Key Aspects of Environmental Approvals for Biomass-Fired Energy Projects

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“Mulch” to Megawatts: 25 MW Biomass Power Plant

- Water Supply: 240 gpm total (surface or well)
- 235 gpm for cooling tower
- 25 gpm boiler water makeup

- Mulch Storage:
  - 5,000 ton
  - 5 to 7 day supply
  - 275,000 ton per year
  - Fugitive dust source

- Biomass Delivery:
  - 25 to 40 trucks per day
  - 7,000 trucks per year
  - Fugitive dust source

- Ash Disposal:
  - 3,300 tons per year
  - Landfill application, concrete amendment, industrial landfill

- Ultimate specifications will be site specific

- Substation
- Reclaim Conveyor
- Hogging & Screening
- Automated Loadout
- Cooling Tower
- Stormwater Collection Pond
- Coal Storage Bed
- Fluid Bed
- 250,000 gpm
- 250 psig/950°F
- 5.33 tons/day
- 25 gpm boiler blowdown

- Exhaust Steam Turbine Generator

- Air Emissions from Existing Sources

<table>
<thead>
<tr>
<th>Emission</th>
<th>25 MW Biomass Storage Generation Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Oxide</td>
<td>290 (uncontrolled)</td>
</tr>
<tr>
<td>NOx</td>
<td>147 (controlled)</td>
</tr>
<tr>
<td>SOx</td>
<td>20</td>
</tr>
<tr>
<td>CO</td>
<td>220</td>
</tr>
<tr>
<td>PM10/PM2.5/PM1</td>
<td>22/17/6/44</td>
</tr>
<tr>
<td>PM condensable</td>
<td>74</td>
</tr>
<tr>
<td>VOC</td>
<td>74</td>
</tr>
<tr>
<td>Lead</td>
<td>0.13</td>
</tr>
<tr>
<td>Fugitive dust</td>
<td>280 (CRC)</td>
</tr>
</tbody>
</table>
Will They Love You Because You’re Green?

Key aspects of environmental approvals

- Environmental review
- Fuel supply assessment and sustainability
- Site assessments
- Air permitting and emission controls
- Water appropriation
- Wastewater discharge
- Solid waste disposal
- Public affairs
Sequence of Events for Biomass-Fired Power Project Development

Permitting timeline: allow 6 to 18 months for agency review, depending on circumstances
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Environmental Review (EIS, EAW)

- Consolidated study consisting of several individual analyses
- Varies by state or province; may also be part of PUC process
- Example triggers:
  - Capacity
  - Emissions increases
  - Wetland disturbance
- Provides for public review and comment
- A no-significant-impacts determination required before permits can be issued
Elements of Environmental Review

- Air emissions
- Water discharge
- Water supply
- **Biomass sustainability**
- Endangered species
- Traffic
- Noise, odor, dust
- Wetlands
- Historical, park, or scenic resources
Key aspects of environmental approvals

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Fuel-Supply Assessment and Sustainability

- 25 MW biomass power plant requires about 275,000 green tons per year
- Reliability requires that 3 to 5 times be available
- Dedicated biomass supply must be identified and committed to support financing (viable market must exist)
- Sustainability evaluations not prescribed
- Multiple area stakeholders could be concerned about supply
- May need to develop a management plan
- Conducting a sustainability study represents wild card in developer’s timeline
Key aspects of environmental approvals

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Site Selection

Size

- 15 to 20 acres minimum for 20 to 40 MW plant
- Driven by on-site fuel storage requirements
- Construction laydown
- Flat and dry (no wetlands)
Existing infrastructure

- Major road access
- Electrical transmission
- Water supply
- Storm and sanitary sewer
- Natural gas for startup and backup fuel
Site Selection

Local issues

• Proximity to neighbors (noise, dust, traffic)
• Airshed and watershed quality
• Zoning and land-use restrictions
• Brownfields redevelopment
• Development tax incentives
Site Assessment

