Biomass Feasibility Assessment

Prepared for:
The Nevada County Biomass Task Force and
The Fire Safe Council of Nevada County
Grass Valley, California

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The TSS Consultants lead team included:

- Tad Mason, Forester and CEO
- Frederick Tornatore, Chief Technical Officer
- Matt Hart, Renewable Energy Specialist

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List of Abbreviations

Organizations

BLM	Bureau of Land Management
BOE	Board of Equalization
CAL FIRE	Department of Forestry and Fire Protection
CARB	California Air Resources Board
CEC	California Energy Commission
CPUC	California Public Utilities Commission
FSCNC	Fire Safe Council of Nevada County
OSHA	Occupation Safety and Health Administration
PG&E	Pacific Gas and Electric
SPI	Sierra Pacific Industries
Task Force	Nevada County Biomass Task Force
TSS	TSS Consultants
UC	University of California
USFS	United States Department of Agriculture, Forest Service

Other Terms

BDT	Bone Dry Ton
Btu	British Thermal Unit
CEQA	California Environmental Quality Act
CUP	Conditional Use Permit
EPIC	Electric Procurement Investment Charge
FTE	Full Time Equivalent
kW	Kilowatt
kWh	Kilowatt-hour
ICE	Internal Combustion Engine
ITC	Investment Tax Credit
LCOE	Levelized Cost of Electricity
MBF	Thousand Board Feet
MMBtu	Million British Thermal Units
MW	Megawatt
MWh	Megawatt-hour
NEPA	National Environmental Policy Act
NMTC	New Market Tax Credit
O&M	Operations & Maintenance
ORC	Organic Rankine Cycle
PTC	Production Tax Credit
ReMAT	Renewable Market Adjusting Tariff
RPS	Renewable Portfolio Standard
SB	Senate Bill
SIS	System Impact Study
TPY	Tons per Year
TSA	Target Study Area
UC	University of California
WUI	Wildland Urban Interface

EXECUTIVE SUMMARY

Introduction

The Nevada County Biomass Task Force (Task Force) and the Fire Safe Council of Nevada County (FSCNC) include community stakeholders that are interested in the potential for siting a community-scale bioenergy facility (scaled at 3 megawatts (MW) or less) within western Nevada County as part of an effort to:

- Encourage and implement local conservation-based fuel reduction programs to protect the people and communities of western Nevada County from the threat of fire;
- Improve local and regional air quality by finding alternative uses for woody biomass material that would normally be open-burned, which adversely impacts air quality;
- Provide an alternative forest biomass disposal opportunity for homeowners and land managers who are conducting fuels reduction, forest restoration, and forest harvest activities in the region;
- Support renewable energy development, thus diversifying local power generation and providing opportunities to efficiently utilize waste material (wood waste) for cogeneration of both power and heat; and
- Provide employment opportunities in the form of sustainable living wage jobs.

The Task Force, in concert with the FSCNC, retained TSS Consultants (TSS) to conduct a feasibility assessment focused on the potential for bioenergy development in the greater Grass Valley and Nevada City area.

Preliminary Site Analysis

TSS conducted a preliminary site analysis of 19 sites across western Nevada County. Sites were identified based on input from the Task Force, recommendations from the project's two community meetings,[1] and by TSS. In coordination with the Task Force, scoring criteria and weighting factors were developed to include available space, biological resources, cultural resources, heating and cooling load, interconnection requirements, land use zoning, proximity to sensitive receptors, road infrastructure, site infrastructure and environmental cleanup status, and water supply and wastewater discharge.

TSS and the Task Force scored sites using Nevada County, Nevada City, and Grass Valley zoning, parcel, and utility maps, aerial imagery, Pacific Gas and Electric (PG&E) grid infrastructure maps, California State Water Resources Control Board's GeoTracker, and local knowledge when available. Based on the findings, the sites with the top five rankings are shown in Table 1. The rankings indicate an objective preliminary analysis of the site without evaluating the willingness of the site owners to participate in the development of a bioenergy project.

[1] Open house public meetings were held May 29, 2014, at the Grass Valley Grange and October 22, 2014, at the Tahoe National Forest Office.

Table 1. Top-Ranked Potential Sites

Site Name	Site Score (Out of 100)	Site Rank
La Barr Meadows Road Rare Earth Site	76.7	1
Centennial Road Site	73.3	2
Airport Site, Charles Drive & Pike Court	71.7	3
La Barr Meadows Road Nevada County Site	71.7	3
Penn Valley Site	71.7	3
Former Sierra Pacific Industries (SPI) Mill Site	70.0	4
Hansen Brothers Site	70.0	4
East Bennett Road South Site	68.3	5

Biomass Feedstock Availability and Cost Analysis

Using a target study area with a 40-mile radius, TSS identified annual sustainable feedstock available of 113,128 bone dry tons (BDT)[2] per year from forest, urban, and agricultural sources. Applying the restrictions of Senate Bill (SB) 1122, the feedstock availability and projected feedstock sourcing blend and weighted-average pricing is identified in Table 2.

Table 2. Projected Project Feedstock Blend

Source	Economically Available (BDT/YR)	Projected Feedstock Blend (BDT/YR)	Feedstock Coverage Ratio	Feedstock Average Price ($/BDT)
Forest	53,920	19,200	2.8:1	$57.50
Urban	25,407	1,000	25.4:1	$26.00
Agriculture	33,801	3,800	8.9:1	$38.00
Totals	**113,128**	**24,000**	**4.7:1**	**$53**

Considering the seasonal availability of forest feedstock, there will need to be infrastructure on site at the bioenergy facility in order to assure that some volume of feedstock is stockpiled for use during winter months when access to forest operations is minimal. TSS recommends that a feedstock procurement strategy be developed that assures feedstock sourcing be concentrated at upper elevation locations during summer months and lower elevation locations in the winter. This will optimize and extend the operating season for feedstock suppliers while mitigating the need to stockpile large volumes of feedstock at the bioenergy facility. In addition, agriculture-sourced feedstock is typically available in the winter months (after nut harvest) and aligns well with feedstock procurement to facilitate wintertime delivery.

Bioenergy Technology Review

TSS reviewed commercially available biomass-to-electricity technologies appropriate for community-scale (3 MW) deployment. Direct combustion and gasification configurations were

[2] A bone dry ton equals 2,000 dry pounds (no moisture content).

reviewed for technological maturity, sensitivity to ambient conditions, water consumption, efficiency, air emissions, and operational costs. Table 3 summarizes the preferred biomass conversion technology. While each technology type offers unique advantages, given the interests communicated from the Task Force related to technology selection, a gasification-to-ICE approach would be preferred.

Table 3. Results of Technology Assessment

Characteristics	Preferred System
Technological Maturity	Direct Combustion
Sensitivity to Ambient Conditions	Direct Combustion
Water Consumption	Gasification
Feedstock Consumption/Efficiency	Gasification
Air Emissions Profile	Gasification
Labor Costs	Gasification

Economic Analysis

The primary product of a biomass gasification system is electricity and by-products include heat, biochar, and carbon credits. There are currently no local heat loads at any of the sites; however, several of the sites have the potential to collocate another enterprise as a potential heat user. For community-scale facilities, there are currently limited market opportunities for carbon credits due to accounting pathways and unreliability of short-term markets.

Using the levelized cost of electricity (LCOE) financial model developed by Black & Veatch for a California Public Utilities Commission (CPUC) analysis of proposed SB 1122 language, TSS performed sensitivity analyses on capital cost, operations and maintenance (O&M) costs, feedstock costs, heat rate, capacity factor, debt percentage, debt rate, debt term, cost of equity, biochar sales, and grant incentive levels. TSS found capital costs, O&M costs, and biochar sales to have the greatest potential impact on project economics. A Nevada County model was developed, and the model projected an LCOE of $160/megawatt-hour (MWh) without the ITC and $154/MWh with the ITC (Table 4).

Table 4. Nevada County LCOE Model

	Model Values		Model Values
Capital Cost ($/kW)	$5,500	Debt Term (years)	12
O&M Costs ($/kW)	$450	Investment Tax Credit (%)	0%
O&M Escalation (%)	2%	Biochar Sales ($/ton)	$325
Capacity Factor (%)	85%	Cost of Equity (%)	15%
Heat Rate (Btu/kWh)	16,500	**LCOE ($/MWh)**	**$170**
Feedstock Cost ($/BDT)	$53.10	Grant Funding ($)	$2,000,000
Feedstock Cost Escalation (%)	1%	**LCOE ($/MWh)**	**$160**
Debt Percentage (%)	70%	With Investment Tax Credit (%)	10%
Debt Rate (%)	5%	**LCOE ($/MWh)**	**$154**

Recommendations and Next Steps

The Task Force has made significant efforts to identify value-added opportunities to promote local economic development, improve public safety, utilize sustainable regionally available resources, and improve air quality. TSS recommends the following next steps to move the project forward:

- Select a Target Site;
- Identify a Technology Developer;
- Commence Land Use Permitting;
- Continue Public Outreach; and
- Identify Synergies with Local Enterprises.

Additionally, grant funding opportunities for pre-development work are available including the U.S. Forest Service (USFS) Wood Innovation Program, Sierra Nevada Conservancy, and the National Forest Foundation Grant program. Each of these organizations regularly changes their grant opportunities, and those should be monitored closely. TSS calls specific attention to the Wood Innovation Program, as it is open now with solicitations due on January 23, 2015. The California Energy Commission's (CEC) Electric Procurement Investment Charge (EPIC) program traditionally offers funding for research and development and commercialization. The EPIC program's focus changes with each round of funding. The next funding cycle is scheduled to be released in July 2015. EPIC is appropriate for funding after the selection of a project developer and the completion of the California Environmental Quality Act (CEQA) review process.

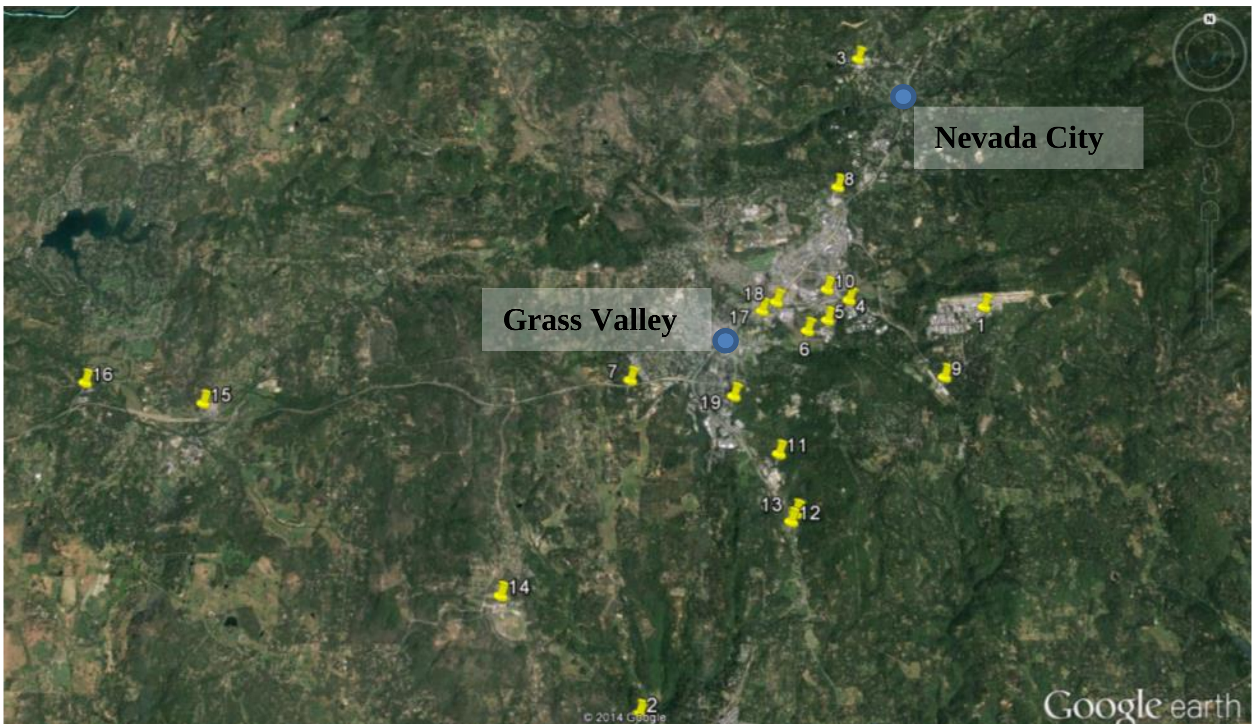
At this stage, TSS recommends that the Task Force focus on developing the framework and relationships necessary to achieve project financing. The next steps, if successfully achieved, will move the project closer to project financing and deployment.

PRELIMINARY SITE ANALYSIS

Site Identification

The process of identifying a successful bioenergy project begins with the identification and preliminary analysis of potential sites. Overall, 19 sites in the greater Nevada City/Grass Valley area were considered for the preliminary analysis based on local knowledge provided by the Task Force and input from the public in response to community outreach.[3] In addition, areas with industrial zoning, as indicated by Nevada County, City of Grass Valley, and City of Nevada City, were considered for this analysis. Figure 1 shows locations of the potential sites. Detailed information about each site is provided in Table 5.

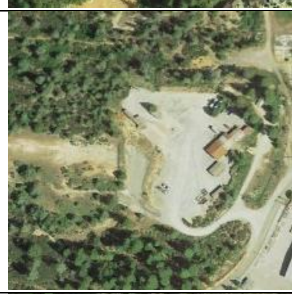
Figure 1. Map of Potential Sites

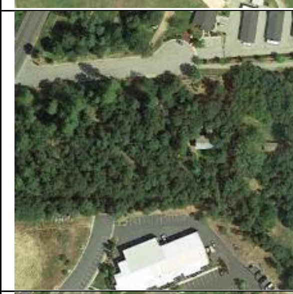
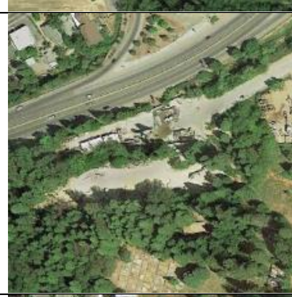


1. Airport Site	11. Hansen Brothers Site
2. Auburn Rd. Site	12. La Barr Meadows Rd. Nevada County Site
3. Cement Hill Site	13. La Barr Meadows Rd. Rare Earth Site
4. Centennial Dr. Site	14. McCourtney Transfer Station Site
5. East Bennett Rd. North Site	15. Penn Valley Site
6. East Bennett Rd. South Site	16. Pleasant Valley Site
7. Fairgrounds Site	17. Railroad Ave. Batch Plant Site
8. Former Meeks Lumber Site	18. Railroad Ave. Propane Facility Site
9. Former SPI Mill Site	19. South Auburn St. Site
10. Grass Valley Hay and Feed Site	

[3] Open house public meetings held May 29, 2014, at the Grass Valley Grange and October 22, 2014, at the Tahoe National Forest Office.

Table 5. Potential Sites for Review

Site Information	Aerial Photograph	Site Information	Aerial Photograph
Name: Airport Site ***Location***: Charles Dr. & Park Ct.		***Name***: Auburn Rd. Site ***Location***: 14940 Auburn Rd. Grass Valley	
Name: Cement Hill Site ***Location***: Intersection of Cement Hill Rd. & Hwy. 49 Nevada City		***Name***: Centennial Dr. Site ***Location***: 1020 Whispering Pines Ln. Grass Valley	
Name: E. Bennett Rd. North Site ***Location***: 11352 E. Bennett Rd. Grass Valley		***Name***: E. Bennett Rd. South Site ***Location***: Southwest of E. Bennett Rd. & Slow Poke Ln. Grass Valley	
Name: Fairgrounds Site ***Location***: North of the Grass Valley fairgrounds parking lot		***Name***: Former Meeks Lumber Site ***Location***: 2347 Nevada City Hwy. Grass Valley	
Name: Former SPI Mill Site ***Location***: South of the E. Bennett Rd. & Brunswick Rd. intersection, Grass Valley		***Name***: Grass Valley Hay and Feed Site ***Location***: 1025 Idaho Maryland Rd. Grass Valley	

Site Information	Aerial Photograph	Site Information	Aerial Photograph
Name: Hansen Brothers Site ***Location***: End of Amsel Way Grass Valley		***Name***: La Barr Meadows Rd. Nevada County Site ***Location***: 12536 La Barr Meadows Rd., Grass Valley	
Name: La Barr Meadows Rd. Rare Earth Site ***Location***: 12270 La Barr Meadows Rd., Grass Valley		***Name***: McCourtney Transfer Station Site ***Location***: 14741 Wolf Mountain Rd. Grass Valley	
Name: Penn Valley Site ***Location***: Northeast of Cattle Dr. & Gray Oak Dr. intersection Grass Valley		***Name***: Pleasant Valley Site ***Location***: South of Pine Shadow Ln. Grass Valley	
Name: Railroad Ave. Batch Plant Site ***Location***: End of Railroad Ave. Grass Valley		***Name***: Railroad Ave. Propane Facility Site ***Location***: Adjacent to 335 Railroad Ave., Grass Valley	
Name: South Auburn St. Site ***Location***: Southeast of the S. Auburn St. & Adams Ln. intersection, Grass Valley			

Siting Criteria

TSS worked with the Task Force to develop ten site criteria to be used as a basis for the preliminary analysis. Of the ten criteria, three were identified as critical. Critical criteria are defined as components that could potentially make a site infeasible and are summarized below.

- Land Use Zoning: The time and cost for a land use zoning change will prohibit bioenergy project development on sites without the potential for securing a Conditional Use Permit (CUP).
- Space: A site without sufficient space (identified as one acre for this project) will prohibit bioenergy development, as the equipment will not fit safely on the site.
- Proximity to Sensitive Receptors: Potential sites proximate to extra-sensitive receptors (e.g., schools and hospitals) were excluded from further analysis due to potential impacts to sensitive populations.

In addition to critical criteria, seven criteria were identified as secondary criteria, which are defined as components that affect the potential to site a project but do not necessarily impose prohibitive constraints. These secondary criteria include:

- Grid Infrastructure;
- Heating and Cooling Load Potential;
- Road Infrastructure;
- Site Infrastructure and Environmental Cleanup Status;
- Water Supply and Discharge;
- Biological Resources; and
- Cultural Resources.

Based on these criteria, TSS developed a scoring system offering a discrete score from 0 to 3 for each criterion. The Task Force independently identified a weighted score for each criterion subject to the priorities of the Task Force (Table 6). The scoring system, along with weight factors, is shown in Appendix A.

Table 6. Site Criteria with Weighted Scoring Factors

	Selection Criteria	Weighting Factor
Critical Criteria	Land Use Zoning	15%
	Space	10%
	Proximity to Sensitive Receptors	25%
Secondary Criteria	Grid Infrastructure	10%
	Heating and Cooling Load Potential	5%
	Road Infrastructure	10%
	Site Infrastructure and Environmental Cleanup Status	10%
	Water Supply and Discharge	5%
	Biological Resources	5%
	Cultural Resources	5%

Findings

TSS, with assistance from the Task Force, reviewed the sites using Nevada County, Nevada City, and Grass Valley zoning, parcel, and utility maps, aerial imagery, PG&E grid infrastructure maps, California State Water Resources Control Board's GeoTracker, observations from site visits, and local knowledge when available. Final site rankings are shown in Table 7, with details available in Appendix B. The rankings indicate an objective preliminary analysis of the site without evaluating the willingness of the site owners to participate in the development of a bioenergy project.

Table 7. Site Analysis Rankings

Site Name	Site Identifier (Figure 1)	Site Score (Out of 100)	Site Rank
La Barr Meadows Road Rare Earth Site	13	76.7	1
Centennial Road Site	4	73.3	2
Airport Site, Charles Drive and Pike Court	1	71.7	3
La Barr Meadows Road Nevada County Site	12	71.7	3
Penn Valley Site	15	71.1	3
Former SPI Mill Site	9	70.0	4
Hansen Brothers Site	11	70.0	4
East Bennett Road South Site	6	68.3	5
East Bennett Road North Site	5	66.7	6
Grass Valley Hay and Feed Site	10	66.7	6
McCourtney Transfer Station Site	14	65.0	7
Railroad Avenue Batch Plant Site	17	63.3	8
Pleasant Valley Site	16	60.0	9
Railroad Avenue Propane Facility Site	18	60.0	9
South Auburn Site	19	51.7	10
Fairgrounds Site	7	50.0	11
Auburn Road Site	2	43.3	12
Cement Hill	3	0.0	13
Former Meeks Lumber	8	0.0	13

BIOMASS FEEDSTOCK AVAILABILITY AND COST ANALYSIS

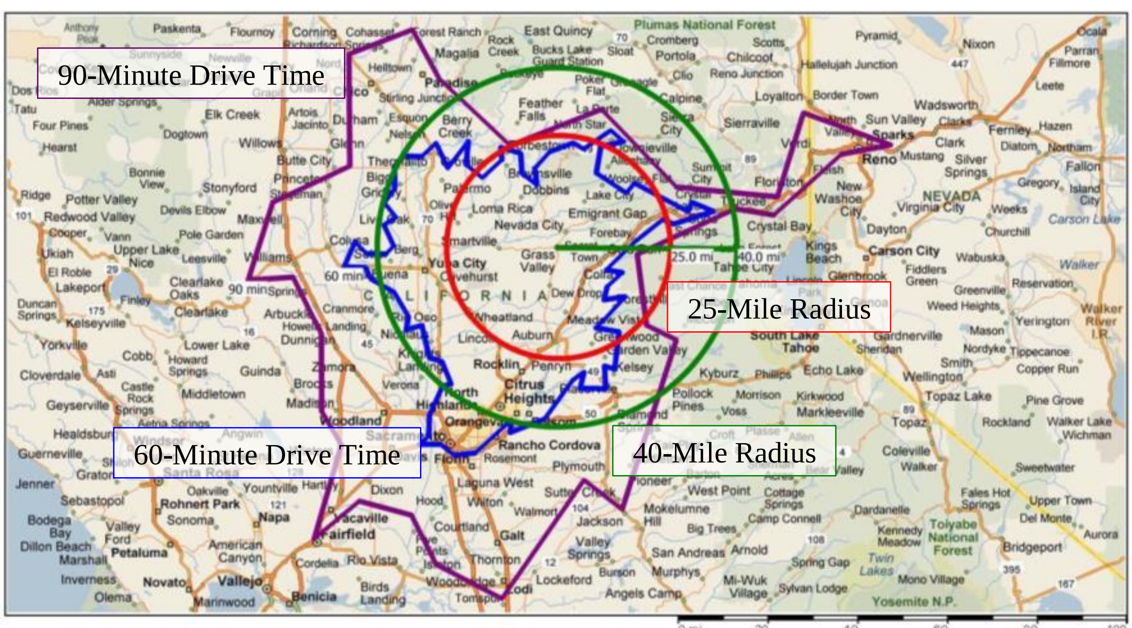
Woody biomass material sources considered in this feedstock availability analysis include a range of forest, urban, and agricultural material.

- Forest-sourced biomass:
    - Timber harvest residuals generated as a by-product of forest management activities (residuals that are typically piled and burned).
    - Excess forest biomass material generated as a by-product of fuels treatment and plantation thinning activities.
- Urban-sourced wood waste, including clean construction, demolition wood waste, and green waste from residential tree trimming and brush removal.
- By-product of commercial agricultural operations.

