 Stevenson, Washington 98648 John McSherry p. 509.427.5484 e. john@portofskamania.org
Principal Authors	Matt King, Renewable Energy Program Coordinator

INTRODUCTION

The Port of Skamania has retained WR Community Solutions Inc. to prepare the FEASIBILITY STUDY FOR A WOODY BIOMASS BASED COMBINED HEAT AND POWER (CHP) UTILITY AT WIND RIVER BUSINESS PARK (WRBP) IN HEMLOCK, WA. The following study is organized to meet the contract agreements and to provide decision-grade information for the client.

The purpose of the study was to determine whether CHP and/or a biomass business/energy center is technically appropriate at the site, and whether CHP could provide economic benefit to WRBP and the county. Assumptions have been made based on preliminary engineering and financial analysis, and from information provided by partners and stakeholders.

Technical potential for CHP is based upon coincident demand for power and thermal energy at the site. Economic feasibility is based upon current and future fuel costs, thermal demands, power markets, and economic benefits. A central purpose of the proposed project is utilizing local woody biomass to produce both thermal and electrical energy. The project proponents anticipate that this project would deliver some of this energy, and potentially other biomass products, to existing or new co-located businesses.

The Feasibility Study accounts for existing initiatives and existing human and capital resources, and draws upon the preliminary operational data of similar project pilots across the Intermountain West, to build the project profile. The study estimates the appropriate size and scale of a combined heat and power plant suited to the region's resources and market opportunities, and outlines the operational interfaces for potential co-located businesses. The study includes financial assessments of the different products, including thermal and electrical energy and potential biomass products. The Study identifies some options to pursue more detailed local analysis to support final decision-making.

In addition to the combined heat and power plant, the study assesses the potential to create a campus where various forest products operations are co-located to optimize value-capture from low-value woody biomass. Research has concluded that co-location of processing facilities is the single most important strategy for reducing costs of woody biomass utilization (Becker, et al, 2009, Han, et al, 2004).

The campus model generates value by grouping businesses that are linked through value and supply chains, labor, inputs, technology, and complementary outputs. In particular, it can be beneficial to manufacture both wood products and biomass energy. A campus model can improve production efficiency in numerous ways, including offering access to lower cost production inputs, improving productivity, reducing biomass handling costs, and increasing profits via high feedstock utilization. Co-location can also spur innovation and amplify community benefits via economic development and forest health.

Lastly, the study identifies potential barriers which could prevent implementation of CHP at the site.

This document includes:

1) A report of:
   a) Woody-biomass availability within target collection radius of the Wind River Business Park site;
   b) Woody-biomass procurement cost parameters;

   c) Sustainable-target power outputs and range of probable fuel/resource inputs for technologically-proven power-conversion systems;
   d) Technologically-proven power-conversion system capital costs;
   e) Electrical and thermal power production costs;
   f) Infrastructure requirements and cost estimates to construct;
   g) Environmental impacts and mitigation cost parameters.
   h) Possible synergistic relationships with other forest-products businesses or initiatives in the surrounding area.
   i) The site's adequacy to support the anticipated development upon project completion.
2) Cost comparison of technologically-proven energy conversion systems:
   a) Capital;
   b) Operating.
3) Estimated miscellaneous start-up costs (e.g., permits, fees, bonding) and costs-of-doing-business (e.g., insurance, office equipment).
4) Identification of targeted industries (customers).
   a) Electrical power customer market analysis;
   b) Thermal power/waste heat customer market analysis.
5) Grant, tax credit, other forms of cost reduction.
6) Table of potential revenues vs. costs associated with technologically-proven systems in context of most likely conversion systems and customers.
7) Brief discussion of "avoided costs," such as implications of reduced fuels in the forests, support for forest restoration work, reduced use of fossil fuels, etc.
8) Action elements linked to timelines.
9) Identification of the group responsible for implementing the marketing strategy and the group's capacity.
10) If the project is deemed feasible, one or more economic outcomes that the project may produce
11) If the project is deemed feasible, additional information including FTEs, new revenues generated, private investment estimates.
12) Site appropriateness (pg. 5 of RFP – with Port assistance)
13) Location analysis of other vacant industrial land (pg. 5 of RFP – with Port assistance)
14) Local economic diversification support (pg. 5 of RFP – with Port assistance)
15) Estimated median hourly wage of jobs created (pg. 5 of RFP – with Port assistance)
16) Median hour wage of new job in relation to County wages (pg. 5 of RFP – with Port assistance)
17) County three-year unemployment rate in relation to state rate (pg. 5 of RFP – with Port assistance)
18) County population change five year trend (pg. 5 of RFP – with Port assistance)
19) Estimated job creation as percentage of County labor force (pg. 5 of RFP – with Port assistance)
20) Estimated job creation as percentage of County unemployed workers (pg. 5 of RFP – with Port assistance)
21) Total funding for public facilities improvements that is secured or will be secured within a given time frame (pg. 5 of RFP – with Port assistance)

ACKNOWLEDGEMENTS -

WR Community Solutions Inc. would like to thank in particular the following individuals and organizations for their assistance during the Study: John McSherry, Port of Skamania, Paul Spencer, WRBU, Norm Ward, WRBU, Nathan Ulrich and Jay McLaughlin, Mount Adams Resource Stewards.

WR Community Solutions Inc. retained Andrew Haden from Wisewood Inc. for system cost assessments and preliminary engineering, and Chuck Serret of Full Circle Consulting for biomass market assessments and process evaluations.

EXECUTIVE SUMMARY

Skamania County, like many rural counties across the west, once relied heavily on the forest products sector for much of its economy. Following shift in national forest management direction in the 1990's, federal timber sales declined drastically and the timber industry collapsed. Rural counties across the Pacific Northwest experienced significant job losses and an out-migration of working families. Beyond these social impacts, the reduction in active management of federal lands has created a glut of biomass in the forest, contributed to increased wildfire risk and occurrence, and left huge stands in need of restoration.

The main goal of the Port of Skamania and the Wind River Biomass Utility is to gain back some of those forest sector job losses, and create new markets for forest biomass to support much needed forest restoration. . This project has the potential to create several direct jobs on site, as well as support several indirect jobs, in biomass feedstock production and a co-located greenhouse facility.

This study evaluates the potential of a Combined Heat and Power plant at two different scales, each with different access to electricity markets. The projects would generate 2 MW or 100 kW depending on the proposed size and waste thermal energy from electricity production could be used to heat greenhouses at the site, between two and ten acres. Either project would include a biomass boiler with requisite fuel management and in-feed equipment and an Organic Rankine Cycle generator to convert thermal energy into electricity. All of the technology considered in this study is commercially available.

There is ample biomass available locally to supply either size of project, which will demand between 2,500 and 16,000 bone dry tons (BDT). This supply is available from a mix of sources, including logging and thinning slash, pulp logs, and regional mill residuals. If biomass was procured directly from the forest, the project would require a small processing line in order to convert the raw biomass into usable fuel. The cost of producing fuel for the project on site is estimated at a minimum of $60 per Bone Dry Ton (BDT). Alternatively, the project could purchase mill residuals from area forest products mills at a cost of approximately $25 per BDT. While sourcing biomass directly from the forest and processing it on site would support the goal of forest restoration and forestry jobs, purchasing biomass as residues from existing mills is clearly the more economical method. Creating new markets for existing mills would arguably contribute to their future viability, and help sustain existing jobs, and the existing market for logs.

The current energy market is not attractive for new renewable energy projects. The regional electricity market is based on the cost of making electricity with natural gas, which has kept the value of electricity low, perhaps the lowest in the US. Natural gas also impacts the thermal energy markets, as it is the most commonly used heating fuel available. Natural gas prices are quite low and the market futures suggest only minor increases in the near future. The current low price-points in the electricity and thermal energy markets create the most significant hurdle to achieving higher rates of return on investment.

Both projects would require significant grant funding in order to achieve a reasonable return on investment. The 2 MW project would require over $6,000,000 out of a total capital cost of nearly $15,900,000, while the 100kW project would require over $450,000 out of a total capital cost of approximately $2,415,000. With these levels of grant funding, both projects would have a 10-year Internal Rate of Return greater than 10%.

The most important piece to moving this project forward is to pursue and access grant funding. Without that financial support, the project will not have a reasonable payback at either size.

If the project can access the requisite grant funding, a myriad of benefits can be achieved. First and foremost, the project could support up to 4 jobs at the biomass plant, another 4-10 jobs at a co-located greenhouse facility, and up to 24 indirect jobs in the forest. If the project buys mill residuals, it will be supporting regional mills and firming up the financial bottom-line of the areas timber economy. If the project harvests wood directly, it will be facilitating greater restoration in the forest and a more balanced timber management plan. By supplying affordable thermal energy to a co-located greenhouse business, the project would support a new business in Skamania County, which would support its own indirect job force. Additionally, the project would keep energy dollars local and support renewable energy in the region, contributing to Skamania County's ownership if its energy future.

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1 INTRODUCTION

Skamania County is located about 40 miles east of the Portland metro area. It's total land area is 1,672 square miles, and includes the Gifford Pinchot National Forest, Columbia River Gorge National Scenic Area, and Mt. St. Helens National Volcanic Monument. 80% of the County is National Forest.[1] The heavily forested nature of the county offers both challenges and opportunities.

Improved utilization of standing timber and woody biomass may provide 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 thinning and slash 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 and sustainable supply of biomass. A woody biomass combined heat and power facility creates opportunities to sustain raw material flow and generate increased value from non-saw log volume.

Skamania County's natural resource economy has historically relied heavily upon the timber industry. However, future economic growth in this natural resource sector is constrained by economic conditions and raw material availability, challenging the County to explore diversification. Diversification could include improved utilization of forest and biomass resources, 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, utilities, economic development agencies, and local businesses.

Much has already been done to initiate this process, particularly with the support of the Wind River Biomass Utility (WRBU) and other local resource groups, including the Mount Adams Resource Stewards, the South Gifford Pinchot Collaborative and the Gifford Pinchot Task Force. These groups collectively support restoration of the public and private forests within Skamania County in a manner that protects the environment, stimulates the local economy, and provides for the health and safety of the communities.

The WRBU has been active in examining options for using woody biomass generated from forest health restoration projects to provide sustainable economic development – addressing ecological restoration while providing quality local jobs.

This available biomass is typically in the form of traditional logging residue and non-saw logs, but also consists of trees too small for existing milling facilities.

In Skamania County, the volume of non-saw log woody biomass is significant. 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. In response to this issue, the Gifford Pinchot National Forest issued the first biomass sale in 2011, the Gotchen AA-L Biomass Sale, to remove approximately 1.5 million board feet of volume for the biomass market. According to Jon Nakae, silviculturalist for the Mt. Adams Ranger District, "Marketing biomass will greatly enhance our ability to manage fuels and restore these forests to a healthy and resilient condition."

[1] http://www.skamaniacounty.org/

Local communities have struggled along with Washington's traditional forest products industry. Numerous forest manufacturing facilities in the state and surrounding region have closed in the last couple of decades and the volume of timber being removed from National Forest Lands has significantly reduced. This has led to a build-up of forest fuels that threaten not only the forest but also the communities that lie within it, through both a decline in forest health and the increasing risk of catastrophic wildfire.

