

BIOMASS FEEDSTOCK SUPPLY REVIEW FOR THE EAST BAY HILLS

**Prepared for:
Hills Emergency Forum**



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INTRODUCTION

The Hills Emergency Forum (HEF) is a consortium of land management agencies and fire districts with a mission to coordinate and share information in support of hazardous fuels reduction in the East Bay Hills. HEF members are actively engaged in the removal and disposal of hazardous fuels. HEF was formed just after the 1991 Tunnel Fire that destroyed over 3,250 residences and killed 25 people.

Current hazardous fuels disposal methods include use as landscape cover, open burning, chip and scatter, stockpiling and landfill delivery. Several HEF members are planning to ramp up fuels reduction efforts as a result of two upcoming FEMA fire mitigation grants. In addition, recent state legislative initiatives (Senate Bill 1122) provide a potential opportunity to secure power sales contracts for delivery of renewable power from small-scale biomass power generation facilities.

HEF has asked TSS to provide a review of biomass feedstock supply that could be utilized for value-added processes such as power generation. The Target Study Area (TSA) for the East Bay Hills is Alameda and Contra Costa counties. Woody biomass material generated within an urban area such as the East Bay Hills TSA will include:

- Construction and demolition wood
- Residential tree trimmings and other green waste
- Fuels reduction residuals (trees, brush)

TSS interviewed land managers, tree service companies, biomass processors and biomass fuel procurement managers to ascertain current plans to manage woody biomass material generated within the TSA.

FINDINGS

Outlined below are findings from the biomass supply availability review.

Biomass Feedstock Supply

Summarized below in Table 1 is the TSS estimate of biomass supply considered technically available on an annual basis from within the East Bay Hills Target Study Area (Alameda and Contra Costa counties).

Table 1. Summary of Biomass Supply Technically Available

BIOMASS FEEDSTOCK TYPE	ESTIMATED VOLUME GENERATED (BDT/YEAR)
Construction and Demolition	316,842
Residential Tree Trimmings	82,949
Fuels Reduction Residuals	12,929
TOTAL	412,720

While TSS findings estimate over 400,000 BDT per year of wood waste technically available within the TSA, it should be noted that the current fate for much of this wood waste includes:

- Compost and mulch (soil amendment market)
- Landscape cover
- Firewood
- Fuel for power generation
- Alternative daily cover (landfill)
- Pile and burn
- Chip and scatter

Value-added use such as feedstock for a small-scale (three megawatts or less) biomass power generation facility could provide an alternate market with enough value to at least recover the cost of transporting wood waste within the TSA.

Potential Biomass Power Siting Locations

As a result of interviews with area land and resource managers, four potential locations for a small-scale biomass power generation facility appear to be promising.¹

- Oakland Army Base (adjacent to East Bay MUD waste water treatment facility)
- City of El Cerrito waste transfer station
- Professional Tree Care Company wood collection yard at Richmond
- UC Berkeley, Richmond Field Station

¹ Note that a detailed assessment of siting opportunities is outside the scope of this project.

ENVIRONMENTAL SETTING

Woody biomass availability for any given region is dependent on vegetation cover, topography, land ownership, management objectives, and urban resident population. This biomass supply availability review focused on these key factors within the context of the East Bay Hills TSA – Alameda and Contra Costa counties.

