Biofuels

John Ranieri
Vice President-General Manager
DuPont Applied BioSciences

WIREC
March 05, 2008
DuPont Applied BioSciences Strategy

*Focus on large, market driven opportunities* enabled by the integration of chemistry and biology . . .

- Target areas with existing and emerging unmet needs where our integrated science creates *unique advantage*

- *Transform the targeted industries* with our integrated knowledge base

- *Partnerships* to expand market opportunities, accelerate speed to market and maximize value creation
Biofuels Value Chain

1. Agricultural Inputs
2. Plant Feedstocks
3. Conversion to Sugars
4. Fermentation Processes
5. Biofuels Formulation

Seed
Crop Protection
$\text{CO}_2$

Sugar
Starch

Cellulose

Biofuels
Ethanol
Advanced Biofuels
We can engineer a cell to economically produce high value products.

Cell software has been re-programmed to increase propanediol production by 500 fold.
Why a Bioprocess?

Targeted advantages over chemical process

Chemical Process

CH$_2$=CHCH$_3$ Propylene
Catalyst
HOCH$_2$CH$_2$CH$_2$OH PDO

Bioprocess

C$_6$H$_{12}$O$_6$ Glucose
Biocatalyst
HOCH$_2$CH$_2$CH$_2$OH Bio-PDO™

~25% Lower manufacture cost
~50% Lower capital
~50% Smaller environmental footprint
DuPont Tate & Lyle Bio Products
Loudon, Tenn., USA
Biofuel Imperatives

High value molecules

Upstream

Feedstock
Adequate Regional Supply

Downstream

Refinery & Pipeline
Compatibility With Existing Infrastructure

Retail & Consumer
Uncompromised Fuel Performance

Current biofuel solutions are inadequate to meet global needs
DuPont - BP Partnership
Resolving Ethanol Constraints

BIOMASS

WORLDWIDE FUEL MARKETS

BUTANOL

Sugar → Fermentation → Butanol

Plant Feedstocks

Metabolic Engineering

Performance Fuels
Cellulosic Biofuels
Concept to Commercialization

Biomass Raw Material
- Corn cob & stover
- Sugarcane bagasse
- Wheat straw
- Rice straw
- Energy crops

Biomass Processing
- Saccarification

Sugar
- C5
- C6

Fermentation
- Proprietary conversion microbes

Cellulosic Biofuels
- Ethanol
- Butanol

DuPont Integrated Corn-Based BioRefinery
- Technology Development
- Pilot Facility
- Commercial
- License Technology Broadly
Value Chain Partnerships

- Feedstock Harvest
- Feedstock Production
- Feedstock Transport
- Feedstock Conversion
- Fermentation Production
- Separation
- Blending
- Fuels
- Materials - Chemicals

© 2007 E.I. du Pont de Nemours and Company. All Rights Reserved.
Summary

- Integrated science approaches are necessary
  - Technical feasibility
  - Environmental sustainability

- Partnerships are essential
  - Technology is complex

- Governmental support is required (at this point)
  - High risk/high investment
  - Value externalities

- Geography specific strategy
  - Regions will require customized solutions