In the past several years large wildfires across the West, both in dry and wet forests, have destroyed hundreds of homes and serve to emphasize the importance of managing fuel loadings, particularly in communities that are literally within the forest. Some manual thinning, piling, and burning of small trees has occurred on forest lands in Skamania 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 forest lands could be treated if the small logs from thinning and the waste fiber could be sold to offset some of the treatment costs. The few remaining sawmills in the region are most often supplied by the surrounding private and state lands, while National Forest Lands remain largely untouched. Efforts have been made in the past to bring more biomass from National Forest Lands for the purposes of restoration, but have been hampered by the lack of available markets. According to the *Washington Forest Biomass Assessment*, a study commissioned by the Department of Natural Resources, roughly two thirds of the biomass produced by logging is left on the landscape, and much more could become available through forest stewardship projects. An improvement in the market for biomass could facilitate stewardship in the forest and increase forest health.

This analysis models and develops a conceptual plan for a combined heat and power facility which uses low value biomass for the production of energy. The conceptual plant operates synergistically with local mills by providing an outlet for low value material and facilitating stewardship work in the forest through increased economic viability of forest restoration treatments. The specific plant sizes considered here reflect the site-specific supply and energy market characteristics in Skamania County, as well as the anticipated energy use of a co-located greenhouse facility, which is anticipated to be the primary heat user.

The concept pursued by WRBU of operating the facility as a utility, supplying heat to a greenhouse operation and electricity to the grid, has been successfully implemented in Europe and the Northeast United States. The success of this model depends on the mutually beneficial relationship between the heat user, the greenhouse business, and the biomass plant, as well as the success of the greenhouse business over the life or the project.

The model design allows for future expansion if the USFS increases its management activity and more low value biomass becomes available. The initial scale considered in this Study is driven by the existing wood supply available at appropriate price points in the current market. There is ample room at the project location to expand both the biomass facility and potential co-located thermal users.

1.1 OVERVIEW OF CHP

The average efficiency of fossil-fuel power plants in the U.S. is 33%, and has remained unchanged for 40 years. Two-thirds of the energy of the fuel is lost as heat during the combustion process. An additional 8% is lost in transmission and distribution[2]. A CHP plant, with a market for both the heat and power,

[2] HUD CHP Guide #2. 2009. Department of Energy Oak Ridge National Laboratory

significantly improves the efficiency of biomass energy production, and accelerates the return on investment.

Identifying any uncontrollable factors that could impede CHP development at the site is critical, including corporate power purchase contracts that prevent installation of onsite power generation or local utility and regulatory policies that prevent or hamper distributed generation.[3] If no major obstacles are identified, conceptual engineering identifies a preliminary system size based on estimated loads and thermal and electrical demand at the site. Estimated load profiles and power-to-heat ratios are determined.

The most cost-effective CHP systems are designed to provide a portion of a site's electrical demand while providing the majority or all of the site's thermal needs. This type of design, known as thermal base loading, provides the greatest efficiency and cost savings by ensuring that all of the energy produced by a CHP system is used on site. Although site needs and final system optimization might call for another approach to CHP design, a base-loaded system is often the best starting point.

Considerations are:

- Amount of heat and power produced by the CHP system and the estimated amount of each to be used on the site
- The avoided costs of utility-purchased heat and power
- The amount and cost of fuel associated with running the CHP system, and
- The budgetary cost to install and maintain the system

When heat and power can be produced on site for less than the cost of power from a utility and fuel for heat (separate heat and power), then may be a positive payback for the project. The length of payback is determined by the difference between purchased and onsite energy production.

Another consideration is that biomass is most economical as a fuel source when the CHP system is located at or close to the biomass fuel stock. In some cases, the availability of biomass in a location may prompt the search for an appropriate thermal host for a CHP application. In other circumstances, a site may be driven by a need for energy savings to search for biomass fuel within a reasonable radius of the facility.

2 WIND RIVER BUSINESS PARK SITE APPROPRIATENESS

The RFP indicated that Wind River Business Park would contribute specific information to the completion of this Study and report. The following information was provided by WRBP or based upon WRBP data and other sources.

2.1 CONTEXT

Skamania County is 98% forested and is over 80% federally controlled. The local economy was based almost exclusively on forest products for 130 years. Reductions in federal-forest timber harvests caused very substantial disruption in the local economy. Tourism-related development replaced some of the jobs and economic activity.

[3] EPA CHP Partnership

The forests were being managed as plantations before the mid-1990s. Due to the management changes brought on by litigation and additional federal law, large areas of the federal forest have been untouched for 30 to 40 years. The result is hundreds of thousands of acres of over-crowded young stands that need thinning to increase forest health and productivity, reduce fuel loads, and restore more natural forest conditions.

In summary, the site is surrounded by federal, WA DNR, and private timberlands in need of extensive thinning due to over-crowded young stands of conifers.

2.2 WIND RIVER BUSINESS PARK

Aerial view of Wind River Business Park.[4]

2.3 ZONING

The Community Development Department is dedicated to the development, implementation, and maintenance of goals and policies that help to guide growth and development for the county. Services include the implementation and maintenance of the County's Comprehensive Plan, which provides a long-term vision and consistency for local development and infrastructure programs (current planning).

According to Port of Skamania the, no zoning restrictions are expected to limit the project in the Wind River Business Park. Their evaluation is that all development will conform to all Federal, State, and local requirements. The Port also states that the proposed site is within the Rural I Land Use designation of

[4] http://www.portofskamania.org/WindRiverBusinessPark.htm#section3

the Skamania County Comprehensive Plan. This designation calls for compatibility of use with the local area and community, concise development, and minimal adverse environmental and aesthetic effects.

2.4 LOCATION ANALYSIS OF OTHER ADEQUATELY SERVED VACANT INDUSTRIAL LAND;

There is in essence no other adequately served vacant industrial land in the county. Almost all of it is occupied by ongoing businesses. The few parcels that are unoccupied are located near residential or commercial areas and have inadequate space for a wood-chip-based operation. Also, all of the unoccupied parcels are located outside of optimal raw-material collection distances, increasing transportation costs and related environmental effects.

The unzoned sections of the County that are potentially suitable for a woody-biomass-based utility are concentrated around the site of interest: the Wind River Business Park. The Business Park has the advantages of a motivated ownership (Skamania County), motivated management (Port of Skamania County), public control of water supply, acreage and buildings suitable for further industrial development, and the afore-mentioned PUD transmission line.

2.5 ANALYSIS OF HOW THE PROJECT WILL ASSIST LOCAL ECONOMIC DIVERSIFICATION EFFORTS

The local community has a long and deep history of forest resource utilization and is very receptive to a return to logging-related activities. The logging and forest-products infrastructure is much reduced but has survived sufficiently to 're-seed' the industry in this area if the USFS expands its vegetation treatment program. A new wood products based business – such as a woody biomass based utility - would provide demand for the low-value parts of the logging process.

Lately, the U.S. Forest Service has recognized the deterioration of the forests and has increased harvest in the name of restoration work. In the immediate area of interest, the Gifford Pinchot National Forest has quadrupled harvest in the last three years. Projections call for similar or increased harvest over the next few years. In other words this is the time and the place to implement this type of project. Sustainable logging and forest-products utilization are appropriate to the area and can back-fill some of the job losses of the last 25 years in the Agricultural/Forestry and Manufacturing categories[5].

2.6 AFFECT TO STATE OF LOCAL TRANSPORTATION SYSTEM

The local transportation system includes Skamania County and U.S. Forest Service roads that were engineered for log-truck traffic and have been under-utilized as compared to the traffic of 25 and more years ago. An advantage of this resource-rich location is that transportation distances are minimal, reducing costs, fossil-fuel use, truck motor emissions, and other impacts.

2.7 UTILITY

The site is the end-of-the-line for PUD service and is the terminus of a 12.5 kV electrical transmission line with capacity in excess of the utility's planned maximum generating output.

[5] Port of Skamania

2.8 CULTURAL ARTIFACT INVESTIGATION

Cultural artifacts will be surveyed during any excavation work, but the surfaces of the fields have served agricultural purposes for a century and no archeological findings are anticipated. If any artifacts are found, excavation work will cease and the State Historic Preservation Office (SHPO) will be notified. Work will resume following permission from SHPO). See Permits and Approvals below.

2.9 JOBS AND POPULATION

Almost 90 percent of Skamania county is timberland, mostly within the Gifford Pinchot National Forest. Much of the non-timber land is concentrated in the southern strip along the Columbia River, and falls under the protection of the Columbia Gorge Scenic Area. As a result of these and other factors, the county has a small population and job base, with projections generally calling for modest growth in jobs and population over the next 20 years.[6]

The Washington State Employment Security Department[7] notes, Skamania county *has been traditionally dependent upon timber for jobs and income, losing both when logging was curtailed on national forests, and Stevenson Co-Ply, the county's largest employer, owned cooperatively by current and former workers, closed. Ten percent of the county's job base disappeared, and unemployment topped 22 percent in February 1992. But a year after the closure, the Skamania Lodge, a new destination resort subsidized by federal funds from the Columbia Gorge Scenic Area Act, opened with almost the same number of jobs. Almost overnight, Skamania had shifted from a timber economy to a tourist economy.*

The transition from timber to tourism was accompanied by a shift in occupational structure, and generally, lower wages and income. While the number of employed residents grew by about 15 percent during the 1990s, the number of ex-timber workers commuting to jobs outside of the county grew by almost 50 percent. Currently, more than half of the county's earned income comes from jobs outside of the county. Almost half of the population growth in the 1990s came in the southwest part of the county, closest to Portland. Since 2008, the local economy has been struggling. Total nonfarm employment lost 100 jobs in 2008 (down 4.2 percent), 90 jobs in 2009 (down 3.9 percent), 40 jobs in 2010 (down 1.8 percent), and 30 more jobs in 2011 (down 1.4 percent).

Within the four-county South Central Workforce Development Council Area (Kittitas, Klickitat, Skamania, and Yakima counties), Skamania County has had the highest unemployment rates during the last few years. The annual average unemployment rate in Washington state increased four percentage points between 2008 (5.4 percent) and 2009 (9.4 percent). Skamania County's rate increased four and four-tenths percentage points in this timeframe (from 8.6 percent in 2008 to 13.0 percent in 2009).

From 2006 to 2008, Skamania County's annual average unemployment rates were running a little more than 2 percentage points above Washington State's rates. This gap widened from 2009 through 2010, as Skamania County's annual average unemployment rates ran more than 3 percentage points higher than statewide averages. Most recently, in 2011, the Skamania County labor force was estimated at 5,170, with an average of 650 unemployed workers. This yielded an annual average unemployment rate of 12.5 percent. Across Washington, in 2011, the labor force was estimated at 3,484,820 residents, with an average of 319,470 unemployed workers. This yielded an annual average unemployment rate of 9.2 percent. The difference in annual average unemployment rates was three and three-tenths percentage points.

[6] Employment Security Department, Washington State, Skamania County Profile. 2012.
[7] Ibid

The jobs accessed by those commuting out of county provided much needed income, but also result in loss of much of the economic multiplier benefits from these jobs, as workers patronize providers of goods and services close to their workplace.

- Skamania County population is approximately 11,000, spread throughout the communities of Washougal, Stevenson, Carson, Stabler, Home Valley, Mill A, Willard and Underwood.[8]
- In 2011, the Quarterly Census of Employment and Wages (QCEW) data showed that Skamania County's labor market provided 2,095 jobs and a total wage income of $68.2 million. The annual average wage in 2011 in Skamania County was $32,539.[9]
- Population growth was slower than the state growth rate from 2001 to 2004, faster than the state growth rate from 2004 to 2006, and slower again that the state rate from 2007 to 2010. During recessions, the county has suffered from outmigration, as more people left the county in search of jobs.

