



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

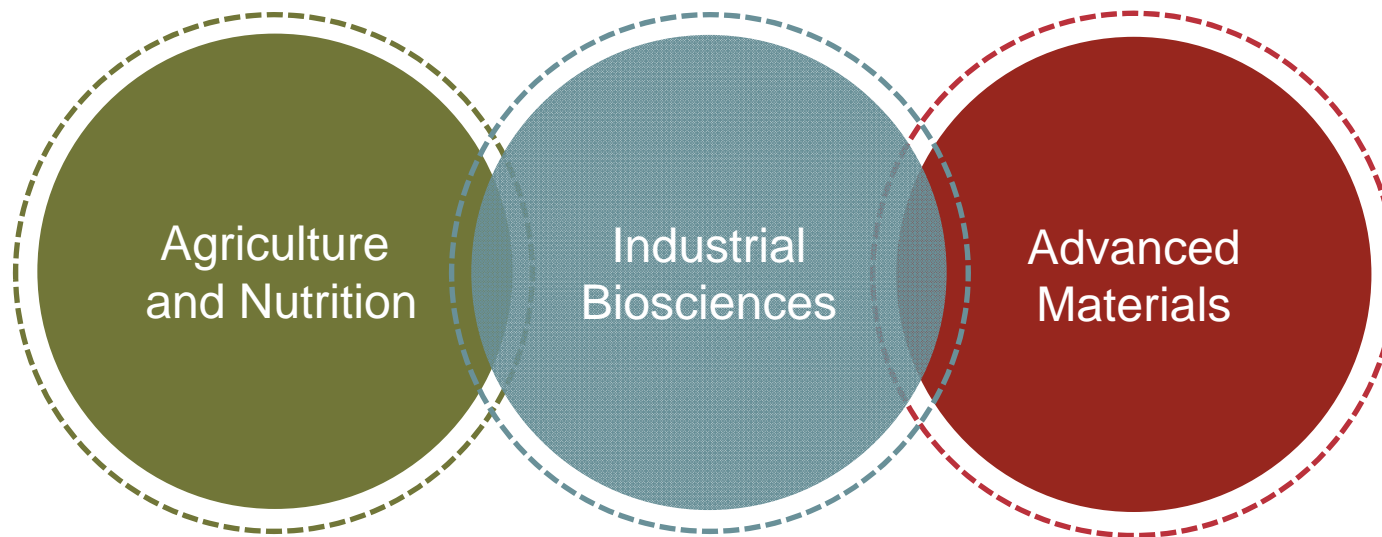
BIO World Congress on Industrial Biotechnology