Target Study Area

Consistent with the objectives of the feedstock availability analysis, the Target Study Area (TSA) was defined by economic haul zones. Figure 2 identifies the 25-mile and 40-mile radius TSA and the 60-minute and 90-minute drive time zones from Grass Valley.

Figure 2. Drive Time Zones

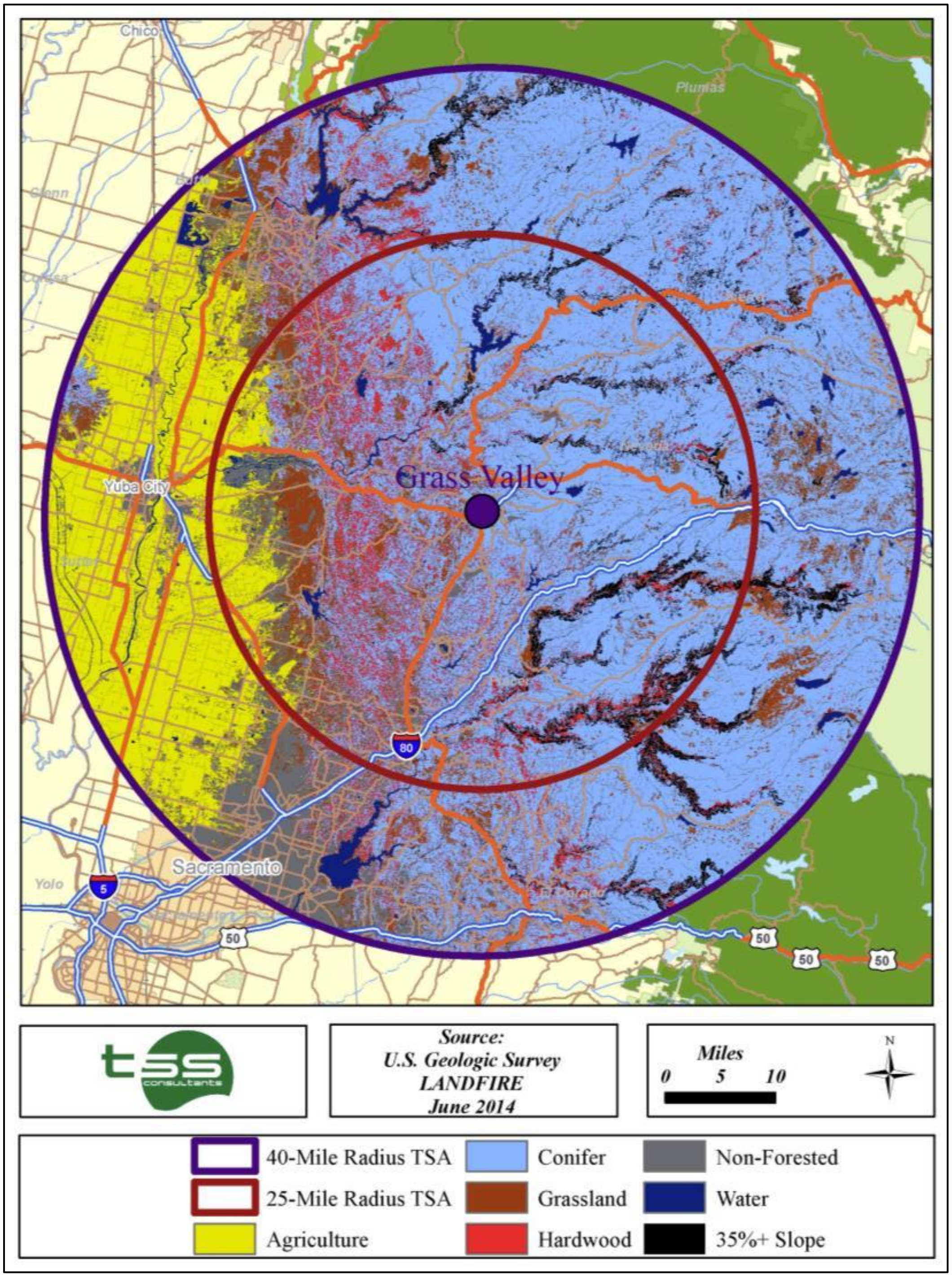


A 25-mile radius encompasses the majority of the 60-minute drive time zone through the forested regions proximate to Grass Valley. While the 60-minute drive time zone extends further east from the 25-mile radius, the focus of this project is to beneficially utilize local forest-sourced woody biomass material. The 40-mile radius captures much of the 90-minute drive time zone and the remainder of the 60-minute drive time zone in the Sacramento Valley. The TSA analysis will include an area equivalent to a 40-mile radius to capture economically viable transport zones in the forest settings.

Vegetation Cover

Woody biomass availability for any given region is heavily dependent on vegetation cover, topography, land management objectives, and ownership. Figure 3 shows the vegetation cover type for the TSA using U.S. Geological Survey LANDFIRE data. The vegetation cover types are categorized as agricultural, conifer, grassland, hardwood, non-forested areas, and water.

Figure 3. Vegetation Cover within the Target Study Area

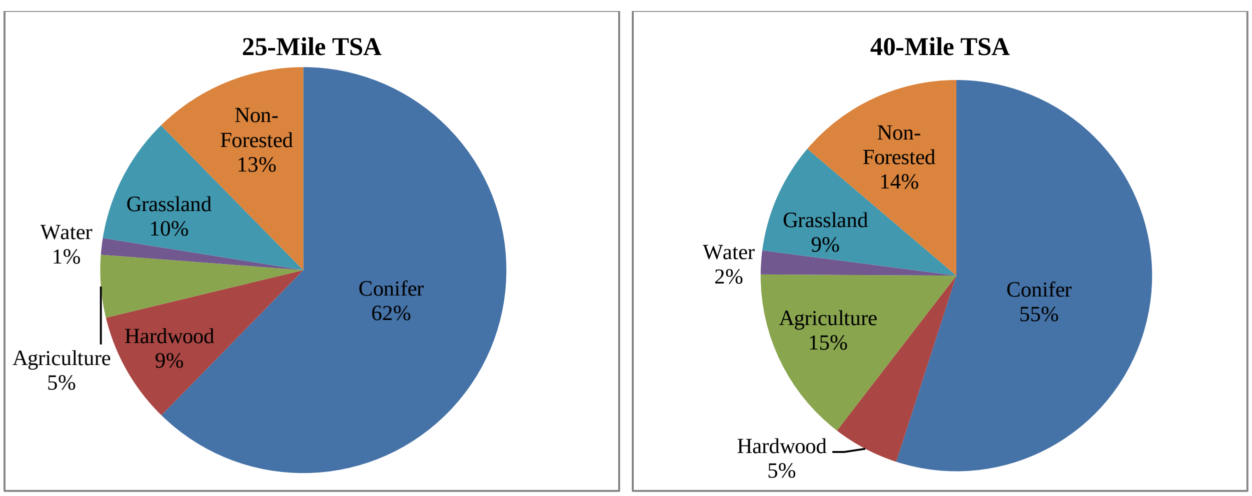


Forest biomass recovery activities are generally restricted to topography that will allow ready access for equipment and crew. Steep topography over 35 percent slope gradient is considered to be the breakoff point for ground-based logging and/or biomass recovery equipment on federally managed[4] lands. Private land managers typically utilize ground-based equipment on slopes up to 50 percent, but the cost of operating on sustained slopes above 35 percent are typically quite high and are considered prohibitive. Areas with 35 percent slope or higher have been excluded from the TSA and are shown in Figure 3. Note that most of the landscape with 35 percent-plus slope conditions is concentrated in riparian areas that are typically considered critical habitat and are not usually treated at the same level of vegetation removal or treatment as other (non-riparian) forest acreage.[5] Table 8 and Figure 4 summarize vegetation cover by category within the TSA.

Table 8. Vegetation Cover within the TSA

	25-Mile TSA		40-Mile TSA	
Cover Categories	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**
Agriculture	59,925	5.0%	454,896	14.6%
Conifer	750,137	62.3%	1,706,269	55.0%
Grassland	121,684	10.1%	284,471	9.2%
Hardwood	107,296	8.9%	169,831	5.5%
Non-Forested	148,839	12.4%	427,687	13.7%
Water	15,862	1.3%	60,771	2.0%
Totals	**1,203,743**	**100.0%**	**3,103,925**	**100.0%**

Figure 4. Vegetation Cover Distribution



[4] Primarily U.S. Forest Service and Bureau of Land Management.

[5] Fuels reduction activities within riparian areas are starting to become of interest due to recognition that typically high stocking levels in riparian areas create conditions that can lead to high intensity fire behavior.

The combination of conifer and hardwood vegetation types makes up the majority of both TSAs (71.2 percent of the 25-mile TSA and 60.5 percent of the 40-mile TSA). The forested landscape is concentrated in the eastern portion of the TSA with conifers as the primary cover type in the higher elevations and hardwoods as the primary cover type in the lower elevations. Agriculture makes up the predominant vegetation cover in the western portions of the TSA and amounts to almost 15 percent of the 40-mile TSA.

Land Ownership/Jurisdiction

Within the forested portions of the TSA, land ownership drives vegetation management objectives. Figure 5 highlights the locations of the various ownerships and jurisdictions. Table 9 and Figure 6 summarize land ownership and jurisdiction within the forested areas of the TSA.

Figure 5. Land Ownership/Jurisdiction within the TSA

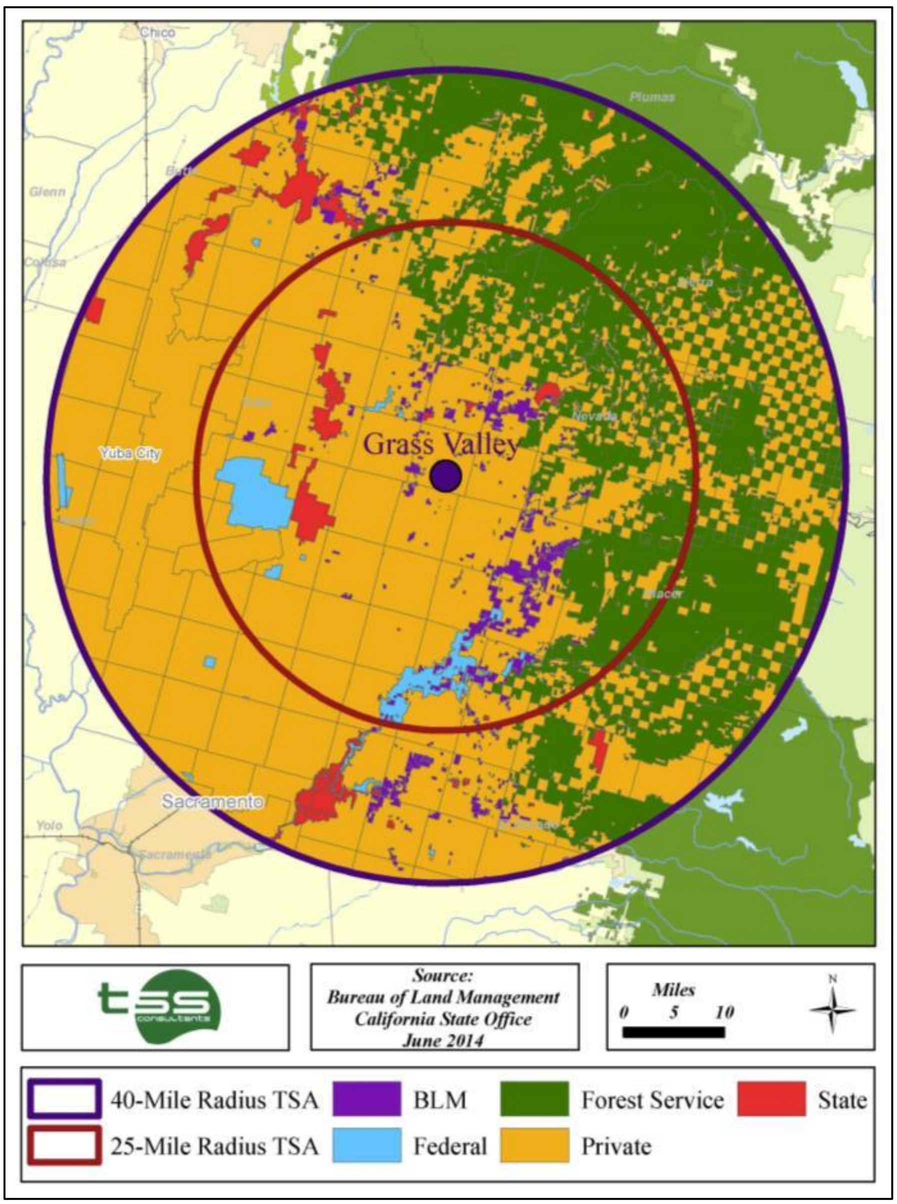
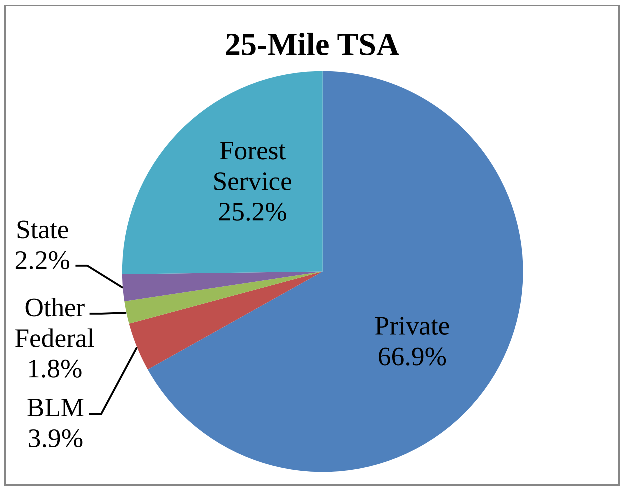


Table 9. Land Ownership and Jurisdiction of Forest Vegetation Cover

Land Owner/ Manager	25-Mile TSA		40-Mile TSA	
	Forested Acres	Percent of Total	Forested Acres	Percent of Total
BLM	33,757	3.9%	46,715	2.5%
Other Federal	15,554	1.8%	16,807	0.9%
U.S. Forest Service	216,199	25.2%	727,914	38.8%
Private	573,387	66.9%	1,052,247	56.1%
State	18,538	2.2%	32,416	1.7%
Totals	**857,435**	**100.0%**	**1,876,099**	**100.0%**

Figure 6. Land Ownership and Jurisdiction Distribution



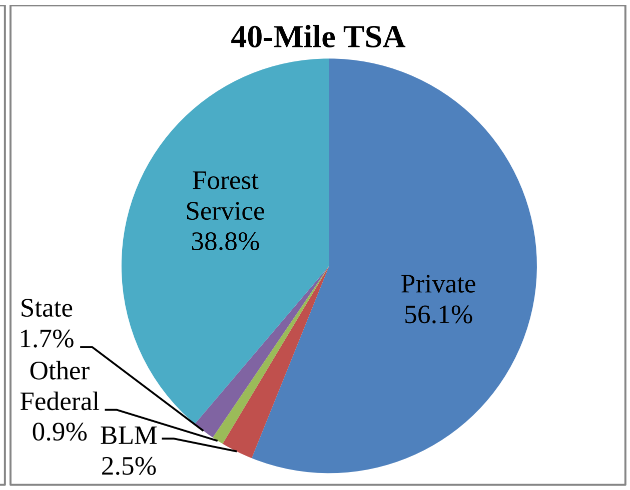


Table 9 and Figure 6 demonstrate the variety in ownership types between the 25-mile and 40-mile TSA. More than half of the private forested ownership and less than one-third of the USFS-managed lands are located within the 25-mile radius. This trend suggests that private forestland management practices will be an important driver of cost-effective feedstock availability, as illustrated in Figure 6, where private landownership represents 67 percent of the ownership within the 25-mile TSA (one-hour haul zone). Extending the TSA to the 40-mile radius will access significantly more USFS-managed land.

For the purposes of this feedstock availability analysis, TSS focused on the 40-mile TSA as the target study area due to its proximity to feedstocks (agricultural and forest) available within an economic haul distance of Grass Valley.

Forest-Sourced Biomass

Timber Harvest Residuals

Timber harvest residuals can provide significant volumes of woody biomass material. Typically available as limbs, tops, and unmerchantable logs,[6] these residuals are by-products of commercial timber harvesting operations. As such, they have no market value, though they can be a relatively economic raw material feedstock source for bioenergy production. Once collected and processed using portable chippers or grinders, this material is an excellent biomass feedstock.

Timber harvest activity within the State of California is monitored by the Board of Equalization (BOE). The BOE levies timber harvest taxes based on annual timber harvest levels. A review of the 2009 through 2013 BOE timber harvest data was conducted to confirm historic timber harvest activities within the TSA. The BOE data are provided for commercial timber harvests on both private and public lands. Table 10 provides results for private timber harvests, and Table 11 provides results for public timber harvests, expressed in thousand board feet (MBF)[7] per year.

Table 10. 2009 Through 2013 Timber Harvest Volume Estimates for Private Sawtimber Generated within the TSA

County	2009 (MBF/YR)	2010 (MBF/YR)	2011 (MBF/YR)	2012 (MBF/YR)	2013 (MBF/YR)	Percent of County in TSA	Weighted Average (MBF/YR)
Butte	70,688	31,739	41,978	43,164	37,034	40.9%	18,371
El Dorado	20,120	15,588	34,559	36,847	57,728	32.9%	10,852
Nevada	22,827	10,237	14,855	13,950	25,239	82.6%	14,398
Placer	9,317	33,657	18,657	11,733	33,483	77.9%	16,648
Plumas	45,257	51,618	53,546	71,954	84,330	7.7%	4,743
Sierra	8,131	11,623	12,984	20,663	13,763	50.7%	6,808
Yuba	12,371	13,946	20,461	21,317	14,253	100.0%	16,470
Totals	**188,711**	**168,408**	**197,040**	**219,628**	**265,830**	**—**	**88,290**

[6] Unmerchantable logs are typically too small or defective (diseased or dead) to manufacture into lumber.
[7] MBF = thousand board foot measure. One board foot is nominally 12″ long by 12″ wide and 1″ thick.

Table 11. 2009 Through 2013 Timber Harvest Volume Estimates for Public Sawtimber Generated within the TSA

County	2009 (MBF/YR)	2010 (MBF/YR)	2011 (MBF/YR)	2012 (MBF/YR)	2013 (MBF/YR)	Percent of County in TSA	Weighted Average (MBF/YR)
Butte	0	0	639	2,034	1,067	40.9%	306
El Dorado	61	4,244	5,908	11,700	11,490	32.9%	2,199
Nevada	1,201	1,950	1,292	581	51	82.6%	839
Placer	1,775	8,414	10,046	9,218	25,779	77.9%	8,606
Plumas	18,485	37,378	20,824	12,698	45,408	7.7%	2,085
Sierra	501	9,132	9,060	10,085	9,844	50.7%	3,915
Yuba	0	4,900	3,611	435	1,073	100.0%	2,004
Totals	**22,023**	**66,018**	**51,380**	**46,751**	**94,712**	**—**	**19,954**

The TSA is made up of portions of seven counties and using GIS analysis, TSS was able to determine the portion of each county that lies within the TSA (as shown in Table 10 and Table 11). Using these data, a weighted average timber harvest figure was calculated for each county. The 2009 through 2013 historic record of timber harvest across all seven counties results in a weighted average annual harvest of 108,244 MBF.

Results of historic timber harvest data review confirm that total harvest levels within the TSA have been inconsistent, ranging from a low harvest in 2009 of 210,734 MBF to a high of 360,542 MBF in 2013. A primary driver is the demand for sawlogs, which was significantly diminished in 2009 and 2010 due to a general downturn in the economy which impacted housing starts and concomitantly, the demand for lumber products and sawlogs. Harvest levels in 2013 suggest that demand for sawlogs has rebounded.

TSS's experience with forest biomass recovery confirms that a recovery factor of 0.9 BDT per MBF of sawlogs harvested would apply for commercial timber harvests in mixed conifer stands within the TSA. This amounts to a gross potential availability of 97,420 BDT per year of timber harvest residuals as feedstock based on historic five-year weighted average timber harvest volume.

Not all road systems will accommodate biomass recovery operations. Based on interviews with land managers[8] and for the purposes of this feedstock analysis, it is assumed that 60 percent of the timber harvest operations on publicly managed lands and 70 percent on privately managed lands within the TSA are located on road systems that will support biomass feedstock transport using conventional chip vans.

Forest biomass that qualifies as feedstock consistent with SB 1122 must be sourced as "by-products of sustainable forest management" as designated by the Department of Forestry and Fire Protection (CAL FIRE). Appendix C includes the full text of SB 1122. CAL FIRE

[8] Mark Brown, Silviculturist, Tahoe National Forest; Clarence Draper, Road Engineer, Tahoe National Forest; Tim Feller, District Manager, Sierra Pacific Industries; Steve Andrews, Forester, Applied Forest Management.

convened a series of workshops during the fall of 2013 and developed suggested guidelines to meet the intent of SB 1122. These guidelines suggest that forest biomass material sourced from even-age management activities does not qualify as by-product of sustainable forest management. The guidelines recommend that 80 percent of the feedstock utilized be sourced from uneven-age management activities. The remaining 20 percent of the feedstock can be made up of by-products from even-age management activities, agricultural by-products or urban wood waste (no treated or painted wood). TSS recommends that due to the more cost-effective nature (as noted in Table 18) and wintertime availability of agricultural by-products and urban wood waste, the 20 percent feedstock blend not include material sourced from even-age forest management activities (even though this is currently allowed by SB 1122 guidelines).

The draft guidelines (Appendix D) were delivered to the CPUC in April 2014. The CPUC is currently deliberating and has not reached a proposed decision, but for the purpose of this feedstock availability analysis, TSS assumes that these guidelines will be implemented.

Interviews with foresters managing private forest lands within the TSA confirmed that about 50 percent of the timber harvested is from even-age management activities. Interviews with foresters managing public lands confirmed that no even-age management activities occur on publicly managed forests within the TSA.

Forest biomass feedstock considered technically available has been screened for road systems that allow biomass transport (60 percent on public lands and 70 percent on private lands), and for SB 1122 compliancy (50 percent on private lands) within the TSA.

Table 12 shows the gross availability along with the technical potential based on the screens previously described.