Land Ownership

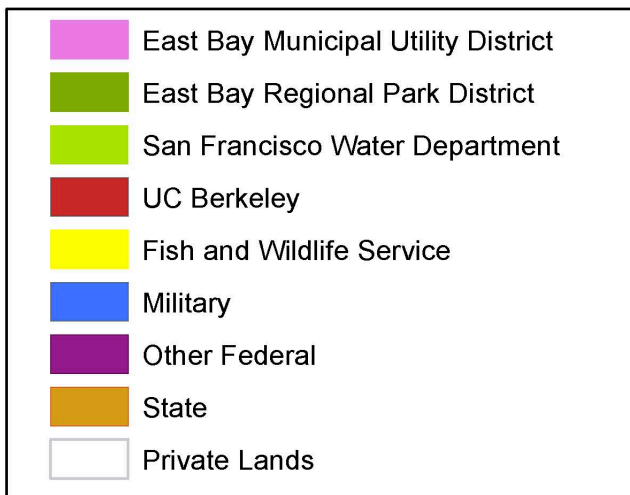
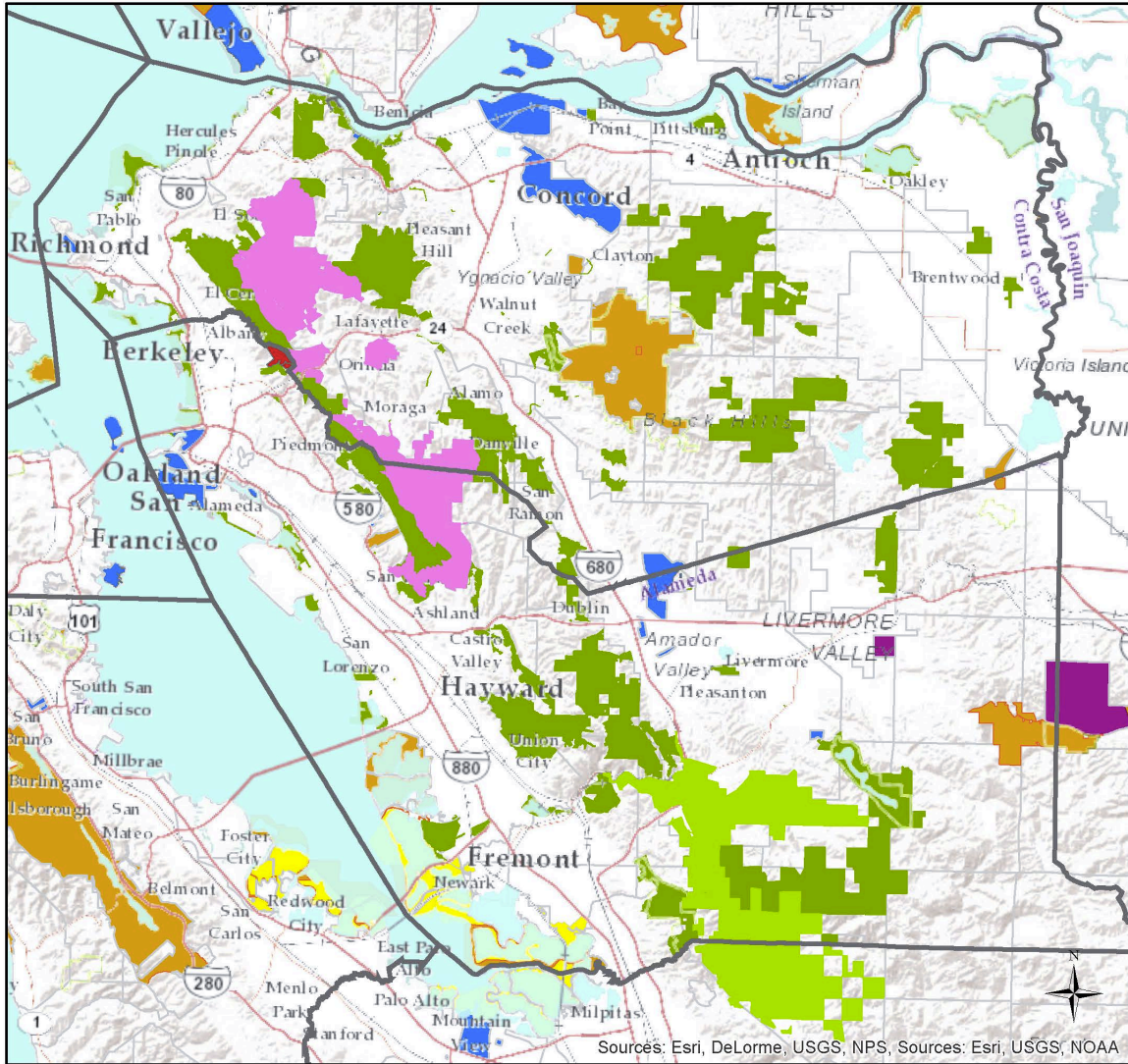
Major public landowners were mapped (Figure 1) and their acreages calculated using ARCGIS software. The public landowner categories are not comprehensive; for example, land ownership by individual city is not included. Public landowners with large acreage holdings of open land were selected to provide an overview of ownership patterns. Land cover was mapped from multiple sources, including BLM Land Surface Estates for federal holdings, East Bay Municipal Utility District, East Bay Regional Park District, San Francisco Public Utility District, and UC Berkeley.