– Due diligence requires “all appropriate inquiries”
– Applies to brownfields and greenfields sites
– Phase I assessment (for hazardous-waste contamination potential)
  • Performed to ASTM E1527-05 (industrial) and E2247-08 (forestland or rural property)
  • Historical document review; on-site inspection
  • Relatively inexpensive
– Phase II assessment

• If deemed necessary by Phase I assessment
• Uses soil borings and lab analysis to verify contamination
• Significantly more expensive; risk of discovery; extended timeline
Key aspects of environmental approvals

✓ Environmental review
✓ Fuel supply assessment and sustainability
✓ Site assessments
  – **Air permitting and emission controls**
  – Water supply
  – Wastewater discharge
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  – Public affairs
## Air Permitting Thresholds (PSD for Attainment Areas)

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Greenfield Site Thresholds (TPY)</th>
<th>Existing Site Thresholds (TPY)</th>
<th>25 MW Biomass-fired Generation Project Potential to Emit (TPY)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>250</td>
<td>40</td>
<td>293 (uncontrolled)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>147 (controlled)</td>
</tr>
<tr>
<td>SO₂</td>
<td>250</td>
<td>40</td>
<td>29</td>
</tr>
<tr>
<td>CO</td>
<td>250</td>
<td>100</td>
<td>220</td>
</tr>
<tr>
<td>PM/PM₁₀/PM₂.₅</td>
<td>250</td>
<td>25/15/10</td>
<td>147/147/95 (uncontrolled)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>22/17/44 (controlled)</td>
</tr>
<tr>
<td>PM condensible</td>
<td>---</td>
<td>---</td>
<td>25</td>
</tr>
<tr>
<td>VOC</td>
<td>250</td>
<td>40</td>
<td>73</td>
</tr>
<tr>
<td>Lead</td>
<td>250</td>
<td>0.6</td>
<td>0.03</td>
</tr>
<tr>
<td>CO₂</td>
<td>---</td>
<td>---</td>
<td>286,000</td>
</tr>
</tbody>
</table>

¹ PM, PM₁₀, are based on NSPS Dc limit for PM (0.1 lb/MMBtu), PM₂.₅ and PM condensible emissions are based on an EPA emission factor for SCC 10100901 (0.065 lb/MMBtu and 0.017 lb/MMBtu, respectively); NOx (0.2-0.3 lb/MMBtu uncontrolled; 0.1-0.15 controlled) and CO (0.15 lb/MMBtu uncontrolled) are based on Babcock & Wilcox information for typical performance of bubbling fluidized-bed (BFB) boilers; VOC (0.03 lb/MMBtu) and lead (0.000002 lb/MMBtu) are based on EPA BACT/LAER Clearinghouse data; SO₂ (0.02 lb/MMBtu) and CO₂ (195 lb/MMBtu) are from EPA AP-42 Table 1.6-2 [http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s06.pdf](http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s06.pdf) (*accessed April 2010*). The heat input capacity for the boiler is assumed to be 335 MMBtu/hr.
# Best Available Control Technology (BACT)

Example limits for 5–100 MW projects

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Coal-Fired</th>
<th>Wood-Fired</th>
<th>Example Control Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>0.09 lb/MMBtu</td>
<td>0.15 lb/MMBtu</td>
<td>SNCR</td>
</tr>
<tr>
<td>SO\textsubscript{2}</td>
<td>0.06 lb/MMBtu</td>
<td>0.087 lb/MMBtu</td>
<td>Venturi scrubber</td>
</tr>
<tr>
<td>CO</td>
<td>0.15 lb/MMBtu</td>
<td>0.1 lb/MMBtu</td>
<td>Catalytic oxidation</td>
</tr>
<tr>
<td>PM\textsubscript{10}</td>
<td>0.012 lb/MMBtu</td>
<td>0.025 lb/MMBtu</td>
<td>ESP or baghouse</td>
</tr>
<tr>
<td>VOC</td>
<td>0.007 lb/MMBtu</td>
<td>0.02 lb/MMBtu</td>
<td>Good combustion practice</td>
</tr>
<tr>
<td>HCl</td>
<td>---</td>
<td>0.017 lb/MMBtu</td>
<td>Spray drier absorber</td>
</tr>
</tbody>
</table>
Other Air Quality Issues