Table 12. Total Timber Harvest Residual Availability within the TSA

County	Gross Available (BDT/YR)		Technically and Economically Available (BDT/YR)	
	Private	**Public**	**Private**	**Public**
Butte	16,534	275	5,787	165
El Dorado	9,767	1,979	3,419	1,188
Nevada	12,958	755	4,535	453
Placer	14,983	7,745	5,244	4,647
Plumas	4,269	1,876	1,494	1,126
Sierra	6,127	3,523	2,144	2,114
Yuba	14,823	1,803	5,188	1,082
Subtotals	***79,461***	***17,956***	***27,811***	***10,775***
Totals	**97,417**		**38,586**	

The final screening tool, volume considered economically available, is directly tied to existing competition for forest biomass feedstock. Due to the fact that existing biomass power generation facilities are not held to SB 1122-compliant feedstock availability screens, TSS anticipates that the availability of forest biomass from even-age forest management activities will more than sustain existing biomass power generation facilities. Thus, technically available timber harvest residuals amounting to 38,586 BDT per year are also considered economically available. If there were no SB 1122 sustainability screens, then approximately 66,397 BDT per year of timber harvest residual feedstock would be technically and economically available. Approximately 27,811 BDT per year are not considered available for an SB 1122-compliant bioenergy facility at Grass Valley.[9]

Fuels Treatment, Plantation Thinning, and Utility Line Clearance

The Grass Valley region is home to numerous communities, with residential neighborhoods situated within the wildland urban interface (WUI). Due to high fire danger conditions within the WUI, there are concerted efforts across all forest ownerships to proactively reduce hazardous forest fuels in support of defensible communities. In addition, forest landowners are conducting pre-commercial thinning activities within plantations in order to achieve fuels treatment and stocking control (reducing the number of trees per acre as plantation age and tree size increase). Utility line clearance activities are also a potential source of forest feedstock.

Discussions with the Tahoe National Forest,[10] Fire Safe Councils,[11] Natural Resource Conservation Service,[12] PG&E,[13] and foresters[14] managing private lands provided data on fuels treatment, plantation thinning, and utility line clearance projects and confirmed plans for future treatments. Summarized in Table 13 are the results of those interviews.

Table 13. Forest Fuels Treatment Activities Planned within the TSA

	Forest Treatment Activities	
Source	**Low Range (BDT/YR)**	**High Range (BDT/YR)**
Fire Safe Council of Nevada County	150	200
Private Landowners	10,300	14,550
USFS – Yuba River and American River Ranger Districts	10,000	15,000
Utility Line Clearance	1,440	2,500
Yuba County Watershed Protection & FSC	250	375
Totals	**22,140**	**32,625**

Due to very limited value-added markets for woody biomass material generated as a by-product of forest fuels treatment activities, most of the fuels treatment operations are processing (mastication or chipping) excess forest biomass and leaving it on site or piling and burning as the

9 Due to even-age management land techniques.
10 Mark Brown, Silviculturist, Tahoe National Forest.
11 Joanne Drummond, Executive Director, Nevada County Fire Safe Council; Glenn Nader, Yuba County Watershed Protection and Fire Safe Council.
12 Matt McNicol, Forester, Natural Resources Conservation Service.
13 Rand Smith, Supervisor, Program Manager, Vegetation Management, PG&E.
14 Steve Andrews, Forester, Applied Forest Management; Tim Feller, District Manager, Sierra Pacific Industries; Dan Kruger, President, Soper Wheeler Company.

primary disposal technique. Discussions with project coordinators and foresters indicated that if a ready market for biomass existed, with values high enough to recover most of the processing and transport costs, significant biomass volume would be diverted away from current business-as-usual activities (e.g., mastication, chip, pile and burn).

Interviews with forest managers and fiber procurement foresters confirmed that between 10 and 15 BDT per acre of biomass is considered recoverable during fuels treatment and plantation thinning activities. Figures shown in Table 13 assume an average recovery factor of 12.5 BDT per acre. In addition to fuels treatment and plantation thinning operations within the TSA, PG&E conducts power distribution and transmission line clearance activities. Discussions with PG&E vegetation management staff[15] confirmed that power distribution and transmission line clearance in support of hazard tree trimming and removal is conducted regularly within the TSA. Based on operations over the last five years, approximately 1,440 BDT to 2,500 BDT per year are generated from utility line clearance activities within the TSA.

Gross availability of fuels treatment and plantation thinning material assumes no screens. Technical availability is screened based on topography and road systems similar to the timber harvest residual screen (70 percent technical availability on private lands and 60 percent technical availability on private lands). There is currently very little market demand or competition for this biomass material, as reflected in the fact that most of this volume is masticated, chipped and scattered, or piled/burned. The economic screen assumes that 80 percent of the fuels treatment and plantation thinning material is available due to the competitive feedstock pricing that an SB 1122-compliant facility will likely be able to provide. In addition, a primary objective of the Task Force is recovery and utilization of forest feedstocks sourced from fuels treatment activities. TSS assumes that a bioenergy facility located at Grass Valley will provide a competitive price for fuels treatment and plantation thinning material. Table 14 summarizes findings regarding availability of fuels treatment and plantation thinning material sourced from within the TSA.

Table 14. Fuels Treatment, Plantation Thinning, and Utility Line Clearance Material Availability within the TSA

Source	Gross Availability (BDT/YR)	Technically Available (BDT/YR)	Economically Available (BDT/YR)
FSC of Nevada County	175	123	98
Private Landowners	12,425	8,698	6,958
USFS – Yuba River Ranger District and American River Ranger District	12,500	8,750	7,000
Utility Line Clearance	1,970	1,379	1,103
Yuba County Watershed Protection and Fire Safe Council	313	219	175
Totals	**27,383**	**19,169**	**15,334**

[15] Rand Smith, Vegetation Management, Distribution and Eric Brown, Vegetation Management Transmission, PG&E.

Summarized in Table 15 are findings regarding forest-sourced feedstock availability within the TSA.

Table 15. Forest-Sourced Biomass Feedstock Availability within the TSA

Source	Gross Availability (BDT/YR)	Technically Available (BDT/YR)	Economically Available (BDT/YR)
Timber Harvest Residuals	97,418	38,586	38,586
Forest Treatments	27,383	19,168	15,334
Totals	**124,801**	**57,754**	**53,920**

Urban-Sourced Biomass

Construction and Demolition Wood

Wood waste generated by local residents, businesses, and tree service companies (not including utility line work) within the TSA regularly generate wood waste in the form of construction debris, demolition wood, industrial by-products (e.g., pallets), and tree trimmings. Within the TSA resides an estimated population of approximately two million residents.[16] Based on TSS's experience with urban wood waste generation, approximately 11.5 pounds per capita of waste is generated daily, with 10.5 percent of the solid waste stream made up of wood waste. Gross annual availability, using this generation factor and assuming a 20 percent moisture content factor (based on previous assessments), is calculated at approximately 113,610 BDT of urban wood waste within the TSA. Of this material, about 65 percent is recoverable as clean wood waste and is considered technically available at 86,847 BDT per year. Economic availability was calculated assuming that 75 percent of the technically available urban wood is utilized as landscape cover, alternative daily cover (at landfills) or as biomass fuel in existing biomass power generation facilities (see feedstock competition discussion below). Approximately 21,712 BDT per year of clean urban wood waste is considered economically available in the TSA.

Tree Trimming Material

Working from previous studies performed by TSS, it is estimated that approximately 100 dry pounds of tree trimmings (not including utility line clearance) suitable for feedstock is generated annually per capita. Based on a population of just over 2 million residents, approximately 37,895 BDT per year of tree trimmings, (gross availability) are generated within the TSA. TSS assumes approximately 65 percent of this wood waste is actually recoverable as biomass feedstock, with technical availability of about 24,632 BDT per year. Existing uses for tree trimming material, including firewood, soil amendment (e.g., mulch), alternative daily cover, and fuel at biomass power plants are well established. TSS assumes that 85 percent of this material is currently utilized. Therefore, TSS calculates that approximately 3,695 BDT of tree trimming material is economically available as biomass feedstock each year sourced from within the TSA.

[16] Per 2013 data provided by the U.S. Census Bureau.

Summarized in Table 16 are findings regarding urban-sourced feedstock availability within the TSA.

Table 16. Urban-Sourced Biomass Feedstock Availability within the TSA

Source	Gross Availability (BDT/YR)	Technically Available (BDT/YR)	Economically Available (BDT/YR)
Construction and Demolition	133,610	86,847	21,712
Tree Trimming	37,895	24,632	3,695
Totals	**171,505**	**111,479**	**25,407**

Agriculture-Sourced Biomass

As noted in the vegetation cover analysis (see Table 8), almost 15 percent of the TSA includes land dedicated to commercial agriculture (approximately 454,896 acres). Many of these acres are dedicated to raising commercial crops that produce significant volumes of wood waste from orchard removal activities and annual pruning practices. Table 17 summarizes commercial orchard acreage currently in production[17] within the TSA.

Table 17. Commercial Orchard Acreage by Crop within the TSA

Crop	Acreage	Percent of Total Orchard Acres in TSA
Almond	7,953	8.0%
Grape	3,445	3.5%
Peaches	3,148	3.2%
Pears	1,107	1.1%
Plums	30,173	30.5%
Walnuts	51,376	52.0%
Other Tree Crops	1,660	1.7%
Totals	**98,862**	**100.0%**

Woody crops are removed on a rotational basis that varies by crop. TSS, in collaboration with the University of California (UC) Davis Agricultural Extension and local orchard removal contractors, has identified replacement intervals and biomass recovery rates for major tree crops within the TSA (Table 18). Crop replacement intervals help provide an assessment of average expected biomass availability, assuming acreage is consistently replanted to commercial orchards.

[17] Data courtesy of National Agricultural Statistics Service.

Table 18. Commercial Crop Replacement Interval and Biomass Recovery Rates

Crop	Replacement Interval (Years)	Biomass Recovery (BDT/Acre)	Average Recovery Rate (BDT/Acre-Year)
Almond	28	28.5	1.02
Grape	22.5	3.7	0.16
Peach	11.25	18.6	1.65
Pear	75	20.9	0.28
Plum	11.25	18.5	1.64
Walnut	30	28	0.93

Using the replacement interval and biomass recovery rates identified in Table 18, TSS calculated gross availability of agriculture-sourced feedstock within the TSA. TSS did not include the potential biomass from the "Other Tree Crop" (considered minor at 1.7 percent of the total) or grape vines, as grape vines removed are contaminated with trellis wire and metal stakes that are impractical to remove.

In addition to orchard removals, there is pruning material generated that if recovered, could be processed into biomass feedstock. Discussions with UC Agricultural Extension staff confirmed potential pruning volumes available by crop. Table 19 summarizes potential pruning feedstock available by crop and the potential harvestable percentage (not all pruning material is considered technically recoverable).

Table 19. Commercial Crop Pruning Material and Biomass Recovery Rates

Crop	Annual Pruning Biomass Yield (BDT/Acre)	Harvestable Percentage
Almond	0.65	70%
Peach	1.3	50%
Pear	1.5	50%
Plum	0.98	50%
Walnut	0.5	70%

Utilizing orchard crop acreage data, crop rotation interval, and pruning yield per acre, TSS estimates gross annual availability of 177,355 BDT for orchard removal and pruning material within the TSA.

Not all pruning material is harvestable, so for the technically available calculation, TSS assumed harvestable fractions for the pruning, as shown in Table 19. Technically available orchard removal and pruning material amounts to about 138,094 BDT per year within the TSA.

The economically available calculations take into account competing uses (e.g., firewood, bioenergy) and recovery costs (no pruning due to high collection costs). TSS found that approximately 75 percent of the technically available material (after removing pruning material) is currently utilized as firewood and biomass fuels, leaving 33,801 BDT of agriculture-sourced feedstock as economically available per year within the TSA. Table 20 provides an overview of gross, technical, and economic availability of orchard material.

Table 20. Agriculture-Sourced Biomass Feedstock Availability within the TSA

Source	Gross Availability (BDT/YR)	Technically Available (BDT/YR)	Economically Available (BDT/YR)
Almond	13,265	9,646	2,024
Peaches	9,296	7,250	1,301
Pears	1,968	1,138	77
Plums	79,188	64,403	19,382
Walnuts	73,639	55,657	11,017
Totals	**177,356**	**138,094**	**33,801**

Biomass Feedstock Availability Findings

Current feedstock availability for the TSA is significant. Table 21 highlights feedstock availability findings.

Table 21. Current Biomass Feedstock Availability by Source within the TSA

Source	Gross Availability (BDT/YR)	Technically Available (BDT/YR)	Economically Available (BDT/YR)
Forest	124,800	57,753	53,920
Urban	171,505	111,479	25,407
Agriculture	177,356	138,094	33,801
Totals	**473,661**	**307,326**	**113,128**

SB 1122-compliant forest feedstock considered economically available totals 53,920 BDT per year. Assuming the community-scale bioenergy facility is scaled at 3 MW (the maximum scale allowed by SB 1122) and utilizes 24,000 BDT per year of forest feedstock, there is a feedstock coverage ratio of 2.25:1. The private financial sector typically requires a feedstock coverage ratio of at least 2:1 as a critical feedstock availability screen for bioenergy project financing. If urban and agriculture sourced feedstocks are included in the calculation (113,128 BDT available), then a feedstock coverage ratio of 4.7:1 is representative of economic availability.

Biomass Feedstock Competition Analysis

<u>Current Competition</u>

Currently there are very limited markets for forest biomass material generated within the TSA. Existing biomass power generation facilities procuring biomass feedstock in the region that may occasionally source feedstock from the TSA are summarized in Table 22.

Table 22. Facilities Currently Sourcing Forest Biomass Feedstock from the TSA

Facility	Location	Scale (MW)	Distance from Grass Valley (miles)[18]
Rio Bravo Rocklin	Rocklin	25	36
Sierra Pacific Lincoln	Lincoln	18	37
DTE Woodland	Woodland	25	70
Buena Vista Biomass Power	Ione	18	73

Interviews with fuel procurement managers in the region confirmed that very little forest biomass feedstock is currently sourced from the TSA. Only Rio Bravo Rocklin and SPI Lincoln have occasionally procured forest feedstock that is tributary to Grass Valley. Both facilities have ready access to more cost-effective urban feedstock, forest products residuals, and agriculture feedstocks that minimize the need to procure more costly forest-sourced feedstocks. In addition, the Buena Vista Biomass Power facility is constrained in its ability to procure forest biomass feedstock due to its commitment with the Center for Biological Diversity to source no more than 15 percent of its total feedstock needs (averaged over a three-year period) from forest operations.

TSS estimates that between 15,000 and 20,000 BDT of forest-sourced feedstock may be procured annually from within the TSA as feedstock for existing biomass power plants that are located tributary to the TSA. Note that none of these facilities are held to the SB 1122 forest feedstock screen of material sourced from "sustainable" forest management operations. There will likely be minimal competitive impacts on forest feedstock volume considered economically available for a project at Grass Valley because existing biomass power plants have ready access to all forest biomass (subject to no SB 1122 screens) generated within the TSA.

Urban and agriculture feedstocks are also utilized by existing biomass power plants and other enterprises as landscape cover, soil amendment, alternative daily cover, and firewood. As part of the economically available screens, TSS assumed that 15 percent of the tree trimmings and 25 percent of the construction/demolition wood (for more details see discussion in Urban-Sourced Biomass section) is available after adjustment for existing competition. For agriculture-sourced feedstock, TSS assumed that 25 percent of the orchard removal material (for more details see the discussion in the Agriculture-Sourced Biomass section) is available after adjustment for existing competition.

Potential Competition

There are several community-scale bioenergy facilities (see Table 23) and one existing biomass power plant restart that may compete for feedstock with the proposed Grass Valley bioenergy facility. Of the four facilities that may compete for feedstock, only the Camptonville facility is likely to require SB 1122-compliant forest feedstock. The Camptonville Community Partnership is the project sponsor and is planning to solicit proposals to complete a bioenergy project

[18] Distance figures were derived from general locations as opposed to specific street addresses, as the bioenergy project site location may change.

feasibility study in the next few months.[19] Table 23 identifies potential bioenergy facilities that may compete for forest biomass feedstock generated within the TSA.

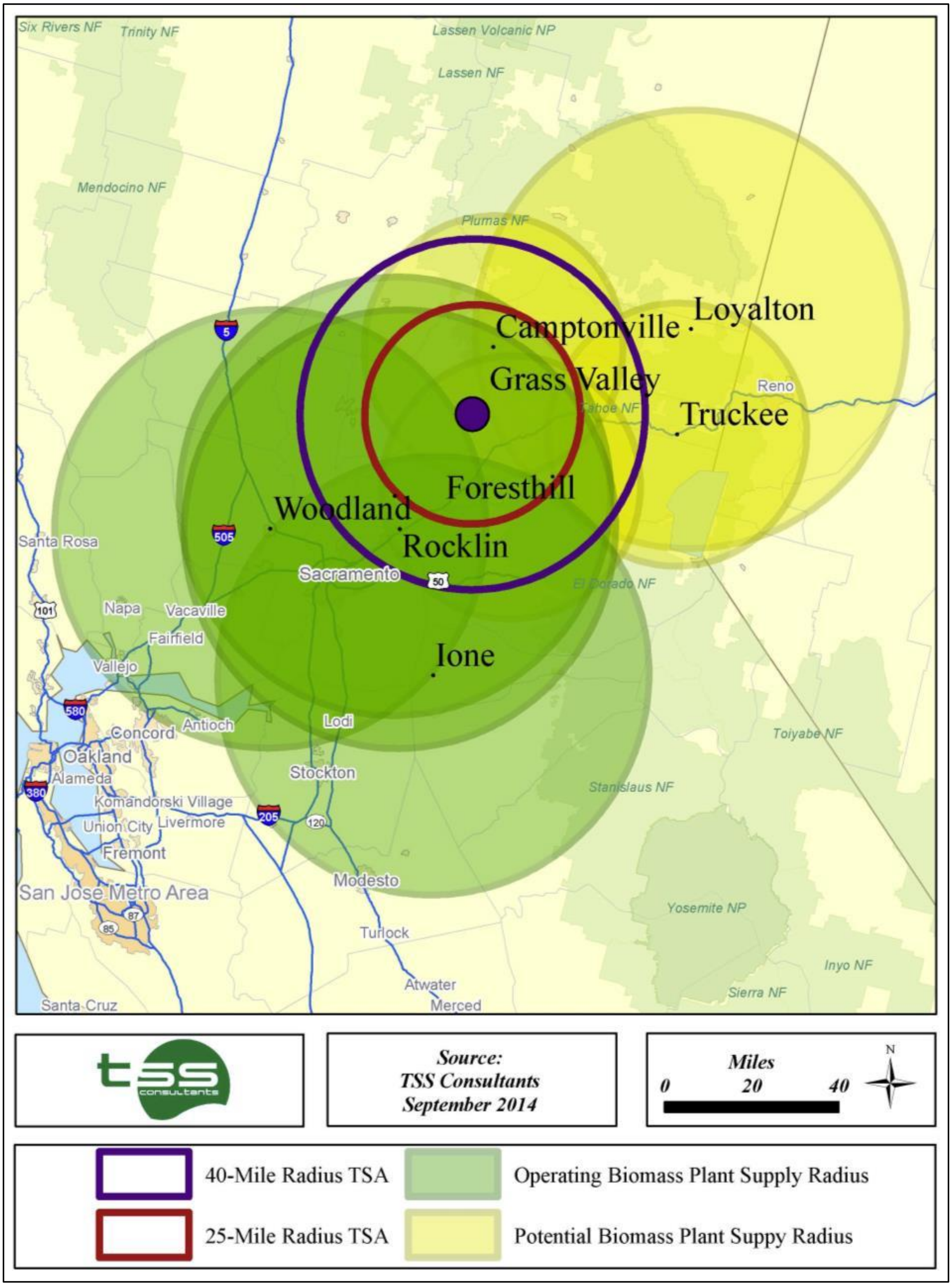
Table 23. Facilities Potentially Competing for Feedstock

Facility	Location	Scale (MW)	Distance from Grass Valley (Miles)
Camptonville	Celestial Valley	2–3	27
Foresthill	Foresthill	3–5	42
Cabin Creek Biomass Power	Truckee	2	58
Loyalton	Loyalton	20	93

At this time, it is too early to predict how the potential Camptonville facility might compete with a bioenergy project at Grass Valley. Due to feedstock transport challenges (e.g., Highway 49), feedstock competition from a bioenergy project at Camptonville (if developed) should be minimal. The location of the biomass power generation facilities is considered to be current and potential competition is highlighted in Figure 7.

[19] Per discussions during the August 21, 2014, community workshop.

Figure 7. Current and Potential Competition for Feedstock within the TSA



Biomass Feedstock Availability Forecast

Summarized in Table 24 are the current, five-year, and ten-year forecasts of biomass feedstock considered economically availability from the TSA.

Table 24. Current, Five-Year, and Ten-Year Forecast of Biomass Feedstock by Source Economically Available within the TSA

Source	Current (BDT/YR)	Five-Year (BDT/YR)	Ten-Year (BDT/YR)
Forest	53,920	57,155	61,727
Urban	25,407	26,169	27,478
Agriculture	33,801	34,477	36,201
Totals	**113,128**	**117,801**	**125,406**

Assumptions used for the five-year forecast include:

- General improvement in the local and regional economy (more urban wood waste generated) with slight increase in population;
- Slightly improved saw timber markets (mild increase in timber harvest on public and private forest lands); and
- Increased forest fuels reduction activities and plantation thinning due to improvement in market prices for forest feedstocks.

Assumptions used for the ten-year forecast include:

- Continued improvement in the local and regional economy (more urban wood waste generated) and increase in population;
- Continued improvements in saw timber markets;
- Reduced regional competition for biomass feedstocks due to Wheelabrator Shasta and Rio Bravo Rocklin curtailment (current power purchase agreements terminate in 2018); and
- Continued increased rates of forest fuels reduction activities and plantation thinning due to improvement in market prices for forest feedstocks.

Costs to Collect, Process, and Transport Biomass Material

Commercial-scale infrastructure to collect, process, and transport biomass material currently exists within the TSA. TSS relied on interviews with local contractors in addition to TSS's past experience to analyze these costs. Table 25 provides results of the cost analysis.

Table 25. Biomass Collection, Processing and Transport Costs with Grass Valley as Destination

Biomass Material Source	Delivered Material	Low Range	High Range
Timber Harvest Residuals	Chips	$45/BDT	$60/BDT
Forest Treatments – USFS/FSC/Private	Chips	$55/BDT	$70/BDT
Urban	Chips	$22/BDT	$30/BDT
Agriculture	Chips	$34/BDT	$42/BDT
Local Homeowners (delivering unprocessed clean wood waste)	Limbs, Construction Debris, Misc. Wood	$10/BDT	$15/BDT

Assumptions used to calculate range of costs:

- No service fees or cost share arrangement is available from public agencies or private landowners.
- One-way transport averages 30 miles for biomass feedstocks.
- Forest biomass is collected and processed (chipped) into the truck at the landing at a cost of $30 to $44/BDT.
- Haul costs are $100/hour for a walking floor chip trailer.
- Local homeowners deliver raw wood (limbs, small trees, clean construction wood) with processing costs ranging from $10 to $15/BDT.
- Delivered costs for urban and agriculture feedstocks are based on current biomass feedstock market prices.
- Biomass feedstocks average 14 BDT/load delivered to Grass Valley.

Note that topography, stand density (pre-treatment), stem size, and road systems all have significant impacts on the costs to collect, process, and transport forest feedstocks. Harvest equipment (e.g., feller bunchers and skidders) does not operate as cost effectively on steep topography (e.g., 25 percent-plus slope conditions) as on level topography. Forest stands that are considered dense (removal rates of 14 to 20 BDT per acre) allow harvest equipment to operate efficiently and cost effectively. Forest stands considered less dense (e.g., 8 BDT or less per acre) require more travel time between trees by the feller bunchers and longer distances between biomass bundles for skidders.