Statistics for Skamania County (SC = Skamania County. WA = Washington State) from U.S. Department of Commerce United States Census Bureau and Washington State Employment Security Department, Skamania County Profiles, unless otherwise noted.

- Unemployment
  - Since 2005 the unemployment rate in Skamania County, Washington has ranged from 5.0% in October 2006 to 16.3% in March 2010. The current unemployment rate for Skamania County is 9.0% in November 2013.[10]
  - Three-year unemployment rate in relation to the state rate
- Population
  - Population change in relation to state rate
  - SC – Population, 2012 estimate: 11,187[11]
  - SC – Population, 2010 estimate: 11,088 (WA: 6,724,540)[12]
  - SC – Population, 2011 estimate: 11,117 (WA: 6,823,267)
  - SC – Population, 2012 estimate: 11,187 (WA: 6,897,012)
  - SC – Population, 2000 estimate: 9,872 (WA: 5,894.121)[13]
  - SC – Population, 2008 estimate: 10,794 (WA: 6,549,224)[14]
  - SC – Population percent change 2000 to 2010: 12.1% (WA: 14.1%)[15]
  - SC - Population, percent change, April 1, 2010 to July 1, 2012: 1.1%[16]
  - WA - Population, percent change, April 1, 2010 to July 1, 2012: 2.5%
- Age
  - SC – 2012 Median age: 44.5
  - WA – 2012 Median age: 37.2
- Income

[8] http://www.skamaniacounty.org/
[9] Washington State Employment Security Department, Skamania County Profile, Aug. 2012
[10] Home Facts
[11] U.S. Department of Commerce United States Census
[12] Washington State Employment Security Department, Skamania County Profile, Aug. 2012
[13] Washington State Employment Security Department, Skamania County Profile, Aug. 2012
[14] U.S. Department of Commerce United States Census
[15] Washington State Employment Security Department, Skamania County Profile, Aug. 2012
[16] U.S. Department of Commerce United States Census

  - SC – 2008-2012 5-year median income (dollars)
    - Households: 55,319
    - Families: 66,875
    - Non-family households: 24,844
  - WA – 2008-2012 5-year median income (dollars)
    - Households: 59,374
    - Families: 71,939
    - Non-family households: 37,441
  - SC – 2012 Median household income (dollars): $55,319
- Employment
  - SC - Civilian labor force, 2012 estimate, employed: 4,340[17]
  - SC - Civilian labor force, 2012 estimate, unemployed: 542 (11.1%)[18]

Jobs the larger facility could be expected to provide include:

- One Manager
- One Engineer
- Four Operators
- Two Line workers
- Related direct jobs: 4 additional logging-related jobs, primarily Operators.

Estimated median hourly wage of the jobs created when development occurs:

- Engineer/Operator - $30/hour
- Equipment operators - $19/hour
- Production line workers - $15/hour

The estimated indirect work force would be approximately 15 jobs, assuming a consumption of 15 BDT of biomass per year (Appendix C).

3 BIOMASS RESOURCE ASSESSMENT

3.1 WOOD BIOMASS AVAILABILITY

The location of the proposed Wind River Biomass Utility, north of Carson, Washington, provides the opportunity to capture feedstock from a variety of sources. For assessment purposes woody biomass feedstock will be classified into three distinct categories; forest direct sources, mill residuals, and urban wood. Within each of the three categories there are a number of different types of materials. In addition to woody biomass there is non-woody biomass which might include materials such as straw from agricultural sources. This discussion will center around the primary source of biomass in and around Skamania County, which is woody biomass directly from the forest.

3.1.1 FOREST DIRECT BIOMASS

- Pre-commercial thinning slash. Pre-commercial thinning slash is seldom considered an economic source of biomass due to the high cost of removal of the small stems from the forest. Slash balers and bundlers have been tested with limited success in bringing down the cost of

[17] U.S. Department of Commerce United States Census
[18] U.S. Department of Commerce United States Census

removing the thinned trees. A more common and conventional method of cutting and removing pre-commercial thinning slash would be through the use of a mechanical feller-buncher and skidder. Assuming a feller-buncher and skidders combined operating cost of $250 per hour and an accomplishment rate of approximately 2 acres per day, the cost per acre would be approximately $1000 per acre. Conventional pre-commercial thinning and subsequent slash mastication might typically cost $650 per acre to accomplish. If it is assumed that the forest manager would pay the $650 per acre, the additional cost of removal of the thinning slash would be approximately $350 per acre. Assuming an average range of 10 – 20 green tons per acre, the resulting cost to remove the thinning slash would be between $35 and $70 per bone dry ton. Keeping in mind that this example only gets the material to the landing and at that point the material would still need to be ground at a cost of approximately $40 per bone dry ton and transported to Wind River as well, it is quite easy to see how the minimal costs could be $100 per bone dry ton delivered. According to a 2005 Washington State University biomass assessment, Skamania County produced approximately 1500 bone dry tons of thinning slash annually. This fuel source is likely to be available well into the future with increased emphasis on fire protection, habitat creation, forest stewardship, and silviculture on both private and public lands. Due to the high cost to remove thinning slash from the forest it is unlikely that a significant amount could be converted to biomass and hauled to Wind River however.

- Logging Slash. Generally log landing slash is available for no cost or at a very low cost. This material is routinely piled at the landing for later burning as part of clean-up and slash reduction on the site. The most cost effective method of recovering this material for use as biomass is through the use of a mobile grinder. Typically a mobile grinder and loader costing approximately $800 per hour to operate will produce around 30 green tons of ground biomass from slash piles per hour. Based on this, it would cost approximately $27 per green ton for grinding. Transportation would add approximately $0.17 per green ton per mile to the cost. Assuming logging slash located 20 miles from Wind River, the estimated cost to grind and transport it would be approximately $30 per green ton or $60 per bone dry ton. The same WSU biomass assessment cited earlier estimated 12,265 bone dry tons of logging slash available annually in Skamania County. Much of that slash is left remaining on the forest floor, however it would be reasonable to assume that 10 -20% of the logging slash could end up piled in landing slash piles and would be available for biomass grinding. This potential source of biomass fuel is likely to be available into the future as long as timber management activities continue on the surrounding forests. The Northwest Forest Plan predicted a rise in harvest levels over the next several decades; however the South portion of the Gifford-Pinchot which includes Skamania County has recently been unable to maintain a significant timber sale program. If ongoing collaborative efforts and stewardship projects being planned by the National Forests are successful, recent volumes could be maintained. Harvest levels on private and other public lands are likely to remain stable. It is safe to assume that 1500 – 2500 bone dry tons of logging slash would be available annually, in fact, much more could be available.

- Pulp logs. Upon occasion, particularly when lumber markets are low and sawmills are curtailed, a shortage of biomass may develop and pulp logs intended for chipping will be ground up for biomass. This last occurred around 5 years ago in the Northwest and it coincided with an active period of in the woods grinding, due to the shortage of biomass. Wind River would be in a competitive position to purchase pulp logs and small diameter thinnings delivered to its

location, particularly those located north of its location. The price for these logs would be partially determined by the local pulp log pricing in area as well as other competitive forces. Currently pulp logs are priced at $28 - $30 per green ton throughout the region. This would convert to $62 - $66 per bone dry ton. The cost of processing at the Wind River Site would likely cost an additional $30 per bone dry ton. The closest competitors for pulp logs are in the White Salmon and Camas, Washington areas.

3.1.2 MILL RESIDUALS

- Biomass (bark and trimmings). Sawmills, plywood mills, and whole-log chippers all produce significant amounts of woody biomass as a residual from the production of their primary products. The Wind River Biomass Utility is located near numerous residual biomass producers and several have indicated the need for additional markets for their biomass. At the current time, biomass residuals are in plentiful supply and will likely continue to be into the future as natural gas prices remain low and sawmills continue to operate. The average price of delivered biomass in the area is approximately $20 - $25 per bone dry ton. Several producers have indicated that the price is almost totally a reflection of the cost to transport the fuel to the buyer's location.

- Shavings and Chips. Planer shavings, which are not considered a good biomass fuel, are not typically used but in some cases may be. Typically, shavings are used by particleboard, MDF, and wood pellet plants. Current values of planer shavings in the Western Oregon area and Washington area, ranges from $31 to $57 per bone dry ton delivered. Wood Chips may occasionally be used for biomass but generally are not due to the high cost relative to other fuels. Currently, residual wood chips sell for $80 - 85 per bone dry ton delivered. Whole log chips are currently selling for $90 - $95.

- Sawdust. Sawdust is not a typically used bio-fuel but may be in certain cases, particularly when biomass is in short supply. Paper mills and other board plants use sawdust and are consistent buyers. Current prices for sawdust in the area are around $35 per bone dry ton delivered.

3.1.3 URBAN WOOD

- Urban wood can be a significant source of woody biomass, particularly in and around larger urban areas. Urban wood is usually made up of construction wood waste, pallets, and tree trimmings and is competitive in price with mill residuals. A urban wood supplier in the area has indicated the willingness to sell up to approximately 60 green tons per day delivered to the Wind River location at approximately $20 per bone dry ton. Fuel quality and contamination can sometimes be an issue with urban wood, depending on the boiler configuration being used and the emissions permitting requirements. The willingness of the supplier to pre-sort prior excluded material to delivery would have to be explored. Additional emissions permitting may be required to use urban biomass as a feedstock.

3.2 CONSULTATIONS

Based on discussions with numerous buyers, suppliers, and producers of woody biomass in the area around Wind River (See Contacts, Appendix D), all agree that the Wind River facility could be fueled at the levels discussed from residual mill and urban wood sources. With natural gas prices being low and expected to remain low for many years, it is unlikely that mill residual woody biomass or urban biomass will increase in value to any large degree.

The most economic source of biomass for Wind River would be to purchase the total supply from residual mill suppliers and urban wood recyclers. Biomass could be delivered in self-unloading "walking floor" vans which would eliminate the need for additional equipment for unloading or processing.

If there was an unanticipated shortfall in biomass residuals available on the open market, the project could use a variety of sources to supply a minimal processing yard. The most economical source would be logging slash, with a significant amount available locally (>12,000 BDT annually), followed by thinning residuals, then pulp logs. Between private, State, and Federal forest land in immediate proximity to the project site, it is generally understood that there will be biomass available from these sources in perpetuity.

The following table summarizes the biomass supply alternatives and compares estimated current costs by type:

Wind River Biomass - Estimate of Biomass Fuel Cost / per bone dry ton

Biomass Type	Distance to Facility from Source				
	0-10 mi.	10-20 mi.	20-30 mi.	30-40 mi.	40-50 mi.
Precommercial Thinning	$ 93	$ 100	$ 107	$ 114	$ 121
Logging Slash	$ 57	$ 64	$ 71	$ 78	$ 85
Pulp Logs	$ 86	$ 86	$ 88	$ 88	$ 90
Biomass (bark & trimmings)	na	$ 15	$ 22	$ 29	$ 36
Shavings	na	$ 35	$ 42	$ 49	$ 56
Chips	na	$ 110	$ 127	$ 134	$ 141
Sawdust	na	$ 15	$ 21	$ 35	$ 42
Urban (recycled wood)					$ 22

4 CHP TECHNOLOGY

CHP facilities are considered distributed generation: they produce both heat and power (compared to separate heat and power).

4.1 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 though 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.

4.2 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 a high capital costs, although 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.