Acreages for public landowners are shown in Table 2. Percent ownership was calculated as the percent of owned land as a portion of the entire TSA. The TSA, Alameda and Contra Costa counties, has 1,040,000 acres in its entirety. Large public landholders in the East Bay constitute about 22% of the total land area. The East Bay Regional Park District is the largest among the public entities with 11.3% of the land in the TSA.

Table 2. Ownership and Acreages for Major Public Landowners in the East Bay

OWNERSHIP	CONTRA COSTA & ALAMEDA COUNTIES		
	ACRES	ACRES	PERCENT
East Bay Municipal Utilities District	27,870		2.7%
East Bay Regional Park District	117,628		11.3%
San Francisco Public Utilities Department	23,534		2.3%
University of California, Berkeley	526		0.1%
State of California	31,633		3.1%
<i>Department of Fish and Wildlife</i>		6063	
<i>Department of Parks and Recreation</i>		21,939	
<i>State Lands Commission</i>		1,107	
<i>Other State</i>		2524	
Federal Government	29,902		2.9%
<i>U.S. Fish and Wildlife</i>		13,422	
<i>Bureau of Land Management</i>		73	
<i>Department of Energy</i>		1,754	
<i>Military</i>		14,275	
<i>National Park Service</i>		368	
<i>Bureau of Indian Affairs</i>		10	
TOTAL	231,093		22.2%

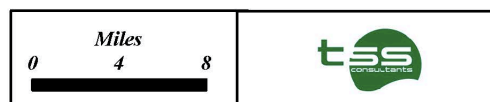
Figure 1. Major Public Landowners



**East Bay
Public Land Ownership**

*Data Sources:
BLM Surface Estates, 2014
EBMUD, EBRPD, UC Berkeley, SFWD*

*Date:
May, 2016*



Vegetation Cover

The major vegetation cover classes were mapped and their acreages calculated using ARCGIS software. The dominant vegetation cover classes were not broken into subcategories, except where a subclass could be of interest to HEF project goals. For example, redwood forest within the conifer forest and specific shrub subclasses relevant for wildland fire dynamics. The non-forest category is mostly comprised of herbaceous cover, in particular annual grasslands. Percent vegetation type cover is calculated as the percent of land in the vegetation type within the entire TSA. The East Bay TSA has 1,040,000 acres in its entirety.

Vegetation types were mapped from the CAL FIRE vegetation classification for the state of California, FVEG15_1 (new 2015 version²). As Figure 2 shows, the East Bay is highly urbanized, yet patches of natural vegetation cover exist. Table 3 provides an acreage summary of the major vegetation cover types found in the TSA. Almost 67.3% of the area is mapped as natural vegetation as opposed to developed land by CAL FIRE. There is a sizable area classed as annual grassland, almost 43% of the East Bay. Oak woodlands, both blue oak woodland and coastal oak woodland, occur on about 15% of the land area.

