Biomass Potential
For Electrical Generation

Bill Johnson
Manager, Biofuels Development
Alliant Energy
24 States & The District of Columbia Mandate Renewable Portfolio Standards

Source: Edison Electric Institute, status as of June 6, 2007.
© 2007 by the Edison Electric Institute. All rights reserved.
Alliant Energy’s Renewable Energy Portfolio

Renewable generation sources by fuel type and total capacity

<table>
<thead>
<tr>
<th>Source</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastewater Treatment Facilities</td>
<td>0.42 MW</td>
</tr>
<tr>
<td>Anaerobic Digesters</td>
<td>0.82 MW</td>
</tr>
<tr>
<td>Biogas</td>
<td>20.09 MW</td>
</tr>
<tr>
<td>Hydro</td>
<td>86.28 MW</td>
</tr>
<tr>
<td>Wind (current)</td>
<td>357.95 MW</td>
</tr>
<tr>
<td>Wind (under construction)</td>
<td>68 MW</td>
</tr>
<tr>
<td>Wind (potential)</td>
<td>300-600 MW</td>
</tr>
<tr>
<td><strong>Total Renewable Capacity</strong></td>
<td><strong>465.56 MW</strong></td>
</tr>
</tbody>
</table>

Total current generation capacity is 5,893.9 MW
We’re In The Biomass Belt
Power Plants in WI, MN & IA

- The 50 mile circles around each represent the likely hauling radius that biomass can be collected from.

- 1,735 power plants, 42,659 MW

- 188 coal plants, 19,161 MW

- 10% replacement, 9,299,210 tons @ 6,000 BTU’s / lb.

Potential for 1,859,842 acres grassland or 4,649,605 acres of corn stover, or 929,921 woodlands annually.
Alliant Energy Biofuels Experience
1995-2006

- 725 MW plant, Ottumwa, IA
- Partners included: USDA-RC&D, National Renewable Energy Laboratory, Prairie Lands LLC, Iowa Department of Natural Resources...
- Substituted coal for switch grass at 5% BTU level
- Potential for 50,000 acres of native grasses
Replacing this . . . . with 5% of this . . . .
Biomass - Renewable Resources

- Native Grasses

- Corn Stover

- Forest Products
  - Wood forest residues
  - Dedicated forest fuel crops (Poplar, Willow, ...)

- [Image of biomass sources]
Grass Bio-Fuels Advantages

- Water Quality >
- Soil Quality >
- Wildlife Habitat >
- Carbon Footprint <
- Local Economic Opportunities >
Grasses Reduce Soil Runoff
Grasslands Reduce Floods
Native Grasses Improve Soil Health

- Decreased windflow and evaporation
- Native C4 perennial
- Can be grown on marginal lands or rotated with other crops
- Excellent nesting and invertebrate habitat
- Deep rooting system benefits
- Root mass can reach 8 dry Mg/ha; an excellent carbon sink

Switchgrass

Wind

Less erosion from surface flow

Water

Deep rooting system benefits

80 cm
Grassland Birds need a continuum of habitat structure…

- No single habitat type will accommodate the needs of all species
Carbon Cycle Improves Carbon Footprint
Local Economic Opportunities
Challenges and Opportunities
Bio-Based Fuels and Conservation

- Land Use Economics and Yield Optimization
- Understanding Land and Wildlife Mgt. Issues
- Harvest, Storage, Transportation & Processing
- Landowner Education and Recruitment
- BMP’s Defined and Enforced
Grassland Establishment and Yield Demonstration Plots
Understanding Wildlife and Land Management Options

- Wildlife and bird habitat
- Local economic development opportunities
Biomass Densification and Storage Research
Quality Control Measures and Unintended Consequences
Wisconsin
Where Soil Conservation Was Born
Grass Protects Highly Erodible Soils
A Bright New Future for Agriculture, Forestry and Conservation!
Contact

Bill Johnson
Manager, Bio Fuels Development
2777 Columbia Dr.
Portage, WI
Home of Aldo Leopold, John Muir and Owen Gromme

(608) 742-0824
billjohnson@alliantenergy.com
Renewable Resources
Surplus Crop Residues

- “Corn Stover...is the largest under-utilized crop in the U.S.”
  - USDOE 2005 report

- Yield 1-2 ton/acre

- 7,200 BTU’s/dry lb

- Chemistry issues
Conventional Grass Harvest to Combustion

Mow & Windrow

Off Load and Store

Pellet

Unload and Store

Pick-Up Bales & Load

Detwine

Load Truck

Grind

Conventional Grass Harvest to Combustion
Typical Generating Station

600MW @ 10% biofuel, stoker or CFB boiler
50 mile radius source acquisition

- 10% biomass fuel, 6,000 BTU/lb.
  - 96,320 acres / year @ 3 tons / acre yield
  - 57,781 acres / year @ 5 tons / acre yield

Estimate 75 % wood and 25% stover & grass

- 21,668 acres of woodlots @ 10 tons / acre
- 24,076 acres of grass & stover @ 3 tons/ acre

Enough for 60,000 homes
In - Field Densification

Mow & Windrow → Unload and Store → Move to Handling System → Load for Transport
Biomass Challenges and Opportunities

CHALLENGES

- Land Use Economics
- Yield Optimization
- BMP’s defined and enforced
- Understanding land and wildlife mgt. issues
- Quality Control
- Landowner education and recruitment…
- Favorable policy treatment…

OPPORTUNITIES

- Grassland establishment incentives-USDA, FEMA..
- Offset with lease hunting or wildlife observation
- Land stewardship standards
- Wildlife & Crop mgt. research
- Prevention of invasives and development of BMP’s
- Increase cover crop establishment…
- Biomass industry development
The Greenhouse Effect

Some solar radiation is reflected by the earth and the atmosphere.

Some of the infrared radiation passes through the atmosphere, and some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm the earth's surface and the lower atmosphere.

Solar radiation passes through the clear atmosphere.

Most radiation is absorbed by the earth's surface and warms it.

Infrared radiation is emitted from the earth's surface.
Order now and SAVE $12.98 off our regular catalog price!

- **Your Round Beauty!**
- **Striking and terrific, an ideal focal point!**

No doubt about it, ornamental grasses are the hottest new idea in landscaping! And the designs of Pampas Grass are sure to draw attention to any area where you place them. This three plant grass 5-7 ft tall planted in full sun and sport bright silver plumes that look stunning in either indoor or outdoor flower arrangements. Makes an attractive screen, too. Choose pink or white in diametric form and covering height make Pampas Grass an undeniably beautiful addition to any garden. Low price makes this ornamental item so easy to buy or order from home or store.

### Pampas Grass Collection

- **Save $2.00**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>4198</td>
<td>White Pampas Grass</td>
<td>$5.98</td>
</tr>
<tr>
<td>4197</td>
<td>Pink Pampas Grass</td>
<td>$5.98</td>
</tr>
<tr>
<td>4199</td>
<td>Pampas Grass Collection</td>
<td>$5.98</td>
</tr>
</tbody>
</table>

**LIFETIME GUARANTEE!**

If you're not happy with any item you order from us, notify us and return for a full refund or credit for a full refund or credit. Use our return form when you return the item. Your complete satisfaction will be expected - with no limits - for as long as you purchase.