The high capital cost and system complexity of steam turbines make them unsuitable for an installation of this size. Additionally, the suitability of ORC units for cogeneration when using reject heat makes ORC the most appropriate technology for the Wind River Biomass Utility.

FACTOR	STEAM TURBINE	ORC
Efficiency (kWth/kWel)	< 35%	< 25%
Parasitic load	Minimal	Circulation pumps
Power Generation	2 MW to 100+ MW	100 kW to 7 MW
Water Treatment	Required	Not Required
Overall System Complexity	High	Low
Service Costs	High, regular major overhauls	Low
Turbine Speed	High	Low

Turndown ratio	40 -45 %	10 - 25 %
Startup Procedure	Complex and Slow	Easy, fast
Approved Operator 24/7	Yes	No (if boiler is under 250°F)
Cogeneration Temperature	Steam/High (>400°F)	Superheated Water (<250°F)
Max Pressure	1000 PSI	200 PSI

For this study, two system sizes were chose for detailed analysis: 2MW electrical and 100kW electrical. Given sufficient biomass available within a reasonable supply radius, the main reason for selecting these options were best fit with market conditions.

- The larger project, 2 MW electrical, was examined due to its ability to balance the sale of a significant amount of electricity while not needed to sell a prohibitive amount of heat, the total cost of system, and site conditions.
- The smaller project, 100kW electrical, was examined due to its ability to net-meter the electricity through a co-located business, which allows the project to capture a better electrical power cost structure while still providing enough heat to serve a significant greenhouse business.

4.3 SUSTAINABLE POWER OUTPUTS

The preliminary engineering analysis indicates that either project could provide sustained output at a capacity factor of 95%, meaning that the plant would be expected to operate 95% of the time (see appendix A for details). The gross thermal output would be 28.6 mmBTU (million Btu) for the large plant or 4.5 mmBTU for the small plant, with electrical outputs of 2 MW and 100 kW, respectively.

The thermal energy available after electrical generation is 21.8 mmBTU or 4.2 mmBTU. This energy can either be used for heating in a greenhouse or similar facility or rejected to the atmosphere through cooling towers. Because ORC electrical generators require a cooling loop to operate, the facility would need to have cooling towers to reject heat when there is less than full demand from the heat user (the greenhouse or like). For this study, it is estimated that 65% of the heat would be delivered to thermal customers with 35% being rejected to the atmosphere.

4.4 TECHNOLOGY SYSTEM CAPITAL COSTS

The capitol costs for the two system sizes are enumerated in Appendix A, and summarized in the table below:

COST ITEM	2 MW (DOLLARS)	100KW (DOLLARS)
Civil/Structural	883,500	180,700
Fuel Storage and Conveyance	284,000	143,000
Biomass Boiler System	4,240,000	576,200
ORC Power Generator	3,005,000	358,000
Piping and Plumbing	862,100	157,300

Mechanical Installation	241,500	62,475
Electrical Interconnection	1,434,000	181,400
Permitting	63,000	10,000
Freight to project site	50,000	10,000
General Contractor	1,804,766	273,914
Development Costs (Engineering, project management, etc)	1,409,077	216,271
Total Contingency Costs	1,621,383	246,396
Total Cost	15,898,325	2,415,654

4.5 ELECTRICAL AND THERMAL PRODUCTION COSTS

The cost for electrical and thermal energy is summarized in the table below.

ANNUAL ENERGY AND COST	2 MW	100KW
Electricity Generation (kW hours)	14,979,600	748,980
Thermal Generation for Heating or rejected to atmosphere (mmBTU)	181,821	35,020
Annual Operational Cost*	$741,589	$106,099
Cost per Kwh	$0.045	$0.141
Cost per mmBTU	$4.07	$3.02

*not including financing costs

4.6 FEEDSTOCK PRODUCTION INFRASTRUCTURE AND COSTS ESTIMATES

Wood yard operating costs are dependent on a number of factors and vary greatly from one location to the next. For the purposes of this analysis, costs are being estimated for two separate sized facilities with the corresponding differences in wood volumes being handled.

2MW option: Assumptions

- 16,321 bone dry tons of biomass demand per year
- 65,284 total bone dry tons needed to produce biomass demand
- Assumes an average 20 day per month operation (240 days per year)
- Daily deliveries needed in bone dry tons = 272
- Daily log truck loads needed = 272 bone dry tons / 14 bone dry tons per load = 19.43 loads

100 kW option: Assumptions

- 2,590 bone dry tons of biomass demand per year
- 10,360 total bone dry tons needed to produce biomass demand

- Assumes an average 20 day per month operation (240 days per year)
- Daily deliveries needed in bone dry tons = 43.17
- Daily log truck loads needed = 43.17 bone dry tons / 14 bone dry tons per load = 3.08 loads

Each of the above options has very different needs in terms of log yard space, equipment, and design.

4.7 100 KW OPTION

For the 100 KW options it would be most economical to simply purchase biomass delivered to the plant and avoid the cost and inefficiency of such a small yard. The current residual market in the region could easily supply an operation of this size, at a much lower cost than feedstock produced on-site using small mobile equipment. The only equipment required for this option is included in the boiler system.

4.8 2 MW OPTION

For the larger 2MW option it may also be possible to negotiate biomass supply agreements that would take care of all the feedstock needs of the facility and thus avoid the cost of operating a supply yard. At the current time this would likely be the most economical method of supplying feedstock to the facility due to the relatively low cost and plentiful supply of residual biomass. The operation of a supply yard would provide the opportunity to capture additional value through the sale of other products and in the longer term could provide more stability in feedstock supply.

The following example provides the basic framework for the land, equipment, and manpower needed to operate a feedstock yard for the 2MW facility (the 100 kW facility would not justify construction of a feedstock yard given the availability and cost of residuals on the local market):

4.8.1 LAND

The minimum acreage needed to operate a yard would be approximately 5 acres just to allow the safe movement of heavy equipment, trucks, and for minimal feedstock supply storage. A 10 acre yard would be more efficient, safer and could allow for the storage of unprocessed logs for feedstock. For each acre of unprocessed log storage it is estimated that approximately 1 – 2 weeks of biomass supply in unprocessed logs could be stored depending on deck height.

4.8.2 SAMPLE EQUIPMENT LIST

- Cat 988F wheel loader (EXAMPLE). The 988F is a used late model loader capable of unloading a log truck in a single lift. It is a 4-wheel drive machine that can efficiently transport logs to and from the decks to processing locations. With a bucket attachment it could easily load bulk materials such as chips and biomass.
- Cat 322C hydraulic loader (EXAMPLE). The 322C is a used late model hydraulic log loader that is capable of sorting and feeding logs into a processing line. With a track undercarriage it is mobile enough to move around a small yard to be used for sorting, decking, loading, and un-loading logs if needed.
- Processing line. The processing line to be built on site would include a log in-feed deck, log cut-off saw, log sort bins, de-barker, chipper, grinder, screens, and storage bins. This system would be made up of either new or used sawmill equipment. It would typically be set up in a linear arrangement with the chipper and grinder near the end of the process.
- Scales and truck trailer loader. A truck scale would be necessary to weigh loads both incoming and outcoming in order to determine payments. In addition a truck trailer loader would be needed for log trucks to allow the driver to self-load the trailer.

4.8.3 MANPOWER.

Assuming an 8 hour per day operation for the processing yard, the conservative estimated manpower needs are as follows:

- 988F operator
- 322C operator
- Debarker / Cut-off saw operator
- Chipper / grinder operator
- Accounting / truck weigh operator
- Yard Manager / log buyer

4.8.4 YARD INCOME STATEMENT.

A *pro forma* income statement using current product values and costs has been developed for the proposed biomass /sort yard. The income statement is based on a return to log (RTL) methodology. In this type of analysis, the estimated product selling values in the yard 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 subsequent difference then represents the income or loss that could be achieved through buying logs at estimated market prices.

For the purposes of this analysis two separate production levels for the yard will be analyzed. The 20 load per day analysis is the approximate level of production needed to operate the facility from delivered logs only, independent of any purchases of mill residuals. The 10 load per day analysis would produce roughly half of the biomass needed for the facility with the other half coming from mill residuals or other sources.

The following table summarizes the yard income from each level:

	PRODUCT YARD VALUE PER BDT	PRODUCT VOLUME BDT @ 20 Lds/Day	PRODUCT VOLUME BDT @ 10 Lds/Day
SALES REVENUE			
Saw logs	$ 74.00	34200	17100
Chips	$ 60.00	17100	14535
Produced Biomass @50% MC	$ 60.00	17100	8550
Purchased Biomass @50% MC	$ 25.00		32400
All Products (240 haul days)		68400	68400
TOTAL SALES REVENUE		**$4,582,800**	**$3,460,500**
	PRODUCT YARD COST PER BDT	ANNUAL COST @ 20 Lds/Day	ANNUAL COST @ 10 Lds/Day
OPERATING COSTS			
Wood Cost	$ 60.00	$4,104,000	$2,754,000
Yard Operating Cost			
Equipment Ownership Cost		$225,940	$225,940
Equipment Operating Cost		$219,300	$219,300
Direct Labor Cost		$240,000	$240,000
TOTAL OPERATING COSTS		**$4,329,940**	**$2,979,940**
Gross Operating Margin		$252,860	$480,560
Gross Operating Margin %		*6%*	*14%*
		ANNUAL COST @ 20 Lds/Day	ANNUAL COST @ 10 Lds/Day
GENERAL & ADMIN. COSTS			
Truck Weigh and Accounting Labor		$44,640	$44,640
Yard Rent		$12,060	$12,060
Labor - buyer / yard mgr		$148,800	$148,800
TOTAL G & A COSTS		**$205,500**	**$205,500**
Net Operating Margin		$47,360	$275,060
Net Operating Margin %		1%	8%

4.9 SITE SUFFICIENCY

As described above, the site has sufficient acreage, access, and utilities to make it suitable for the project.

5 BIOMASS CAMPUS

This analysis examines the viability and potential profitability of a small log forest products campus co-located with the CHP facility. This "campus" model is also called a forest "business cluster" approach. Co-location of processing facilities that result in shorter haul distances, and improved raw material

utilization rates, can be an 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[19].

A campus or cluster is a group of firms and institutions located in close proximity to each other and whose businesses are interlinked through value and supply chains, labor, use of similar inputs, technology and complementary products[20]. Co-located businesses benefit from lower costs through improved logistics and shared innovation. 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 and co-located biomass-based businesses provide 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.

Proximity is not enough to drive efficiencies. 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. It is similar to the model being implemented in Wallowa County, Oregon, the "Integrated Biomass Energy Campus" near Wallowa. As much flexibility as possible is being built into the Wallowa facility to allow for potential future expansion while scaling to match the existing economic wood supply available from private lands alone.

Similar flexibility will be built into a Skamania County model to allow for future growth while at the same time matching current economic wood supply.

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.

5.1 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.

The biomass material considered is that which is generated by forest practices such as harvest, thinnings and salvage; from fuels reduction and forest restoration projects; and from other sources.

A Sort Yard (SY) can be an opportunity-driven response to a potential economic opportunity. A sort yard provides both a service and a product for co-located and other customers, 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.

19 Becker, D.R. et al (2009). Financial Considerations of Policy Options to Enhance Biomass Utilization for Reducing Wildfire Hazards. Forest Policy and Economics, 628-635.
20 The Status of and Opportunities for Business Clustering within the Forest Products Sector in the U.S. (2009) US Endowment for Forestry and Communities

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.