As shown in Table 25, the delivered cost of forest feedstock from fuels treatment activities is significant ($55 to $70 per BDT). There is potential for cost-share funding (federal and state) from existing programs that are designed to support fuels reduction, forest health improvement, and watershed protection. Programs administered by the USFS, CAL FIRE, and the Natural Resources Conservation Service may provide cost-share funding that reduces the delivered cost of forest feedstocks.

The most cost-effective forest feedstock will be sourced from timber harvest residuals stockpiled at the landing. As a by-product of commercial timber harvests, this material (limbs, tops) has been harvested and skidded to the landing in conjunction with sawlog harvesting. The current fate of this material is disposal, using open burning as the preferred technique. In addition to being the most cost-effective forest feedstock, utilizing this wood waste as biomass feedstock for bioenergy significantly reduces air emissions[20] when compared to the current pile/burn technique.

Local homeowners generate significant quantities of limbs and small stems consistent with fuels reduction activities near homes. In addition, miscellaneous wood waste (e.g., clean construction wood) is potentially available and could be utilized as feedstock. TSS recommends that the Grass Valley bioenergy facility (if developed) consider accepting woody material from Nevada County homeowners and tree service companies. This material can be stockpiled on site, and a mobile chipper can be utilized from time to time (e.g., every 60 days) to process this material for use as a feedstock.

Current Market Prices

Demand for woody biomass material currently exists within the TSA. Several biomass power plants are actively procuring biomass fuel in the form of delivered chips. Current prices range from approximately $38 to $46 per BDT for forest-sourced feedstock, $24 to $28 per BDT for urban-sourced feedstock, and $34 to $38 per BDT for agriculture-sourced feedstocks. Note that in some cases, the feedstock suppliers' costs to deliver biomass feedstock to a bioenergy facility exceed market prices (e.g., forest-sourced feedstocks). In these cases, the feedstock is either located in close to the bioenergy facility (low transport costs) or the landowner is paying a service fee (usually assessed per acre) to the feedstock supplier.

Time of Year Availability

Discussions with Grass Valley area foresters confirm that the typical season for field operations is April 15 through November 15. A variety of factors impact this, including inclement weather patterns, snow depth, and wet conditions (e.g., concerns regarding potential soil disturbance). Considering the seasonal availability of forest feedstock, there will need to be accommodations on site at the bioenergy facility in order to assure that some volume of feedstock is stockpiled for use during winter months when access to forest operations is minimal. TSS recommends that a feedstock procurement strategy be developed that assures feedstock sourcing be concentrated at upper elevation locations during summer months and lower elevation locations in the winter. This will optimize the operating season for feedstock suppliers while mitigating the need to stockpile large volumes of feedstock at the bioenergy facility. In addition, agriculture-sourced feedstock is typically available in the winter months (after nut harvest) and aligns well with feedstock procurement to facilitate wintertime delivery. SB 1122 draft guidelines currently allow for up to 20 percent of the annual feedstock volume utilized can be made up of by-products from even-age management activities, agricultural by-products, or urban wood waste (no treated or painted wood). TSS recommends that most of the 20 percent feedstock considered for the Grass Valley facility be sourced during winter months from urban and agriculture sources. There may be an opportunity to recommend to local residents that tree pruning be conducted during late fall and winter when there are optimal conditions (trees are typically dormant), and the bioenergy facility has room for additional feedstock.

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[20] Bruce Springsteen, Ton Christofk, Steve Eubanks, Tad Mason, Chris Clavin, and Brett Storey, "Emission Reductions from Woody Biomass Waste for Energy as an Alternative to Open Burning," *Journal of the Air and Waste Management Association,* Volume 61, January 2011, pp. 63–68.

State and Federal Environmental Compliance

Commercial forest operations on private lands such as timber harvests require a State of California approved Timber Harvest Plan, in compliance with CEQA. CAL FIRE is the lead state agency that administers Timber Harvest Plans.

On federally managed lands, vegetation management activities must be compliant with the National Environmental Policy Act (NEPA). The USFS and the Bureau of Land Management (BLM) conduct a NEPA analysis before commencement of vegetation management activities. Forest biomass utilized as feedstock is primarily a by-product of forest management activities that will occur, with or without a ready market for the by-product material. As noted earlier, the current business-as-usual practice is to pile and burn this material.

Five-Year Biomass Feedstock Cost Forecast

The optimized feedstock blend for the facility is shown in Table 26 and represents an SB 1122-compliant feedstock mix. Noting that there is more than enough feedstock to sustain a bioenergy facility scaled at 3 MW, TSS assumed an annual feedstock demand of 24,000 BDT.

Table 26. Optimized Feedstock Blend

SOURCE	VOLUME (BDT/YR)	PERCENT OF TOTAL
Forest	19,200	80%
Urban	1,000	4%
Agriculture	3,800	16%
TOTALS	**24,000**	**100%**

Table 27 represents a five-year biomass feedstock cost forecast for a community-scale bioenergy facility at Grass Valley. The five-year forecast commences in 2017, as this would likely be the earliest that a community-scale bioenergy facility at Grass Valley could attain commercial operations.

The starting cost of $53.10 per BDT is based on the weighted average (Table 26) of feedstock availability (Table 24) and cost (Table 25).

Table 27. Five-Year Feedstock Cost Forecast 2017 to 2021

	2017	2018	2019	2020	2021
Base Case	$53.10	$53.63	$54.05	$54.62	$55.16
Worst Case	$55.90	$57.58	$59.30	$61.09	$62.93

The feedstock cost forecast presented in Table 27 is based on the following assumptions.

Base Case:

- The feedstock supply chain is fully developed with feedstock available from forest-based operations.
- Diesel fuel prices remain near $4.25 per gallon through 2017, then escalate at 1.5 percent per year.
- Labor rates remain stable through 2017, then climb at 2 percent per year.
- The Wheelabrator Shasta Energy and Rio Bravo Rocklin facilities curtail operations in 2018 (as current power purchase agreements terminate), causing regional urban and agriculture feedstocks to drop slightly in market value.
- Biomass feedstock costs escalate at a 1 percent annual rate due to increased diesel fuel and labor costs from 2017 through 2021.

Worst Case:

- Feedstock supply chain is fully developed with feedstock available from forest-based operations.
- Loyalton biomass power facility is restarted in 2015, Camptonville community-scale bioenergy facility commences commercial operations in 2017 causing market response and elevated market prices for feedstocks.
- Diesel fuel prices remain near $4.25 per gallon through 2017, then escalate at 4 percent per year.
- Labor rates remain stable through 2013, then climb at 2 percent per year.
- Biomass feedstock costs escalate at 3 percent annual rate due to increased diesel fuel and labor costs from 2014 through 2017.

Forest-Sourced Biomass Collection, Processing and Transport Jobs

A 3 MW bioenergy facility will utilize approximately 19,200 BDT of forest feedstock per year (Table 26). This equates to approximately ten truckloads per weekday for seven months. A forest feedstock collection, processing, and transport enterprise scaled at ten truckloads per day and focused on utilization of timber harvest residuals will require approximately six skilled equipment operators (including truck drivers) and one field supervisor. Urban and agriculture feedstocks collection, processing, and transport will require skilled operators as well, but to a lesser degree, considering the optimized feedstock blend (Table 26).

BIOENERGY TECHNOLOGY REVIEW

There are a variety of options for the conversion of woody biomass feedstocks to energy, including biomass-to-heat and biomass-to-electricity. In addition, significant research has been focused on the conversion of woody biomass to produce biomethane, advanced biofuels, biochemicals, and bio-products. However, these advanced conversion alternatives have not yet reached commercial deployment, particularly at the community-scale level.

Biomass-to-heat is the most fundamental and widespread conversion technology, as shown by the basic campfire. Now, commercial boiler systems have developed high-efficiency systems to capture and transport heat in a clean-burning environment. Biomass-to-heat projects typically replace high-cost propane and fuel oil and are found throughout the northern U.S., particularly in New England (where there is significant demand for thermal energy).

Commercial biomass-to-electricity conversion technologies entered California in the 1980s with the development of large-scale biomass power plants rated to generate 20 MW to 50 MW of renewable electricity. These installations utilized various direct combustion technologies, including stoker boilers, bubbling fluidized bed boilers, and circulating fluidized bed boilers. In 2010, the first community-scale commercial biomass-to-electricity product was developed using gasification technology at a scale of 0.5 MW. Interest in gasification technology has developed throughout California due to the technology's relatively small footprint, clean emissions profile, limited water demand, and efficiencies at the community scale (3 MW or less).

Woody biomass feedstock for these processes can be in the form of ground or chipped material, torrefied wood, or pellets. In California, processed material is the most common feedstock resource in the biomass-to-electricity sector. While the pellet market has grown significantly over the last decade, growth in the market is primarily driven by European demand for woody biomass feedstock to reduce greenhouse gas emissions.

As identified in the Preliminary Site Analysis, there are no significant heat loads identified during the site selection process within western Nevada County. TSS will focus the technology review on technologies designed for the conversion of biomass to electricity.

Technology Opportunities

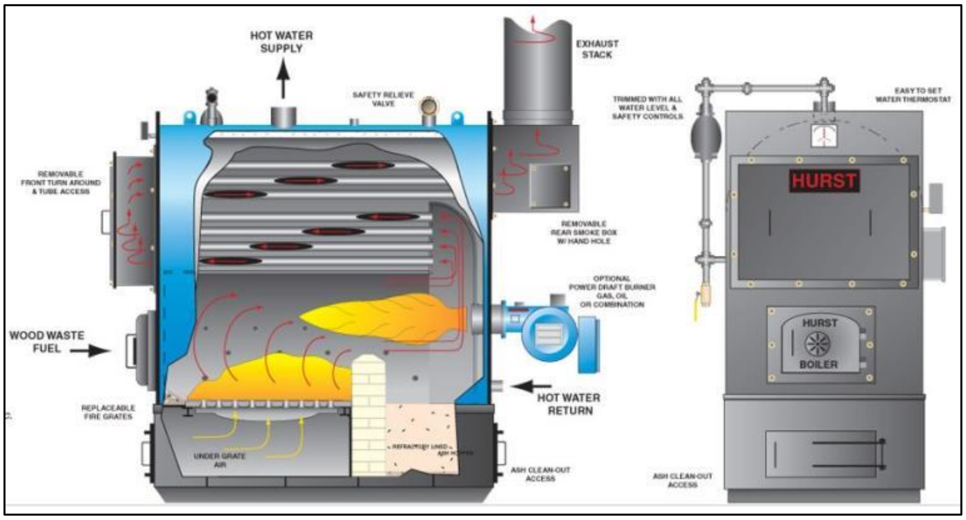
Woody biomass cannot be directly converted to electricity. Two pathways are common with current technological innovations:

- Biomass-to-Heat
- Biomass-to-Gas

<u>Biomass-to-Heat</u>

Biomass-to-heat can occur with both direct combustion technologies and gasification technologies. The biomass-to-heat process in a direct combustion configuration results from the combustion of wood to produce heat that is transferred to a liquid solution. This process is depicted in Figure 8, with the biomass combustion at the base of the equipment and the heat exchanger shown as the piping in the top-half of the equipment.

Figure 8. Direct Combustion Schematic



Source: Hurst Boiler (http://www.hurstboiler.com/boilers/solid_fuel_fired/firebox_lpd_hf)

The biomass-to-heat process in a two-stage combustion[21] or gasification configuration results from the biomass being converted to a gas that is subsequently combusted to produce heat, which is captured with a liquid solution. As shown in Figure 9, a two-stage combustion configuration gasifies the feedstock in the left chamber and ignites the gas for combustion in the right chamber, where the heat exchanging pipes are located.

Figure 9. Two-Stage Combustion Schematic

Source: Chiptec (www.chiptec.com)

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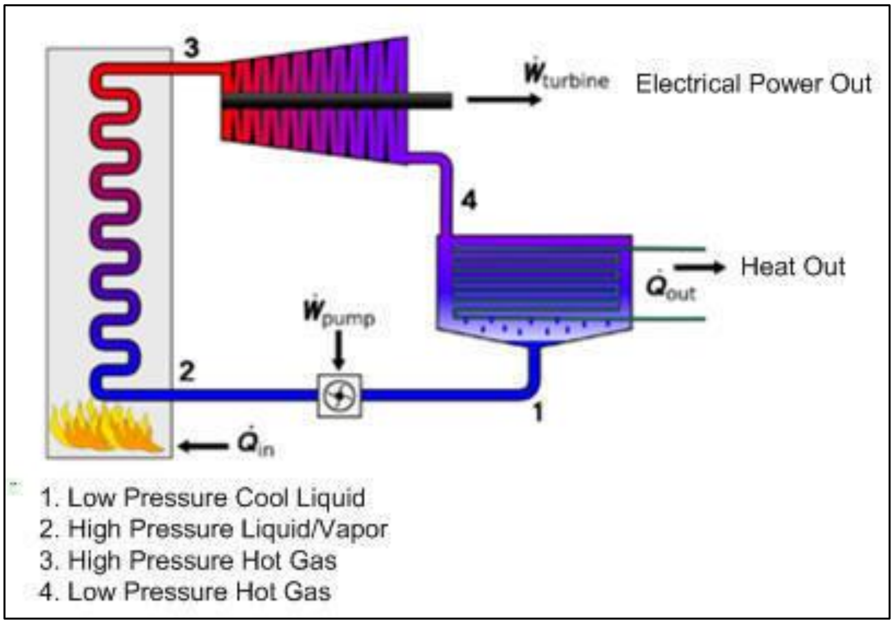
[21] The definition of *gasification* can be complex. Some technologies have the ability to capture the gas while others direct the gas to an alternate chamber where it is combusted without the potential for capture and diversion. For the purposes of this report, *two-stage combustion* is defined as a system configuration that has a gasification step but is not configured to capture and divert the gas. Gasification technologies offer the ability to capture and divert gas.

The heated liquid solution is utilized in a closed-loop system with an evaporating, expanding, and condensing side. In a traditional simple-cycle boiler system, the liquid solution is primarily water. Heat creates steam which expands through the steam turbine and is subsequently condensed for return to the boiler. An organic Rankine cycle (ORC) unit utilizes similar technology but uses a working fluid (e.g., toluene, ammonia, refrigerants) to increase efficiencies. ORC units typically have higher efficiencies in small applications. Figure 10 illustrates an ORC cycling with the heat source located on the left, which heats the liquid solution. The liquid solution runs through a turbine and then is cooled and condensed. The pump in Figure 10 between step 1 and step 2 is not present in a simple-cycle steam turbine.

Figure 10. Organic Rankine Cycle Schematic



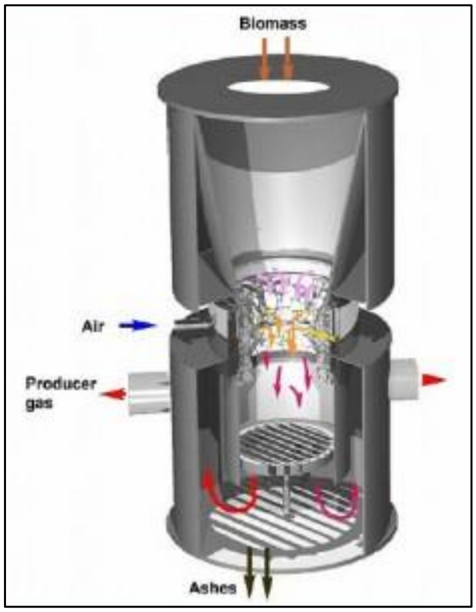
Source: ForceField Energy (http://www.forcefieldenergy.com/orc.htm)

Biomass-to-Gas

Biomass-to-gas is unique to gasification configurations. While gasification is not a new technology, it has only recently entered the commercial markets. Figure 11 shows a schematic of a down-draft gasification system. Biomass enters in the top chamber where it is heated without the presence of oxygen by the heat generated in the combustion zone in the middle. Air input is carefully regulated to maintain proper temperature and combustion levels within the combustion zone. Gases from the biomass are released in the high-temperature environment and do not combust due to the lack of oxygen. The gas is pulled through the gasification system and removed in the lower chamber. The remaining material also drops through the gasifier (with help from gravity) and is removed from the bottom grate. While Figure 11 shows the residue as ash, the by-product of the gasification product is biochar.[22]

[22] Biochar is a carbon-rich by-product with a high percentage of fixed carbon. The biochar market is currently immature but includes filtration and agricultural application.

Figure 11. Gasification System Schematic



Source: Ananta Gasifier Energy Pvt. Ltd.
(www.anantagasificer.com/technology)

The biomass-to-gas process typically requires a gas conditioning system to remove non-combustible material (e.g., water) and contaminants (e.g., tars which are recycled back into the gasifier). The conditioned gas (also known as *synthetic gas* or *syngas*) is subsequently used in an internal combustion engine (ICE) to power a generator.

At the community-scale level, gasification technology with gas conditioning is typically the most efficient conversion technology due to the relatively high efficiency of the ICE compared to comparably-sized steam turbines and ORC engines. However, the required gas conditioning components add extra costs.

Technology Comparison

Table 28 provides a comparison of the technologies outlined above and ranks each configuration relative to the other technology configurations. Technology screens considered include:

- **Technological Maturity:** How long has the specific technology configuration been commercially deployed?
- **Sensitivity to Ambient Conditions:** How much does the technology's performance depend on ambient conditions (e.g., humidity, temperature)?
- **Water Consumption:** How much water is required to operate the system?
- **Feedstock Consumption/Efficiency:** How much feedstock is required to generate a fixed amount of electricity?
- **Air Emissions Profile:** While air emissions can be mitigated, a review of air emissions offers insight into the cost of mitigation necessary to meet local air quality standards.
- **Operational Costs:** An indication of the labor requirements to operate a facility (e.g., number of personnel, special certifications necessary).

Table 28. Technology Review Matrix

	Direct Combustion to Steam Turbine	Direct Combustion to ORC	Gasification to ICE	Gasification to ORC
Technological Maturity	B	C	C	C
Sensitivity to Ambient Conditions	A	C	B	C
Water Consumption	D	B	B	B
Feedstock Consumption/ Efficiency	D	C	A	C
Air Emissions Profile	C	C	B	B
Labor Costs	D	B	B	B

Technological Maturity:
- A: Commercial deployment of the integrated system at scale
- B: Commercial deployment of system components, but not the integrated system at scale
- C: Limited commercial deployment of the integrated system at scale
- D: No commercial deployment of the integrated system at scale

Sensitivity to Ambient Conditions (e.g., temperature, humidity):
- A: No variation in output with fluctuations in ambient conditions
- B: Output varies minimally with fluctuation in ambient conditions
- C: Output may vary significantly with fluctuations in ambient conditions
- D: Operation of the system is limited by ambient conditions

Water Consumption:
- A: No water is used for system operations
- B: Water use can be mitigated by the use of air-cooled radiators
- C: Some water use is required for normal operations
- D: Significant water use is required for normal operations

Feedstock Consumption/Efficiency:
- A: Total system efficiency is, on average, greater than 20 percent
- B: Total system efficiency is, on average, between 15 and 20 percent
- C: Total system efficiency is, on average, between 10 and 15 percent
- D: Total system efficiency is, on average, less than 10 percent

Air Emissions Profile:
- A: No emissions treatment necessary to meet local air standards
- B: Limited air emissions control devices are necessary to meet local air standards
- C: Air emissions control devices are necessary to meet local air standards
- D: Cannot meet local air standards with treatment

Labor Costs:
- A: The system can operate without staff present
- B: The system can operate with two employees per shift without any specific certifications
- C: The system requires more than two employees per shift (without any specific certifications)
- D: The system requires specialty certifications (e.g., high pressure steam boiler operator)

Considering the findings in Table 28, and given the interests communicated from the Task Force related to technology selection, a gasification-to-ICE approach would be preferred.

Gasification Technologies

Updraft, downdraft, and cross-draft gasifiers are the most common type of gasifier configurations. Each configuration is characterized by air flow through the gasification unit. The principle geometry of each gasifier is similar (Figure 11). The gasification schematic in Figure 11 is a downdraft gasifier defined by the direction of airflow moving down through the gasifier, first passing the loaded fuel, then the combustion zone, and finally through the reduction zone (biochar). Downdraft gasification is the most common gasification configuration due to a tendency to create cleaner gas, since the gas is filtered through the biochar in the reduction zone before collection.

Updraft gasification is comparable to the Figure 11 schematic but with opposite direction of airflow. Updraft gasifiers tend to have high-energy-value gas but often with more tar contaminants (which must be removed for use in an ICE). Thus far, updraft gasification has been used predominantly in larger distributed generation applications (greater than 3 MW) to achieve economies of scale for gas cleanup.

Cross-draft gasifiers have air flow that cross the gasifier (perpendicular to the flow of wood). Cross-draft gasifiers can achieve relatively high temperatures; however, gas flow may vary throughout the gasifier, yielding inconsistent tar cracking, and like the updraft gasifier, significant cleanup may be necessary.

Fluidized bed gasifiers follow updraft or downdraft configurations but have a solid additive (e.g., engineered sand) that provides for more consistent heating across the gasification vessel. Fluidized bed gasification is typically used for large reactors to more efficiently maintain consistent heat throughout the reaction vessel. Community-scale gasification typically utilizes relatively small gasifiers where, due to their size, uniform heat distribution is not as challenging; therefore, fluidized bed gasifiers are typically found in larger-scale applications (greater than 20 MW).

In addition to these three main gasifier configurations, many hybrid variations exist. For any technology considered for the Nevada County biomass project, operational data should be reviewed and evaluated as part of the selection criteria.

Technology Manufacturers

TSS reviewed technology companies manufacturing direct combustion, two-stage combustion, and gasification technologies. TSS filtered technology providers based on unit capacity to identify a subset of technology manufacturers that specialize in community-scale biomass-to-electricity applications. While many additional companies provide components in this process (e.g., engines, gasifiers, combustors), TSS focused on companies with experience integrating all of the system components.

In addition to evaluating the technology itself, TSS recommends that the Task Force evaluate the project developer, as the best technology alone will not itself result in a successful project. Identifying the right technology for the application and the right developer is paramount. TSS has identified a select list of technology providers and project developers with experience working on community-scale wood-to-energy projects (Table 29).

Table 29. Select Technology Manufacturers and Developers

Company Information	Technology Type	Unit Sizes
Biogen www.biogendr.com	Gasification	0.5–1.5 MW
Chiptec Wood Energy Systems www.chiptec.com	Two-Stage Combustion	1.0–5.0 MW
Emery Energy Company www.emeryenergy.com	Gasification	1.0–12 MW
Hurst Boiler www.hurstboiler.com	Direct Combustion	1.0–5.0 MW
PHG Energy www.phgenergy.com	Gasification	1.0–2.0 MW
Phoenix Energy www.phoenixenergy.net	Gasification	0.5–1.5 MW
Tucker RNG www.rngnow.com	Gasification	0.5–1.5 MW
West Biofuels www.westbiofuels.com	Gasification	0.25–1.0 MW
Zero Point Clean Tech www.zeropointcleantech.com	Gasification	0.5–2.0 MW
Zilkha Energy www.zilkha.com	Two-Stage Combustion	1.5–20 MW

Operations and Maintenance Labor Requirements

All of the gasification and combustion technologies listed in Table 29 are configured to operate as 24/7 power generation facilities. Skilled labor will be required to operate and maintain these facilities around the clock. A community-scale facility is expected to require a minimum of two employees onsite during all hours of operation. A total of nine to ten trained staff members would likely be required (including administrative personnel) to operate and maintain the facility.