- Fugitive emissions (traffic): 25 MW plant implies 35 to 40 trucks per day for biomass delivery; fugitive emissions can be problematic

- PM$_{2.5}$ regulation being implemented
  - test method approval expected soon (mid 2010)
  - background concentrations are high (mobile sources)
  - May require complex area models to simulate photochemical
Other Air Quality Issues

- New one-hour ambient standards for NOx (100 ppm), SO₂ (50-100 ppm) will challenge many combustion projects.
- EPA proposed new “Boiler MACT” regulation April 29, 2010; will regulate hazardous air pollutants (dioxin, particulate matter, hydrogen chloride, and carbon monoxide):
  - Existing, major biomass units: 250 ppm CO (proposed)
  - New, major biomass units: 40 ppm CO; 0.008 lb/MBtu particulate (proposed)
- Rewritten CAIR rule will regulate NOx (and SO₂) to stricter levels (states east of the Mississippi River).
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Water Supply

• Demand for a 25 MW biomass power plant
  – About 215 gpm (primarily cooling tower losses)
  – Assumes dry emission controls; wet scrubbing would increase demand

• EIS will require analysis of impact of withdrawal on aquifer or surface-water source
Water Supply

• Project could trigger federal CWA requirements for intake structures (section 316b)

• Grey-water supply is innovative
  – May be POTW discharge
  – May be collocated industrial wastewater treatment discharge
  – Need to consider degree of treatment required by boiler
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✓ Water supply
  – **Wastewater discharge**
  – Solid waste disposal
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Wastewater Discharge

• Sources include:
  – Cooling-tower blowdown
  – Boiler blowdown
  – Scrubber blowdown if wet scrubber is used for air emissions control
Wastewater Discharge (cont.)

- NPDES wastewater discharge permits are site-specific
  - Anti-degradation requirements limit impacts
  - May be influenced by TMDL standards allowing no new impacts

- Stormwater management – a biomass-fired power plant site will require a stormwater permit and control system.
Wastewater Discharge (cont.)

- Strict standards could lead to a zero-liquid-discharge (ZLD) strategy
- Wastewater disposal options can have significant impacts on project feasibility or site selection
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Solid-Waste Disposal

- 25 MW biomass plant can generate 3,300 tpy of fly ash and bottom ash (assuming 1.2% ash content)

- Disposal options
  - Beneficial land application, if approved; returns nutrients to soil
  - Beneficial use as a concrete ingredient, if accepted; would save energy and landfill space
  - Landfill (least desirable option); biomass ash typically passes a TCLP test
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Public Affairs

- Don’t ignore — start early
- Determine hot-button issues before public-notice periods
- 95% of public may support project, but 5% opposition can stop you
- Work toward getting informed consent; be transparent; gain public’s trust
- Public may not like it, but if informed, can accept it
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Rich Hardegger, Barr Engineering Company

Rich is a chemical engineer with 20 years of experience in managing and executing environmental projects for utility, mining, and manufacturing facilities, with an emphasis on complex air quality permitting and compliance. He has shared leadership in Barr’s growing portfolio of biomass-fueled projects as clients seek to address renewable energy opportunities and mandates. His projects have included evaluating a biomass-fired CHP opportunity for a paper-recycling facility, assisting with permitting and compliance for RDF-fired power plants, and providing comprehensive environmental assistance for several biomass-fired food-waste-drying facilities.

Presentation slides and full paper available for download at www.barr.com/biomass