The campus Sort Yard would conduct the economic and technical operations of receiving, handling, and distributing woody biomass for use by co-located or regional businesses. 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 factors[21]; managerial and labor skills; contractual agreements between various participants; and other factors.

A Sort Yard has the potential to offer Campus producers' 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 Campus producers' appetites for woody biomass used in value-added processing. The project has the added benefit of increasing the volume produced of useful products, jobs, and tax revenues.

A Sort Yard may be a completely separate business or a division of a campus tenant. In either case, it must be operated as a business.

Typically, individual biomass processing businesses purchase sorted log loads (i.e. log loads of certain diameter, species, and length) because they lack the handling capacity or the volume demand to buy unsorted log loads for a cheaper price. If owned by campus tenants collectively, it would enable collaborative campus purchases of unsorted log loads, at gross savings per green ton compared to sorted log loads.

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 facility could vastly improve access to supply by the companies.

For example, at current production levels, the IBEC Sort Yard in Wallowa, Oregon, could handle 220,000+ green tons of woody biomass over its 20 year lifespan, offering producers estimated gross savings of $440,000 in raw material costs. The savings stem from decreased harvest costs in the woods, where loggers aren't required to sort logs before they come to the yard. More than fifty percent of this material will be processed into 90,000+ tons of finished bioenergy products. Additionally, the IBEC sort yard has room to expand its operations as markets grow, and could eventually process up to 70,000 green tons of biomass a year.

The Sort Yard has the potential to enhance bio-production in Skamania County by (a) improving the operational efficiency of Campus producers (b) improving the bottom-line of campus producers via raw material cost savings, especially those utilizing low-value material (c) increasing County revenues from high-value material which can be sold to markets outside the County.

[21] Woody Biomass Feedstock Yard Business Development Guide (2010) The Federal Woody Biomass Utilization Working Group.

6 BUSINESS SYNERGIES

The Wind River Biomass Utility would create various opportunities for business synergies with regional businesses. As described in this study, the project could operate in a mutually beneficial relationship with local mills by providing an outlet for additional biomass and purchasing that biomass form the mills. Additionally, if the project included a sort yard, short saw logs and high grade chips that would otherwise remain unharvested or left in the woods in burn piles could be provided to regional facilities, thereby increasing the availability of their supply and enhancing their bottom line.

Beyond wood products, the project would operate synergistically with the co-located thermal customer. A significant portion of the business development and a bulk of the job creation stemming from this project would come from this co-located business. For the purposes of this study, we anticipate that this customer would be a greenhouse operation, although many other uses are possible, such as a micro-brewery or other value-added wood processing.

6 PERMITS AND APPROVALS

Obtaining the required utility interconnection, environmental compliance, and pre-construction, construction and operations permits for the CHP facility is an essential and potentially time-consuming step in the project development process. Permit conditions often affect project design, and neither construction nor operation may begin until all permits are in process or in place. Permits and approvals also represent an ongoing cost for compliance and reporting.

The permitting and approvals process generally involves completing and submitting necessary application forms and fees; review of the application by the entity for completeness; issue of the relevant approval or permit; inspection or confirmation that the installation is operating as described and within the compliance criteria both initially and over time.

The number of permits and approvals vary depending on project characteristics including the size and complexity of a project, geographic location, extent of other infrastructure modifications, extent of potential environmental impacts of construction and operation[22], and so on.

6.1 COLUMBIA RIVER GORGE NATIONAL SCENIC AREA

The Wind River Business Park is not within the Columbia River Gorge National Scenic Area. The project would not require the Combined NSA/SALII application.

6.2 SKAMANIA COUNTY COMMUNITY DEVELOPMENT DEPT.[23]

The Skamania County Community Development Department provides planning services including review and processing of land use permit applications, state environmental policy act (SEPA) decisions, National Scenic Area applications, critical area and shoreline applications, and clear and grade applications.

6.2.1 SALII

All projects must have a Site Analysis Level II (SALII) review for the property under development prior to acceptance of any development permits. It may be determined that the project may be exempt from

[22] EPA Combined Heat and Power Partnership
[23] http://www.skamaniacounty.org/Departments.htm. Telephone: (509) 427-3900

the SALII process. However, other permits may be required. A base fee of $200 is required and is part of a complete SALII application.

During Phase 1 review of the SALII process, multiple departments and agencies will review the application to determine the studies, reports and applications which may be required to complete the proposed project. SCCDD staff will conduct a site visit to the subject property and review the proposed development area. SCCDD will then issue a letter of Application & Report Requirements listing all applications, reports, and studies required for the project. Applicants will also be notified at this phase if the proposal is not feasible under current County regulations. The applicant will receive a Site Analysis Level II Site Plan Approval letter if the project does not require additional reports or studies. The site plan will be stamped approved and you will be able to proceed with submitting the required applications. The applicant then has five (5) years to submit the applications and complete the project.

An additional fee of $175 is required should the project require reports or studies. This fee must be submitted with the reports or studies in order to proceed with review.

6.2.2 BUILDING/CONSTRUCTION

Building a new structure requires approval by Skamania Community Development Department. The Department includes building permit services, fire information services, environmental health services, current planning, long-range planning projects, permit center, code enforcement, office of hearing examiner, and planning commission. The proposed project would require permits for building, plumbing, mechanical/solid fuel, and others.

The applicant must complete the SALII process before they can submit a building permit.

- Building permit services include reviewing construction plans and performing building inspections to ensure compliance with the International Building Code and other applicable construction codes. The County Engineer is the Building Official. Typical processing time 4 weeks; fees vary; construction permits are valid for 180 days (six months) from the date of issuance
- Electrical inspections are conducted by Washington Department of Labor and Industries as scheduled by contractor; fees vary.

6.3 AIR QUALITY EMISSIONS

Air pollution control in Washington is based on federal, state and local laws and regulations. The federal Environmental Protection Agency, the Department of Ecology (Ecology), and local clean air agencies all regulate air quality in Washington.

Businesses that are new, replacing or modifying emission control equipment, or are increasing their air pollutant emissions must undergo New Source Review (NSR). NSR requires businesses that emit air pollution in Ecology-regulated counties to get a permit called a "Notice of Construction (NOC) Order of Approval." A NOC is also called a "pre-construction permit," because the business owner must get this permit before starting construction or operation of the business.

The Southwest Clean Air Agency is the permitting agency for Clark, Cowlitz, Lewis, Skamania and Wahkiakum counties[24] for any project which will involve construction of a new source of air pollution or modification of an existing source of air pollution. SWCAA is concerned with particulate matter (PM),

[24] http://www.swcleanair.org/ Vancouver, WA. Telephone: 360.574.3058.

particulate matter small than 10 microns (PM10), carbon monoxide (CO), ozone (O3), volatile organic compounds (VOCs), nitrogen oxides (NOx), sulfur dioxide (SO2), lead as well as toxic and hazardous air pollutants (TAPS and HAPs).

The first step in acquiring the NOC is to contact the Air Pollution Control Officer to discuss the project. Then the applicant completes the Notice of Construction Application: New Project or Modification of an Existing Permit[25]. This form enables businesses to request a permit to construct a new project or to request a change in an existing permit (ECY 070-410).

- A Notice of Construction application[26] (form ECY 070-410) is required for review of any project to construct a new project or modify an existing source of air pollution. Instructions for the NOC application are summarized in form ECY 070-410A.
- The permit is issued by the Department of Ecology.
- Review time depends on how complete the application is. If the application is complete and accurate, then review time could be 60 to 90 days.
- Application review fees vary, depending on the type/complexity of the project and the time it takes Ecology to review the project. More complicated projects pay higher fees. Each application must be submitted to Ecology with an initial fee. The initial fee covers the cost of a set number of review hours (see New Air Quality Permitting Fees, Effective July 2011). If review of the project exceeds the base hours for that permit type, the rate is $95 per hour. Initial fees range from $200 to $15,000, depending on the project type.
- Before a Notice of Construction Permit can be approved, the project must be completed the State Environmental Policy Act review process. Environmental review is required for any proposal which involves a government "action," as defined in the SEPA Rules (WAC 197-11-704), and is not categorically exempt (WAC 197-11-800 through 890). A categorical exemption is a type of government action that is specifically designated as being exempt from SEPA compliance because it is unlikely to have a significant adverse environmental impact. If a public comment period and/or a public hearing are required, all comments must be considered before the permit can be issued. Other conditions may apply.
- The permit is valid for the lifetime of the business or industrial facility.
- Related forms/information
    - Emissions Estimations, form ECY 070-410B

6.4 SKAMANIA COUNTY PUBLIC UTILITY DISTRICT #1[27]

The Skamania County PUD provides power service to the WRBP. The Skamania PUD is a customer-owned utility providing electric service in Skamania County. Public Utility District #l of Skamania County is a municipal corporation formed in 1938 under the laws of the state of Washington.

6.4.1 WASHINGTON INTERCONNECTION STANDARDS

The Washington Utilities and Transportation Commission adopted interconnection standards for distributed generation (DG) including CHP systems <20 MW in capacity. The standards provide for two separate levels of interconnection based on system capacity. The first level applies to systems <300 kW. The second level, which applies to systems >300 kW but <20 MW, is based on the Federal Energy

[25] https://fortress.wa.gov/ecy/publications/summarypages/ecy070410.html
[26] https://fortress.wa.gov/ecy/publications/SummaryPages/ECY070410.html.
[27] http://skamaniapud.com/services.html. Telephone: 509.427.5126.

Regulatory Commission's (FERC) interconnection standards. The UTC's standards apply to the state's investor-owned electric utilities -- but not to municipal utilities or electric cooperatives.

Interconnection of systems <300 kW must conform to all applicable codes and standards for safe and reliable operation, including the National Electric Code (NEC); National Electric Safety Code (NESC); the standards of the Institute of Electrical and Electronics Engineers (IEEE); the standards of the North American Electric Reliability Corporation (NERC); the standards of the Western Electricity Coordinating Council (WECC); American National Standards Institute (ANSI); Underwriters Laboratories (UL) standards; local, state and federal building codes, and any electrical company's written electric service requirement approved by the UTC.

With utility approval, interconnection to spot networks and area networks is permitted for systems <300 kW. A UL-approved safety disconnect switch is generally required. However, this requirement may be waived under certain circumstances.

Utilities have the authority to review the need for a dedicated distribution transformer. If such equipment is necessary, the customer must pay for the costs. Systems eligible for net-metering do not require additional liability insurance. However, utilities are authorized to require additional insurance and indemnification for systems ineligible for net-metering (but <300 kW).

Utilities must have a designated point of contact for customers seeking to interconnect systems <300 kW, and must file with the UTC a standard form application and a model interconnection agreement. Application fees are limited to $100 for systems <25 kW, and $500 for systems >25 kW but <300 kW.

The UTC's rules include provisions for dispute resolution. For systems sized 300 kW to 20 MW, interconnection procedures are based on FERC standards. The FERC guidelines for systems <20 MW provide for three levels of interconnection. However, the first level -- the 10 kW inverter process -- does not apply in Washington, because these smaller systems are covered by the rules described above. The UTC could approve an alternative proposal if a utility demonstrates that the FERC's interconnection standards will impair service adequacy, reliability or safety, or will otherwise be incompatible with the utility's electric system.

