Overview

- Market for Renewable Fuels
- Introduction to Dupont Danisco Cellulosic Ethanol (DDCE)
- Risk Management
  - Feedstocks
  - Supply Chain
  - Business Models
Market for Cellulosic Biofuels

- 2007 Energy Bill mandates specific levels of blending for renewable fuels
  - Renewable fuel defined by feedstock source and lifecycle greenhouse gas (GHG) reduction
  - Implementation may occur in beginning or middle of 2010

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>GHG Reduction</th>
<th>Biofuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn starch</td>
<td>&gt;20%</td>
<td>Conventional</td>
</tr>
<tr>
<td>Renewable (non-corn)</td>
<td>&gt;50%</td>
<td>Advanced</td>
</tr>
<tr>
<td>Renewable</td>
<td>&gt;50%</td>
<td>Biomass-based biodiesel</td>
</tr>
<tr>
<td>Cellulose, hemicellulose, or lignin</td>
<td>&gt;60%</td>
<td>Cellulosic</td>
</tr>
</tbody>
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* >20% for corn applies to plants starting construction after December 2007

Renewable Fuels Standard

Renewable fuel defined by feedstock source and lifecycle greenhouse gas (GHG) reduction. Implementation may occur in the beginning or middle of 2010.
Cellulosic Biofuel

- 50/50 joint venture between DuPont and Danisco/Genencor
- $140 million investment over 3 years
- Commercialize integrated technology to produce cellulosic ethanol
  - Full license & engineering package including:
    - On site biocatalyst production
    - Future design improvements
- Feedstock-flexible demonstration plant in December 2009
  - Cob & switchgrass, Eastern Tennessee
- Commercial deployment
  - 2012: 25 MGY cob plant in Midwest
  - 2013: 15 MGY switchgrass plant in TN
DDCE’s Cellulosic Biomass Technology

- Pretreatment
- Enzymatic hydrolysis
- Mixed sugar ethanologen

- >$100 million invested prior to formation of DDCE
- DOE & NREL support & collaboration
- Significant enabling patent estate
- Demonstrated capabilities in scale up & design

Demonstration Plant
Vonore, Tennessee

- Joint investment including $40.7 from TN
- Nominal nameplate capacity 250kgal/yr
- Facility on-line 4Q 2009

- Process development unit, pelletizer and demo plant on site
- Demo Unit provides scale-up data for commercial facilities
- Applications lab/ support capability
- Manufacturing prototypical (40 - 100x scale-up)
Risk Management

► Define the goal
  ▪ Achieving sustainable production of cellulosic ethanol that can be competitive in today’s energy markets and achieve national goals

► Evaluate the Risks
  ▪ Development of Supply Chain
  ▪ Technology
  ▪ Government Programs
  ▪ End-use Markets

► Determine business models that can mitigate these Risks and achieve Goal

Supply Chain Risk Management

► Feedstock Price
  ▪ Biomass is not a commodity today
  ▪ Contract options
    ▪ Multi-year contracts
    ▪ Pooling cooperative structure
    ▪ Integrated control

► Feedstock Supply
  ▪ To site a plant, there must be reasonable assurances supply will be available at startup

Feedstock supply must be aligned with goals of the biorefinery to achieve success.
Supply Value Chain Formation

- New Supply Chains will need to be Developed
  - On Farm - In the field
    - Equipment to planting, harvest, and densify feedstock
  - Off Farm
    - Transportation equipment, storage methods, pre-processing options
  - Biorefinery
    - Offloading, grinding and feedstock preparation

Feedstock Supply Chain

- Farmer assumes production & collection risk
  - Yield, feedstock format, and quality are key variables
- Feedstock Intermediary assumes aggregation and delivery risk
  - Storage and consistent composition become key factors
  - Profitability based on ability to deliver feedstock within spec to biorefinery
- Biorefinery
  - Biorefinery assumes technology and ethanol market risk
  - Delivery of feedstock into processing stream
Feedstock Intermediary

- Procure feedstock from farmers
- Transport feedstock to selected storage facilities
- Store feedstock in covered or uncovered facilities
- Preprocess & grind feedstock to preferred processing size offsite
- Store in bulk and deliver to biorefinery site
- Delivery of feedstock into processing stream

Corn Supply Chain

- Harvest
- Off Farm Storage
- Biorefinery
Cob Supply Chain

- Harvest
- Off Farm Storage
- Biorefinery

Cob Harvest Equipment

- **Single Pass**
  - **Corn Cob Mix**
    - Harvest seed & cob for separation later
  - **Towed Cob Separation**
    - Cart behind combine collects cobs and separates stalk & husk
  - **Dual Stream Harvesting**
    - Flexible Rear Combine
    - On-combine storage

- **Two Pass**
  - **Baling**
Switchgrass Development

- University of TN / Genera Program
  - ~2600 acres planted to date
  - Aiming for 6,000 total acres by spring 2010
- Planned research: agronomic practices, harvest, storage techniques
  - Proposed grants under multiple USDA/DOE programs

Mitigating Risk throughout Value Chain

- Business model and government policies must incorporate risk management principles to support the industry’s development
  - Business Relationship
    - Independent, Coop, Integrated control
  - Government Policies
    - Initiation of new Supply Chains - BCAP
    - Crop Insurance to Protect Farmers
    - Treatment of Base Acres used for Dedicated Energy Crops
Summary

- Energy policy will continue to have an increasing role on agriculture
- New Supply Chains are on the horizon to support the cellulosic ethanol industry
- Business model and government policies must incorporate risk management principles to support the industry’s development