STATUS UPDATE OF CALIFORNIA'S BIOMASS POWER SECTOR

Forest Vegetation Management Conference
Jan 25, 2017

Tad Mason, CEO
TSS Consultants
Brief history and overview of California’s biomass power sector

Governor’s Oct 30, 2015 proclamation and its implications

BioRAM I

BioRAM II

Current status

SB 1122

Observations

Questions
ABBREVIATED HISTORY OF THE CALIFORNIA BIOMASS POWER SECTOR

- Forest products sector was an early adopter.
  - Market response – 60+ new biopower plants (approx. 900+ MW of generation capacity).
- Power contract buyouts.
- CA Renewable Portfolio Standard – 50% renewable by 2030.
- Currently 21 operating plants (approx. 560 MW of capacity).
- Senate Bill 1122.
- Gov’s Proclamation
- SB 859
8. The California Public Utilities Commission shall utilize its authority to extend contracts on existing forest bioenergy facilities receiving feedstock from high hazard zones.

9. The California Public Utilities Commission shall take expedited action to ensure that contracts for new forest bioenergy facilities that receive feedstock from high hazard zones can be executed within six months, including initiation of a targeted renewable auction mechanism and consideration of adjustments to the BioMat Program defined pursuant to Public Utilities Code section 399.20. No later than six months after the BioMat program begins, the California Public Utilities Commission shall evaluate the need for revisions to the program to facilitate contracts for forest bioenergy facilities.
RESPONSE TO GOVERNOR’S EMERGENCY PROCLAMATION

- **CA Legislature Response:**
  - Senate Bill 859 is signed by the Governor in Sept 2016.

- **CA PUC response:**
  - Directed investor owned utilities (PG&E, SCE, SDG+E) and publicly owned utilities (SMUD, LADWP, IID, MID, etc.) to procure power from facilities that source forest biomass using the Renewable Auction Mechanism.
  - BioRAM only applies to IOU’s and POU’s with at least 100,000 customers.
  - Target allocation is at least 180 MW.
  - Applies only to biomass power plants on line before June 1, 2013.
Power Purchase Agreements are a minimum of five years duration targeting 180 MW (minimum).

BioRAM I fuel requirements:
- 2016: 40% from HHZ
- 2017: 50% from HHZ
- 2018: 60% from HHZ
- 2019 and out: 80% from HHZ

BioRAM II fuel requirements:
- 80% from “sustainable” forest management with at least 60% from HHZ.

Fuel tracking protocols require plants to report quarterly to the IOU's.

If plants do not meet minimum fuel sourcing requirements then either the PPA is terminated or the energy price drops to $89.23/MWh.
## BIORAM I AND II FACILITIES

<table>
<thead>
<tr>
<th>FACILITY</th>
<th>SCALE (MW)</th>
<th>ANNUAL FEEDSTOCK USAGE (BDT/YEAR)</th>
<th>OPERATION DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacific Ultrapower Chinese Station</td>
<td>18</td>
<td>160,000</td>
<td>3/1/2017</td>
</tr>
<tr>
<td>Rio Bravo Fresno Biomass</td>
<td>24</td>
<td>200,000</td>
<td>1/2/2017</td>
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<tr>
<td>Rio Bravo Rocklin Biomass</td>
<td>24</td>
<td>200,000</td>
<td>1/2/2017</td>
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<tr>
<td>Burney Forest Power</td>
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<td>10/1/2017</td>
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<tr>
<td>Wheelabrator (BioRam II)</td>
<td>34</td>
<td>300,000</td>
<td>12/1/2017</td>
</tr>
<tr>
<td>Greenleaf Power / Honey Lake</td>
<td>24</td>
<td>200,000</td>
<td>1/1/2017</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>153</strong></td>
<td><strong>1,292,000</strong></td>
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</table>
# BIORAM I AND II FACILITY FUEL MANAGERS

<table>
<thead>
<tr>
<th>FACILITY</th>
<th>Fuel Manager</th>
<th>Email address</th>
<th>Phone</th>
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<tbody>
<tr>
<td>Pacific Ultrapower Chinese Station</td>
<td>Dennis Serpa</td>
<td><a href="mailto:dserpa@chinesestation.net">dserpa@chinesestation.net</a></td>
<td>209.984.4660</td>
</tr>
<tr>
<td>Rio Bravo Fresno Biomass</td>
<td>Hector Lara</td>
<td><a href="mailto:hlara@rbfresno.com">hlara@rbfresno.com</a></td>
<td>559.264.4575</td>
</tr>
<tr>
<td>Rio Bravo Rocklin Biomass</td>
<td>Eric Olsen</td>
<td><a href="mailto:eolsen@rbrocklin.com">eolsen@rbrocklin.com</a></td>
<td>916.645.3383</td>
</tr>
<tr>
<td>Burney Forest Power</td>
<td>Tom Hickman</td>
<td>thickman@burneyforest power.com</td>
<td>530.335.5023</td>
</tr>
<tr>
<td>Wheelabrator (BioRam II)</td>
<td>Gordon Bauer</td>
<td><a href="mailto:gbauer@wtienergy.com">gbauer@wtienergy.com</a></td>
<td>530.339.7626</td>
</tr>
<tr>
<td>Greenleaf Power / Honey Lake</td>
<td>Mark Shaffer</td>
<td><a href="mailto:mshaffer@greenleaf-power.com">mshaffer@greenleaf-power.com</a></td>
<td>530.254.6161</td>
</tr>
</tbody>
</table>
CURRENT OPERATING FACILITIES