- Applicable sectors: Commercial, Industrial, Residential, Nonprofit, Schools, Local Government, State Government, Fed. Government, Agricultural, Institutional
- CHP eligibility: Both fossil-fueled and renewably-fueled CHP systems are eligible for standardized interconnection.
- Eligible project size (for standardized interconnection): system <20 MW
- Forms/information: http://www.wutc.wa.gov/energy

6.4.2 WASHINGTON NET-METERING RULES[28]

Washington adopted net metering rules in 1998, administered by the Washington Utilities and Transportation Commission. These rules are summarized below:

Washington's net-metering law applies to systems <100 kW that generate electricity using solar, wind, hydro, biogas from animal waste, or CHP technologies (including fuel cells). CHP systems are called net-metering systems defined to be a fuel cell, a facility that produces electricity and used and useful thermal energy from a common fuel source, or a facility for the production of electrical energy that generates renewable energy, and that:

[28] http://apps.leg.wa.gov/RCW/default.aspx?cite=80.60

- *Has an electrical generating capacity of not more than 100 kW.*
- *Is located on the customer-generator's premises.*
- *Operates in parallel with the electric utility's transmission and distribution facilities.*
- *Is intended primarily to offset part or all of the customer-generator's requirements for electricity.*

All customer classes are eligible, and all utilities -- including investor-owned utilities, municipal utilities and electric cooperatives -- must offer net-metering.

Net-metering is available on a first-come, first-served basis until the cumulative generating capacity of net-metered systems equals 0.25% of a utility's peak demand. This limit will increase to 0.5% on January 1, 2014. At least one-half of the utility's available aggregate net-metering capacity is reserved for systems generating electricity using renewables.

Energy is measured with a single, bi-directional meter which the utility must provide. However, the customer is responsible for providing the current transformer enclosure, meter sockets, and junction box. Net excess generation (NEG) is credited at the utility's retail rate on the customer's next bill. If there is any remaining NEG on April 30 of each year, it is surrendered to the utility without customer compensation. Meter aggregation is provided at a customer's request and is limited to 100 kW per customer.

Utilities are not permitted to require customers to comply with additional safety or performance standards, and they are not allowed to charge additional standby, capacity, interconnection or other fees without approval from the Washington Utilities and Transportation Commission.

6.5 WASHINGTON DEPARTMENTOF ARCHAEOLOGY & HISTORIC PRESERVATION[29]

6.5.1 STATE HISTORIC PRESERVATION OFFICE (SHPO)

Federal and state agencies working with historic properties and private property owners, companies or local government receiving federal or state funds may be required to provide a letter from the Washington SHPO (Department of Archaeology and Historic Preservation) concerning the project's effect on cultural and historic resources. These are sites are protected by a variety of state and federal laws in Washington, including Section 106 of the National Historic Preservation Act and Washington Executive Order 05-05. Satisfying the requirements of these regulations involves a process for archaeological resources and for historic buildings.

For historic resources, in most cases compliance requires the hiring of a professional who meets the federal standards of the Secretary of the Interior. The department has developed a set of guidelines (Washington State Standards for Cultural Resource Reporting) which outlines how to conduct the historic building survey and the inventory process.

- More information about compliance with historic buildings: Greg Griffith, Deputy State Historic Preservation Officer phone: (360) 586-3073 e-mail: Greg.Griffith@dahp.wa.gov

Compliance with archaeological resources requires the hiring of a professional archaeologist who meets the federal standards of the Secretary of the Interior and State Law. This individual(s) will handle the formal consultation with DAHP. The department has developed a set of guidelines (Washington State Standards for Cultural Resource Reporting) which outlines how to conduct the archaeological survey and inventory process.

[29] http://www.dahp.wa.gov. Phone 360.586.3065.

- More information about compliance with archaeological resources: Rob Whitlam, State Archaeologist, phone: (360) 586-3080 e-mail: Rob.Whitlam@dahp.wa.gov
- Application review: approx. 30 days
- Permit cost: none
- Consultation: decision on permit dependent on consultation and on-site archaeological survey
- How long permit is valid: depending upon funding agreement
- Reference: 05-05 compliance/Environmental permit handbook

6.5.2 FOREST PRACTICES ACT

The Forest Practices Rules Board establishes standards for forest practices such as timber harvest, pre-commercial thinning, road construction, fertilization, and forest chemical application (Title 222 WAC). The rules are designed to protect public resources such as historic and cultural sites while maintaining a viable timber industry.

The Forest Practices Act may or may not directly impact the proposed CHP facility. If the owner/operator is also harvesting the feedstock and/or managing forestlands for these feedstocks, the provisions of the Forest Practices Act will apply. These regulations will apply to the entity harvesting the biomass material, thus compliance by this contractor is important to the sustainable feedstock supply for the facility.

The Department of Natural Resources (DNR), with the assistance of the Department of Archaeology & Historic Preservation (DAHP) maintains a record of archaeological sites and tribes with an interest in cultural resources in specific geographical areas.

After submitting a Forest Practices Application, DNR may determine that the harvest area has a cultural resource such as an archaeological site or evidence of Native American cairns, graves or glyptic records. If so, state law requires that a permit by obtained from the DAHP before conducting any operation or activities that would disturb or potentially damage the site or objects.

In addition to the state laws protecting archaeological sites, the forest practices rules (WAC 222-20-120) require DNR to notify tribes in Washington of forest practices applications that have been submitted in areas where one or more tribes have identified an interest.

Archaeological Site Protections Plans are required any time a forest practices application will have an effect on an archaeological site. Any actions involving the need to alter, excavate into, or otherwise affect an archaeological site during a Forest Practice, it is necessary to obtain an archaeological excavation permit. This includes Native American archaeological sites and historical period archaeological sites, such as pioneer homesteads, logging camps, and linear sites such as railroad grades and ditches. It includes sites on both public and private lands.

7 MARKETS

In addition to wood products, the main markets that need to be assessed for this study are the thermal and electrical markets. At this time, both markets are quite low largely due to the price of natural gas. Natural gas impacts both the electrical market and the thermal market, as it is used both for heating and the production of electricity.

7.1 ELECTRICAL POWER CUSTOMERS/MARKET

Electricity produced by the project can be marketed in a few ways, all of which require interconnection with the Skamania County Public Utility District #1. It could be net-metered through a co-located facility, where the price would be fixed to the rate paid by the electrical customer. For the net-metering option, the customer would have to have sufficient electrical appetite to use the electricity that is produced. A sort yard or a greenhouse operation would have sufficient electrical appetite to capture all of the electricity production, as any extra production is captured by the utility on an annual basis. The PUD has a maximum allowable capacity for net metering of 100 kW, hence the smaller project is sized at 100 kW electrical. Alternatively, electricity could be sold on the market as a wholesale producer. In this case, the local utility has clearly stated that it is not interested in entering into a Power Purchase Agreement with the project, although would be willing to "wheel" the power to an adjacent utility, in this case Pacific Power. Pacific Power would enter into a Power Purchase agreement with the project, and sell power at the avoided-cost rate, which is based in the cost of natural gas and quite low. The combination of the avoided cost rate structure and the need to wheel the power (at an estimated $2,000/month) make the market conditions very difficult.

There has been much discussion of the future market conditions for renewable energy when Renewable Portfolio Standards increase in Oregon and Washington over the next couple years

7.2 THERMAL POWER CUSTOMERS/MARKET

The thermal customer market is somewhat clearer than the electrical market. Prices for thermal energy products are tracked by the Energy Information Association, a federal government agency. For Washington, and everywhere else in the county, natural gas is the lowest cost fossil fuel used for heating. Biomass is similar in cost on a per BTU basis, but the infrastructure costs for biomass are much higher. The current industrial rate for natural gas in WA is about $10 per 1000 cubic feet, which is equivalent in thermal energy to 1 mmBTU, and residential rates are slightly higher. While not available at the Wind River Business Park, any potential thermal customer is likely to look for a location within natural gas territory in order to capture the lower cost of heating. The next cheapest alternative fuel at the site would be propane, and the current industrial cost per mmBTU of propane is around $18. For the financial analysis in this study, it's assumed that the facility would sell at the natural gas equivalent.

7.3 BIOMASS PRODUCTS

In addition to the thermal and energy outputs of the proposed utility there exists the potential to market additional fiber products. With the development of a whole log chipping and grinding facility, additional products may be produced on site including small sawlogs, paper chips, landscape bark, and excess biomass. Initially, development of the utility could occur without the addition of the on-site chipping and grinding capabilities by simply purchasing delivered biomass from outside suppliers. In either case, the utility would be subject to local market pricing – either paying market rates for delivered biomass or paying market prices for delivered chip logs. The following is a discussion of the proposed outputs and the current values in the market area.

- Small Sawlogs. With a log merchandising system in place, there would be a certain percentage of the purchased logs that would make a small sawlog or chip-n-saw specification and could then be re-sold to local mills. The closest mill to Wind River, WKO has shown interest in the small saw-logs as well as has Interfor in Mollala, Oregon. Assuming an average 45 foot log to a

2-3 inch top, approximately 50% of the log weight would be made up of the sawlog portion to be resold. These sawlogs would currently be worth approximately $500 per thousand board feet (mbf) delivered to Molalla. Subtracting an estimated haul cost of $130 per mbf leaves a value of $370 per mbf at the Wind River facility. Assuming a load size of 2.8 mbf per load and an average of 14 bone dry tons per load produces a value of the logs at the Wind River site of approximately $74 per bone dry ton. No estimate was made to the nearby WKO facility as it would be expected the price for logs would be negotiated along with a purchase agreement for residual biomass.

- Whole Log Chips. Whole log chips are also a necessary component of the proposed operation at Wind River. The logs that the facility would compete for have a chippable component and therefore to be competitive in their purchase, Wind River would likely need to capture chip values from them as well. Again assuming the average 45 foot log to a 2" top, approximately 25% of the log weight would be made up of chips. That assumes the portion of the log between approximately 6" diameter and 2" diameter would be chipped. Currently, chips would be worth approximately $60 -$65 per bone dry ton at the Wind River location.
- Excess Biomass and Bark. Currently the value of excess biomass and bark produced at the Wind River facility would be negligible due to the supply of biomass available in the market. Many of the producers in the area are selling biomass at or near the cost to cover the transportation to market. From the example log above, all the bark plus the log from 4" diameter to 2" diameter would be ground up for biomass. It is estimated that biomass would make up approximately 25% of the total log weight.

Using the above log yield and product values, an estimate of the price that could be paid for logs delivered to the facility can be calculated. From this price the cost to handle the logs and process them would then need to be subtracted to get the final purchase price. The following formula illustrates the calculation:

Biomass Raw Material Cost Calculation (prior to processing)

DLC per BDT = BM % (x) BMC per BDT (+) SLY % (x) SLV per BDT (+) WLCY % (x) WLCV per BDT

Where:

- DLC is delivered log cost
- BDT is bone dry ton
- SLY is sawlog yield
- SLV is sawlog yard value
- WLCY is chip yard yield
- WLCV is chip yard value
- All values are a calculated at the Wind River Facility

The above formula would thus produce the following for the Wind River facility:

$67 = .25*$60 + .5*$74 +.50*$60

Assuming that handling and processing the logs could be accomplished for approximately $7 - $9 per bone dry ton, results in a log purchase price of $28 to $30 per green ton. This is at or near current prices for pulp logs in the local market, therefore it would indicate the facility could be competitive in purchasing logs. A more detailed analysis is covered in the Biomass Yard Cost Analysis, Appendix B.

9 POLICIES AND INCENTIVES

Combined Heat and Power offers an opportunity for the Wind River Business Park to enhance business competitiveness, support energy infrastructure, increase energy efficiency, and improve energy security while offering environmental and climate change benefits[30]. Policies are in place in Washington which are supportive of renewable energy and of biomass utilization.

