Agricultural Biomass for Energy in Minnesota: Trends and Future

Mark Lindquist, Biofuels Program Manager, MN DNR

Fueling the Future: The Role of Woody Biomass for Energy Workshop

April 29, 2009
St. Cloud

Sponsored by:
University of Minnesota Extension, Onanegozie RC&D, Minnesota Forest Resource Council, Natural Resource Conservation Service, Soil and Water Conservation District – Stearn County, Minnesota Department of Natural Resources

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Ag. Biomass for Energy in Minnesota: Trends and Future

By: Mark Lindquist Biofuels Program Manager

To: Fueling the Future: The Role and Use of Biomass for Energy

April 29, 2009
DNR Mission

- Work with citizens to conserve/manage state’s natural resources
- Provide outdoor recreation opportunities
- Provide for commercial uses of natural resources to create sustainable quality of life
Biomass – Always a part of the energy system

Source: US Energy Information Agency
Agricultural Biomass Utilization

First Generation Biofuels – Policy Driven

- **Ethanol**: 850 million gallons capacity
  - ~310 million bushel
  - ~5 ¾ million ton, accounting for distillers grains
  - ~250 million plus idle capacity

- **Biodiesel**
  - ~63 million gallons cap.
  - ~123,000 tons vegetable oil
  - ~30 million gallons idle capacity
Long term Corn Productivity

Corn Price and Yield 1947 - 2007

Note: Prices adjusted for inflation using 1982 as the base year
Biomass – Well-Defined Development Path

Feedstock
• Corn

Technology
• Dry Mill Ethanol Plant

Market
• Gasoline extender
Future Driving Factors

- Long term price trends for oil and gas
- Federal cellulosic fuel standard
- State and federal renewable electric standards.
- Greenhouse gas regulations
- Sustainability concerns
- Farm program structure
Biomass – Ill-Defined Development Path

**Feedstock**
- Grain
- Crop residue
- Timber
- Slash
- Mill Residue
- Manure
- Urban Wastes
- SRWC
- Prairie grass

**Technology**
- Combustion
- Gasification
- Pyrolysis
- Fermentation
- Combined Heat and Power

**Market**
- Electric Power
  - Grid
  - On-Site
- Industrial Process Heat
- Home Heating
- Transportation Fuels
- Chemicals
Federal RFS

5 billion gal. max. - Advanced = non-corn starch + 50% lifecycle CO2 reduction

16 Billion gal. min. Cellulosic

15 billion gal. max. corn starch: Must reduce lifecycle CO2 by 20%

Currently under const.

Current capacity
Next Gen Energy Act

GHG Emissions Goal Relative to 2005 Base Year

Emissions

Year

2000 2010 2020 2030 2040 2050 2060
Agricultural Biomass Utilization

- Fibrominn 55 MW Power plant ~ 500,000 tons turkey litter
- 60,000 tons oat hulls sold for fuel
- Rahr Malting/KODA Energy
  - 175,000 tons mixed biomass
- CornPlus Ethanol – Thin Stillage
- 3 Dairy manure digesters
Emerging Ag Biomass Projects

- Chippewa Valley Ethanol
  Corn cobs ~ 100,000 tons / year

- University of Minnesota Morris
  Corn stalks, prairie ~ 6,000-9,000 tons / Yr

- Minnesota Valley Alfalfa Producers
  Biomass pellets ~

- Northern Quality Seeds
  Grass seed chaff
Significant Projects to Watch

- Poet Project Liberty Cellulosic EtOH - IA
- Show Me Energy Coop - Pellets – MO
- EERC Small Scale Gasifier – ND
- Chariton Valley Switchgrass Co-Firing IA
Crop Residue

- IT IS NOT A WASTE
- Corn stover
  - Largest identified resource – Backbone of USDOE “Billion Ton Study”
  - USDA Soil Scientists: No harvest on land that produces less that 150 bu corn
- Cereal Grain Straw
  - Similar issues to stover
The Cob

- Very good fuel properties
- Relatively little contribution back to soil fertility
- Relatively easy harvest, transport storage logistics
- Poet leading the way with Project Liberty

~4 million ton potential in MN
A Matter of Scale

<table>
<thead>
<tr>
<th>MN Energy Goal</th>
<th>Dry Biomass</th>
<th>Compar</th>
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</thead>
<tbody>
<tr>
<td>80% MN Energy</td>
<td>100 mm</td>
<td></td>
</tr>
<tr>
<td>40% FFR ~ equal to oil</td>
<td>50 mm</td>
<td>All major crops</td>
</tr>
<tr>
<td>25 x 25</td>
<td>33 mm</td>
<td>Corn crop</td>
</tr>
<tr>
<td>2% of federal Cel. RFS.</td>
<td>4 mm</td>
<td>All cobs or Timber</td>
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“Non-Food Crops”

- Prairie Grasses
  Improved or wild
- Exotic Grasses – ex. miscanthus
  Significant ecological concerns
- Short rotation woody crops
  Verso Paper 25,000 acres
- Do you convert conservation lands or croplands?
Multiple Demands from the Land

- Urban Development
- Food
- Energy
- Conservation/Environmental Functions
- Recreation
- Fiber -wood
- Other Industrial Materials
Productivity and Trade Offs

MORE:

- Crops / Biomass
- Wildlife
- Clean Water
- Jobs...

FIGURE 39-2 THE WAR INDUSTRY AND THE PRODUCTION POSSIBILITIES CURVE
Where can we get more, without getting less?

- **Corncobs** – low soil fertility value, good fuel properties
- **Corn stover / cereal straw** – may require agronomic or technology mitigation to return organic matter to soils
- **Prairie grass harvest** every 3-4 years on conservation lands like CRP to improve conservation values
Where is the market going?

- Biomass development path is not well defined – competing visions
- Better broad-based understanding of the size of the biomass supply
- Need more definition of the most strategic and beneficial use of biomass
Challenges

- There are real and meaningful opportunities
- We will make mistakes
- We need to anticipate mistakes and manage risk / consequences
- We need to think about how to enhance productivity very broadly – beyond conventional agronomy.
If we do it right, we get more...

Wildlife

Clean Water

Rural Prosperity
Questions?

mark.lindquist@dnr.state.mn.us
507-359-6038
www.mndnr.gov