Koda Energy
Biomass to Energy for Economic Survival
What is Koda Energy, LLC.?

- Koda is a partnership between Rahr and SMSC that creates “green energy” from burning dry biomass fuels
- Koda’s combined heat and power plant power plant to be located on the Rahr property in Shakopee MN
Rahr Malting Company

- The Rahr family has made malt for 160 years.
- Operational in Shakopee since 1936
- The Shakopee plant currently employs over 100 highly skilled workers
- It is the 2\textsuperscript{nd} largest malting facility in one location in the world.
Shakopee Mdewakanton Sioux Community (SMSC)

- A federally recognized Indian Tribe
- The largest employer in Scott County
- Nearly $700 million in annual revenues in Minnesota attributed to SMSC
Why a Biomass Energy Plant?

- Concern with long term energy costs & supplies
  - Electrical
  - Natural gas
- Ideal CHP location
  - 7x24 operation
  - Large electrical & thermal demand
- Environmental sustainability
Biomass Energy Values

- Barley Byproducts: 7600 BTU/LB
- Malt Sprouts: 8326 BTU/LB
- Barley Needles: 7600 BTU/LB
- Barley Dust: 7650 BTU/LB
- Hulls: 7563 BTU/LB
Grasses for Fuel

- 7000-8000 btu/lb (10%mst)
- Annual Harvest
- Bail Storage
- Creative options for land use?
- 5000-7000 acres for 15% of our fuel needs
- ~$3.50 - $4.00/mmbtu
- 4 ton/acre = ~64 mmbtu
## Biomass TPA

<table>
<thead>
<tr>
<th>Energy Crop</th>
<th>Land Currently Planted with Major Crops</th>
<th>Idle and Pasture Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchgrass</td>
<td>2.0 to 6.7</td>
<td>1.7 to 5.7</td>
</tr>
<tr>
<td>Hybrid poplar</td>
<td>3.25 to 6.0</td>
<td>2.8 to 5.1</td>
</tr>
<tr>
<td>Willow</td>
<td>3.15 to 5.8</td>
<td>2.7 to 4.9</td>
</tr>
</tbody>
</table>

**Source:** Oak Ridge National Laboratory.
Key Biomass Characteristics for Koda Energy

- **Cost**
  - Material
  - Transportation

- **Availability**

- **Physical Characteristics**
  - Dry – <15% moisture
  - Low bulk density
  - Small particle size – dust & chaff
Key Fuel Based Emission Components

- Protein (nitrogen) - NOX
- Sulfur Content – SO2
- Silica content - Boiler fouling
- LB. Alkali/mmbtu
  - >1.0 high fouling potential
- Chlorine – HCl & Dioxin formation
- Moisture - CO
Plant Design

• Boiler options evaluated for Koda
  – Fluidized bed system
    • Better suited for higher moisture – lower quality fuels
  – Stoker system
    • Not ideal for burning “dust”
  – Gassifer

• Suspension burning system chosen for Koda
  – Flame stability
    • Self sustaining combustion w/o natural gas – 100% Biomass fired
  – Lower emissions & higher efficiency than stoker
  – Low unburned carbon
  – Combustion temperature control to avoid slagging <1600f
  – Rapid response & 50% turn down capability
  – Fuel ground to a “powder like” consistency
Sister Biomass Plant In Thailand
Commissioned December 2005
Koda Boiler Characteristics

- **Biomass Input**
  - 41,500 pounds/hour
  - 308 mmbtu/hr

- **Boiler output**
  - 900 psig
  - 900 F
  - 220,000 pph steam

- **Exhaust**
  - 127,000 acfm
  - 350 f

- **Boiler Efficiency 80%**
Koda Energy LLC

- 22 PSI Steam to HX
- 250f Glycol to Rahr Malting
Koda – Project Status

11/04/2007

3/11/2008

7/25/2008

10/15/2008
Koda Fuel storage bins
4 days capacity
Koda fuel preparation
4 – 250 hp hammer mills
Post Grind Fuel Mix Sizing
View into the boiler from top
Top of boiler suspension connections
Biomass Burners
Six total (2 per floor)
Steam turbine
Plate & frame steam to glycol heat exchanger

22 psi steam in

Glycol to malt plant heated from 160f to 250 f
Biomass Truck unloading
Koda Energy in Operation Jan 2008
Environmental Benefits

• Renewable base load energy production

• CO$_2$ emission reduction from avoided natural gas use for heat
  – 70,000 tons/year

• CO$_2$ emission reduction from electrical generation
  – 190,000 tons/year compared to coal emission for electrical generation

• SO$_2$ emission reductions of 500 tons/year compared against fully controlled coal plant emissions

• Mercury emissions extremely low

• Energy Crops
  – Sequestering carbon
  – Reduce soil erosion
  – Improved water quality
Encouraging Biomass

• Right Location
  – Energy users
  – Biomass availability

• Storage and transportation infrastructure development

• Government incentives
  – Section 45 tax credit
  – Energy crop programs

• Expanding carbon trading programs