Financial incentives can take a variety of forms, including direct financial grants, tax incentives, low-interest loans, rebate programs, and feed-in tariffs. Policy opportunities include establishing output-based emissions regulations, including CHP/waste heat to power in state portfolio standards, implementing standardized interconnection requirements, and including CHP targets in state energy and climate plans.

Incentives and policies may benefit a project at the planning, implementation or operational phases, or actually provide a secondary benefit to suppliers and associated business and service providers. Below is a list of policies and incentives which may be relevant to the project. The project proponent will need to consult with appropriate tax and legal experts to assess these opportunities.

Policy/Incentive Name	Policy/Incentive Type	State
2012 Washington State Energy Strategy	State Energy Plan	WA
Okanogan County PUD – Sustainable Natural Alternative Power Program	Production Incentive	WA
Renewable Energy Cost Recovery Incentive Payment Program	Production Incentive	WA
Renewable Energy Sales and Use Tax Exemption (WA)	Tax	WA
Washington Interconnection Standards	Interconnection Standard	WA
Washington Net-Metering Rules	Net-Metering Policy	WA
Washington Renewable Energy Standard	Portfolio Standard	WA

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9.1 WASHINGTON RENEWABLE ENERGY SALES AND USE TAX EXEMPTION

Washington State offers a 75% exemption from taxes on the sales of certain equipment used to generate electricity. Purchasers may claim an exemption in the form of a remittance. The tax exemption applies to labor and services related to the installation of the equipment, as well as to the sale of equipment and machinery.

- Eligible recipients: Purchasers of systems that generate electricity using fuel cells, wind, sun, biomass energy, tidal or wave energy, geothermal, anaerobic digestion, or landfill gas.
- Eligible fuels: Biogas; Woody Biomass; Landfill Gas; Other
- Eligible project size (MW): 0.001 MW or greater
- Form: http://dor.wa.gov/Content/FindTaxesAndRates/TaxIncentives/IncentivePrograms.aspx#Energy
- Documentation: Completion of Buyers' Retail Sales Tax Exemption Certificate for vendor on purchases that are 100 percent; Complete Application for Sales Tax Refund on Purchases &

[30] Environmental Protection Agency

Installation of Qualified Renewable Energy Equipment and send to Department of Revenue with proof of tax paid

- Contact: Beth Mills at (360) 705-6642.

9.2 RENEWABLE ELECTRICITY PRODUCTION TAX CREDIT (PTC)[31]

Certain sales and use tax exemptions apply to purchases of and charges for installing machinery and equipment that will be used directly to generate electricity using fuel cells, sun, wind, biomass energy, tidal and wave energy, geothermal resources, anaerobic digestion, technology that converts otherwise lost energy from exhaust, or landfill gas in a facility that generates not less than one kilowatt of electricity based on the nameplate of the equipment.

The federal renewable electricity production tax credit (PTC) is a per-kilowatt-hour tax credit for electricity generated by qualified energy resources and sold by the taxpayer to an unrelated person during the taxable year. Originally enacted in 1992, the PTC has been renewed and expanded numerous times, most recently by the American Recovery and Reinvestment Act of 2009 (H.R. 1 Div. B, Section 1101 & 1102) in February 2009 (often referred to as "ARRA") and the American Taxpayer Relief Act of 2012 (H.R. 6, Sec. 407) in January 2013.

The February 2009 legislation revised the credit by: (1) extending the in-service deadline for most eligible technologies by three years (two years for marine and hydrokinetic resources); and (2) allowing facilities that qualify for the PTC to opt instead to take the federal business energy investment credit (ITC) or an equivalent cash grant from the U.S. Department of Treasury. The availability of the cash grant option expired December 31, 2011, though the ITC may still be claimed for eligible projects. The ITC for PTC-eligible technologies is generally equal to 30% of eligible costs.*

The January 2013 legislation revised the credit by: (1) removing "placed in service" deadlines and replacing them with deadlines that use the beginning of construction as a basis for determining facility eligibility; (2) extending the deadline for wind energy facilities by one year, from December 31, 2012 to December 31, 2013; (3) extending the permission for PTC-eligible facilities to claim the ITC through 2013 (also using the start of construction rather than placed in service date as a reference); and (4) revising the definition of the term "municipal solid waste" to exclude "paper that is commonly recycled and which has been segregated from other solid waste". The definitional change for municipal solid waste applies to electricity produced and sold after the enactment date of the legislation (January 2, 2013) in taxable years ending after that date.

In April 2013 the IRS issued guidance on how it will evaluate whether construction has commenced for the purpose of the year-end 2013 deadline. The guidelines establish two paths for meeting this benchmark, which are very similar to those used by the U.S. Department of Treasury under the former Section 1603 Grant in Lieu of Tax Credit program. Under one path, a project is considered to have begun construction when "physical work of a significant nature" has started. Under the other path, construction of a facility is considered to begun when five percent of the total cost of the facility has been incurred by the taxpayer, and the taxpayer makes continuous efforts to complete the facility thereafter. The guidance also provides that in certain circumstances the evaluation can take place on a project-wide basis rather than separately for each individual piece of equipment. For further information on this and other aspects of the IRS guidance please see the full text of IRS Notice 2013-29.

[31] http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=US13F

The tax credit amount is 1.5¢/kWh in 1993 dollars (indexed for inflation) for some technologies and half of that amount for others. The rules governing the PTC vary by resource and facility type. The table below outlines two of the most important characteristics of the tax credit -- the begin construction deadline and the credit amount -- as they apply to different facilities. The table includes changes made by H.R. 8 in January 2013 and the inflation-adjusted credit amounts are current for the 2013 calendar year, as published in the April 3, 2013 Federal Register.

Resource Type	Begin Construction Deadline	Credit Amount
Wind	December 31, 2013	2.3¢/kWh
Closed-Loop Biomass	December 31, 2013	2.3¢/kWh
Open-Loop Biomass	December 31, 2013	1.1¢/kWh
Geothermal Energy	December 31, 2013	2.3¢/kWh
Landfill Gas	December 31, 2013	1.1¢/kWh
Municipal Solid Waste	December 31, 2013	1.1¢/kWh
Qualified Hydroelectric	December 31, 2013	1.1¢/kWh
Marine and Hydrokinetic (150 kW or larger)**	December 31, 2013	1.1¢/kWh

In addition, the tax credit is reduced for projects that receive other federal tax credits, grants, tax-exempt financing, or subsidized energy financing. The credit is claimed by completing Form 8835, "Renewable Electricity Production Credit," and Form 3800, "General Business Credit." For more information, contact IRS Telephone Assistance for Businesses at 1-800-829-4933.

9.3 CERB PROSPECTIVE DEVELOPMENT CONSTRUCTION PROGRAM

CERB assists rural communities with funding economic development infrastructure for CERB-eligible prospective development projects when feasibility is demonstrated. Jurisdictions in rural counties and communities – including Skamania[32] - are eligible for Prospective Development awards. The applicant must provide evidence that a private development or expansion is likely to occur as a result of the public improvements.

CERB requires that the project generate either significant job creation or significant private investment in order to be eligible for funding. Applicants must demonstrate convincing evidence (based on a feasibility study) that the median hourly wage of the private sector jobs created after the project is completed will exceed the countywide median hourly wage[33]. Applicants must also demonstrate the need for CERB assistance and that no other timely source of funds is available at a reasonably similar rate to the current CERB rate.

9.3.1 CERB[34] GRANTS

To facilitate the location and expansion of industry, Washington State has created a special contingency fund to finance local public improvements required for development. The Community Economic Revitalization Board (CERB) administers the development fund for the state. CERB monies are awarded as loans, or in special cases grants, to local governments on an as-needed basis for public works projects. Eligible activities include access roads, sewer and water extensions and other public

[32] http://www.commerce.wa.gov/commissions/CommunityEconomicRevitalizationBoard
[33] Ibid.
[34] Ibid

improvements. In order to stimulate a significant level of investment and job creation, CERB has established general funding guidelines, which take into account the following:

- Number of jobs to be created
- Economic diversification potential
- Public and private sector capital commitment
- Feasibility of project completion
- Ability of applicant to repay

The Community Economic Revitalization Board oversees grants to local and regional municipalities that can improve infrastructure including roads, ports, power, water or Internet connectivity. Eligible projects typically benefit communities or public entities by creating jobs and economic vitality locally.

9.4 DEPT. OF COMMERCE BUSINESS DEVELOPMENT UNIT

The Business Development Unit is focused on business recruitment, retention and expansion throughout Washington State to build a healthy and prosperous future. By facilitating job growth and assisting Washington companies to retain their current employees, the Business Development Unit is fully aligned with the core mission of the Department of Commerce.

- Contact: Mary Trimarco, Managing Director, Business Development, 206.256.6146

9.5 DEPT. OF COMMERCE BUSINESS LOAN PORTFOLIO

The Business Loan Portfolio offers a growing number of financing assistance programs to local businesses, primarily in the state's rural areas. Commerce administers several revolving loan programs through the use of federal grant and program funds to meet the economic development needs of businesses and communities throughout the state. The Business Loan Portfolio program services all aspects of the revolving loan programs. The program mission is to diversify local economies by attracting and retaining small businesses in rural areas to create and retain jobs and expand the local tax base.

The program makes direct loans of federal funds, together with other federal, state and local financing tools (including federal loan guarantees) to leverage private investment. Individual loan programs include:

- Rural Washington Loan Fund ($6.7 million in total lending capacity)
- Community Development Block Grant Float Loan Program ($12 million in total lending capacity)
- Forest Products Revolving Loan Fund ($2 million lending capacity)
- Contact: Jane Swanson, Project Manager, Small Business Credit Initiative,206.256.6155

9.6 PRIVATE INVESTMENTS/FINANCING

A limited number of private foundations and organizations may have funding available to support renewable energy project development, the StEPP Foundation[35], for example. Usually these opportunities exist in response to RFPs (request for proposal) announced by the entity and with particular sector and eligibility criteria. The availability of these types of funds could be explored at the go/no go decision point.

[35] http://stepp.steppfoundation.org/main

9.7 USDA RURAL DEVELOPMENT ENERGY PROGRAMS

9.7.1 RURAL ENERGY FOR AMERICA PROGRAM GRANTS[36]

The Rural Energy for America Program (REAP) provides financial assistance to agricultural producers and rural small businesses in rural America to purchase, install, and construct renewable energy systems; make energy efficiency improvements to non-residential buildings and facilities; use renewable technologies that reduce energy consumption; and participate in energy audits, renewable energy development assistance, and feasibility studies. Guaranteed Loan and grant eligibility is limited to rural small businesses and agricultural producers. An agricultural producer is an individual or entity directly engaged in the production of agricultural products (crops, livestock, forestry products, hydroponics, nursery, and aquaculture) whereby 50 percent + or greater of their gross income is derived from the operations. A private entity is considered a small business in accordance with Small Business Administration's Small Business Size Standards.

For loans, the lender must be eligible for the program. Most lenders are eligible, including Federal and State-chartered banks, Farm Credit System banks, and savings and loan associations. Other lenders may be eligible if approved by USDA.

Qualifying for a REAP opportunity would depend upon the legal ownership structure determined for the CHP facility. Grants are funded through the Farm Bill and state allocations vary each year. Grants cover up to 25% of the cost of the capital purchase of technology. Some states allocate a larger portion of the state funds to support requests of $20,000 or less.

