Local Biomass Feedstock Availability for Fueling Ethanol Production

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Study Funded by VeraSun Energy

Corn Ethanol Production Process

• Disadvantage: relies on fossil fuel
  – Mostly natural gas

• Alternative fuel source: biomass

• This study: use biomass to fuel ethanol plant expansion
  – VeraSun Energy ethanol plant
  – Aurora, South Dakota

VeraSun Energy Ethanol Plant
Aurora, SD

Overall Objective

• Assess biomass availability & costs of delivery to central location
  – Use biomass as fuel source in ethanol plant expansion

Aurora Facility

• Corn use: 43 million bu / yr
• Output:
  – Ethanol production: 120 mln gallons / yr
  – Distillers grains: 390,000 tons / yr
Specific Objectives

- Assess biomass types & amounts
  - Corn stover
  - Wheat straw
  - Perennial grasses
- Gauge impact of biomass removal on
  - Soil productivity
  - Ecological sustainability
- Estimate costs:
  - Harvesting
  - Storing
  - Transport to plant

Study Area Around Aurora, SD

- Study area: 50 mile radius from production facility

County Types

- Two groups of counties
  - Tier 1: within 50 mile radius
  - Tier 2: partially outside of 50 mile radius

Cost Considerations: Biomass Production

- Sources:
  - Corn stover, grains straw, grass hay
    - Based on local cropping system
- Production
  - Yields
- Availability
  - Comply with minimal NRCS needs
    - For erosion control
    - Technical ability to remove

Cost Considerations: Other

- Soil productivity losses
  - Nutrients
    - Fertilizer replacement
  - Other
    - Organic material
    - Soil compaction
    - Soil erosion
- Competing biomass uses
- Producer incentive

Cost Considerations: Collection, Handling, Transport

- Collection
  - Flail mowing, raking, baling
- Loading & unloading
- Transport
  - In-field
  - To plant
Production

- Plant residue
  - 1 ton of corn grain → 1 ton of corn stover
  - 1 ton of wheat grain → 1.4 tons of straw

- Meet minimum NRCS requirements
  ≥ 35% of residue must remain on field

- Harvesting equipment limitations
  - Collect about 45 percent of available corn stover
  - With yields of 130-150 bu/acre

Results: Corn Stover

<table>
<thead>
<tr>
<th>Operations</th>
<th>Per Unit ($)</th>
<th>Per Bale ($)</th>
<th>Per Ton ($)</th>
<th>Per Acre ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Moving per acre</td>
<td>7.75</td>
<td>1.72</td>
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<td>Baling per Bale (Lg Sq)</td>
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<td>Transport to Field Edge</td>
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<td>Fertilizer Replacement</td>
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Results: Wheat Straw

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Results: Grass & CRP Hay

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<td>Per Acre</td>
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Alternative Biomass Sources

- Switchgrass
- CRP land
- Other residue-producing crops

Factors Affecting Biomass Availability

- Technical
- Weather conditions
- Producer willingness to sell crop residues
- Time constraints
- Equipment availability
- Plant residue fertilizer value
- Farmer compensation
  - Labor
  - Capital
  - Financial incentives
Caveats

- Accounting issue
  - Based on
    • Existing infrastructures
    • Currently available equipment
- Risk
  - No risk sharing
    • Among producers, distributors, purchaser
  - Risk-sharing instruments
    • Production / marketing contracts
- Rapidly changing conditions

Bottom Line

- Our cost estimates provide lower-bound of the actual costs involved with collecting, handling, & transporting biomass