DuPont Biofuels:
Building a Sustainable Future

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DuPont™
Renewably-sourced™
Materials

The miracles of science™

TECHNOLOGY THAT *fuels*™

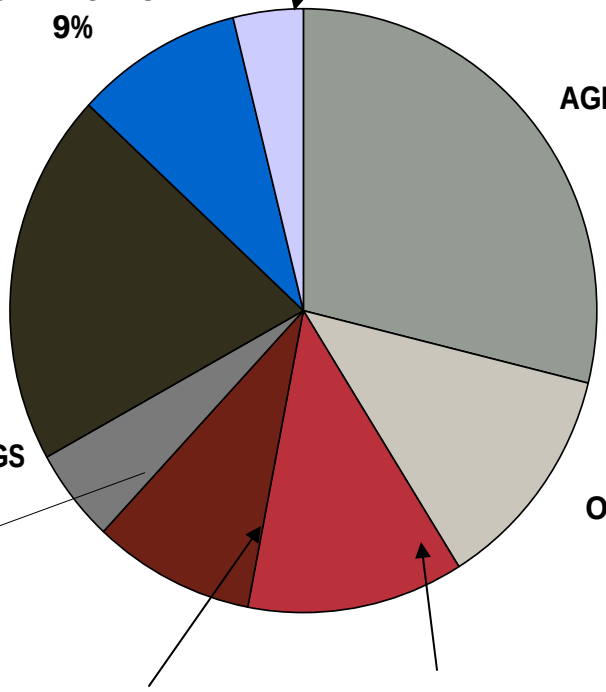
DuPont Mission – Sustainable Growth

The creation of shareholder and societal value while we reduce the environmental footprint* along the value chains in which we operate.

* DuPont defines "footprint" as all injuries, illnesses, incidents, waste, emissions, use of water and depletable forms of raw materials and energy.