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

PRODUCTS

Food, beverages, feed,  
detergents, personal  
care, textiles

END USE MARKETS



## Biomaterials

Biochemicals  
Biomaterials

PRODUCTS

Carpet, apparel,  
automotive

END USE MARKETS



## Biorefineries

Bioprocessing aids  
Biofuel technology

PRODUCTS

Carbohydrates,  
ethanol, butanol,

END USE MARKETS



## 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

## Full service licensing and Enzyme solutions



### 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



## Joint venture with BP



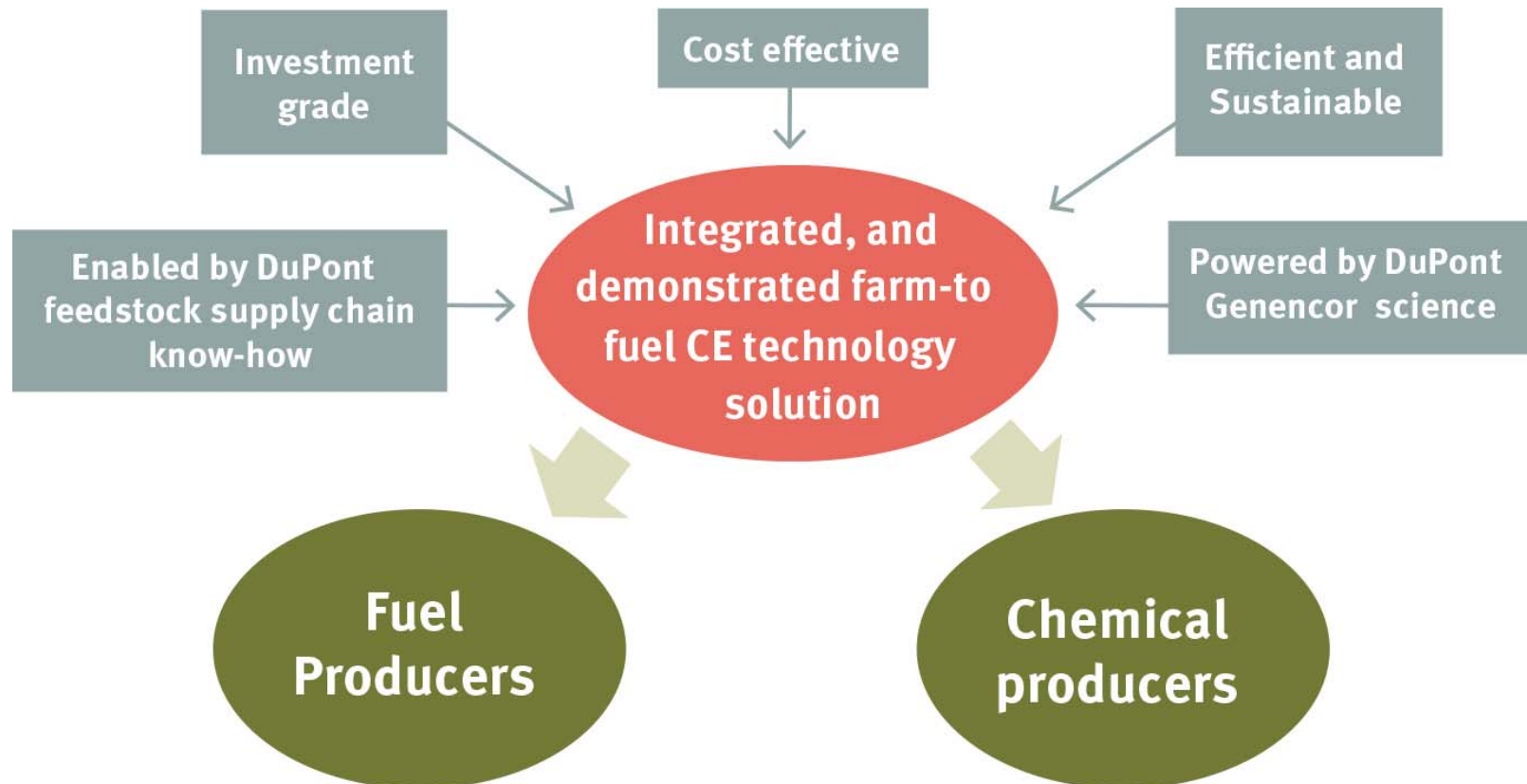
### Biobutanol Advantages:

**Biobutanol** is more compatible with all steps of the existing supply chain

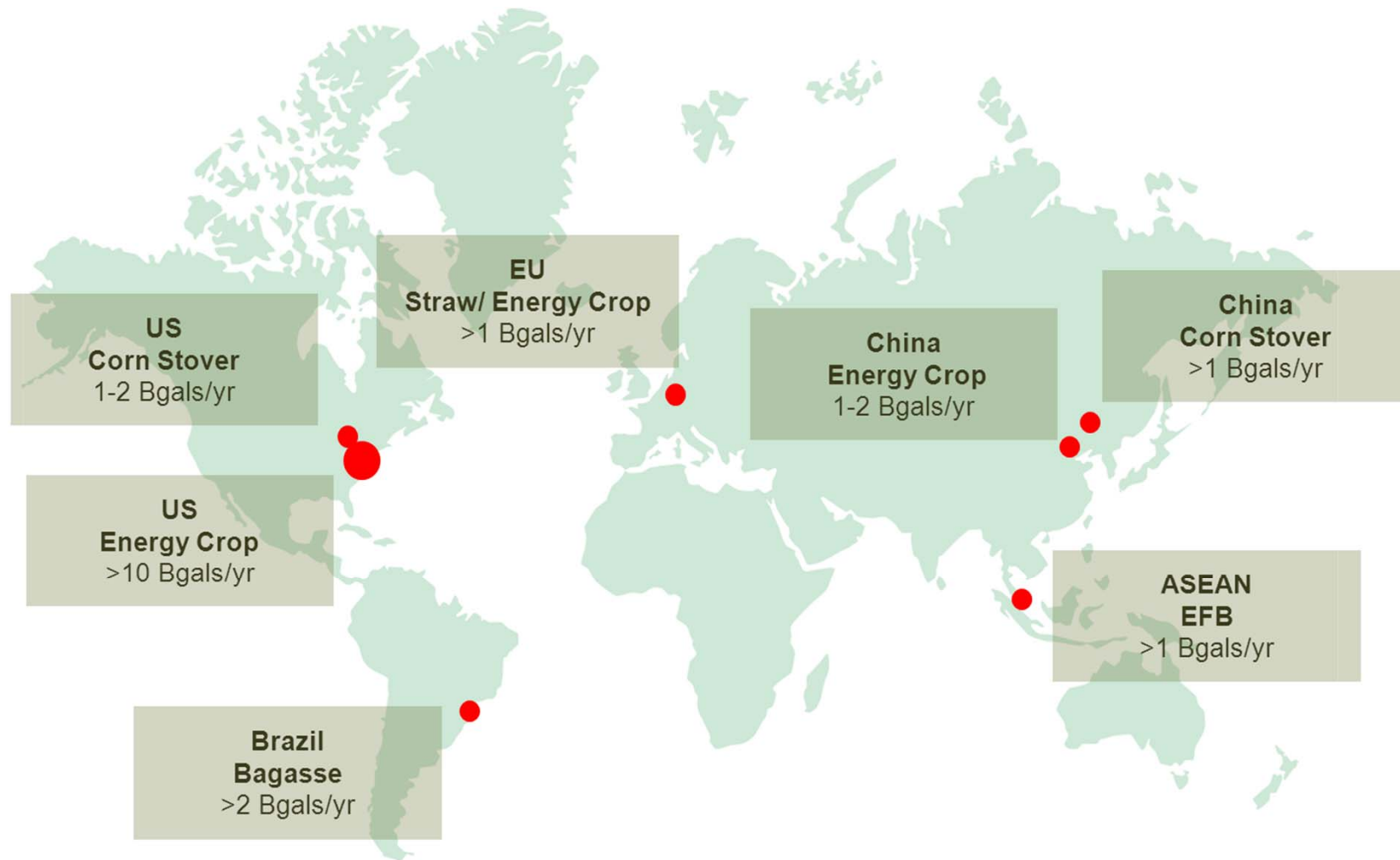
- Drop-in fuel
- High blends without infrastructure changes
- Refinery can use more fractions of oil
- Higher energy content

## DuPont Cellulosic Ethanol and Its Offering

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



# Global Biofuels Feedstocks and Opportunity



# 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



Farmer  
Contracts



Biomass  
Collection



Storage



Transport



Preprocessing  
& Delivery

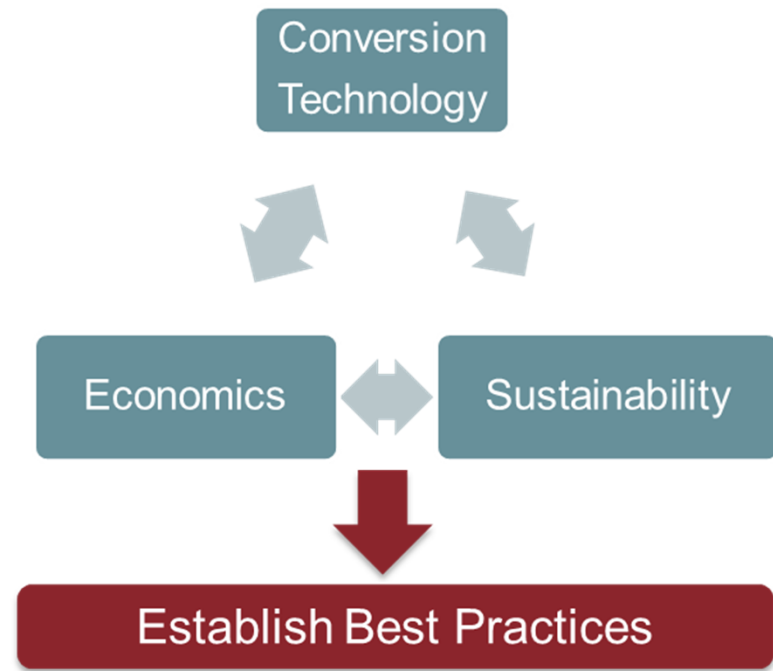
- Large-scale test harvest validations
- Agronomic understanding
- Multi-year grower involvement
- Commercial equipment
- Storage quality and stability tests
- Collaboration and credibility



