DuPont Cellulosic Ethanol: Sustainable, Economic, Farm-to-Fuel Solutions

BIO World Congress on Industrial Biotechnology
Raffaella Cristanetti, June 2013
DuPont Industrial Biosciences

Focused growth through bioprocessing technologies

- Build on Genencor’s expertise in designing and operating cell factories
- Leverage Pioneer’s knowledge of production agriculture and relationship with growers
- Apply DuPont’s capabilities in engineering and advanced materials

Intersection for innovation across DuPont’s competencies
Industrial Biosciences Business

Three biobased segments, serving a diverse set of customers

Bioactives
- Enzymes
- Proteins
- Peptides

Biomaterials
- Biochemicals
- Biomaterials

Biorefineries
- Bioprocessing aids
- Biofuel technology

Key Capabilities
- Microbiology
- Protein and metabolic engineering
- Enzyme design
- Fermentation
- Biochemistry
- Bioprocessing
- Polymer science

Applying the power of biotechnology, DuPont™ Genencor® Science brings together a broad set of scientific fields to create disruptive technologies and transform markets.
Innovation and Investment to Satisfy the Global Demand for Alternative Fuels

Cellulosic Ethanol Advantages:

- Cellulosic Ethanol gives access to more and diverse sources of biomass
- >60% greenhouse gas reduction
- Non-food sources and marginal land
- Additional income for farmers

Biobutanol Advantages:

- Biobutanol is more compatible with all steps of the existing supply chain
- Drop-in fuel
- High blends without infrastructure changes
- Refinery can use more fractions of oil
- Higher energy content

Full service licensing and Enzyme solutions

Joint venture with BP

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DuPont Cellulosic Ethanol and Its Offering

DCE is dedicated to develop and commercialize cellulosic ethanol technology to satisfy the global demand for alternative fuels.

- Investment grade
- Cost effective
- Efficient and Sustainable
- Enabled by DuPont feedstock supply chain know-how
- Powered by DuPont Genencor science

Integrated, and demonstrated farm-to-fuel CE technology solution

Fuel Producers

Chemical producers
Global Biofuels Feedstocks and Opportunity

- **US Corn Stover**: 1-2 Bgals/yr
- **US Energy Crop**: >10 Bgals/yr
- **EU Straw/Energy Crop**: >1 Bgals/yr
- **China Energy Crop**: 1-2 Bgals/yr
- **China Corn Stover**: >1 Bgals/yr
- **ASEAN EFB**: >1 Bgals/yr
- **Brazil Bagasse**: >2 Bgals/yr
Cellulosic Ethanol: DuPont Advantages

Feedstock
- DuPont Pioneer agronomic expertise
- Grower relationships and service
- Experienced supply chain management

Conversion
- Demonstrated integrated process
- Optimized technology package – enzymes and fermentation organisms
- Low cost, low capital

Technology Deployment
- Differentiated licensing solutions
- Enzyme production and capital utilization
- Global reach and presence
Creating a Scalable and Sustainable Supply Chain

- Large-scale test harvest validations
- Agronomic understanding
- Multi-year grower involvement
- Commercial equipment
- Storage quality and stability tests
- Collaboration and credibility

Sustainable Biofuels Awards
2012 Winner
Sustainable Feedstock Innovation
Field Experience – Success Stories

Yr 2010 - 2500 acres
Yr 2011 - 7500 acres
Yr 2012 - 25,000 acres
Yr 2013 - 75,000 acres
Yr 2014 - 190,000 acres
DCE Process Generates Two Renewable Fuel Products

Renewable Solid Fuel
(lignin and syrup)

Co-products can be utilized in on-site biomass boiler
Commercial sale of dried biofuels to off-site power generators
(coal–fired boiler blending or other utilities)

Transportation Fuel

Use of fuel by local gasoline blenders and suppliers
Quantifying Environmental Impacts
Life Cycle Assessment

- Compilation of environmental impacts along the value chain
- Holistic approach to evaluate impact of all upstream and downstream products and processes
- LCA ISO standards 14040 series - only standardized method to evaluate the environmental footprint of the whole supply chain

DCE technology provides >100% GHG reduction (g CO2 eq/MJ) compared to conventional gasoline
DuPont Cellulosic Ethanol Business Mission

Limited plant investment to demonstrate technology
Agricultural residues - Nevada, Iowa
Energy Crops in Southeastern USA

Global licensing strategy
Targeted regions: North America, South America,
China, Central Europe, Southeast Asia

Full service licensing offering to global customers:
Engineering Services
Technical Support
Proprietary Equipment
Biocatalyst Supply
Feedstock Supply Services
DuPont is building the largest commercial CE biorefinery in the world located in Nevada, Iowa

- Feedstock: corn stover
- Groundbreaking: November 2012
- Startup: 3rd quarter 2014
- Conducted larger corn stover test harvest in 2012 around Nevada facility

More info @ biofuels.dupont.com
Integrated, economic, efficient, sustainable – and backed by DuPont science and know-how across the value chain.
THANK YOU.
Contact DuPont Cellulosic Ethanol
http://biofuels.dupont.com/cellulosic-ethanol/

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The DuPont Nevada Site Cellulosic Ethanol Facility is expected to be completed in mid-2014. Situated in a prime agricultural location, this over $200 million facility will be among the first commercial-scale cellulosic biorefineries in the world.

- Ethanol production: 30 million gallons/year
- Corn stover in supply radius: 815,000 acres
- Corn stover harvest rate: 2 tons/acre
- Corn stover harvested: 190,000 acres
- Corn stover inventory: 375,000 tons/year
- Corn stover bales: 590,000 per year
- Additional ethanol from corn: 150 gallons/acre

More info: biofuels.dupont.com