ECONOMIC ANALYSIS

This section will assess job creation potential, labor force wages and availability in the area, product markets, specific cost centers (including regulatory requirements), development costs, capital investment costs, operational costs, and projected revenues.

Per the findings in the Bioenergy Technology Review section, gasification technology was selected as the preferred renewable energy technology. While each gasification system provider will have different requirements (e.g., feedstock specifications, labor, site footprint), the marketplace has demonstrated gasification technology to be cost competitive between technology providers. TSS utilized publicly available data[23] to identify anticipated costs for a 3 MW bioenergy project. During the technology selection process (after completion of this feasibility study), TSS urges the Task Force to select a specific developer using an open solicitation process. The cost assumption utilized in this section should be used as a framework by which to evaluate any economic data offered as part of a proposal response submitted by a technology vendor.

Job Creation and Employment

Community-scale gasification offers direct employment opportunities at the plant while supporting forest feedstock collection, processing, and transport infrastructure. A biomass gasification facility requires a minimum of two personnel per staffed operating shift.[24] A community-scale facility is expected to run three shifts per day, every day of the year (with the exception of scheduled maintenance). The time-of-day energy rate schedule ($/kWh), as set by the power off-take entity (e.g., PG&E), will be a driving factor to determine operations schedules. To staff each shift with two employees requires 2.9 full time equivalent (FTE) employees, yielding a total of 5.8 FTE employees for a two-shift operation and 8.7 for a three-shift operation. Staffing requirements vary substantially based on technology and site location (if labor sharing is an option).

Unlike direct combustion technology using a steam turbine as the primary driver, gasification does not require any specific certifications for its employees; however, basic electrical, mechanical, and plumbing skill sets are valued. Wages ranging from $12 per hour to $20 per hour are anticipated, dependent on skill set and time with the organization.

Employment statistics for Grass Valley and Nevada County are shown in Table 30. With a relatively high unemployment rate in Grass Valley and in Nevada County, labor force availability is not expected to be a challenge. The wage rates are expected to be competitive for the area.

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[23] "Small-Scale Bioenergy: Resource Potential, Costs, and Feed-in Tariff Implementation Assessment." Black & Veatch. October 31, 2013.
[24] Per OSHA requirements.

Table 30. Employment Statistics for Grass Valley and Nevada County

	Grass Valley	Nevada County
Labor Force Size	5,430	47,864
Percentage in Related Industries[25]	14.4%	18.5%
Unemployment Rate	12.0%	10.4%
Median Household Income	$36,612	$57,382
Mean Household Income	$52,961	$74,619

In addition to direct job creation, support jobs are projected to be generated at a 2:1 ratio compared to plant employment.[26] This project is expected to support an additional 12 to 16 FTE jobs. Jobs supported by the development of a bioenergy facility in the Grass Valley area include chip truck drivers, private land managers, chipping operations, fuels treatment programs personnel, mechanics, diesel fuel supplies, and tire shops. As noted in the Biomass Feedstock Availability and Cost Analysis section of this report, TSS estimates that approximately 6 FTE operators and one field supervisor will be required to provide feedstock to a 3 MW bioenergy facility in Grass Valley.

Product Markets

Biomass-to-electricity projects generate electricity, heat, and solid residuals. For biomass gasification technology, the solid residual is biochar, while for biomass direct combustion technology, the solid residual is ash. Both of these residuals can have economic value.

<u>Electricity</u>

The primary product for a biomass gasification system is electricity. Electricity generated is typically sold to the local electric grid, which for this project is owned by PG&E. There are two feed-in tariff programs currently offered by PG&E for small-scale (less than 3 MW) distributed generation. Both programs are called the Renewable Market Adjusting Tariff (ReMAT), with SB 32 governing all renewables and SB 1122 governing bioenergy-specific projects.

The SB 32 ReMAT has been active since October 2013, with price offerings every two months. The ReMAT program is designed to have the price adjust up or down relative to market demand. Pricing for the SB 32 ReMAT program starts at $89.23 per MWh and has three generation categories: as-available peaking, as-available non-peaking, and baseload. Table 31 shows the status of the SB 32 ReMAT offerings as of October 2014 (the program has allowed for price fluctuations for approximately one year).

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[25] Related industries include (1) Agriculture, Forestry, Fishing, and Mining, (2) Construction, and (3) Manufacturing.
[26] Morris, Gregory Paul. *The value of the benefits of US biomass power*. National Renewable Energy Laboratory, 1999.

Table 31. SB 32 ReMAT Current Offering Prices

	As-Available Peaking ($/MWh)	As-Available Non-Peaking ($/MWh)	Baseload ($/MWh)
PG&E	$57.23	$89.23	$89.23
SCE	$81.23	$89.23	$89.23
SDG&E	$89.23	$89.23	$89.23

Note: SCE = Southern California Edison; SDG&E = San Diego Gas & Electric

The SB 1122 ReMAT is designed for bioenergy projects exclusively (not including landfill gas projects). As with the SB 32 ReMAT, the SB 1122 ReMAT has three program categories, but they are based on feedstock type: urban feedstock, agricultural feedstock (including orchard by-products and dairy manure), and forest residue. The final program details for the SB 1122 ReMAT program are currently being finalized by the CPUC. The most recent Administrative Law Judge decision indicated the starting price to be $127.72 per MWh. Depending on market demand, after each offering (every two months) the base price can move up or down with sufficient program participation.[27] Table 32 shows the potential for the price to fluctuate up if there are no projects that accept a price offering (column 2) and the potential for the price to fluctuate down if there are sufficient projects that accept each price offering (column 3).

Table 32. SB 1122 ReMAT Price Fluctuation Potential

	Price Increase ($/MWh)	Price Decrease ($/MWh)
Program Period 1 (Base Price)	$127.72	$127.72
Program Period 2	$131.72 (+$4)	$123.72 (-$4)
Program Period 3	$139.72 (+$8)	$115.72 (-$8)
Program Period 4	$151.72 (+$12)	$103.72 (-$12)
Program Period 5	$163.72 (+$12)	$91.72 (-$12)

At this time, TSS estimates that the SB 1122 ReMAT process will begin in the second or third quarter of 2015. The project in the Grass Valley region would fall into Category 3, utilizing forestry residues. If the SB 1122 program begins at that time, TSS believes the price will have to increase in order to accommodate projects that will participate in Category 3. There is a risk that there will not be sufficient projects to justify a price increase under the proposed rules. A number of parties in the CPUC proceedings have advocated for a change in the rules to allow the price to fluctuate with a small number of unaffiliated projects (two rather than five) in the queue.

Thermal Energy

For a gasification-to-ICE system, a by-product of electricity production is heat. Heat is generated by the engine and the gas conditioning system. The primary source of waste heat is the ICE. The exhaust from the ICE provides high-temperature air (approximately 700°F to 900°F) and the jacket water (used to cool the engine body) captures low-temperature heat

[27] The most recent Administrative Law Judge decision requires a minimum of three unaffiliated projects per category to trigger the first series of price changes.

(approximately 120°F to 150°F). In many systems, the gas conditioning system cools the syngas with a combination of ambient passive cooling and active radiator cooling. Availability of heat from the conditioning system will vary greatly depending on ambient conditions. For gasification systems using forest-sourced biomass, much of the excess heat is used to dry the biomass (typically 40 percent to 55 percent) to an optimized moisture content for the gasification unit (10 percent to 25 percent moisture content).

Based on the Preliminary Site Analysis results, there are no sites that currently have a use for waste heat, although several sites have potential for additional development of businesses that could utilize waste heat. Revenue from the utilization of waste heat is typically based on alternative heat sources (e.g., propane, fuel oil, natural gas). As noted earlier, some of the available waste heat will be used onsite to dry feedstock.

<u>Solid Residual By-products</u>

Biochar is generated as part of the gasification process in a relatively lower-temperature, low-oxygen environment. Ash is generated as part of the direct combustion process in a relatively high-temperature, high-oxygen environment. Both ash and biochar are predominantly comprised of fixed carbon. Ash tends to have a relatively high concentration of alkali metal oxides (due to the high-temperature and high-oxygen environment), limiting the potential for ground application (as soil amendment) due to relatively high pH levels. Relatively low temperatures and low oxygen environments in biomass gasification technologies minimize the impacts of alkali metal oxides; however, the gasification environment will yield products of incomplete combustion, including polycyclic hydrocarbons and aldehydes (which will reduce the quality of biochar for agricultural and filtering applications). Air and gas flow through the gasification vessel determine the characteristics of biochar.

For a community-scale biomass-to-energy project, solid residual production quantities are relatively low: approximately 8 percent to 15 percent of dry feedstock input (weight basis) for biochar or 5 to 10 percent of dry feedstock input for ash. For a 3 MW project, biochar yields are expected to be between 1,920 and 3,600 tons per year (TPY), while ash yields (using direct combustion) are expected to be between 1,200 and 2,400 TPY.

Primary markets for both biochar and ash include soil amendment, concrete additive, and filtration agent. Table 33 outlines a comprehensive list of existing market applications for biochar and ash (both bottom ash and fly ash).

Table 33. Biochar and Ash Market Applications[28]

Application	Function	Sector
Binders alternative for standard cement	Component	Building Industry and Civil Engineering
C-fix	Filler	
Concrete (products) low-quality	Reactive Filler	
Road construction material	Binder/Raw Material	
Sand-lime bricks	Filler	
Infrastructure works (e.g., embankments, fillings)	Filling Material	
Soil stabilization	Binder	
Synthetic aggregates (including synthetic basalt)	Raw Material	
Fuel	Combustion	Energy Production
Back-filling mining	Filler	Mining
Polymers	Filler	Industry
Metals	Filler	
Phosphor production	Raw Material	
Zeolites	Raw Material	
Metals recovery	Raw Material	
Mineral fibers	Raw Material	
Soil improvement and fertilizer	Product/Raw Material	Agricultural
Neutralization of waste acids	Product	Environmental technology
Adsorption material	Raw Material	
Impermeable layer	Raw Material	

Market prices for biochar are heavily dependent on the chemical characterization of the material. With a relatively immature market, prices vary by producers; however, prices currently are reported from $100 to as high as $1,600 per ton wholesale and $0.50 to $2.00 per pound retail.

Fly ash and bottom ash prices range from $30 to $40 per ton depending on the ash characteristics and the proximity of preferred markets. Some fly ash and bottom ash generated at existing biomass power plants in California are currently hauled to landfills as a primary disposal option. There is also land application of biomass power plant ash in the Central Valley.

Carbon Credits

Biomass power is considered renewable energy that has the potential to generate carbon credits based primarily on the diversion of feedstock from open pile burning. Greenhouse gas offsets associated with the displacement of fossil fuel power are incorporated into the power purchase agreement of any Renewable Portfolio Standard (RPS) contracts. SB 1122 contracts fall under the RPS umbrella; therefore, these offsets will be sold and bundled with the electricity. Average 2014 price for carbon is $11.96 per metric tonne;[29] however, purchase contracts for carbon

[28] Pels, J. *Overview of options for utilization of (biomass) ashes*. Ash Utilization Conference – Stockholm, 25–27 January 2012. Accessed: http://www.varmeforsk.se/files/program/askor/ECN_Pels_final.pdf. 1 October 2014.
[29] California Carbon Dashboard. http://calcarbondash.org/.

credits are typically less than three years of duration, making them challenging to use as part of project financing. Additionally, biomass gasification projects currently lack a pathway with the California Air Resources Board (CARB) to quantify carbon offsets. Placer County is working on a pathway for biochar, but the pathway is still under development. Carbon credits are currently not a reliable source of additional revenue for biomass gasification projects.

Financial Analysis

As part of the CPUC's assessment of small-scale bioenergy, Black & Veatch was commissioned to assess the resource potential, costs, and feed-in tariff implementation.[30] As part of the assessment, Black & Veatch developed a financial analysis tool with representative costs for gasification technologies. While pricing will range by developer, TSS (through its extensive experience assessing community-scale biomass gasification technology) supports the technical assumptions used in the Black & Veatch model (Table 34). Careful consideration should be exercised if evaluating specific developer proposals with operations data outside of these ranges.

Table 34. Technical Assumptions from Black & Veatch

Technical Components	Low Range	Medium Range	High Range
Capital Cost ($/kW)	$5,000	$6,000	$7,500
O&M Costs ($/kW)	$347	$553	$590
O&M Escalation (%)	2%	2%	2%
Capacity Factor (%)	90%	85%	80%
Heat Rate (Btu/kWh)	15,000	16,500	18,000

In addition to these technical assumptions, TSS used the financial assumptions show in Table 35.

Table 35. Financial Assumptions Specific to Nevada County Project

Financial Components	Low Range	Medium Range	High Range
Feedstock Costs ($/BDT)	$50.30	$53.10[31]	$55.90
Feedstock Cost Escalation (%)	0.5%	1%	3%
Debt Percentage (%)	80%	70%	60%
Debt Rate (%)	4%	5.5%	7%
Debt Term (year)	15	12	10
Cost of Equity	10%	15%	18%

Additionally, several factors remain constant throughout the financial analysis:

- Project Size: 3 MW
- Discount Rate: 7%
- Economic Life of the Project: 20 years

[30] "Small-Scale Bioenergy: Resource Potential, Costs, and Feed-in Tariff Implementation Assessment." Black & Veatch. October 31, 2013.
[31] Consistent with 2017 base feedstock price forecast as noted in Table 20.

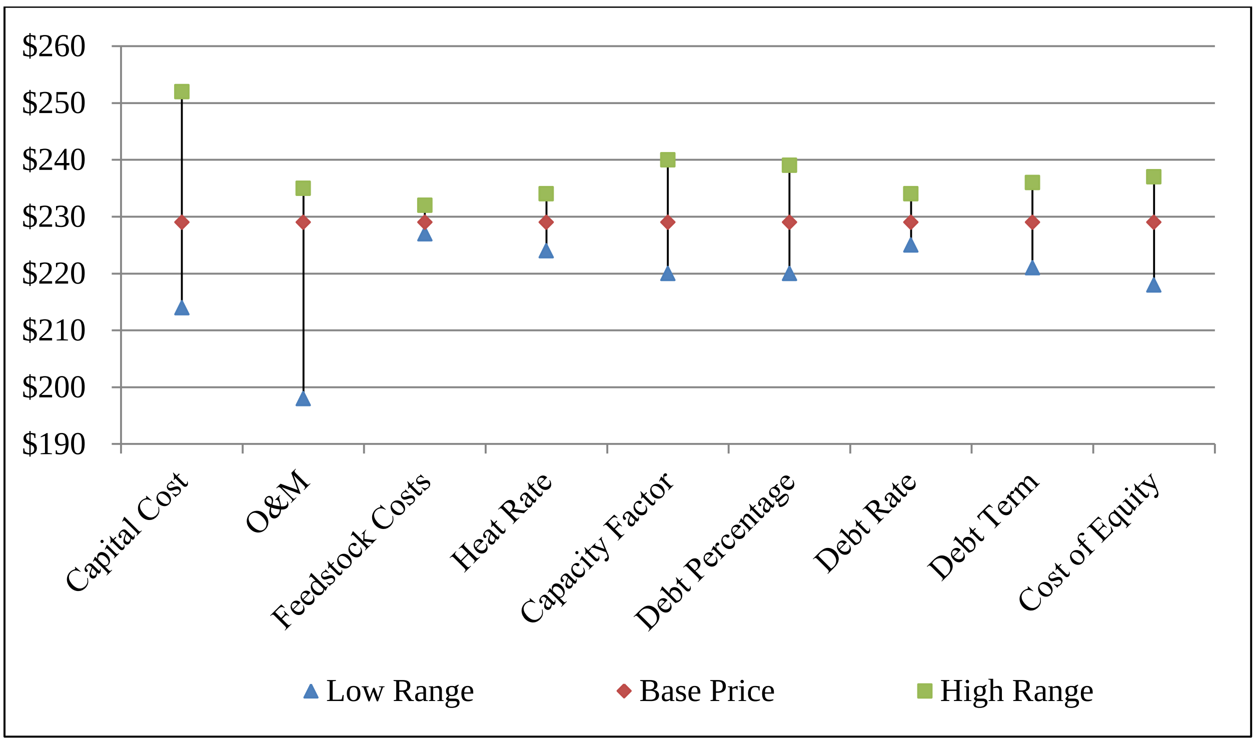
- Percent Depreciated: 100%
- Tax Rate: 40% (Federal and California tax)

Using the inputs in Table 33, Table 34, and Table 35, TSS developed a base case sensitivity analysis for the proposed project without any by-product sales or federal tax credits (e.g., Investment Tax Credit or Production Tax Credit). The base case will identify the cost of generating electricity without additional contracts for by-product sales. Table 36 and Figure 12 show the results of the preliminary sensitivity analysis.

Table 36. Base Case Sensitivity (No Incentives or By-product Sales)

Sensitivity Analysis	Low Cost ($/MWh)	Base Case ($/MWh)	High Cost ($/MWh)
Capital Cost	214	229	214
O&M Costs	198	229	198
Feedstock Costs	227	229	227
Heat Rate	224	229	224
Capacity Factor	220	229	220
Debt Percentage	220	229	239
Debt Rate	225	229	234
Debt Term	221	229	236
Cost of Equity	218	229	237

Figure 12. Base Case Sensitivity (No Incentives or By-product Sales)



As identified in Table 36, the base case price, without incentives or by-product sales, is $229 per MWh. With electricity sales alone, the economics of a biomass gasification project are challenging, particularly with relatively high feedstock costs. Figure 12 illustrates the sensitivity to system variables, particularly noting the importance of capital cost and O&M costs. These two variables offer the greatest potential to impact the overall project economics and should be a critical factor for technology selection; particularly the need for low O&M costs.

Effective project siting and technology selection can significantly adjust O&M costs. A stand-alone project must employ a minimum of two staff personnel per shift to meet Occupational Safety and Health Administration (OSHA) safety requirements. By collocating a project with an additional operation, shared labor can provide the safety necessary to meet OSHA requirements while optimizing the labor requirements to meet operational needs. Additionally, selecting a technology that does not require staffing during all operating hours can reduce labor costs by eliminating staff during one shift per day.

Capital costs can be mitigated by selecting a site that requires minimal infrastructure improvements. The locations identified as preferred sites in the siting analysis accounted for these cost considerations. The top site, the La Barr Meadows Road site collocated with Rare Earth Landscaping Materials, offers an opportunity to realize cost savings based on shared labor and with existing infrastructure and grading.

By-product Sales

Without any existing opportunities for heat sales at any of the preferred sites, biochar sale represents the most significant opportunity for additional revenue. Current market prices range from $100 to $1,600 per ton of biochar (freight-on-board truck at the bioenergy site); however, TSS estimates an average price of $325 per ton, as $1,600 per ton appears to be an outlier in reported data. As noted earlier, gasification equipment typically yields biochar at a rate between 8 percent and 15 percent of feedstock input (by weight). With approximately 24,000 BDT per year feedstock demand at the 3 MW scale, TSS estimates approximately 2,400 tons of biochar available per year. Using the base case identified in Table 36, Table 37 shows the potential impact of biochar on the levelized cost of electricity.

Table 37. Impacts of Biochar Sales on the Base Case

	Base Case	Low Price	Medium Price	High Price
Biochar Price ($/ton)	$0	$100	$325	$1,600
Impact on Base Case ($/MWh)	-	-$10	-$31	-$171
Levelized Cost of Electricity ($/MWh)	$229	$219	$194	$58

Biochar has the potential to have a serious and beneficial impact on the financial outlook of a project. With an immature market, developing a biochar offtake agreement will be critical for the financial community and for an accurate financial assessment of the project moving forward.

There is limited, but growing, demand for biochar in local landscaping markets in Grass Valley.[32]

Grants and Incentives

Forest biomass projects can be assisted by grant programs and federal tax incentive programs, particularly the Investment Tax Credit (ITC). Other federal tax credits such as the New Market Tax Credit (NMTC) are quite attractive, but the NMTC only applies to projects sited in areas of relatively high poverty. The Nevada County project is not eligible for the NMTC. On a federal level, the ITC is being renewed; however, biomass gasification may not apply, as current legislation imposes a minimum methane yield of 53 percent for qualifying biogas technologies. Gasification is not expected to be able to meet these standards (gasification technology produces a hydrogen-based gas, not a methane-based gas). If legislation is changed, TSS expects the ITC to be offered at a rate of 10 percent (previously the rate was 30 percent) of the total project cost. The ITC would decrease the base case power sales requirement from $229 per MWh to $211 per MWh.

State agencies such as the CEC, the National Forest Foundation, the Sierra Nevada Conservancy, and the U.S. Forest Service offer financial assistance in support of bioenergy project development. The CEC's EPIC program,[33] funded through utility ratepayers, offers the most significant investment in biomass-to-electricity projects, funding up to $5,000,000 in project capital costs. Each year, these state agencies revise and reassess their funding goals. They should be closely monitored for funding opportunities.

Table 38. Impacts from Grant Funding

	Base Case	Small Grant	Medium Grant	Large Grant
Grant Award ($)	$0	$1,000,000	$2,000,000	$5,000,000
Impact on Base Case ($/MWh)	-	-$5	-$10	-$25
Levelized Cost of Electricity ($/MWh)	$229	$224	$219	$204

At the 3 MW project scale, grant funding has limited potential to impact the overall project economics provided the size of existing grant opportunities. However, grant funding can significantly increase the interest of the private financial sector and allow for improved debt financing opportunities.

Sensitivity Analysis Findings

The sensitivity analysis identified capital cost, O&M costs, and biochar sales as the greatest potential impacts to the project price. In addition, the siting analysis indicates that the preferred project site has the potential to share labor and offers a site with some existing infrastructure.

[32] Jim and Jami Hopper, owners of Rare Earth Landscaping Materials, Grass Valley
[33] Electric Program Investment Charge website: http://www.energy.ca.gov/research/epic/

With the grant funding opportunities currently available and the significant demand for these funds, TSS anticipates that grant funding for bioenergy projects will continue for the next several years. Lastly, the preferred project site is collocated with a composting operation and proximate to a concrete batch plant, both of which offer potential for biochar sales.

Given these factors, TSS anticipates that a gasification project can be sited at the preferred location with the financial model factors as shown in Table 39.

Table 39. Financial Analysis for Nevada County Project

	Base Case	**Nevada County Project**
Capital Cost ($/kW)	$6,000	$5,500
O&M Costs ($/kW)	$553	$450
O&M Escalation (%)	2%	2%
Capacity Factor (%)	85%	85%
Heat Rate (Btu/kWh)	16,500	16,500
Feedstock Cost ($/BDT)	$53.10	$53.10
Feedstock Cost Escalation (%)	1%	1%
Debt Percentage (%)	70%	70%
Debt Rate (%)	5.5%	5%
Debt Term (years)	12	12
Investment Tax Credit (%)	0%	0%
Biochar Sales ($/ton)	0	$325
Cost of Equity (%)	15%	15%
Levelized Cost of Electricity ($/MWh)	**$229**	**$170**
Grant Funding ($)	0	$2,000,000
Levelized Cost of Electricity ($/MWh)	**$229**	**$160**
With Investment Tax Credit (%)	10%	10%
Levelized Cost of Electricity ($/MWh)	**$211**	**$154**

With SB 1122 proposed pricing mechanisms, a project requiring $154 to $160 per MWh would require five consecutive price increases to reach the desired price and without the grant, a sixth consecutive price increase would be required. Provided there are sufficient projects in the queue to trigger price movement, TSS anticipates that the price could rise to the required price offering of $160 per MWh. Using the assumptions in Table 39, Table 40 shows a detailed financial pro forma for the project if a $160 per MWh power purchase agreement were executed. Table 40 includes $2,000,000 grant funding but does not include the Investment Tax Credit.