**Sustainable Biofuels  
Awards**

**2012 Winner**

**Sustainable Feedstock Innovation**

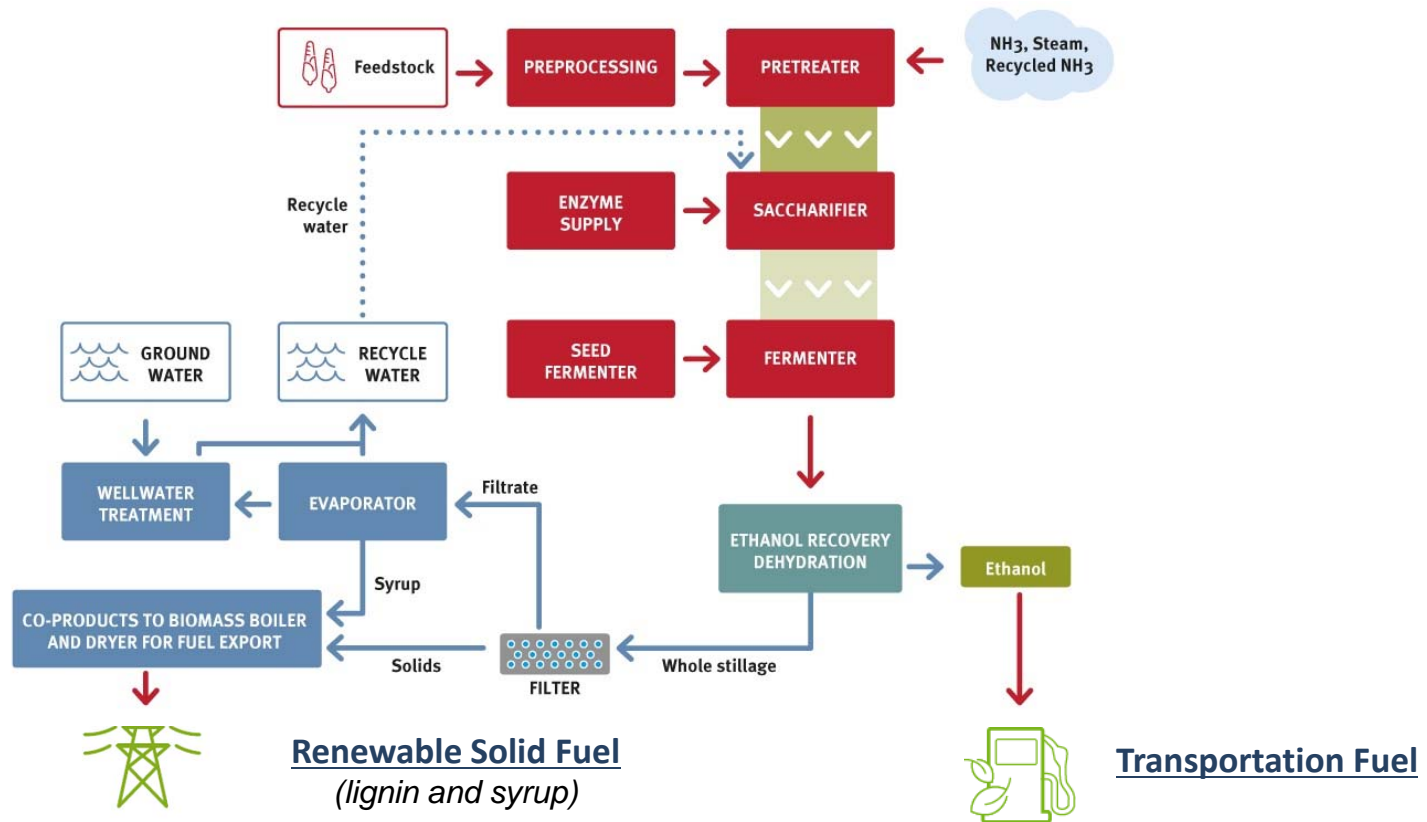




# Field Experience – Success Stories



# DCE Process Generates Two Renewable Fuel