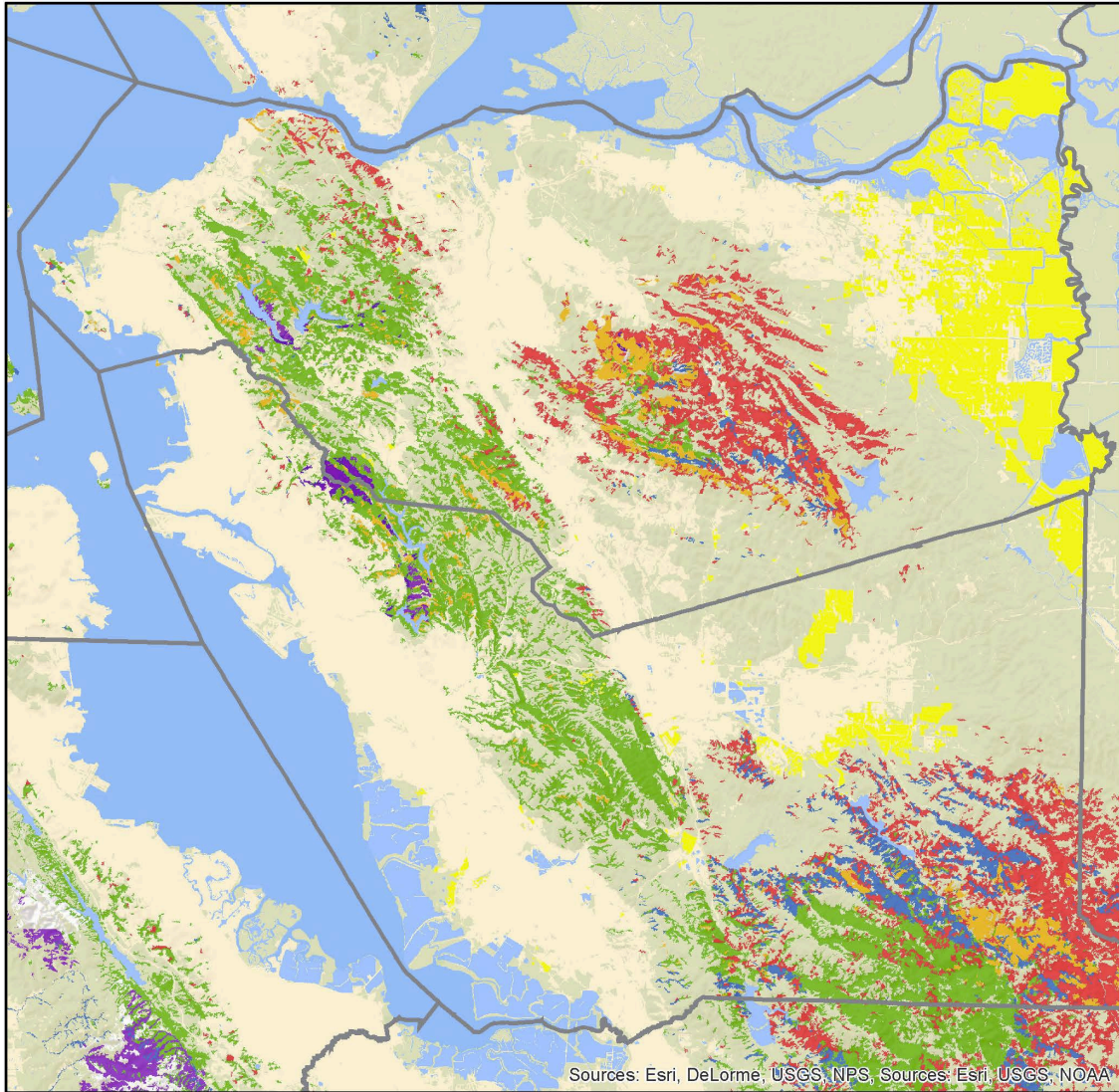
Table 3. Major Vegetation Types in the East Bay


VEGETATION TYPE	CONTRA COSTA & ALAMEDA COUNTIES		
	ACRES	ACRES	PERCENT*
Conifer Forest	3,274		0.3%
<i>Redwood</i>		867	
Shrub	20,506		2.0%
<i>Chamise-Redshank Chaparral</i>		8,835	
<i>Coastal Scrub</i>		5,376	
<i>Mixed Chaparral</i>		6,295	
Blue Oak Woodland	61,454		5.9%
Coastal Oak Woodland	93,222		9.0%
Montane Hardwood	17,833		1.7%
Non-Forest	442,793		42.6%
<i>Annual Grassland</i>		341,256	
Agriculture	60,398		5.8%
TOTAL	699,480		67.3%

*Percent is calculated as percent land ownership within the entire East Bay area of Alameda and Contra Costa counties.

² CAL FIRE, Fire and Resource Assessment Program (FRAP); http://frap.fire.ca.gov/data/frapgisdata-sw-fveg_download

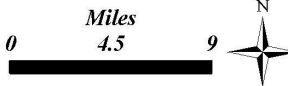
Figure 2. Vegetation Cover Map





East Bay Vegetation Cover
SOURCE: Cal Fire FVeg
2015 Vegetation Map

Miles
0 4.5 9



Land Cover Classes		
	Agriculture	
	Conifer Forest	
	Shrub	
		
		
		
	Contra Costa and Alameda County Borders	

BIOMASS FEEDSTOCK SUPPLY ANALYSIS

With an understanding of vegetation types, landownership and resident population within the TSA, TSS conducted a biomass feedstock supply analysis. Outlined below are the methodologies used to generate feedstock supply estimates and annual wood waste estimates generated as a result of the analysis. Note that the common unit of measure for wood waste is bone dry ton (BDT).³

Construction and Demolition Wood

Wood waste generated by local residents, businesses, and construction projects within the TSA regularly produce wood waste in the form of construction debris, demolition wood, and industrial byproducts (e.g., wood pallets). Based on TSS’ experience and research on urban wood waste generation, approximately 11.5 pounds per capita of waste are generated daily with 10.5 percent of the solid waste stream made up of wood waste. Urban wood feedstock is assumed to have a 20 percent moisture content factor.⁴ Approximately 65 percent of the total potential volume of urban wood feedstock is recoverable as clean⁵ wood waste and is considered technically available. Table 4 summarizes construction and demolition wood waste considered technically available.