Table 40. Financial Pro Forma for Nevada County Project

Year	0	1	2	3	4	5	6	7	8	9	10
Annual Generation (MWh)		22,338	22,338	22,338	22,338	22,338	22,338	22,338	22,338	22,338	22,338
Cost of Generation ($/MWh)		$160.02	$160.02	$160.02	$160.02	$160.02	$160.02	$160.02	$160.02	$160.02	$160.02
Operating Revenues		**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**
Fixed O&M ($/yr)		$1,350,000	$1,377,000	$1,404,540	$1,432,631	$1,461,283	$1,490,509	$1,520,319	$1,550,726	$1,581,740	$1,613,375
Var. O&M ($/yr)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fuel Cost ($/yr)		$1,148,732	$1,160,219	$1,171,821	$1,183,539	$1,195,375	$1,207,329	$1,219,402	$1,231,596	$1,243,912	$1,256,351
Incentives ($/yr)		$780,000	$780,000	$780,000	$780,000	$780,000	$780,000	$780,000	$780,000	$780,000	$780,000
Operating Expenses		**$1,718,732**	**$1,757,219**	**$1,796,361**	**$1,836,170**	**$1,876,658**	**$1,917,838**	**$1,959,721**	**$2,002,321**	**$2,045,652**	**$2,089,726**
Interest Payment		$507,500	$475,616	$442,138	$406,986	$370,076	$331,321	$290,629	$247,901	$203,037	$155,930
Principal Payment		$637,678	$669,562	$703,040	$738,192	$775,101	$813,857	$854,549	$897,277	$942,141	$989,248
Debt Service		**$1,145,178**	**$1,145,178**	**$1,145,178**	**$1,145,178**	**$1,145,178**	**$1,145,178**	**$1,145,178**	**$1,145,178**	**$1,145,178**	**$1,145,178**
Tax Depreciation		$2,072,050	$3,551,050	$2,536,050	$1,811,050	$1,294,850	$1,293,400	$1,294,850	$646,700	$0	$0
Taxable Income		($723,755)	($2,209,358)	($1,200,022)	($479,679)	$32,942	$31,968	$29,327	$677,604	$1,325,838	$1,328,871
PTC		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ITC		$0									
Taxes		**($289,502)**	**($883,743)**	**($480,009)**	**($191,872)**	**$13,177**	**$12,787**	**$11,731**	**$271,042**	**$530,335**	**$531,548**
Total	***(4,350,000)***	***1,000,119***	***1,555,873***	***1,112,997***	***785,051***	***539,514***	***498,724***	***457,897***	***155,986***	***(146,638)***	***(191,925)***

Table 40 is continued on the next page.

Year	11	12	13	14	15	16	17	18	19	20
Annual Generation (MWh)	22,338	22,338	22,338	22,338	22,338	22,338	22,338	22,338	22,338	22,338
Cost of Generation ($/MWh)	$160.02	$160.02	$160.02	$160.02	$160.02	$160.02	$160.02	$160.02	$160.02	$160.02
Operating Revenues	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**	**$3,574,527**
Fixed O&M ($/yr)	$1,645,642	$1,678,555	$1,712,126	$1,746,369	$1,781,296	$1,816,922	$1,853,261	$1,890,326	$1,928,132	$1,966,695
Var. O&M ($/yr)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fuel Cost ($/yr)	$1,268,914	$1,281,604	$1,294,420	$1,307,364	$1,320,437	$1,333,642	$1,346,978	$1,360,448	$1,374,052	$1,387,793
Incentives ($/yr)	$780,000	$780,000	$780,000	$780,000	$780,000	$780,000	$780,000	$780,000	$780,000	$780,000
Operating Expenses	**$2,134,557**	**$2,180,159**	**$2,226,546**	**$2,273,733**	**$2,321,734**	**$2,370,564**	**$2,420,239**	**$2,470,774**	**$2,522,185**	**$2,574,488**
Interest Payment	$106,468	$54,532	$0	$0	$0	$0	$0	$0	$0	$0
Principal Payment	$1,038,710	$1,090,646	$0	$0	$0	$0	$0	$0	$0	$0
Debt Service	**$1,145,178**	**$1,145,178**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Tax Depreciation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Taxable Income	$1,333,502	$1,339,836	$1,347,981	$1,300,794	$1,252,793	$1,203,963	$1,154,288	$1,103,753	$1,052,342	$1,000,039
PTC	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
ITC										
Taxes	**$533,401**	**$535,934**	**$539,192**	**$520,318**	**$501,117**	**$481,585**	**$461,715**	**$441,501**	**$420,937**	**$400,016**
Total	***(238,609)***	***(286,744)***	***808,789***	***780,477***	***751,676***	***722,378***	***692,573***	***662,252***	***631,405***	***600,023***

Findings

A biomass gasification project in western Nevada County is feasible with the correct combination of factors. Several sites offer land with relatively low development costs due to ease of road access, grading, and access to utilities. Additionally, the local landscaping yard (Rare Earth Landscaping) and cement plant (Hansen Brothers) offer the potential for local biochar offtake agreements. As identified in the Biomass Feedstock Availability and Cost Analysis, Highway 49 is one of the major access routes for feedstock transportation.

Despite these site advantages, biomass gasification in the forested setting presents a challenging financial model due primarily to the relatively high cost of feedstock (compared to agricultural or urban-sourced wood) and relatively low prices of electricity (compared to pricing outside the United States). As shown in Table 40, the project will work at $160 per MWh if each of the project components in this pro forma are met. Key aspects of project development include the following:

- ***Permitting*****:** When the site location has been finalized, obtaining a CUP for the gasification project is likely required. Obtaining the CUP will represent the completion of the CEQA review for the project. CEQA is a critical component of project development and should be a top priority to move the project forward.

- ***Technology Selection*****:** Selecting a project development partner is a critical next step in project development. The development partner should have experience with the construction and operation of biomass gasification facilities and have experience obtaining project financing through private equity markets, debt financing, and grants. The developer will assist with selecting an appropriate technology for the site and will work in close coordination with the project team to develop the site.

- ***Feedstock Procurement*****:** The financial markets require feedstock offtake agreements verifying the price and time frame for secured feedstock. Identifying a reputable organization to supply a long-term feedstock agreement for at least 70 percent of the necessary feedstock is critical.

- ***Biochar Offtake Agreements*****:** Biochar represents an important revenue stream for the project. Identifying long-term biochar purchasers and purchase price will be critical for leveraging funding from the financial markets.

- ***SB 1122 Eligibility*****:** SB 1122 will be the feed-in tariff that provides the primary revenue stream for the project. The system impact study (SIS) conducted by PG&E is the most significant undertaking to reach SB 1122 eligibility. After a technology has been selected with the project developer, conducting the SIS is a time-sensitive step that should be undertaken quickly to establish an early position in the SB 1122 queue.

RECOMMENDATIONS AND NEXT STEPS

The Task Force has made significant efforts to identify value-added opportunities to promote local economic development, improve public safety, utilize sustainable, regionally available resources, and improve air quality. The development of a biomass gasification facility is complex. This Feasibility Study evaluates the potential feedstock availability, reviews technology opportunities, identifies potential project sites, and evaluates the high-level risks and opportunities for community-scale gasification development. Financial viability is critical for project success, and the Task Force can make significant progress to move the project forward with pre-development work. TSS recommends the following next steps.

- Select a Target Site: While the Preliminary Site Analysis identified preferred sites, the interest of the site owners and managers is paramount. TSS suggests that the Task Force continue their outreach to owners of preferred sites to identify the most interested parties and select a target site based on site characteristics (as identified in the Preliminary Site Analysis) and ownership interest.

- Identify a Technology Developer: With a selected site, the Task Force should update the project description to reflect the attributes of the target site with particular attention to the opportunities for additional revenue (e.g., biochar and heat sales). Given the structure of the Task Force, TSS recommends that the Task Force focus on developer experience instead of technology type. A developer with a proven track record of successful projects will be able to work with the Task Force to drive the project forward in a more substantive manner than a technology vendor. The developer should have expertise in evaluating technologies that surpass those of the Task Force. The development process is likely to take time, and building a relationship with the project developer will be critical to project success and local acceptance.

- Land Use Permitting: The CEQA review process is an important part of project development. The development of a biomass gasification system is significant and will require CEQA review for a CUP (all sites reviewed in the Preliminary Site Analysis are in land use zones that may allow biomass power development with a CUP). TSS recommends that before applying for a CUP, the Task Force (with help from the selected developer and outside consultants, if necessary) develop detailed background documents to help inform the agency reviewers about the technical aspects of the project. This should help reduce the cost and time of the CEQA review and improve the chances of receiving a mitigated negative declaration or negative declaration and avoiding the time-intensive processes of a full environmental impact report.

- Public Outreach: Throughout the process, the Task Force should continue regular and transparent public outreach to keep local stakeholders informed about the project. This upfront effort builds local project support that can be critical for project success during pre-development, development, and operational stages.

- Identify Synergies with Local Enterprises: Successful project development relies on cooperation with local enterprises. Financing a biomass gasification project requires long-term feedstock supplies, by-product sales, and a local workforce. Identifying how the biomass gasification project can interact with the community increases local support and improves the project's economic viability.

- Grant Funding: Pre-development work takes time and costs money. Without significant investment partnerships, the Task Force must rely on state funding programs to provide bridge funding (before project financing is complete). Sources of pre-development and development funding that the Task Force should consider are outlined below.

    - *USFS Wood Innovation Program*: The USFS has released the Wood Innovation program, with proposals due January 23, 2015, for the upcoming grant cycle. The Wood Innovation program focuses on reducing hazardous fuels and improving forest health on national forest systems and other forest lands, reducing costs of forest management, and promoting the economic and environmental health of communities. The Wood Innovation program offers the opportunity to receive funding for "engineering designs, cost analyses, permitting, and other requirements for wood energy projects that are necessary in the later stages of project development to secure financing." Due to the short time frame, identifying project partners will be essential to accessing this funding source. Historically, the USFS has supported wood energy projects and is expected to continue funding project development costs over the near term. Past programs include the Woody Biomass Utilization Grant and the Wood to Energy program.

    - *Sierra Nevada Conservancy Grant Programs*: The Sierra Nevada Conservancy historically has funds available for pre-development advancement of forest biomass utilization programs. In 2014, the Conservancy's Proposition 84 grant program was completed. The Task Force should monitor the Conservancy as their next grant program is developed, likely in response to Proposition 1 funding. Proposition 1, the Water Bond, is focused on protecting and restoring California rivers, lakes, streams, and watersheds. Community-scale biomass gasification projects promote healthy and sustainable forest management which has many links into improved watershed health. The new grant program is expected to have opportunities for biomass gasification projects utilizing forest residue.

    - *CEC's EPIC Program*: The EPIC program, administered by the CEC, is funded through utility ratepayers. For each funding cycle, the specific EPIC program goals are revised and historically, there has been funding for research and development as well as demonstration of pre-commercial technologies. The EPIC program is designed for biomass gasification projects in the forested setting, as there are currently no commercial-scale projects and innovative solutions are required to address challenges related to the utilization of forest biomass. Participation in the EPIC program should be in partnership with the selected project developer and after CEQA review has been completed. The next EPIC funding cycle is expected to be released July 2015.

- *National Forest Foundation*: The National Forest Foundation has a variety of assistance programs designed to conservation work in America's national forests. In particular, the Forest Stewardship Fund is designed to support on-the-ground conservation work through a partnership with local businesses on or near national forests.

At this stage, TSS recommends that the Task Force focus on developing the framework and relationships necessary to achieve project financing. This feasibility study has identified that there is sufficient sustainably available biomass for a 3 MW facility, there are commercially available technologies that can utilize the local feedstock, and there are market mechanisms that could provide long-term contracts at an attractive rate. The next steps, as outlined above, if successfully achieved, will move the project closer to realization.

Appendix A. Site Scoring Criteria with Weight Factors

The siting criteria are listed and identified in two groups: critical and secondary. Critical criteria may likely cause the project to be infeasible due primarily to the potential high development costs and timeliness. In addition to the critical criteria, secondary constraints are used to compare sites. A zero score for any of the critical criteria will deem the project to be infeasible. Otherwise, no minimum threshold has been identified to filter for project viability.

Critical Criteria

1. Land Use Zoning (15%)
    - 3 Points: Industrial Zones or parcels already zoned for power production (existing Conditional Use Permit)
    - 2 Points: Zones with some flexibility but with limited industrial accepted uses (e.g., Public Purpose, Special Purpose, General Agriculture, Forest Resource/Timber Production Zone)
    - 1 Point: Zones already permitted for some machinery (e.g., Commercial)
    - 0 Points: Zones that explicitly exclude industrial uses or with specific intended uses (e.g., Residential, Hospital)

2. Space (10%)
    - 3 Points: Has over 3 acres of available space
    - 2 Points: Has 2 to 3 acres of available space
    - 1 Point: Has 1 to 2 acres of available space
    - 0 Points: Has less than 1 acre of available space

3. Proximity to Sensitive Receptors[34] (Noise, Air Quality, Public Health and Safety, Traffic, and Community and Regulatory Acceptance) (25%)
    - 3 Points: No receptors
    - 2 Points: No sensitive receptors, but have neighboring facilities
    - 1 Point: Sensitive receptors
    - 0 Points: Extra-sensitive receptors (e.g., schools, hospitals, etc.)

[34] Sensitive receptors are evaluated based on the potential opposition to a bioenergy project due to noise, air quality, and public health and safety concerns.

Secondary Criteria

1. Grid Infrastructure (10%)
    - 3 Points: Circuits with a net peak load greater than 20 MW (Peak Load – Existing Generation)
    - 2 Points: Circuits with a net peak load greater than 6 MW and less than 20 MW
    - 1 Point: Circuits with a net peak load less than 6 MW
    - 0 Points: No electric lines to site

2. Heat and Cooling Load Potential (5%)
    - 3 Points: Has a thermal load greater than 15 MMBtu/hr of installed capacity utilized on greater than 50% of the day (on average)
    - 2 Points: Has a thermal load greater than 15 MMBtu/hr of installed capacity utilized less than 50% of the day (on average)
    - 1 Point: Has a thermal load less than 15 MMBtu/hr of existing installed capacity
    - 0 Points: Has no potential thermal load

3. Road Infrastructure (Transportation and Traffic) (10%)
    - 3 Points: Existing tractor trailer access to the site
    - 2 Points: Former tractor trailer access to the site
    - 1 Point: Limited access via roads with existing tractor trailer use
    - 0 Points: No access via roads with existing tractor trailer use

4. Site Infrastructure & Environmental Clean Up Status (Economic Suitability) (10%)
    - 3 Points: Existing road access, fire hydrants, grading, and no relevant active clean up on the site
    - 2 Points: Missing 1 – Existing road access, fire hydrants, grading, and no relevant active clean up on the site
    - 1 Point: Missing 2 – Existing road access, fire hydrants, grading, and no relevant active clean up on the site
    - 0 Points: Missing 3 or more – Existing road access, fire hydrants, grading, and no relevant active clean up on the site

5. Water Supply and Discharge (5%)
    - 3 Points: Fire supply water and wastewater discharge system existing on site
    - 2 Points: Fire supply water already on site, no existing access to wastewater discharge system
    - 1 Point: Access for domestic water but no fire supply water or access to wastewater discharge system
    - 0 Points: No access to water

6. Biological Resources (5%)
    - 3 Points: Highly disturbed site with no known sensitive biological activity (e.g. wetlands, migration routes)
    - 2 Points: Disturbed site with known areas of sensitive biological activity
    - 1 Point: Regenerated or undisturbed site without known areas of sensitive biological activity
    - 0 Points: Regenerated or undisturbed site with known areas of sensitive biological activity

7. Cultural Resources (5%)
    - 3 Points: Developed parcel with no known cultural resources
    - 2 Points: Developed parcel with known cultural resources
    - 1 Point: Undeveloped site with no known cultural resources
    - 0 Points: Undeveloped site with known cultural resources

Appendix B. Site Ranking Matrix

Site Name	Weighting Factor	Airport	Auburn Rd. Site	Cement Hill	Centennial	East Bennett Rd. North Site
Site Location		39°13'12.53"N 121°00'18.02"W	39°09'13.61"N 121°04'51.37"W	39°16'04.27"N 121°01'44.53"W	39°13'18.3"N 121°02'03.4"W	39°13'05.61"N 121°02'21.00"W
Jurisdiction/Zoning Designation		Nevada County Light Industrial	Nevada County AG	Nevada City R1-SC-AN	Grass Valley M1	Nevada County Business Park
Site Information		Industrial Park	Rural area, woodlands	Wood storage lot and open space	Old Mine Ownership	Commercial site (older)
Land Use Zoning	15%	3	2	0	3	1
Space	10%	2	3		3	3
Proximity to Sensitive Receptors	25%	2	1		2	2
Interconnection Requirements	10%	1	1		1	2
Heating/Cooling Load	5%	0	0		0	0
Road Infrastructure	10%	3	0		3	3
Site Infrastructure & Environmental Cleanup Status	10%	2	2		2	2
Water Supply & Discharge	5%	2	1		1	1
Biological Resources	5%	3	1		3	3
Cultural Resource	5%	3	1		3	3
Total Score (of 3)		2.15	1.30	0.00	2.20	2.00
Total Score (of 100)		71.7%	43.3%	0.0%	73.3%	66.7%

Site Name	Weighting Factor	East Bennett Rd. South Site	Fairgrounds	Former Meeks Lumber	Former SPI Site	Grass Valley Hay and Feed
Site Location		39°12'58.59"N 121°02'32.07"W	39°12'27.76"N 121°04'57.73"W	39°14'33.05"N 121°02'07.90"W	39°12'28.73"N 121°00'52.66"W	39°13'25.49"N 121°02'20.18"W
Jurisdiction/Zoning Designation		Nevada County Light Industrial	Nevada County Public	Grass Valley C-2	Nevada County Light Industrial	Grass Valley M-1
Site Information		Vacant lot	Empty area of County Fairgrounds	Vacant retail lumber sales facility Former sawmill	Vacant - former sawmill site	Various current uses
Land Use Zoning	15%	3	2	0	3	3
Space	10%	3	2		3	2
Proximity to Sensitive Receptors	25%	2	1		1	2
Interconnection Requirements	10%	2	2		1	1
Heating/Cooling Load	5%	0	1		0	0
Road Infrastructure	10%	3	1		3	2
Site Infrastructure & Environmental Cleanup Status	10%	2	1		3	2
Water Supply & Discharge	5%	1	1		2	1
Biological Resources	5%	0	2		3	3
Cultural Resource	5%	1	3		3	3
Total Score (of 3)		2.05	1.50	0.00	2.10	2.00
Total Score (of 100)		68.3%	50.0%	0.0%	70.0%	66.7%

Site Name	Weighting Factor	Hansen Brothers	La Barr Meadows Rd. - Nevada County	La Barr Meadows Rd. - Rare Earth	McCourtney Transfer Station	Penn Valley Site
Site Location		39°11'32.15"N 121°03'04.09"W	39°11'04.31"N 121°02'52.22"W	39°10'19.34"N 121°06'34.87"W	39°10'19.34"N 121°06'34.87"W	39°12'15.61"N 121°10'35.89"W
Jurisdiction/Zoning Designation		Nevada County Light Industrial	Nevada County Public	Nevada County M2	Nevada County Public	Nevada County Light Industrial
Site Information		Unused space	County storage area	Former Sawmill Site	Solid waste transfer station	Vacant land
Land Use Zoning	15%	3	2	3	2	3
Space	10%	3	3	3	3	3
Proximity to Sensitive Receptors	25%	2	2	2	1	2
Interconnection Requirements	10%	2	2	2	1	2
Heating/Cooling Load	5%	0	0	0	0	0
Road Infrastructure	10%	3	3	3	3	3
Site Infrastructure & Environmental Cleanup Status	10%	2	2	2	3	2
Water Supply & Discharge	5%	1	1	1	2	2
Biological Resources	5%	1	3	3	3	1
Cultural Resource	5%	1	3	3	3	1
Total Score (of 3)		2.10	2.15	2.30	1.95	2.15
Total Score (of 100)		70.0%	71.7%	76.7%	65.0%	71.7%

Site Name	Weighting Factor	Pleasant Valley Site	Railroad Ave M-2 Site	Railroad Ave M-1 Site	South Auburn Street
Site Location		39°12'28.64"N 121°12'11.41"W	39°13'11.85"N 121°03'12.60"W	39°13'17.51"N 121°03'00.94"W	39°12'17.78"N 121°03'36.92"W
Jurisdiction/Zoning Designation		Nevada County Light Industrial	Grass Valley M-2	Grass Valley M-1	Grass Valley M-1
Site Information		Vacant land	Batch Plant	Storage and vacant land	Scattered business and vacant land
Land Use Zoning	15%	3	3	3	3
Space	10%	3	1	1	3
Proximity to Sensitive Receptors	25%	1	1	1	1
Interconnection Requirements	10%	2	2	2	1
Heating/Cooling Load	5%	0	0	0	0
Road Infrastructure	10%	2	3	3	2
Site Infrastructure & Environmental Cleanup Status	10%	2	2	1	1
Water Supply & Discharge	5%	2	2	2	1
Biological Resources	5%	1	3	3	1
Cultural Resource	5%	1	3	3	1
Total Score (of 3)		1.80	1.90	1.80	1.55
Total Score (of 100)		60.0%	63.3%	60.0%	51.7%

Appendix C. Senate Bill 1122 Text

Senate Bill No. 1122

CHAPTER 612

An act to amend Section 399.20 of the Public Utilities Code, relating to energy.

[Approved by Governor September 27, 2012. Filed with Secretary of State September 27, 2012.]

LEGISLATIVE COUNSEL'S DIGEST

SB 1122, Rubio. Energy: renewable bioenergy projects.

Under existing law, the Public Utilities Commission has regulatory authority over public utilities. Existing law requires every electrical corporation to file with the commission a standard tariff for electricity generated by an electric generation facility, as defined, that qualifies for the tariff, is owned and operated by a retail customer of the electrical corporation, and is located within the service territory of, and developed to sell electricity to, the electrical corporation. Existing law requires an electrical corporation to make the tariff available to the owner or operator of an electric generation facility within the service territory of the electrical corporation, as specified, until the electrical corporation meets its proportionate share of a statewide cap of 750 megawatts, as specified.