Products



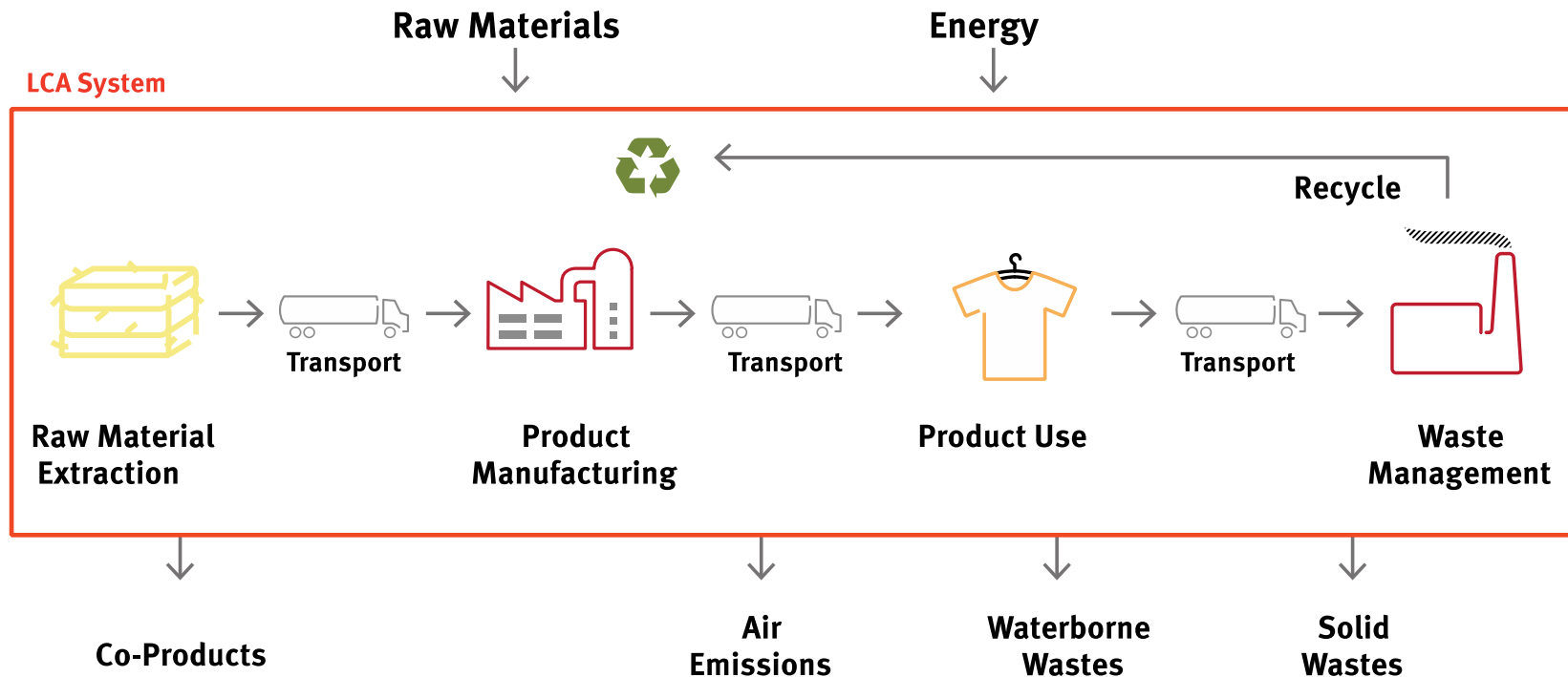
Co-products can be utilized in on-site biomass boiler

Commercial sale of dried biofuels to off-site power generators  
(coal-fired boiler blending or other utilities)