Table 4. Construction and Demolition Wood Waste

COUNTY	COUNTY 2015 POPULATION	WOOD WASTE VOLUME (LBS/YEAR)	WOOD WASTE FEEDSTOCK (BDT/YEAR)
Alameda	1,638,215	577,618,227	288,809
Contra Costa	1,126,745	397,279,020	198,640
POTENTIALLY AVAILABLE			487,449
ADJUSTMENT FOR RECOVERY			- 170,607
TECHNICALLY AVAILABLE			316,842

Residential Tree Trimming Material

Working from previous studies performed by TSS, it is estimated that approximately 100 dry pounds of residential tree trimmings suitable for feedstock are generated annually per capita. TSS assumes approximately 60 percent of this wood waste is recoverable⁶ as biomass feedstock. Table 5 summarizes residential tree trimming material considered technically available.

³ One bone dry ton represents 2,000 dry pounds of wood.
⁴ From TSS’ experience procuring urban wood waste feedstocks.
⁵ Clean wood waste is woody debris that is free of paint, resins, pesticides or chemical treatment.
⁶ From TSS’ experience procuring urban wood waste feedstocks.

Table 5. Residential Tree Trimming Material

COUNTY	COUNTY 2015 POPULATION	TREE TRIMMING VOLUME (DRY LBS/YEAR)	TREE TRIMMING FEEDSTOCK (BDT/YEAR)
Alameda	1,638,215	163,821,500	81,911
Contra Costa	1,126,745	112,674,500	56,337
POTENTIALLY AVAILABLE			138,248
ADJUSTMENT FOR RECOVERY			- 55,299
TECHNICALLY AVAILABLE			82,949

Fuels Reduction Residuals

Interviews with land and natural resource managers representing major land ownerships within the TSA yielded data regarding acres targeted for treatment over the next five years. TSS (with help from HEF staff)⁷ issued a data request survey form (Appendix A). Using survey form results and field visits to the East Bay hills to view acreage targeted for fuels treatment activities, TSS was able to analyze potential fuels reduction availability. Almost 400 acres of the total acres targeted for treatment in the next five years (see Table 6) are likely to be treated as a direct result of a FEMA grant that primarily targets high hazard eucalyptus dominated sites. In addition to large landowners conducting fuels reduction, there are smaller ownerships actively treating landscapes at risk to wildfire and this is reflected in the “other ownerships” category listed in Table 6. Not all fuels treatment residuals will be accessible for removal due to topography, road systems, and onsite biomass retention standards. For the purpose of this analysis, TSS assumes that 70% of the volume targeted for removal is technically available.

Table 6. Fuels Reduction Residuals

LANDOWNER	ACRES TARGETED FOR TREATMENT	BIOMASS VOLUME REMOVED (BDT/YEAR)
East Bay Municipal Utility District	315	11,220
East Bay Regional Parks	395	2,050
UC Berkeley	70	2,200
Other Ownerships	500	3,000
POTENTIALLY AVAILABLE	1,280	18,470
ADJUSTMENT FOR RECOVERY		- 5,541
TECHNICALLY AVAILABLE		12,929

⁷ Cheryl Miller.

BIOMASS SUPPLY AVAILABILITY

Summarized below in Table 7 is the TSS estimate of biomass supply considered technically available on an annual basis from within the East Bay Hills TSA.

Table 7. Biomass Supply Technically Available

BIOMASS FEEDSTOCK TYPE	ESTIMATED VOLUME GENERATED (BDT/YEAR)
Construction and Demolition	316,842
Residential Tree Trimmings	82,949
Fuels Reduction Residuals	12,929
TOTAL	412,720

While TSS findings suggest that there are over 400,000 BDT per year of wood waste technically available within the TSA, it should be noted that the current fate for much of this wood waste includes:

- Compost and mulch (soil amendment market)
- Landscape cover
- Firewood
- Fuel for power generation
- Alternative daily cover (landfill)
- Pile and burn
- Chip and scatter

Value-added use such as feedstock for a small-scale bioenergy facility (3 megawatts or less) could provide an alternate fate with enough value to at least recover the cost of transporting wood waste within the TSA. In many cases, an alternative use to alternative daily cover (landfill) or pile and burn will be a net positive outcome that extends landfill life while mitigating greenhouse gases. Air emissions studies⁸ demonstrate a clear reduction in net air emissions by diverting woody biomass to controlled combustion or gasification facilities for production of renewable power.