This bill would require the commission, by June 1, 2013, to direct the electrical corporations to collectively procure at least 250 megawatts of cumulative rated generating capacity from developers of bioenergy projects that commence operation on or after June 1, 2013. The bill would require the commission, for each electrical corporation, to allocate shares of the additional 250 megawatts based on the ratio of each electrical corporation's peak demand compared to the total statewide peak demand. The bill would require the commission to allocate those 250 megawatts to electrical corporations from specified categories of bioenergy project types, with specified portions of that 250 megawatts to be allocated from each category. The bill would require the commission to encourage gas and electrical corporations to develop and offer programs and services to facilitate development of in-state biogas for a broad range of purposes. The bill would authorize the commission, in consultation with specified state agencies, if it finds that the allocations of those 250 megawatts are not appropriate, to reallocate those 250 megawatts among those categories.

The people of the State of California do enact as follows:

SECTION 1. Section 399.20 of the Public Utilities Code is amended to read:

399.20. (a) It is the policy of this state and the intent of the Legislature to encourage electrical generation from eligible renewable energy resources.

(b) As used in this section, "electric generation facility" means an electric generation facility located within the service territory of, and developed to sell electricity to, an electrical corporation that meets all of the following criteria:

(1) Has an effective capacity of not more than three megawatts.

(2) Is interconnected and operates in parallel with the electrical transmission and distribution grid.

(3) Is strategically located and interconnected to the electrical transmission and distribution grid in a manner that optimizes the deliverability of electricity generated at the facility to load centers.

(4) Is an eligible renewable energy resource.

(c) Every electrical corporation shall file with the commission a standard tariff for electricity purchased from an electric generation facility. The commission may modify or adjust the requirements of this section for any electrical corporation with less than 100,000 service connections, as individual circumstances merit.

(d) (1) The tariff shall provide for payment for every kilowatthour of electricity purchased from an electric generation facility for a period of 10, 15, or 20 years, as authorized by the commission. The payment shall be the market price determined by the commission pursuant to paragraph (2) and shall include all current and anticipated environmental compliance costs, including, but not limited to, mitigation of emissions of greenhouse gases and air pollution offsets associated with the operation of new generating facilities in the local air pollution control or air quality management district where the electric generation facility is located.

(2) The commission shall establish a methodology to determine the market price of electricity for terms corresponding to the length of contracts with an electric generation facility, in consideration of the following:

(A) The long-term market price of electricity for fixed price contracts, determined pursuant to an electrical corporation's general procurement activities as authorized by the commission.

(B) The long-term ownership, operating, and fixed-price fuel costs associated with fixed-price electricity from new generating facilities.

(C) The value of different electricity products including baseload, peaking, and as-available electricity.

(3) The commission may adjust the payment rate to reflect the value of every kilowatthour of electricity generated on a time-of-delivery basis.

(4) The commission shall ensure, with respect to rates and charges, that ratepayers that do not receive service pursuant to the tariff are indifferent to whether a ratepayer with an electric generation facility receives service pursuant to the tariff.

(e) An electrical corporation shall provide expedited interconnection procedures to an electric generation facility located on a distribution circuit that generates electricity at a time and in a manner so as to offset the peak demand on the distribution circuit, if the electrical corporation determines that the electric generation facility will not adversely affect the distribution grid. The commission shall consider and may establish a value for an electric generation facility located on a distribution circuit that generates electricity at a time and in a manner so as to offset the peak demand on the distribution circuit.

(f) (1) An electrical corporation shall make the tariff available to the owner or operator of an electric generation facility within the service territory of the electrical corporation, upon request, on a first-come-first-served basis, until the electrical corporation meets its proportionate share of a statewide cap of 750 megawatts cumulative rated generation capacity served under this section and Section 387.6. The proportionate share shall be calculated based on the ratio of the electrical corporation's peak demand compared to the total statewide peak demand.

(2) By June 1, 2013, the commission shall, in addition to the 750 megawatts identified in paragraph (1), direct the electrical corporations to collectively procure at least 250 megawatts of cumulative rated generating capacity from developers of bioenergy projects that commence operation on or after June 1, 2013. The commission shall, for each electrical corporation, allocate shares of the additional 250 megawatts based on the ratio of each electrical corporation's peak demand compared to the total statewide peak demand. In implementing this paragraph, the commission shall do all of the following:

(A) Allocate the 250 megawatts identified in this paragraph among the electrical corporations based on the following categories:

(i) For biogas from wastewater treatment, municipal organic waste diversion, food processing, and codigestion, 110 megawatts.

(ii) For dairy and other agricultural bioenergy, 90 megawatts.

(iii) For bioenergy using byproducts of sustainable forest management, 50 megawatts. Allocations under this category shall be determined based on the proportion of bioenergy that sustainable forest management providers derive from sustainable forest management in fire threat treatment areas, as designated by the Department of Forestry and Fire Protection.

(B) Direct the electrical corporations to develop standard contract terms and conditions that reflect the operational characteristics of the projects, and to provide a streamlined contracting process.

(C) Coordinate, to the maximum extent feasible, any incentive or subsidy programs for bioenergy with the agencies listed in subparagraph (A) of paragraph (3) in order to provide maximum benefits to ratepayers and to ensure that incentives are used to reduce contract prices.

(D) The commission shall encourage gas and electrical corporations to develop and offer programs and services to facilitate development of in-state biogas for a broad range of purposes.

(3) (A) The commission, in consultation with the State Energy Resources Conservation and Development Commission, the State Air Resources Board, the Department of Forestry and Fire Protection, the Department of Food and Agriculture, and the Department of Resources Recycling and Recovery,

may review the allocations of the 250 additional megawatts identified in paragraph (2) to determine if those allocations are appropriate.

(B) If the commission finds that the allocations of the 250 additional megawatts identified in paragraph (2) are not appropriate, the commission may reallocate the 250 megawatts among the categories established in subparagraph (A) of paragraph (2).

(4) For the purposes of this subdivision, “bioenergy” means biogas and biomass.

(g) The electrical corporation may make the terms of the tariff available to owners and operators of an electric generation facility in the form of a standard contract subject to commission approval.

(h) Every kilowatthour of electricity purchased from an electric generation facility shall count toward meeting the electrical corporation’s renewables portfolio standard annual procurement targets for purposes of paragraph (1) of subdivision (b) of Section 399.15.

(i) The physical generating capacity of an electric generation facility shall count toward the electrical corporation’s resource adequacy requirement for purposes of Section 380.

(j) (1) The commission shall establish performance standards for any electric generation facility that has a capacity greater than one megawatt to ensure that those facilities are constructed, operated, and maintained to generate the expected annual net production of electricity and do not impact system reliability.

(2) The commission may reduce the three megawatt capacity limitation of paragraph (1) of subdivision (b) if the commission finds that a reduced capacity limitation is necessary to maintain system reliability within that electrical corporation’s service territory.

(k) (1) Any owner or operator of an electric generation facility that received ratepayer-funded incentives in accordance with Section 379.6 of this code, or with Section 25782 of the Public Resources Code, and participated in a net metering program pursuant to Sections 2827, 2827.9, and 2827.10 of this code prior to January 1, 2010, shall be eligible for a tariff or standard contract filed by an electrical corporation pursuant to this section.

(2) In establishing the tariffs or standard contracts pursuant to this section, the commission shall consider ratepayer-funded incentive payments previously received by the generation facility pursuant to Section 379.6 of this code or Section 25782 of the Public Resources Code. The commission shall require reimbursement of any funds received from these incentive programs to an electric generation facility, in order for that facility to be eligible for a tariff or standard contract filed by an electrical corporation pursuant to this section, unless the commission determines ratepayers have received sufficient value from the incentives provided to the facility based on how long the project has been in operation and the amount of renewable electricity previously generated by the facility.

(3) A customer that receives service under a tariff or contract approved by the commission pursuant to this section is not eligible to participate in any net metering program.

(*l*) An owner or operator of an electric generation facility electing to receive service under a tariff or contract approved by the commission shall continue to receive service under the tariff or contract until either of the following occurs:

(1) The owner or operator of an electric generation facility no longer meets the eligibility requirements for receiving service pursuant to the tariff or contract.

(2) The period of service established by the commission pursuant to subdivision (d) is completed.

(m) Within 10 days of receipt of a request for a tariff pursuant to this section from an owner or operator of an electric generation facility, the electrical corporation that receives the request shall post a copy of the request on its Internet Web site. The information posted on the Internet Web site shall include the name of the city in which the facility is located, but information that is proprietary and confidential, including, but not limited to, address information beyond the name of the city in which the facility is located, shall be redacted.

(n) An electrical corporation may deny a tariff request pursuant to this section if the electrical corporation makes any of the following findings:

(1) The electric generation facility does not meet the requirements of this section.

(2) The transmission or distribution grid that would serve as the point of interconnection is inadequate.

(3) The electric generation facility does not meet all applicable state and local laws and building standards and utility interconnection requirements.

(4) The aggregate of all electric generating facilities on a distribution circuit would adversely impact utility operation and load restoration efforts of the distribution system.

(o) Upon receiving a notice of denial from an electrical corporation, the owner or operator of the electric generation facility denied a tariff pursuant to this section shall have the right to appeal that decision to the commission.

(p) In order to ensure the safety and reliability of electric generation facilities, the owner of an electric generation facility receiving a tariff pursuant to this section shall provide an inspection and maintenance report to the electrical corporation at least once every other year. The inspection and maintenance report shall be prepared at the owner's or operator's expense by a California-licensed contractor who is not the owner or operator of the electric generation facility. A California-licensed electrician shall perform the inspection of the electrical portion of the generation facility.

(q) The contract between the electric generation facility receiving the tariff and the electrical corporation shall contain provisions that ensure that construction of the electric generating facility complies with all applicable state and local laws and building standards, and utility interconnection requirements.

(r) (1) All construction and installation of facilities of the electrical corporation, including at the point of the output meter or at the transmission or distribution grid, shall be performed only by that electrical corporation.

(2) All interconnection facilities installed on the electrical corporation's side of the transfer point for electricity between the electrical corporation and the electrical conductors of the electric generation facility shall be owned, operated, and maintained only by the electrical corporation. The ownership, installation, operation, reading, and testing of revenue metering equipment for electric generating facilities shall only be performed by the electrical corporation.

Appendix D. CAL FIRE Draft Guidelines for Sustainable Forest Biomass

Forest Derived Biomass Supply Eligibility under

SECTION 1. Section 399.20 of the Public Utilities Code

Background

At the request of the Energy Division staff at the California Public Utilities Commission (CPUC), the Department of Forestry and Fire Protection (CAL FIRE), with the assistance and facilitation of Sierra Nevada Conservancy and a variety of other stakeholders, this whitepaper was prepared to assist in determining fuel sourcing bioenergy production eligibility criteria for "byproducts of sustainable forest management" consistent with the term as used in Public Utilities Code Section 399.20 (f)(2)(A)(iii). The intent of this whitepaper is to: 1) propose a definition of "sustainable forest management" and 2) provide recommendations for a process for certification, verification, and monitoring to be utilized by sellers and purchasers of eligible by-products to verify that biomass feedstocks utilized by a particular facility are supplied in a manner consistent with the statutory provision for sustainable forest management Section 399.20.

Since submission of the whitepaper in late 2013, staff from CAL FIRE and Board of Forestry and Fire Protection (BOF) identified the need for some changes in the original document. Changes have been made to ensure that the objectives of SB 1122 are achieved, while recognizing the current adequacy of regulations governing commercial timber operations under the Z'berg-Nejedly Forest Practice Act and BOF forest practice regulations.

Issue 1-Recommendations for Defining of "Byproducts of Sustainable Forest Management"

SB 1122 directs 50Mw of bioenergy using byproducts of sustainable forest management allocated based on the proportion of bioenergy derived from Fire Threat Treatment Areas as designated by the Department of Forestry and Fire Protection. The current Fire Threat Treatment Area designation by the Department was completed in 2005 and reflects an index of expected fire frequency and fire behavior based upon fuel ranking and anticipated fire frequency (Sethi, et.al, 2005). Estimates of bioenergy which are to be used for allocation purposes from Fire Threat Treatment Areas were made based on datasets which reflected inventories and vegetation structure on forested lands and shrublands.

The categories of potential bioenergy sourcing were adapted from the Public Interest Energy Resources publication titled "An assessment of biomass resources in California" published in 2004. Categories included in the assessment for development of biomass and bioenergy estimates included 1) logging slash, 2) forest thinning, 3) mill wastes, and 4) shrub. These categorizations are sufficient to support an allocation of the 50Mw to the investor owned utilities (IOUs).

However, given the assumptions utilized to develop the overall estimates and the scale at which the bioenergy estimates were developed, the Department concurs with the Black and Veatch draft consultant report (April, 2013) that the resource potential and data assumptions for forest materials that would be considered sustainable at the project level needs to be refined for the purposes of determining whether a particular project which supplies by-products, meets the sustainable forest management criteria.

The process for determining sustainable forest management byproduct eligibility under the provisions of SB 1122 relies on the definition of sustainable forestry in part 2 of the Society of American Foresters definition (Appendix A) as well as the federal level defined in FS-979 (Appendix B) and a series of public workshops which were held to refine these broad definitions for the purposes of determining byproduct eligibility under SB 1122. To meet eligibility requirements all biomass feedstocks that are used within this program must be derived from projects that are conducted in conformance with local, state, and federal policy, statutes and regulation, including CEQA and the National Environmental Policy Act (NEPA). This whitepaper, however, does not support requiring CEQA or NEPA review on projects that would not have otherwise been required to be reviewed under those laws.

The workshop process was planned and facilitated to assist in refining and integrating the key elements of the two definitions of forest sustainability applicable to the determination of feedstock eligibility for purposes of compliance with PUC Section 399.20. This five month process included stakeholders from the environmental, community, governmental and private industry sectors. Numerous background materials were prepared and circulated, three workshops were held to facilitate input and build consensus and multiple drafts of this white paper were circulated for comment. This paper reflects a balance of viewpoints and attempts to ensure that the majority of biomass feedstock is derived from sustainable forest management practices while providing the biomass energy operators enough flexibility to be able to use diverse sources to ensure year-round reliability.

Environmental stakeholders expressed concerns focused on the potential for markets for biomass materials to lead to utilization of components of existing vegetation types which have not been traditionally utilized at a pace and scale that would not be sustainable over time. This concern also mirrors concerns raised in literature review including a comprehensive literature review done by Stewart et. al. (July, 2011).

Paraphrasing Stewart, et. al. the structural stand components most likely to be harvested or manipulated during woody biomass operations include:

1. Dead or downed wood (pre-existing) and harvest generated slash,
2. Understory shrub, herbaceous plants and non-merchantable trees,
3. Wildlife structural trees (decaying live trees, cavity trees, mast producing trees, etc.)

Stewart further notes:

> "The maintenance recruitment of structural elements such as large tree and snags, logs, and coarse woody debris that would otherwise not be replaced under an intensive biomass harvesting regime is an issue of critical concern for biodiversity and food webs related to these elements."

There was general concurrence from the workshop participants regarding these key areas and recognition that approaches to evaluating the potential impacts of a proposed forest management vary somewhat between federal, private, and state ownerships both in terms of environmental permitting requirements, review, approval, implementation, inspections, enforcement, etc. Furthermore, the literature reviewed as part of this process did not make specific recommendations on prescriptive retention standards.

There was also general concurrence that there be some certainty for supply of by-products and that the process for verifying that by-products were eligible be kept as simple and straightforward as possible.

Existing California Sustainable Forest Management Regulatory and Management Framework for Non-federal and Federal lands.

Forest management activities on federal, state and private ownerships in California, that could provide biomass to 3Mw or less electric generation facilities as defined in Section 399.20(b), are subject to numerous statutes and regulation.

Existing Regulatory Framework for Non-federal Lands - Forest management activities conducted on state and private forest ownerships, meeting the statutory definition of *timberland*, involving the barter or sale of biomass byproducts, is subject to regulation under the provisions of the Z-berg-Nejedly Forest Practice Act (Division 4, Chapter 8, Public Resources Code) and associated regulations under Title 14, California Code of Regulations, Chapter 4. The Public Resources Code and its associated regulations apply to activities that include a wide range of prescriptive standards designed to protect water quality, wildlife habitat, fisheries habitat, soils productivity, archaeological resources, aesthetics, and forest productivity. Landowners with more than 50,000 acres of forestland are required by regulation to demonstrate how their planned management activities will meet long-term sustained yield objectives.

Private forest land owners with less than 2,500 acres of timberland are eligible to submit a Non-industrial Timber Management Plan which outlines the long term management strategy for the property. Once approved through a multi-agency review, the landowner can conduct timber operations under a Notice of Timber Operations. Non-industrial Timber Management Plans have a core component that requires an assessment of long-term sustained yield based on an uneven-age silvicultural prescription. The practice of uneven aged management requires demonstration of natural regeneration and the maintenance of a balanced forest stand structure. State and private landowners may also conduct timber harvesting operations designed to address fuel management, including biomass harvesting, under a variety of exemptions and emergency notice provisions.

It is also anticipated that forest management activities that will generate biomass from private or state forest landownerships that do not meet the definition of timberland, under the Z'berg-Nejedley Forest Practice Act, will be eligible. These lands would typically not support a stand of commercial tree species, but may still support other non-commercial tree species or other woody vegetation. While these projects are not subject to regulation under the Forest Practice Act, they would generally fall under the provisions of the California Environmental Quality Act (CEQA). Therefore, the types of forest management activities that generate biomass feedstocks from most forest fuel hazard reduction activities will fall within the definition of sustainable forest management given their alignment with subpart (f) of the attached definition of sustainable forestry endorsed by the Society of American Foresters (Appendix A), as well as by meeting the intent of SB 1122. As such, these feedstocks will be classified as eligible.

Existing Regulatory Framework for Federal Lands - Federal policy for sustainability activities on National Forest Lands is described in the National Forest Management Act of 1976 (P.L.94-588). National Forests are required to prepare Forest and Resource Land Management Plans to guide how forests are managed and to guide design of project level activities consistent with 36 CFR 219. The first priority under 36 CFR 219.2 is to maintain or restore ecological sustainability of national forests to provide for a wide variety of uses, values, products and services and to conform to all applicable environmental laws and regulations. Additional federal policy on sustainability is outlined in the *National Report on Sustainable Forests—2010* (FS 979). Current guidance regarding management activities on federal lands in the

National Forest System in California emphasize application of restoration principles identified in General Technical Report (GTR)-220 (North, et.al., 2009) with management guidance provided in GTR-237, titled *Managing Sierra Nevada Forests* (North, 2012).

Biomass Utilization and Sustainable Forest Management

A number of authors have recognized the clear benefits of reducing density of vegetation, particularly on dry forest types to achieve numerous goals including reducing impacts associated with fire, improving forest health, improving resilience of forests in light of anticipated climate change, and maintaining sustainable carbon stocks and sequestration capacity of forested landscapes (Naeem, et. al. 1999, Aber, et. al., 2000, Franklin and Johnson, 2013, Forest Guild 2013, Franklin and Johnson, 2012). In addition, reducing density of vegetation while maintaining important forest structure elements like snags, down woody debris and native oaks often increase forest structural diversity and enhance wildlife habitats (Spies and Franklin, 1991, Hayes et al., 1997), and increase overall wildlife and native plant biodiversity at both the project and landscape scale (Hayes et al., 2003, Rupp et al. 2012, Verschuyl et al. 2011, Zwolak, 2009).

Markets for biomass feedstocks generated from forested landscapes in California have generally been confined to those areas in close proximity to existing biomass facilities. It is anticipated that build out of 50 new Mw of capacity under the provisions of Public Utilities Section 399.20 will expand existing markets for biomass feedstocks.

Sustainable Forest Management Definition Recommendations for Purposes of Determining Byproduct Eligibility

While the Department recognizes that timber operations on private timberlands must address sustained yield, sustainable forest management practices within the context of PUC Section 399.20 encompasses a broader set of criteria and includes acreage in federal ownership. Given the emphasis of SB 1122 on fire threat treatment linked to sustainable forest management activities and the input from workshop participants, the Department recommends that CPUC staff focus on utilization of the definition developed by the Society of American Foresters as a basis for determining sustainable forest management. Further, the Department recommends that eligible project types for the purposes of determining byproduct eligibility focus on 1) projects that incorporates the specific element in the SAF definition associated with maintenance of long term socioeconomic benefits associated with public safety, jobs, air quality, and economic benefits fuel treatment will provide if markets are found for by-products of fuel treatments, [Paraphrase of SAF definition subpart 2(f)] as well as, 2) projects that maintains biodiversity, productivity, regeneration capacity, vitality and potential to fulfill relevant ecological, economic, and social functions[Paraphrase of SAF definition subpart 2].

Specifically, the Department recommends that CPUC staff consider the following definition of **sustainable forest management** for purposes of determining eligibility of by-products—

> *Qualifying byproducts from sustainable forest management include materials derived from projects that are conducted to reduce fuels which pose a threat to public and the environment in an around communities as well as projects which can be demonstrated to contribute to restoration of forests, enhance the resilience of forests through reduction in fire threat, contribute to restoration of unique forest habitats or maintains or restores forest biodiversity, productivity and regeneration capacity.*

Issue 2-Verification, Certification, and Monitoring of Feedstock Eligibility

Consistent with the above definition, to meet the sustainable forest management eligibility fuel sourcing criteria the owner or operator must ensure that biomass feedstock from any project is sourced from one or more of the following project types and that, where appropriate, a third-party verification process addresses the key elements and gaps related to sustainable forest management risk associated with biomass operations identified by Stewart and others. The key elements to be evaluated are listed in appendix C-2:

<u>Eligible Byproduct Sources:</u>

I. ***Fire Threat Reduction*** *- biomass feedstock which originates from fuel reduction activities identified in a fire plan approved by CAL FIRE or other appropriate state, local or federal agency. On federal lands this includes fuel reduction activities approved under 36 CFR 220.6(e)(6)ii and (12) thru (14).*

II. ***Fire Safe Clearance Activities*** *- biomass feedstock originating from fuel reduction activities conducted to comply with PRC Sections 4290 and 4291. This would include biomass feedstocks from timber operations conducted in conformance with 14 CCR 1038(c) (150' Fuel Reduction Exemption) as well as projects that fall under 14 CCR 1052.4 (Emergency for Fuel Hazard Reduction), 14 CCR 1051.3-1051.7 (Modified THP for Fuel Hazard Reduction), and 14 CCR 1038(i) (Forest Fire Prevention Exemption), and categorical exclusions on federal lands approved under 36 CFR 220.6(e)(6)ii and (12)-(14).*

III. ***Infrastructure Clearance Projects*** *- biomass feedstock derived from fuel reduction activities undertaken by or on behalf of a utility or local, state or federal agency for the purposes of protecting infrastructure including but not limited to: power lines, poles, towers, substations, switch yards, material storage areas, construction camps, roads, railways, etc. This includes timber operations conducted pursuant to 14 CCR 1104.1(b),(c),(d),(e),(f) &(g).*

IV. ***Other Sustainable Forest Management*** *– biomass feedstock derived from sustainable forest management activities that accomplish one or more of the following: 1) forest management applications that maintain biodiversity, productivity, and regeneration capacity of forests in support of ecological, economic and social needs, 2) contributes to forest restoration and ecosystem sustainability, 3) reduces fire threat through removal of surface and ladder fuels to reduce the likelihood of active crown fire and/or surface fire intensity that would result in excessive levels of mortality and loss of forest cover or, 4) contributes to restoration of unique habitats within forested landscapes.*

It is recommended by the Department that by-products which do not meet the criteria listed above would not be eligible by-products of sustainable forest management. Based on input from the workshop participants, it was recognized that some flexibility be provided to producers relative to mix of fuel sources and that some provision be provided to allow a producer to utilize material sourced from projects that would not meet the eligibility criteria listed above. To accommodate this need for some supply flexibility the Department recommends that CPUC staff consider allowances for up to 20% of the by-products be sourced from "other" sources as described below.