Use of fuel by local gasoline blenders and suppliers

# Quantifying Environmental Impacts

## Life Cycle Assessment



**DCE technology provides >100% GHG reduction (g CO<sub>2</sub> eq/MJ) compared to conventional gasoline**

- 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

## 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 Cellulosic Ethanol Commercialization



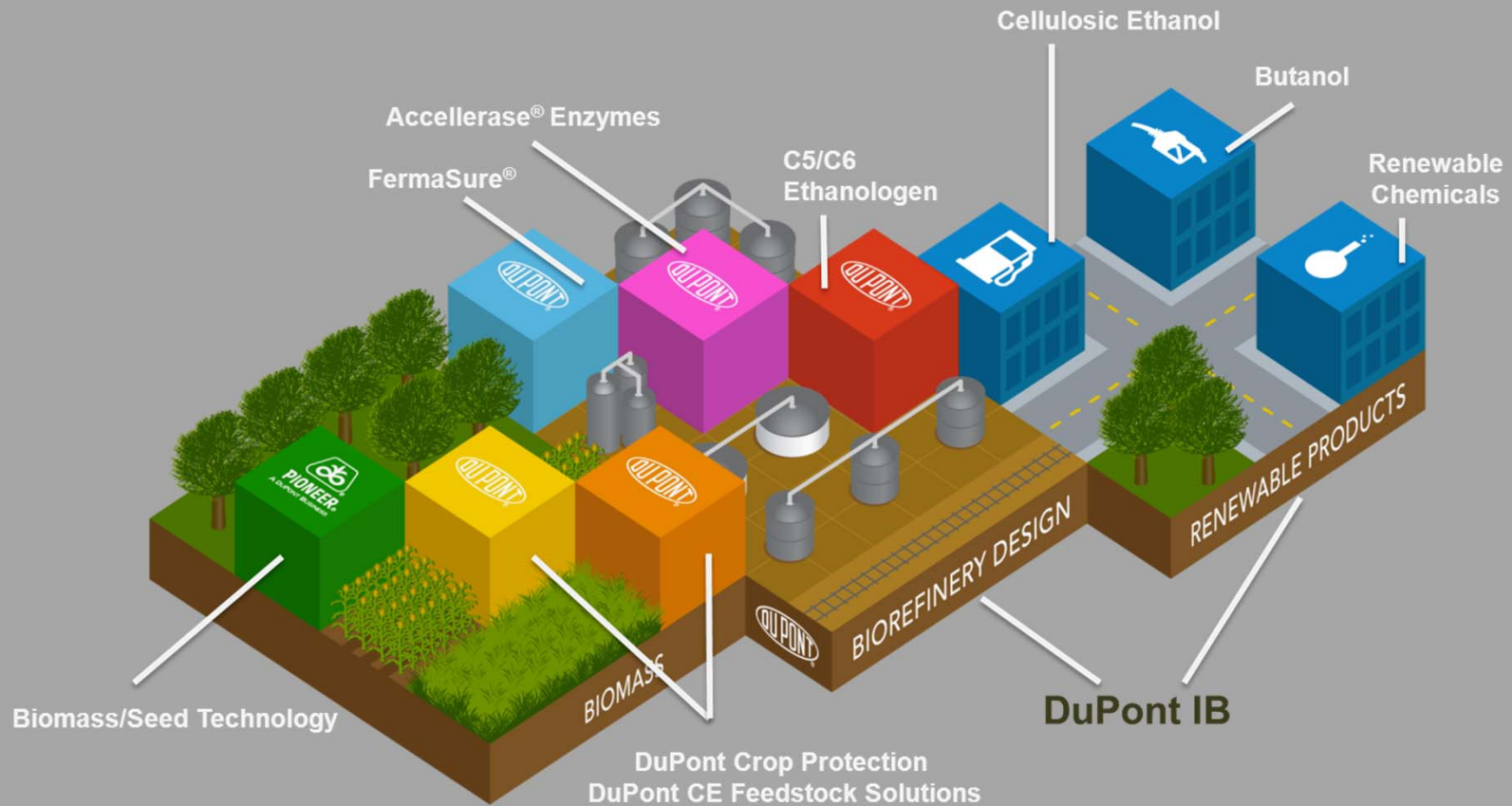
***DuPont is building the largest commercial CE biorefinery  
in the world located in Nevada, Iowa***



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

*More info @ [biofuels.dupont.com](http://biofuels.dupont.com)*

# DuPont Cellulosic Ethanol Solutions



***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 miracles of science™*



## More info: [biofuels.dupont.com](http://biofuels.dupont.com)

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.