Over the last three decades, woody biomass material from the East Bay has been transported to biomass power plants at Antioch, Tracy, Woodland and Stockton. Power plants at Tracy and Antioch have reached the end of their power sales agreement with PG&E and are no longer operational. Woodland Biomass will reach the end of their power sales agreement in 2020 and will likely curtail operations at that time. The DTE Energy facility at Stockton will continue to procure fuel for some time, as their power sales agreement terminates in 2038. However, DTE will likely procure fuel from sources located close to Stockton once Woodland Biomass closes in order to minimize transport costs.

⁸ Placer County Air Pollution Control District sponsored studies in 2010 and 2013. <https://www.placer.ca.gov/departments/air/apcdbiomass>

RECOMMENDATIONS

Summarized below are recommendations regarding potential site locations for value-added processing of wood waste and suggestions for next steps to consider (phase II).

Biomass Power Generation as a Value-Added Use

There are a number of value-added alternatives to consider. However, biomass power generation shows considerable promise due to recent California policy implementation as a result of Senate Bill 1122. This legislation was signed into law in September 2012 and carves out 250 megawatts for biomass power generation within the state, requiring the investor-owned utilities (PG&E, Southern California Edison, and San Diego Gas and Electric) to implement procedures for long-term biomass power purchases. Biomass power generation facilities compliant with SB 1122 must be scaled at 3 megawatts or less and utilize certain types of biomass material (urban wood, food waste, agricultural byproducts or forest material). The urban wood waste category (recommended) has been allocated 110 megawatts out of the 250 megawatt total allocation (see Appendix B for additional information).

If biomass power generation is a targeted value-added use, then a key siting attribute to consider will be location of power distribution infrastructure relative to candidate sites listed below.

Potential Value-Added Site Locations

Interviews with resource managers, tree service companies and fuel procurement managers concluded that the following four locations show promise as potential value-added utilization sites:

- Oakland Army Base (adjacent to East Bay MUD waste water treatment facility)
- City of El Cerrito Recycling Center
- Professional Tree Care Company wood collection yard at Richmond
- UC Berkeley, Richmond Field Station

Next Steps

A key finding of this biomass feedstock supply analysis is that biomass availability within Alameda and Contra Costa counties is significant and will likely increase in the next few years as existing biomass power plants curtail operations. If the HEF decides that the SB 1122 business model bears additional research, TSS suggests the following Phase II set of tasks.

- Meet with key area compliance agencies (e.g., Bay Area AQMD) to brief them regarding interest in a small-scale biomass power facility.
- Conduct a siting assessment to confirm and rank candidate locations based on key site attributes including:
 - Location relative to existing power distribution system.
 - Road system that will accommodate commercial truck traffic.
 - Land use zoning that will allow power generation.
 - At least two acres of flat, usable land.

- Secondary considerations:
 - Is there an onsite use for heat and/or power?
 - Are there sensitive neighbors?
 - Water availability?
- Biomass feedstock procurement plan:
 - Confirm current market value of biomass feedstock delivered to the #1 ranked site.
 - Assess current competition (if any) for targeted biomass feedstock supply.
 - Analyze current biomass market conditions and the top 10 potential biomass feedstock suppliers. Rank the potential suppliers based on:
 - Ability to deliver high quality feedstock.
 - Ability to deliver cost effective feedstock.
 - Financial stability.
 - Commence discussions with top-ranked biomass suppliers.
 - Secure letters of interest to provide feedstock long term.
 - Develop short-term and long-term feedstock purchase agreements.
 - Generate a detailed feedstock procurement plan with implementation schedule.
- Attract project development partner. Use candidate site location findings and fuel procurement plan as risk assessment documents to commence discussions with promising project developers.
 - Interview and rank potential project development partners and assess their ability to build, own, and operate a SB 1122 compliant facility within the TSA based on:
 - Proven technology.
 - Ability to meet environmental regulatory and compliance.
 - Financial stability.
 - Knowledge of tax credit incentives (e.g., New Market Tax Credits).
 - Ability to secure grant funding (helpful, but not a requirement).
 - Launch a request for information to select biomass power generation developers that are interested in developing a SB 1122 compliant project within the TSA.
 - Review and rank responses from project developers.
 - Select top ranked candidate for in-depth discussions. Issue a memorandum of agreement confirming mutual interest and outlining next steps.