- 21 biomass plants in commercial service – about 540 MW capacity.
- Utilize a blend of urban, ag and forest feedstocks. Urban feedstock is the low price leader, then ag, with forest biomass as the highest priced.
- Power Purchase Agreements for many of these facilities term out by 2020.
- Six existing plants have PPAs extended due to Governor Brown’s October 30 Proclamation and SB 859.
- 15 idle plants with about 260 MW capacity.
- Most recent entry is SPI Anderson at 31 MW.
Signed into law Sept 2012.

Bioenergy specific carve out for 250 MW of small-scale (3 MW or less) distributed generation.

- Urban sourced – 110 MW
- Dairy and other Ag sourced – 90 MW
- Forest sourced – 50 MW

Designed to address waste diversion and air emissions reduction goals of the CA Energy Commission, CalRecycle, CA Air Resources Board and the State’s Bioenergy Action Plan.

Administered by the CA Public Utilities Commission.

Initial BioMAT auction likely to take place starting February 2016.
At least 80% sourced as byproducts of “Sustainable Forest Management”
  - Sustainable Forest Management as designated by CPUC
  - Verified by third party

Other 20% of feedstock:
  - Byproducts of agricultural operations
  - Clean urban wood waste

Annual Reporting to the CPUC
  - Volume by feedstock type
Phoenix Energy 500 kWh Gasification Unit at Merced, CA
COMMUNITY-SCALE BIOPOWER FACILITY EXAMPLE – NORTH FORK COMMUNITY POWER

- 2 MW project being considered at North Fork, California.
- New plant construction cost = $10 to $12 million.
- Will consume about 46 BDT/day (approx. 1 BDT/MWh burn rate).
- Biomass transported approx. 30 - 40 miles (one way).
- Most feedstock in the early years will be cull logs from drought and beetle kill clean up/restoration.
- Commercial operations should commence Q2 2017.
- Average electrical energy economic production cost: ~ $0.15 - $0.17/kWh
## SB 1122 Projects in Early Phase Development

<table>
<thead>
<tr>
<th>Facility</th>
<th>Scale (MW)</th>
<th>Annual Feedstock Usage (BDT/Year)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Fork Community Power</td>
<td>2</td>
<td>16,000</td>
<td>North Fork</td>
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<tr>
<td>CHIPS Value-Added Product Yard</td>
<td>3</td>
<td>24,000</td>
<td>Wilseyville</td>
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<tr>
<td>Burney Hat Creek Bioenergy</td>
<td>3</td>
<td>24,000</td>
<td>Burney</td>
</tr>
<tr>
<td>Crescent Mills Wood Utilization Campus</td>
<td>3</td>
<td>24,000</td>
<td>Crescent Mills</td>
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<tr>
<td>Collins Pine</td>
<td>3</td>
<td>24,000</td>
<td>Chester</td>
</tr>
<tr>
<td>Camptonville Community Partnership</td>
<td>3</td>
<td>24,000</td>
<td>Camptonville</td>
</tr>
<tr>
<td>Nevada County Bioenergy</td>
<td>3</td>
<td>24,000</td>
<td>Grass Valley</td>
</tr>
<tr>
<td>Mariposa Biomass Project</td>
<td>2</td>
<td>16,000</td>
<td>Mariposa</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>22</strong></td>
<td><strong>176,000</strong></td>
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</tr>
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</table>
THE LONG-TERM FUTURE OF BIOMASS POWER PLANTS IN CALIFORNIA DEPENDS ON ...

- Relative price of natural gas and power.
- Environmental issues:
  - Air emissions – particulate, black carbon, etc.
  - Carbon accounting
- Technological innovation – biomass plants as dispatch-able assets. Maybe power storage?
- KEY - Monetization of societal and ratepayer benefits:
  - e.g., AB 590
Hourly Average Breakdown of Renewable Resources

This graph shows the production of various types of renewable generation across the day.

Source: HTTP://content.caiso.com
September 17, 2013
ADDITIONAL RESOURCES

Tree Mortality Viewer
http://egis.fire.ca.gov/TreeMortalityViewer/

Statewide Wood Energy Team
http://ucanr.edu/sites/swet/

Placer Co Air Pollution Control District
http://www.placer.ca.gov/departments/air/apcdbiomass

CA Biomass Energy Alliance
http://www.calbiomass.org/

Bioenergy Association of California
http://www.bioenergyca.org/

UC Division of Ag and Natural Resources
http://ucanr.edu/sites/WoodyBiomass/
Tad Mason, Forester
TSS Consultants
916.600.4174
tmason@tssconsultants.com
www.tssconsultants.com