For both loan guarantees and grants, project must meet the following conditions:

- The loan/grant must go towards the purchase of a renewable energy system or to make energy efficiency improvements
- The technology is pre-commercial or commercially available, and replicable
- The project must have technical merit, as specified in Rural Development Regulation 4280 subpart B
- A rural small business must be located in a rural area, though an agriculture producer may be located in a rural or non-rural area
- The applicant must be the owner of the project and control the revenues, expenses, operations, and maintenance of the project
- Sites must be controlled by the agricultural producer or small business for the financing term of any associated Federal loans or loan guarantees
- The project must have satisfactory sources of revenue, for the life of the project, that will be used for the operation, management, maintenance, and debt service of the project

9.7.2 USDA BUSINESS AND INDUSTRY (B&I) GUARANTEED LOAN PROGRAM

Provides financial backing for rural businesses through guarantees up to 80 percent of a loan made by a commercial lender. Loans may be used for working capital, machinery and equipment, buildings and real estate, and certain types of debt refinancing. Biobased, bioenergy, and other qualified energy projects may be financed through the program for technologies that convert biomass into affordable, commercially proven electricity, fuel chemicals, pharmaceuticals, and other materials in cost competitive ways for large national and international markets.

[36] http://www.rurdev.usda.gov/BCP_ReapResEei_Eligibility.html

9.8 SALES AND USE TAX EXEMPTIONS[37]

Sales and use tax exemptions are available to manufacturing, research and development and computer-related service businesses locating or expanding their work force, plant complex, machinery and equipment in Skamania County. No repayment is required.

To qualify, a business must create one full time employment position for every $750,000 of capitalized project costs. Under the program, the business must invest in machinery, equipment and plant by: constructing a new building; leasing a newly-constructed, previously unoccupied building-, purchasing an unoccupied building or; expanding or modernizing an existing building with costs in excess of 25 percent of the value prior to improvement.

A business must submit an application to the Washington State Department of Revenue for approval before construction begins or machinery and equipment is acquired.

9.9 BUSINESS AND OCCUPATION TAX CREDIT

This program allows a credit against the B&O Tax for manufacturing, research and development and computer-related service businesses for each new employment position created. It also applies if the existing work force is increased by 15 percent over the average number of full-time employment positions maintained in the prior year.

A business may receive a B&O tax credit of $2,000 for each new fulltime employment position expected to be filled during the year application is made. These new positions must be maintained for 12 consecutive months. The business must create and fill enough new positions to meet the 15 percent increase by December 3 1 of the year in which it applies for credit. An application must be submitted to the Washington State Department of Revenue prior to filling new positions. Businesses that have applied for the sales and use tax exemptions program may also apply for the B&O tax credit. A maximum credit of $300,000 is allowed.

9.10 DEVELOPMENT LOAN FUND

The State of Washington administers a Development Loan Fund that provides below market term loans for gap financing for new industries. The Development Loan Fund may loan up to $350,000 and can provide one dollar for every two dollars of private loans or capital. The loan amount is determined by the financing "gap" and job impact.

Development Loan Funds may be used for the acquisition, engineering, improvement, rehabilitation, construction, operation or maintenance of any property, real or personal, used by the business. Working capital term loans are also eligible. The DLF funds are designated to finance that portion of a project which cannot be financed through other sources and which is the last gap needed to be filled before the project can proceed. Rates of interest and other loan terms are determined by the need for the project and by competitive factors.

[37] www.dor.wa.gov

10 PROJECT ECONOMIC AND FINANCIAL ANALYSIS

10.1 REVENUES AND COST ASSUMPTIONS

The financial assumptions used to evaluate potential revenues for this project were determined using current values in the electrical and thermal energy markets. For the 2 MW project, a Power Purchase Agreement with Pacific Power would allow the project to sell electricity at the avoided cost rate, less wheeling fees through the Skamania PUD lines, which comes to approximately $0.03 per kWh. For the 100 kW project, electricity could be sold at the net-metering rate, which is fixed to the retail rate, approximately $0.08 per kWh. Should future changes in the market materialize due to the Renewable Portfolio Standards or some other significant departure from current market trends, the project could potential exceed these assumptions. For thermal energy, the sales price was set at the current cost of commercial natural gas, the cheapest thermal energy fuel alternative, at $10.00 per mmBTU.

The main assumption for operational costs is the cost of fuel supply. Given that the cost of producing fuel on-site far exceeds the cost of purchasing residuals on the open market, it is assumed that the project will use fuel sourced from the open market, at an estimated cost of $25 per BDT. All of the mill procurement officers contacted for this study indicated that volumes in excess of what would be required for this project are available now and would likely be available into the foreseeable future.

For detailed analysis of revenues and cost, see appendix A.

10.2 ANCILLARY BENEFITS

Should the project include a campus design, some additional benefits would e created, including: (1) reduced impact on the restoration site and costs associated with processing in the forest, (2) integrated and diversified marketing abilities to generate the highest value from raw material (3) diversity, stability, and predictability for the local economy, (4) additional wood supply for other mills and regional customers of industrial forest products, and (5) increased forest health. Given the current price of chips currently available on the market, this would likely be

10.3 POTENTIAL ECONOMIC IMPACTS

10.3.1 DIRECT ECONMIC OUTCOMES

Beyond creating jobs on site, the project will support the local forest products industry, by creating a market for residuals that would otherwise be unmarketable under current conditions. Should the project include a campus design, it could operate in concert with regional mills in a mutually beneficial manner.

The project would also support a co-located greenhouse business. The greenhouse operation would likely require several additional employees at the site. The two project sizes considered here could support a 2 or a 10 acre greenhouse, for the smaller or larger project.

11 FINANCIAL ANALYSIS SUMMARY

The project financial analysis is summarized in the table below. The values below reflect the assumptions from the above document regarding the potential cost of biomass coming into the facility and the potential values of the energy produced. The financial summary includes a grant amount that

brings the project into a reasonable rate of return, thereby creating a target for the grant money that would have to be raised in order to capture financing.

PROFIT AND LOSS	2 MW (DOLLARS)	100KW (DOLLARS)
Total Capital Cost	15,898,325	2,415,654
Grant Funds %	40%	19%
Grant Funds	6,359,330	458,974
Total Cost after Grants	9,538,995	1,956,680
Project Equity/Debt %	25%/75%	25%/75%
Loan Rate %	5.0%	5.0%
Loan Term	20 yr	20 yr
Annual Revenue	1,639,944	289,228
Annual Operating Costs	741,589	106,099
Annual Debt Payments	574,075	117,757
Annual Operating Revenue	324,279	65,372
10 year IRR on Equity	10.5%	10.1%
Total Cost	15,898,325	2,415,654

12 TASK LIST OF ACTION ITEMS

Developing the CHP facility requires business planning and development guided by a plan of work which involves numerous concurrent actions. A person/office with oversight experience, skills, responsibility and authority is necessary. If grants or donor funds are used, these monies will likely have specific financial, budgetary and reporting requirements and their administration would have to be considered.

For the purposes of a CHP facility, these actions generally fall under a set of basic tasks. If a sort yard is developed, this entity would be established as a stand-alone or subsidiary business and also necessitate a discrete set of tasks.

General task outline for development of the CHP facility:

- Task: Project Development - Project development involves identifying, examining and preparing necessary planning and implementation documents for internal project management and external project development accountability/communications. Site acquisition and ownership. Communications with various agencies and entities for materials relating to proceeding with the project, including the State Historic Preservation Office (SHPO) clearance, and so on. Project

budget and financial plans. Communications by phone, email and mail, meetings, strategy sessions among team members and others, correspondence, administrative linkage of tasks and subtasks.

- Task: Financial and Legal Structure - Financial and legal organization to provide necessary controls for financing, planning, managing, reporting, budgeting, site control, contract personnel, ownership. Development of necessary utility, power and thermal rates and contracts; agreement with the utility finalized; projections for future operations. Direct and indirect costs.
- Site Acquisition and Control - Establish and assure control of the property and structures in order to proceed with project development and implementation. (Site control also provides the means to expedite future co-location of wood products businesses.)
- Task: Feedstock Supply Contracts - To establish prices, volumes, quality, forest stewardship expectations, and delivery terms; to assure uninterrupted feedstock supply availability to the facility, to reduce risks and uncertainties; to provide for orderly estimations of costs of production. One or more feedstock supply contracts developed and executed for feedstock supplies sufficient for facility operation.
- Task: Permitting and Approvals - Acquire and submit the required local, state and federal permits and approvals is to assure the facility is designed and operated to meet or exceed all siting, land use, construction, environmental, operational, and health and safety standards, including applications, inspections.
- Task: Facility Build and Equip - Engineer, design, construct and equip a facility for safe, efficient and economic operation. Identify engineering, technology, constructions and related trades firms, develop RFPs as appropriate, negotiate contractual terms and conditions, and execute contracts. Includes budget refinement, site preparation, engineering and design, equipment/technology identification and procurement, construction contracting/management/oversight, utility and service interconnections.
- Task: Project Commissioning and Operations - Once tests are complete and the facility is commissioned, manage the facility to maintain permit compliance, to operate efficiently, and to avoid adverse economic consequences that might impact the owners or others. Equipment properly operated and maintained. Record keeping orderly and secure. Final tests, inspections and approvals will be completed. Operations and maintenance.
- Task: Project Management - including reporting if required for funding sources. Management of consultants, and coordination with permitting agencies and partners for all development, permitting, installation, commission and start-up test operations. Negotiation and purchase of technology and approval of delivered equipment and associated parts. Reports and other deliverables if required by funding sources.

The Wind River Biomass Utility would be responsible for implementing the marketing strategy for the project. The group has significant experience in project development and is well-prepared to take the lead on developing the project.

13 CONCLUSIONS AND RECOMMENDATION

The purpose of the study was to determine whether a stand-alone biomass combined heat and power CHP or a biomass business/energy center is technically and financial viable at the designated site within the WRBP. Assumptions have been made based on preliminary engineering and financial analysis, and from information provided by partners and stakeholders.

Technical potential for CHP is based upon coincident demand for power and thermal energy at the site. Economic feasibility is based upon current and future fuel costs, thermal demands, power markets, and economic benefits. A central purpose of the proposed project is utilizing local woody biomass to produce both thermal and electrical energy. The project proponents anticipate that this project would deliver some of this energy, and potentially other biomass products, to existing or new co-located businesses.

Following an analysis of biomass supply, commercially available technologies, current energy markets, it is clear that the project is technically viable with respect to raw material supplies, and their delivered cost, and to existing, proven technologies to convert biomass feed stocks readily available to the WRBP into heat and power.

However, the current energy market is not conducive to renewable energy. This report considered two options for a CHP facility. The energy market is unfavorable for the larger 2 MW project, which would require a Power Purchase Agreement at (state the rate). The smaller project could capture a better electricity rate through Net Metering Agreement at (State the rate) and could sell thermal energy to the proposed co-located greenhouse. This smaller project would be able to supply enough heat for approximately 2 acres of greenhouses.

Both projects would require grant funding to achieve the targeted 10% rate of return on investment. The smaller project also has a much lower grant fund percentage (19%) required to get a reasonable return, and a much lower grant value ($458,947) over-all.

Our recommendation is that WRBU proceed with the 100 kwh net-metered CHP project by seeking grant funding, and concurrently evaluating the greenhouse business opportunity. If grant funding is secured, and the greenhouse business opportunity is pursued, the project has a strong probability of success.