Appendix A. Biomass Feedstock Supply Survey Data Request

Enterprise Name	Contact Person	Location	Comments

Is any of the vegetation planned for removal destined for pile/burn disposal?

If so, please provide estimates of tonnage that will be burned over the next five years (average tons per year estimate).

Or landfill disposal?

If so, please provide estimates of tonnage that will be sent to landfill over the next five years (average tons per year estimate).

From your experience with vegetation management, are there strategic sites or existing operations that are well suited for collocation of a small-scale biomass power operation?

Other comments or observations?

Thank you for your time and consideration,

Tad Mason, Forester, TSS Consultants
831.574.3168
tmason@tssconsultants.com

Appendix B. California Senate Bill 1122 One-Page Overview



Senate Bill 1122: Bioenergy Renewable Market Adjusting Tariff (BioMAT)

Category 1: Urban Waste

Category 1: Urban Waste

- Biogas from wastewater treatment plants
- Biogas from municipal organic waste diversion
- Biogas from food manufacturing activities
- Biogas from codigestion

Category 2: Dairy and Agricultural Waste

- Biogas generated primarily ($\geq 80\%$) from the anaerobic digestion of dairy cattle manure
- Biogas or biomass generated through agricultural or horticultural production

Category 3: Byproducts of Sustainable Forest Mgmt.

- Biomass from forest byproducts derived from fire threat reduction, infrastructure clearance projects or sustainable forest management activities.

What is SB 1122?

Senate Bill 1122 is a bioenergy specific carve out introduced by the California legislature to incubate the development of small-scale distributed generation facilities that address and support waste diversion and emissions reduction goals of the California Energy Commission, CalRecycle, and the State's Bioenergy Action Plan. The SB 1122 ReMAT is modeled after the existing ReMAT for all renewables but is exclusive to small-scale (< 3 MW) bioenergy projects. A total of 250 MW has been allocated to this program: 110 MW to urban sourced bioenergy, 90 MW to dairy and agricultural bioenergy, and 50 MW to forest sourced bioenergy.

Category 1: Urban Waste

Category 1 is intended to promote the utilization of energy feedstock generated from a diversion of organic solid wastes from disposal at solid waste landfills or transformation facilities, from where the organic solid wastes decomposable by microbial and fungal action, and from organic solid wastes generated by residential, commercial, and industrial sources or were generated at construction and demolition sites, at food-processing facilities, or at treatment works for water and waste water.

Project Participation and Project Development

Requirements to prepare for the ReMAT auction include:

- System sizing based on sustainable feedstock availability;
- Technology and vendor selection;
- Negotiate Memorandum of Understanding (MOU) for project development roles and responsibilities; and
- IOU System Impact Study for interconnection.

Additional pre-development work includes:

- Feasibility Study (if necessary);
- Review site zoning and apply for a Conditional Use Permit (CUP) if necessary;
- Contract feedstock (if necessary); and
- Detailed financial model and plan to acquire financing.

Program Eligibility*

- 1) Located in IOU territory
 - Is your site located in PG&E, SCE, or SDG&E territory?
- 2) Uses an Eligible Renewable Energy Resource
- 3) Is a FERC Qualifying Facility
- 4) Contract size is less than 3.0 MW
- 5) Interconnection Study/Strategically Located
 - Must be performed by the IOU
- 6) Site Control
- 7) Developer Experience
 - Part of the technology selection process
- 8) No Daisy Chaining
- 9) Project has not previously received solar or SGIP incentives

Price Adjustments

Starting Price: \$0.127/kWh
Adjustment 1: to \$0.131/kWh
Adjustment 2: to \$0.139/kWh
Adjustment 3: to \$0.151/kWh
Adjustment 4: to \$0.163/kWh

Adjustment occur when fewer than 20% of the allocation for an offering are subscribed when sufficient bidders are in the queue.

*Subject to PUC approval

For more information, contact TSS Consultants – Tad Mason, CEO, 916.600.4174
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