Sales by Market

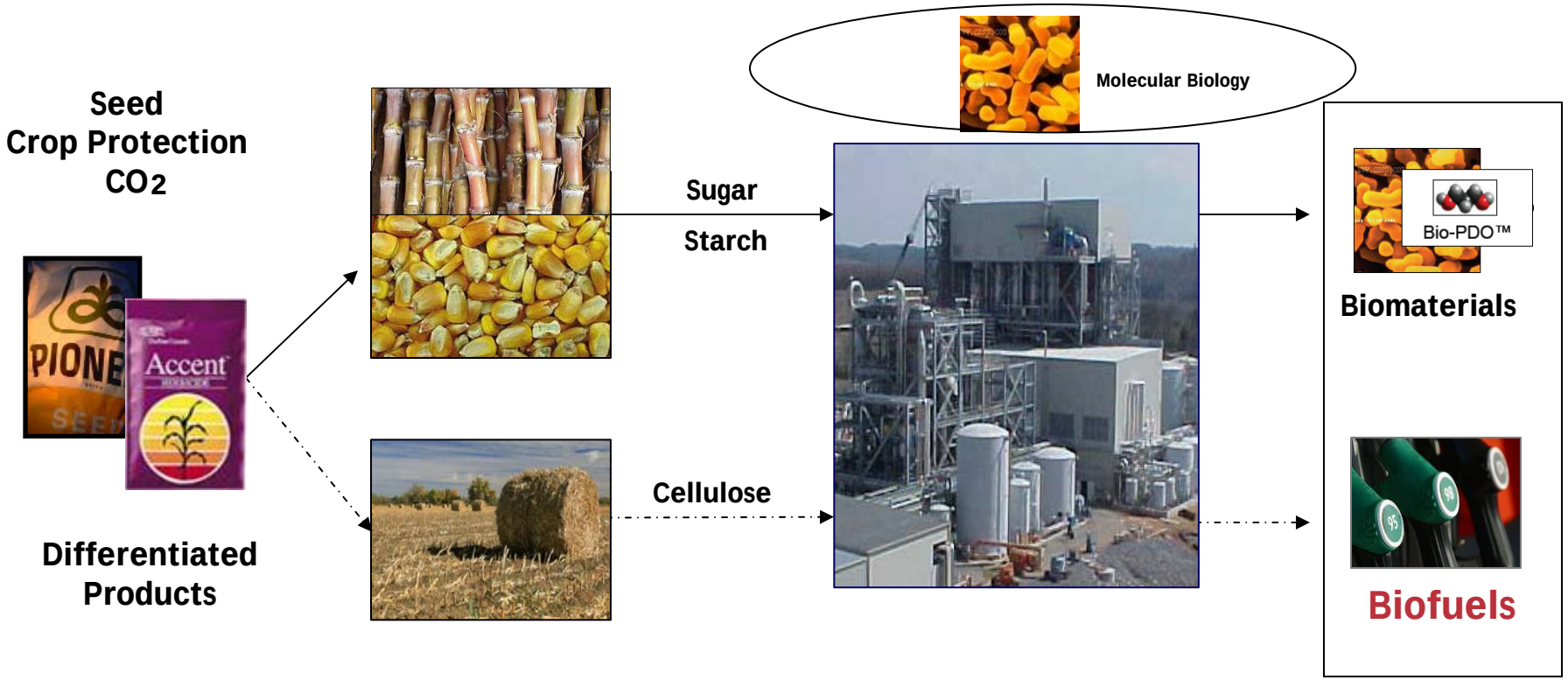
2008- $30.5B



Applied BioScience Platform at DuPont

exploring "carbohydrate" based business opportunities

Agricultural Inputs → Plant Feedstocks → Conversion to Sugars → Fermentation Processes → Biofuels Biochemicals



Biofuel Demand Drivers and Market Issues

Transportation Fuels - Abundance of Issues

Pending demand increase for transport fuel

Global concern over the environment

Biofuels

40 - 60 BGY Opportunity*

Real concern over security of supply and cost

Increasing demand on agriculture

World continues its historic change…

Energy is the globe's greatest economic threat and opportunity over the next decade

* 2020 DuPont estimate

Global Biofuel 'Value Chain' Challenges

Upstream

Feedstock

Adequate Regional Supply

Developing Non-food Feedstock

Downstream

Refinery & Pipeline

Biofuel Compatibility

With

Existing Gas Refinery Infrastructure

Retail & Consumer

Uncompromised

Fuel Performance

Compatibility with existing infrastructure

Current biofuel solutions are inadequate to meet global needs

DuPont Technologies Address Market Challenges

Feedstock Options

PRODUCTION PER ACRE

CELLULOSE CONVERSION

DuPont Danisco Cellulosic Ethanol LLC

Better Fuels

REFINERY BLENDING

FUEL COMPATIBILITY

MILEAGE

ENGINE DURABILITY

DuPont BP Partnership

PIONEER® A DuPont Company | *Science with Service Delivering Success™*

DuPont Biofuels:
Three Strategies

Agricultural Inputs
Seeds & Crop Protection

Solutions for Sustainable Feedstock

Biofuels From Biomass

Cellulosic Ethanol

Advanced Biofuels

Biobutanol

#1 - Solutions for Sustainable Feedstock

"more bushels per acre & more ethanol per bushel"