<u>Other Eligible Supply Sources</u>: Eligible byproducts from this category include the following:

I. biomass feedstocks derived from other forest management activities that fail to meet 12 out of 15 of the eligibility criteria in the checklist found in Appendix C-1 and C-2.

ii. biomass feedstocks that will be used at the facilities from "other" waste streams identified in SB 1122

Establishing the Basis for and Use of Eligibility Criteria

It is recommended that by-products from projects which fall into the Fuel Reduction, Fire Safe Clearance, and Infrastructure Categories as defined above (i, ii and iii) be presumed to be eligible and would not be required to fill out the eligibility criteria form in Appendix C-1 and C-2. These projects will, however, need to submit a certification form (Appendix D) and be compliant with other applicable federal, state and local laws.

With some exceptions, as noted below, forest management activities not associated with the above referenced categories are required to fill out the eligibility form in Appendix C-1 and C-2 to determine if the biomass to be generated by the project is eligible and meets the criteria of Sustainable Forest Management Practices for the purposes of SB 1122.

Evaluations, completed by a Registered Professional Forester or appropriate federal officer, with exceptions noted herein, must be done on a project-by-project basis upon an assessment of the applicable management practices.

<u>Evaluation of biomass supply eligibility from by-products of sustainable forest management for federal projects</u> - Federal projects which generate biomass on National Forest System Lands or other federally owned or managed lands which incorporate management principles identified in GTR-220 and GTR-237 will generally be eligible as being sourced from Sustainable Forest Management. To document the consistency of a specific project with the restoration principles in the GTR guidance document, the appropriate Forest Officer or agency official will utilize the eligibility form to determine whether biomass feedstock meets sustainability criteria and can be certified as a by-product of sustainable forest management consistent with Section 399.20. The Forest Biomass Sustainability Byproduct Eligibility Form is used to help evaluate the project to determine and document if byproducts from a forest management project are eligible as a sustainable forest management source.

<u>Evaluation of biomass supply eligibility from by-products of sustainable forest management from projects subject to regulation under the Z'Berg-Nejedley Forest Practice Act -</u> For timber harvesting conducted on state and private timberlands, removal of biomass material for sale constitutes a commercial activity and is subject to regulation under the Forest Practice Act. Current forest practice rules generally do not have c prescriptive regulatory requirements specifically addressing biomass harvesting because the low volume harvesting of small woody material (tree tops, branches, slash from logging operations, and small sapling/pole sized conifers and hardwoods) has not been viewed as an activity likely to result in significant adverse or cumulative impacts. CAL FIRE would expect that biomass harvesting, incidental to the more common types of commercial timber operations, not to rise to the level of potential significant adverse impacts, and therefore the requirements of CEQA (disclosure, evaluation and mitigation) would not be triggered. However, in cases where a fair argument for

significant adverse impacts is raised, CAL FIRE would expect the registered professional forester preparing the timber harvesting plan (THP) to address those impacts in sufficient detail to mitigate the impacts.

Since the Board of Forestry and Fire Protection's forest practice rules are not tied to the proposed definition of 'sustainable forest management' as described in Appendix A of this document, it is recommended that CPUC should recognize the need for a separate governance process for biomass harvesting operations that would be subject to Section 399.20 of the Public Utilities Code. CAL FIRE does not view the two processes in conflict (enforcement of the Forest Practice Act by the department and enforcement of Section 399.20 by PUC). THPs are intended to address significant adverse impacts, and not necessarily intended to address the broader definition of sustainable forest management as described in this whitepaper. While the Forest Practice Regulations (FPRs) governing THPs generally address "the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality, and potential to fulfill, now and in the future, relevant ecological, economic, and social functions at local, national, and global levels", the FPRs were not intended for the type of specificity required in determining byproduct eligibility under SB 1122 . The FPRs do not explicitly mention stewarding lands to fulfill economic and social functions at a local or national level. Nonetheless, the department and many participants in the aforementioned workshops deemed this to be an important consideration.

A checklist approach for certification has been provided in Appendix C-2; however, this should be viewed as a recommendation, where the specific content could be modified or edited by PUC as improvements, clarifications, or new issues are identified.

For each of the elements to be addressed in Appendix C-2 it is recommended that the seller of biomass describe the planned operations and potential positive and/or negative impacts to each resource issue to be addressed in Appendix C. Review of concepts from GTR 220, GTR 237, CEC-500-2011-036, (Stewart, et.al), and GTR 292 (Jain et. al., 2012) are recommended as important references to assist in assessing and addressing the sustainability of proposed operations where biomass removals are proposed to achieve forest management, forest restoration, and/or fire threat reduction objectives.

Utilization of this approach will facilitate environmental review by third party verifiers, as well as completion of Appendix C-2 (Forest Biomass Sustainability Byproduct Eligibility Form) for determination of whether the biomass generated by the project meets eligible byproducts under PUC Section 399.20.

For ownerships with approved Sustained-Yield Plans or Programmatic Timber Environmental Impact Reports, harvest documents may rely on the assessment of sustainability contained in the programmatic documents to the extent that those elements are addressed and summarize the operational elements applicable to any project under the appropriate area in Appendix C-2.

Exceptions to the requirement to apply Appendix C-1 and C-2 for Biomass Produced During Restoration Projects and Small Projects: The following project types are assumed to meet the sustainable forest management criteria or small project size and are recommended to be exempted from completing the Forest Biomass Sustainability Byproduct Eligibility Form (Appendix C-2).

1) Sustainable forest management projects implemented on state, federal, and private ownership which involve meadow restoration, restoration of wetlands, restoration of aspen and other similar activities which are undertaken for restoration purposes and are subject to environmental review under CEQA or NEPA.

2) Operations conducted pursuant to an approved Non-Industrial Timber Management Plan where the plan or amendment to the plan evaluates and provides for a discussion of intended biomass operations and byproducts that may have potential significant adverse impacts, evaluates potential significant impacts, and mitigates potential significant impacts.
3) Operations conducted pursuant to an approved Timber Harvesting Plan or Modified Timber Harvesting Plans on non-industrial timberland ownerships where the landowner is not primarily engaged in the manufacture of wood products and where the approved plan or amendment to the plan evaluates and provides for a discussion of intended biomass operations and byproducts that may have potential significant adverse impacts, evaluates potential significant impacts, and mitigates potential significant impacts.
4) Operations with a total estimated volume of 250 bone dry tons or less.

These projects will need to submit a certification form (Appendix D) and be compliant with other applicable federal, state and local laws.

Certification, Verification and Monitoring to Determine Biomass/Byproduct Eligibility Requirements

Certification: For projects on private timberlands, completion of the "Forest Biomass Sustainability Byproduct Form (Appendix C-2)" by a Registered Professional Forester as defined in Title 14 of the California Code of Regulations, Chapter 10 is recommended. Representations of the Registered Professional Forester in completion of the form and certification will be subject to the disciplinary guidelines as described in Public Resources Code Sections 774-779 and the provisions of the California Code of Regulations, Chapter 10, Sections 1612-1614.

For federal projects certification will be completed by the appropriate federal officer with authority to approve project decisions pursuant to Forest Service Manual 2400 and all subtitles. Representatives with responsibility for accuracy of the certification are subject to personnel procedures outlined in Code of Federal Regulations Title 5, Subpart 430, Performance Management.

Certification by the Registered Professional Forester or appropriate federal representative should be completed utilizing the certification form included in Appendix D. It is expected that each project will have an identifier, map, certification relative to fuel source and an estimated volume by fuel source category or categories.

Verification: The owner/operator of the bioenergy facility will be responsible for verifying that the fuel has been appropriately certified. Trip tickets and loads origin will demonstrate a chain-of-custody to the project source. Information shall be available at the bioenergy facility for audit.

Monitoring for Compliance with Eligibility Criteria: It is recommended that a random audit procedure be established to ensure compliance with program requirements. The consequences for failure to comply should be discussed and developed collaboratively between the CPUC, appropriate federal agencies and CAL FIRE.

Recommended Audit Period and Remediation: It is also recommended that for purposes of verifying that an individual biomass facility is securing supplies from eligible biomass feedstock sources in a proportion consistent with the targets, the compliance with biomass feedstock supply mix criteria shall be determined based on a 5-year rolling average. It is also recommended that CPUC staff develop a process or processes that bring the biomass feedstock supply mix into conformance with the eligibility requirements, if it is determined that a given facility is out of compliance. A process for facilities to alter the eligible biomass feedstock mix should also be developed.

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APPENDIX A

Society of American Foresters: The Dictionary of Forestry

(sustainable forestry) (SFM) *this evolving concept has several definitions* **1.** the practice of meeting the forest resource needs and values of the present without compromising the similar capability of future generations —*note* sustainable forest management involves practicing a land stewardship ethic that integrates the reforestation, managing, growing, nurturing, and harvesting of trees for useful products with the conservation of soil, air and water quality, wildlife and fish habitat, and aesthetics (UN Conference on Environment and Development, Rio De Janeiro, 1992) **2.** the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality, and potential to fulfill, now and in the future, relevant ecological, economic, and social functions at local, national, and global levels, and that does not cause damage to other ecosystems (the Ministerial Conference on the Protection of Forests in Europe, Helsinki, 1993) —*note* criteria for sustainable forestry include (a) conservation of biological diversity, (b) maintenance of productive capacity of forest ecosystems, (c) maintenance of forest ecosystem health and vitality, (d) conservation and maintenance of soil and water resources, (e) maintenance of forest contributions to global carbon cycles, (f) maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs of societies, and (g) a legal, institutional, and economic framework for forest conservation and sustainable management (Montréal Process, 1993) —*see* biological legacy, certify, chain of custody, criteria and indicators, criterion, ecosystem management.

This definition last updated 10/23/2008.

APPENDIX B

United States Department of Agriculture: Forest Service: “*National Report on Sustainable Forests”, June 2011 (* FS-979).

Sustainable forest management definition:
The stewardship and use of forests and forest lands in such a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, and vitality, and forest’s potential to fulfill, now and in the future, relevant ecological, economic, and social functions at local, national, and global levels, and not cause damage to other ecosystems.
The criteria and indicators are intended to provide a common understanding of what is meant by sustainable forest management. They provide a framework for describing, assessing, and evaluating a country’s progress toward sustainability at the national level and include measures of:

1. Conservation of biological diversity.
2. Maintenance of productive capacity.
3. Maintenance of forest ecosystem health.
4. Conservation and maintenance of soil and water resources.
5. Maintenance of forest contribution to global carbon cycles.
6. Maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs of society.
7. Legal, institutional, and economic frameworks for forest conservation.

APPENDIX C - 1

SB1122 Forest Biomass

Forest Biomass Sustainability Byproduct Eligibility Form:

Instructions and Worksheet

Instructions

Projects which fall into the Fuel Reduction, Fire Safe Clearance, and Infrastructure categories as defined under sustainable forest management are presumed to be eligible and are not required to fill out Appendix C-2. Projects which meet the sustainable forest management criteria, but are exempt from submitting Appendix C-2 must still meet the minimum sustainability criteria outlined in Appendix C-2. Projects conducted under "I", 'ii", "iii" or "iv" (including exempt projects) must submit a certification form (Appendix D).

With the exception of projects types noted below, forest management activities not associated with forest biomass categories "i", "ii", and "iii", referenced below, will require use of the Forest Biomass Sustainability Byproduct Eligibility Form (Appendix C-2) to determine if the biomass generated by the project is eligible, and meets the criteria of Sustainable Forest Management Practices under PUC 399.20.

Ranking criteria have been developed to reflect and support the broad criteria described within the above referenced definition of Sustainable Forest Management. Evaluations, completed by a Registered Professional Forester or appropriate federal officer with exceptions noted herein, must be on a project-by-project basis upon an assessment of the applicable management practices.

Eligible Forest Biomass Categories

*i. **Fire Threat Reduction** - biomass feedstock which originates from fuel reduction activities identified in a fire plan approved by CAL FIRE or other appropriate, state, local or federal agency. On federal lands this includes fuel reduction activities approved under36 CFR 220.6(e)(6)ii and (12) thru (14).*

*ii. **Fire Safe Clearance Activities** - biomass feedstock originating from fuel reduction activities conducted to comply with PRC Sections 4290 and 4291. This would include biomass feedstocks from timber operations conducted in conformance with 14 CCR 1038(c) 150' Fuel Reduction Exemption,* as well as projects that fall under 14 CCR 1052.4 (Emergency for Fuel Hazard Reduction), 14 CCR 1051.3-1051.7 (Modified THP for Fuel Hazard Reduction), and 14 CCR 1038(i) Forest fire Prevention Exemption, Categorical exclusions on federal lands approved under 36 CFR 220.6.(e).(6)ii.,

*iii. **Infrastructure Clearance Projects** - biomass feedstock derived from fuel reduction activities undertaken by or on behalf of a utility or local, state or federal agency for the purposes of protecting infrastructure including but not limited to: power lines, poles, towers, substations, switch yards, material storage areas, construction camps, roads, railways, etc. This includes timber operations conducted pursuant to 14 CC1104. 1(b),(c),(d),(e),(f) &(g).*

*iv. **Other Sustainable Forest Management** – biomass feedstock derived from sustainable forest management activities that accomplish one or more of the following: 1) forest management applications that maintain biodiversity, productivity, and regeneration capacity of forests in support of ecological, economic and social needs, 2) contributes to forest restoration and ecosystem sustainability,* *3) reduces fire threat through removal of surface and ladder fuels to reduce the likelihood of active crown fire and/or surface fire intensity that would result in excessive levels of mortality and loss of forest cover or, 4) contributes to restoration of unique habitats within forested landscapes.*

The following project types meet the sustainable forest management criteria and are <u>exempted</u> from submitting the Forest Biomass Sustainability Form (Appendix C-2)

1) Sustainable Forest Management projects implemented on state, federal, and private ownership which involve meadow restoration, restoration of wetlands, restoration of aspen and other similar activities which are undertaken for restoration purposes and are subject to environmental review under CEQA or NEPA.
2) Operations conducted pursuant to an approved Non-Industrial Timber Management Plan where the plan or amendment to the plan evaluates and provides for a discussion of intended biomass operations and byproducts that may have potential significant adverse impacts, evaluates potential significant impacts, and mitigates potential significant impacts.
3) Operations conducted pursuant to an approved Timber Harvesting Plan or Modified Timber Harvesting Plans on non-industrial timberland ownerships where the landowner is not primarily engaged in the manufacture of wood products and where the approved plan or amendment to the plan evaluates and provides for a discussion of intended biomass operations and byproducts that may have potential significant impacts, evaluates potential significant impacts, and mitigates potential significant impacts.
4) Operations with a total estimated volume of less than 250 bone dry tons.

<u>Section I</u>

Ownership Category: identify if the parcel on which the project is conducted is owned by a private entity, the state or the Federal Government
Number of Acres: Identify how many acres are being treated / harvested by the project
Type of Harvest Document (if applicable): Identify the type of harvest document, State Permit, Federal Permit or exemption that apply to this project
Harvest Document Designator: Identify the State or Federal entity that issued the harvest permit, exemption or other document that applies to this project
Facility Identifier: Provide the identifier for the SB1122 (or other) forest biomass facility which will receive and utilize the forest waste (biomass) to generate energy.

<u>Section II</u>

To qualify under forest biomass category **"iv"**, treatment activities must provide co-benefits for at least 12 of the 16 items identified in Appendix C-2, Section II, Items A – E. In addition, at least one item must come from each of Section II A – D. A Registered Professional Forester should determine if planned activities meet the sustainability criteria under section "iv".

APPENDIX C - 2

Forest Biomass Sustainability Byproduct Eligibility Form

SECTION I

Ownership Category: ☐ Private ☐ State ☐ Federal Number of Acres: ________

Type of Harvest/NEPA Document: ______________Harvest/NEPA Document Designator: ____________

Facility Identifier: ______________

SECTION II

Note: Please keep responses brief (under 250 words) and focused on the basis for the determination that the project will support sustainability of the specific objective. In lieu of providing a written response or in addition to the written response, where appropriate provide source references to the approved harvest/NEPA document where discussion of potential significant adverse impacts, evaluation and mitigation measures are provided.

A. Habitat, Temporal and Spatial Diversity Objectives (Pick all that apply)

☐ Openings for shade intolerant species were created to promote regeneration and habitat diversity.
Please describe percent and distribution of areas in small openings less than 2.5 acres in size and planned regeneration methods:

____

____

☐ Multi-age, multi-species tree habitats were created at the project level.
Please describe how the project immediately post harvest will support maintenance, enhancement and/or restoration of canopy cover and maintain or increase the QMD of an overstory of multi-age, multi-species tree habitats.

____

____

☐ Understory vegetation was retained and distributed across the project site consistent with fire threat reduction and habitat objectives and contributes to spatial heterogeneity by varying treatments to retain untreated patches, openings and widely spaced single trees and clumps.
Please describe objectives for retention of understory shrubs and trees and estimate post-harvest areas of untreated patches and openings.

____

563 B. <u>Habitat Elements</u>: (Pick all that apply)

☐ Snags are retained consistent with safety, FPRs, and fire threat reduction goals.
<u>Please describe post harvest snag retention objectives and estimate the percentage of existing snags to be removed as part of the planned forest management activities.</u>

☐ Down logs with benefit to habitat diversity are retained consistent with fire threat reduction goals.
<u>Please describe project treatment objectives for retention of existing or project related down woody material.</u>

☐ Large hardwoods and Legacy trees are retained as post treatment stand components and habitat.
<u>Please describe post harvest retention objectives for hardwoods and legacy trees.</u>

☐ Management practices and harvesting associated with the project impacts are consistent with objectives of retaining or recruiting large trees at the project and landscape level.
<u>Please describe post harvest old growth tree retention objectives:</u>

564 C. <u>Forest Health and Fire Management Objectives</u>: (Pick all that apply)

☐ Fire threat is reduced through treatment of ladder fuels and surface fuels to achieve reduction in incidence of crown torching in overstory trees and to avoid active crown fires under most conditions.
<u>Please describe post harvest spatial arrangement objectives for retention of understory shrubs and trees in relation to overstory trees.</u>

☐ Outcomes support reintroduction of prescribed fire.
<u>Please describe, if applicable post harvest surface and ladder fuel conditions and proposed use of prescribed fire.</u>

☐ Improvement of overall forest health through reduction in overstocking in small tree sizes and reduction of competition for soil moisture with overstory trees.
Please describe:

565 D. Air and Water Quality Protection: (Pick all that apply)

☐ Avoided emissions by eliminating need for open burning of slash piles and/or decomposition.
Please describe the relative reduction in emissions attributable to removal of material from the project site for use as fuel for energy generation in comparison to piling and burning or piling and decomposition.):

☐ Measures have been incorporated to address moist microsites, and near stream habitats.
Please describe what measures will be employed to protect moist microsites and near-stream habitats.

☐ Soil protection measures used to minimize compaction and loss of A-horizons and soil carbon. Please describe.

☐ Operational plans provide for the retention of fine woody debris to minimize potential threats to soil productivity and meet fire threat reduction objectives. Please describe.

566 E. Societal and Economic Benefits: (Pick all that apply)

☐ Project contributes to societal benefits of local communities by way of fire safety, improved environmental health and overall quality of life. Please describe.

☐ Project contributes to local economies by way of providing additional local employment opportunities and investment.
Please describe .

APPENDIX D **SB1122 Forest Biomass**

Project Eligibility Certification

Ownership Category: ☐ Private ☐ State ☐ Federal Number of Acres: __________
Type of Harvest/NEPA Document: ____________ Harvest/NEPA Document Designator: _____________
Facility Identifier: __________________RPF License Number (if Applicable): ______________

Eligible Fuel Source: (Pick one)

To meet the eligible fuel sourcing criteria the owner or operator must ensure that biomass feedstock from any project is sourced from one or more of the following project types:

☐ ***Fire Threat Reduction*** *- biomass feedstock which originates from fuel reduction activities identified in a fire plan approved by CAL FIRE or other appropriate, state, local or federal agency, Categorical exclusions on federal lands approved under 36 CFR 220.6.(e).(6)ii.*

☐ ***Fire Safe Clearance Activities****- biomass feedstock originating from fuel reduction activities conducted to comply with PRC Sections 4290 and 4291. This would include biomass feedstocks from timber operations conducted in conformance with 14 CCR 1038(c) 150' Fuel Reduction Exemption, or Categorical exclusions on federal lands approved under36 CFR 220.6(e)(6)ii and (12) thru (14).*

☐ ***Infrastructure clearance projects****- biomass feedstock derived from fuel reduction activities undertaken by or on behalf of a utility or local, state or federal agency for the purposes of protecting infrastructure including but not limited to: power lines, poles, towers, substations, switch yards, material storage areas, construction camps, roads, railways, etc. This includes timber operations conducted pursuant to 14 CC1104.1(b),(c),(d),(e),(f) &(g).*

☐ ***Other Sustainable Forest Management**** *– biomass feedstock derived from sustainable forest management activities that accomplish one or more of the following: 1) forest management applications that maintain biodiversity, productivity, and regeneration capacity of forests in support of ecological, economic and social needs, 2) contributes to forest restoration and ecosystem sustainability, 3) reduces fire threat through removal of surface and ladder fuels to reduce the likelihood of active crown fire and/or surface fire intensity that would result in excessive levels of mortality and loss of forest cover or, 4) contributes to restoration of unique habitats within forested landscapes.*

Other Fuel Sources:

Eligible fuel from this category includes the following:

☐ *biomass feedstocks derived from other forest management activities that fail to meet the requirements of the checklist found in Appendix "C".*

☐ *biomass feedstocks that will be used at the facilities from " other " waste streams covered by SB 1122*

I hereby certify that the information contained in this certification is complete and accurate to the best of my knowledge and conforms to State and Federal Laws,

Print Name:_______________________________ Signature:________________________________

As appropriate attach Forest Biomass Sustainability Byproduct Eligibility Form.

*** The following project types are assumed to meet the sustainable forest management criteria and are exempted from completing the Forest Biomass Sustainability Form (Appendix C-2)**

1) Sustainable Forest Management projects implemented on state, federal, and private ownership which involve meadow restoration, restoration of wetlands, restoration of aspen and other similar activities which are undertaken for restoration purposes and are subject to environmental review under CEQA or NEPA.
2) Operations conducted pursuant to an approved Non-Industrial Timber Management Plan where the plan or amendment to the plan evaluates and provides for a discussion of intended biomass operations and byproducts that may have potential significant adverse impacts, evaluates potential significant impacts, and mitigates potential significant impacts.
3) Operations conducted pursuant to an approved Timber Harvesting Plan or Modified Timber Harvesting Plans on non-industrial timberland ownerships where the landowner is not primarily engaged in the manufacture of wood products and where the approved plan or amendment to the plan evaluates and provides for a discussion of intended biomass operations and byproducts that may have potential significant adverse impacts, evaluates potential significant impacts, and mitigates potential significant impacts.
4) Operations with a total estimated volume of less than 250 bone dry tons.