Renewable Energy Education Field Days -- Anaerobic Digester Webinars
Thermophilic Digestion

March 14, 2012
Technology - Types of Digesters

I. Total Solid Ranges:
   - Covered Lagoon: 0.5 – 3% total solids
   - Complete Mix: 3 – 10% total solids
   - Plug Flow: 10 – 13% total solids

II. Temperature Regimes:
   - Psychrophilic: 50 – 77°F
   - Mesophilic: 77 – 104°F
   - Thermophilic: 120 – 140°F
Different Temperature Regimes

- **Thermophilic**
- **Mesophilic**
- **Psychrophilic**
Existing Wisconsin Facilities

**Five Star Facility,**
Elk Mound, WI
Commissioned by HB Energy staff 2005. 69,000 MMBtu used to generate 775kW of electricity
Farmer-owned; operated by HRE

**Norswiss Facility,**
Rice Lake, WI
Commissioned by HB Energy staff 2005. 68,000 MMBtu used to generate 848kW of electricity
Farmer-owned; operated by HRE

**Wild Rose Facility,**
La Farge, WI
Commissioned by HB Energy staff 2005. 69,000 MMBtu used to generate 775kW of electricity
Farmer-owned; operated by HRE
Substrate Tank

Digester Tank

Auxiliary Boiler

Control and Pumping Station

Gas Clean-up

Engine / Genset

Interconnection
Wisconsin Thermophilic Digesters

HBE Wisconsin Digesters Annual Biogas Output

Capacity Factors: 2008 - 2011

Stargest (Five Star Dairy)  Buckeye (Wild Rose Dairy)  Norswiss
## Biogas Output

### GAS OUTPUT - MODELED VERSUS ACTUAL

<table>
<thead>
<tr>
<th></th>
<th>Modeled</th>
<th>Actual 2009-10 (8 mth period)</th>
<th>Modeled</th>
<th>Expected &amp; Tested (7 day period)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target</strong></td>
<td>100%</td>
<td>159%</td>
<td>100%</td>
<td>159%</td>
</tr>
<tr>
<td><strong>Actual above Modeled</strong></td>
<td>0%</td>
<td>59%</td>
<td>0%</td>
<td>59%</td>
</tr>
<tr>
<td><strong>Manure Gal/day</strong></td>
<td>46,968</td>
<td>46,968</td>
<td>36,000</td>
<td>36,000</td>
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<tr>
<td><strong>Substrate Gal/day</strong></td>
<td>6,770</td>
<td>6,770</td>
<td>12,000</td>
<td>12,000</td>
</tr>
<tr>
<td><strong>Substrate %</strong></td>
<td>13%</td>
<td>13%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td><strong>Raw Gas MMBtu/day</strong></td>
<td>188</td>
<td>299</td>
<td>292</td>
<td>464</td>
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<tr>
<td><strong>Raw Gas MMBtu/Year (90% CF)</strong></td>
<td>61,758</td>
<td>98,222</td>
<td>95,768</td>
<td>152,473</td>
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Summary for Success

- Technology – Complete mix, more efficient and allows for a greater variety of feedstocks
- Temperature – Thermophilic, more efficient and lowers hydraulic retention time
- Digester Health – Monitor HRT, temperature, pH, volatile fatty acid count, organic loading, etc.
- Operation and Maintenance – Implement preventative maintenance program
- Feedstock Management – Quality assurance and supply management
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