PIONEER® A DuPont Company | Science with Service Delivering Success™

Pioneer – the World Leader in Seed Genetics

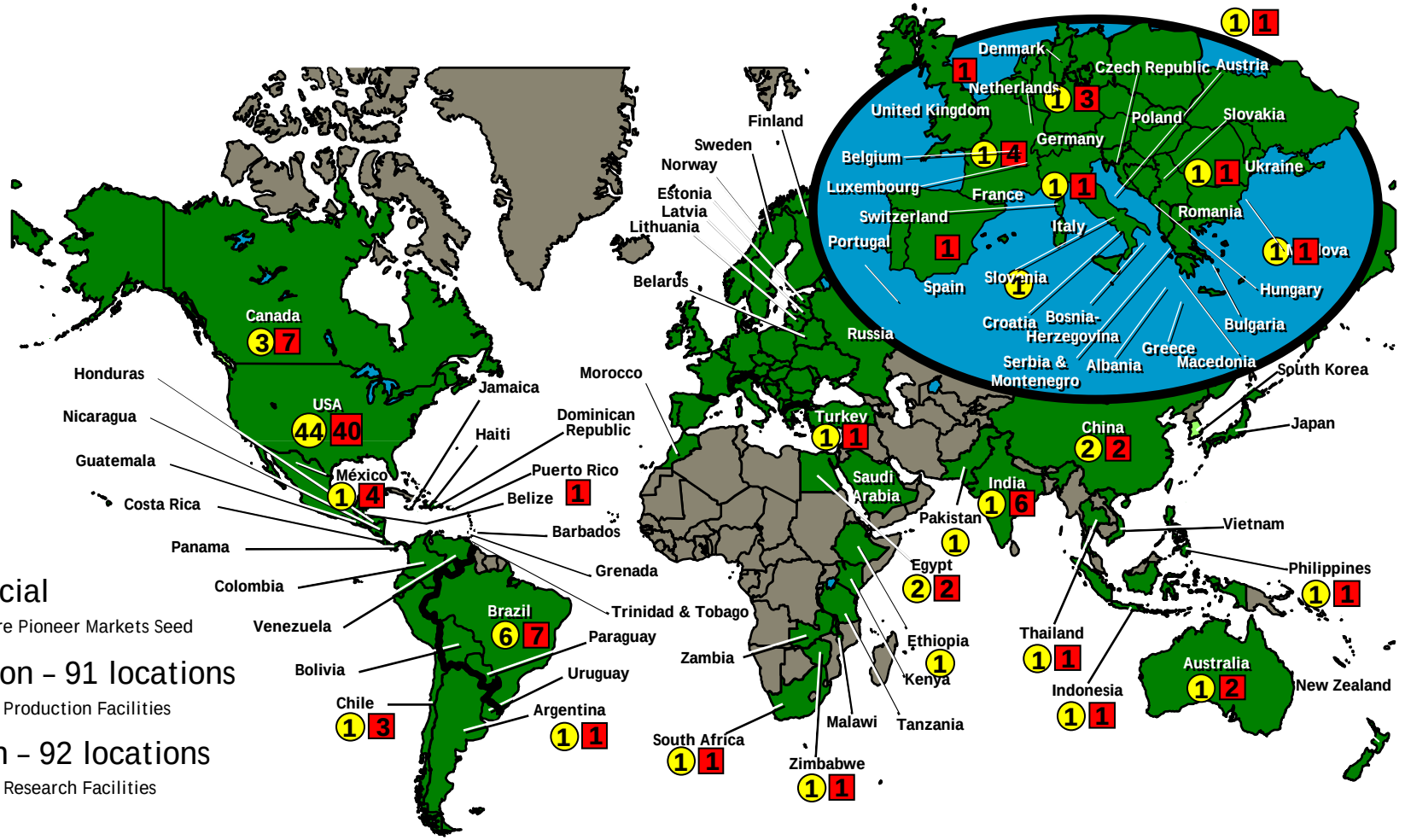
Founded By Henry Wallace as the Hi-Bred Seed Company in 1926 – the first company to develop, produce and market hybrid seed corn

- ~$4.0 billion in sales
- 8,500 employees
- ~$2MM / day in research
- #1 or #2 position in most crops worldwide

