Biomass for Energy Production: Finding the Hay In a Stack of Needles?

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Future Biomass Needs

• 1 Billion tons of biomass per year needed by 2030 - (US DOE)

• If every state contributed equally, that would mean that Minnesota would supply 20 Million tons of biomass by 2030.
Biomass In the United States

This study estimates the technical biomass resources currently available in the United States by county. It includes the following feedstock categories:
- Agricultural residues (crops and animal manure)
- Wood residues (forest, primary mill, secondary mill, and urban wood)
- Municipal discards (methylene emissions from anaerobic and domestic wastewater treatment)
- Dedicated energy crops (on Conservation Reserve Program and Abandoned Mine Lands)

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Current Agricultural Biomass Supply

- Other residues: 31 million dry tons per year
- Manures: 35 million dry tons per year
- Grains to biofuels: 15 million dry tons per year
- Other crop residues: 21 million dry tons per year
- Small grain residues: 6 million dry tons per year
- Wheat straw: 11 million dry tons per year
- Corn stover: 75 million dry tons per year
Emerging Market For Biomass

• Household Scale
  – Pellets Stoves
  – Wood

• Community Scale
  – Pellets
  – Ag residues, wood slash, industrial bi-products

• Industrial Scale
  – Ag residues, wood slash, industrial bi-products
Permitted Biomass Facilities in Minnesota
Regional Biomass Needs*

<table>
<thead>
<tr>
<th>Organization</th>
<th>Annual Needs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>U of M Morris</td>
<td>7,000-10,000 tons</td>
<td>Mixed biomass</td>
</tr>
<tr>
<td>Chippewa Valley Ethanol Coop</td>
<td>70,000-100,000 tons</td>
<td>After final phase, Wood at this point</td>
</tr>
<tr>
<td>Central Minnesota Ethanol Coop</td>
<td>90,000-100,000 tons</td>
<td></td>
</tr>
<tr>
<td>Fibrominn</td>
<td>500,000 tons</td>
<td>Turkey Litter</td>
</tr>
<tr>
<td></td>
<td>150,000+ tons</td>
<td>Plant Biomass</td>
</tr>
</tbody>
</table>

*for illustration purposes
## Ethanol from Agricultural Biomass

### Assumptions

<table>
<thead>
<tr>
<th>Ethanol Plant Size (mgy)</th>
<th>Corn Stover</th>
<th>Native Grass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion Rate (Gal/ton)</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>Tons Harvested per Acre</td>
<td>2.5</td>
<td>4</td>
</tr>
<tr>
<td>Tons per truckload</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>% of Acreage</td>
<td>45</td>
<td>5</td>
</tr>
<tr>
<td>Harvest Rotation</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

### Results

<table>
<thead>
<tr>
<th></th>
<th>Corn Stover</th>
<th>Native Grass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tons Needed</td>
<td>588,235</td>
<td>588,235</td>
</tr>
<tr>
<td>Acres Needed</td>
<td>235,294</td>
<td>147,059</td>
</tr>
<tr>
<td>Radius From Plant (miles)</td>
<td>16.1</td>
<td>38.3</td>
</tr>
<tr>
<td>Truckloads Per Day</td>
<td>80.6</td>
<td>80.6</td>
</tr>
</tbody>
</table>
Developing Biomass Energy

• Need to increase volumes of biomass

• Stable supply of biomass is critical
  (or have stored fuels or substitutes for backup)

• Costs for biomass must be somewhat predictable
Identifying Underused Biomass

• Examples:
  – Wheat straw
  – Turkey Manure
  – Almond Shells
  – Newspaper
  – Sugar Beet Pulp
  – Oat Hulls
Infrastructure to Manage Biomass

• Harvesting Equipment
• Transportation Equipment
• Roads
• Storage Facilities
• Processing Equipment
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