Corn	Soybean
Canola	Sunflower
Alfalfa	Wheat
Sorghum	Rice
Hybrid Rice	Cotton

Pioneer's Global Reach

Sales, Seed Production and Research

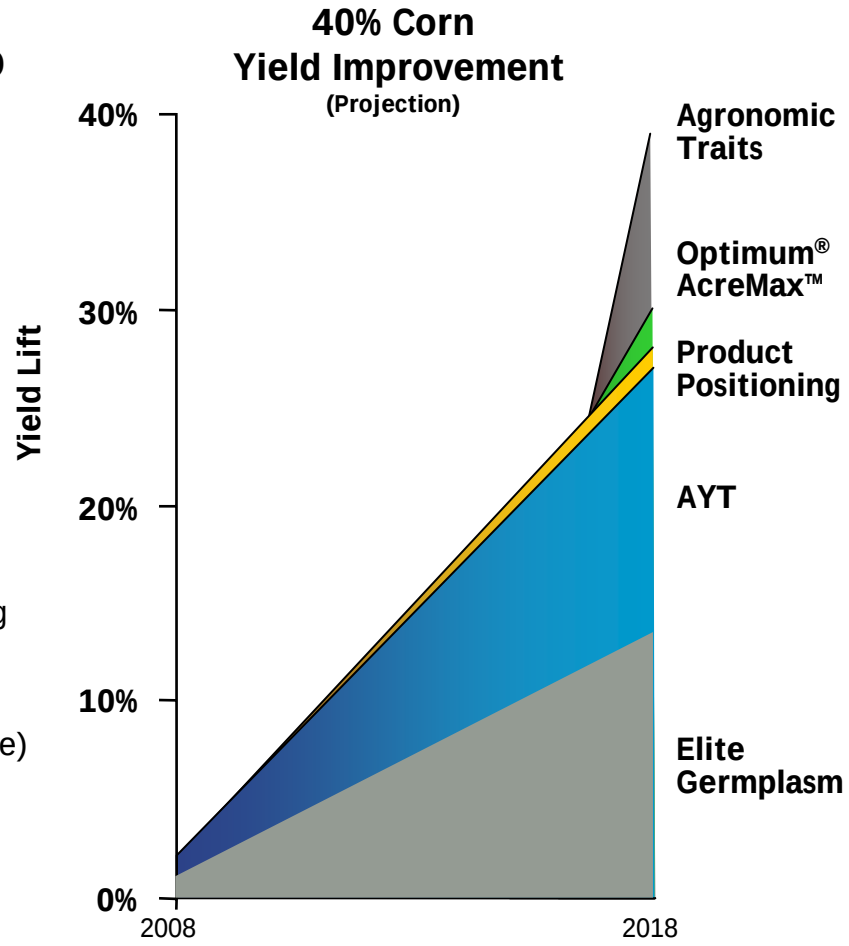


- **Commercial**
  Countries where Pioneer Markets Seed
- **Production – 91 locations**
  Countries with Production Facilities
- **Research – 92 locations**
  Countries with Research Facilities

"more bushels per acre & more ethanol per bushel"

Pioneer Corn Yield Growth Target

- **Current rate of genetic gain is expected to double from today's 1.5% per year**
- **Pioneer is targeting a 40% growth in U.S. corn yield in the next 10 years**
  - Current World Record: 442 bushels / acre
  - 154 bushels per acre in 2008 (US average)
  - 210 bushels per acre targeted by 2018
- **Factors contributing to yield lift:**
  - Elite germplasm
  - Accelerated Yield Technology (AYT) – combination of breeding technologies and techniques that enable genetic gains far greater than any of the individual components
  - Product positioning (getting the right product on the right acre)
  - Next generation herbicide tolerance and insect protection – more protection on more acres
  - Agronomic traits – drought tolerance, nitrogen use efficiency, disease and pest resistance
  - Transgenic yield (corn trait target is 10% increase; soybean trait target is 8% increase)



Pioneer Research Focus

- Opportunities for crop productivity research include:
  - The need to make presently unusable soils productive
  - The need to increase the genetic potential of individual production and farming systems

- Pioneer is working on technologies to better utilize input resources
  - Drought tolerance traits in corn
  - Nitrogen use efficiency (NUE)

With & Without NUE Trait

Pioneer Cellulosic Feedstock Development

Pioneer is evaluating options with alternative feedstock crops

- Cob and Stover characterization – how much variation exists in existing corn genetics
- Define compositional improvement targets
- Exploration of new energy crop alternatives (switchgrass, sweet sorghum, other)
- Harvest and storage considerations
- Soil management and fertility – how much residue should be removed
- Impact on farming operations (farming speed, management complexity)

#2 – Cellulosic Ethanol

Deliver Innovations that Transform the Market

Upstream

Feedstock

Technology for Conversion of
Non-Food Feedstock to Ethanol

DuPont Danisco Cellulosic Ethanol LLC

Uniting two leaders in cellulosic ethanol

- 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 enzyme production
    - future design improvements
- Feedstock-flexible demonstration plant in 2009
- Commercial deployment
  - 25MGY cob plant in Midwest in 2012
  - 15MGY switchgrass plant in TN in ~2013

The Challenges: Path to Commercialization

- Technical Development
  - Capital costs
  - Operating costs
- Develop Feedstock Supply Chain
- External Factors
  - Political support
  - Market demand
  - Access to capital

The world's first robust, integrated solution for biomass-to-ethanol

Pretreatment

Enzymatic hydrolysis

Mixed sugar ethanologen

Including:
- >$100 million invested since 2000
- DOE & NREL support & collaboration
- Significant enabling patent estate
- Demonstrated capabilities in scale up & design

Demonstration Plant

Vonore, Tennessee

- Joint investment including $40.7 million from Tennessee
- Nameplate capacity 250kgal/yr
- On-line 4Q 2009
- Process development unit, pelletizer on site
- Applications lab/ support capability
- Focus on optimal US feedstocks: corn cob and switchgrass

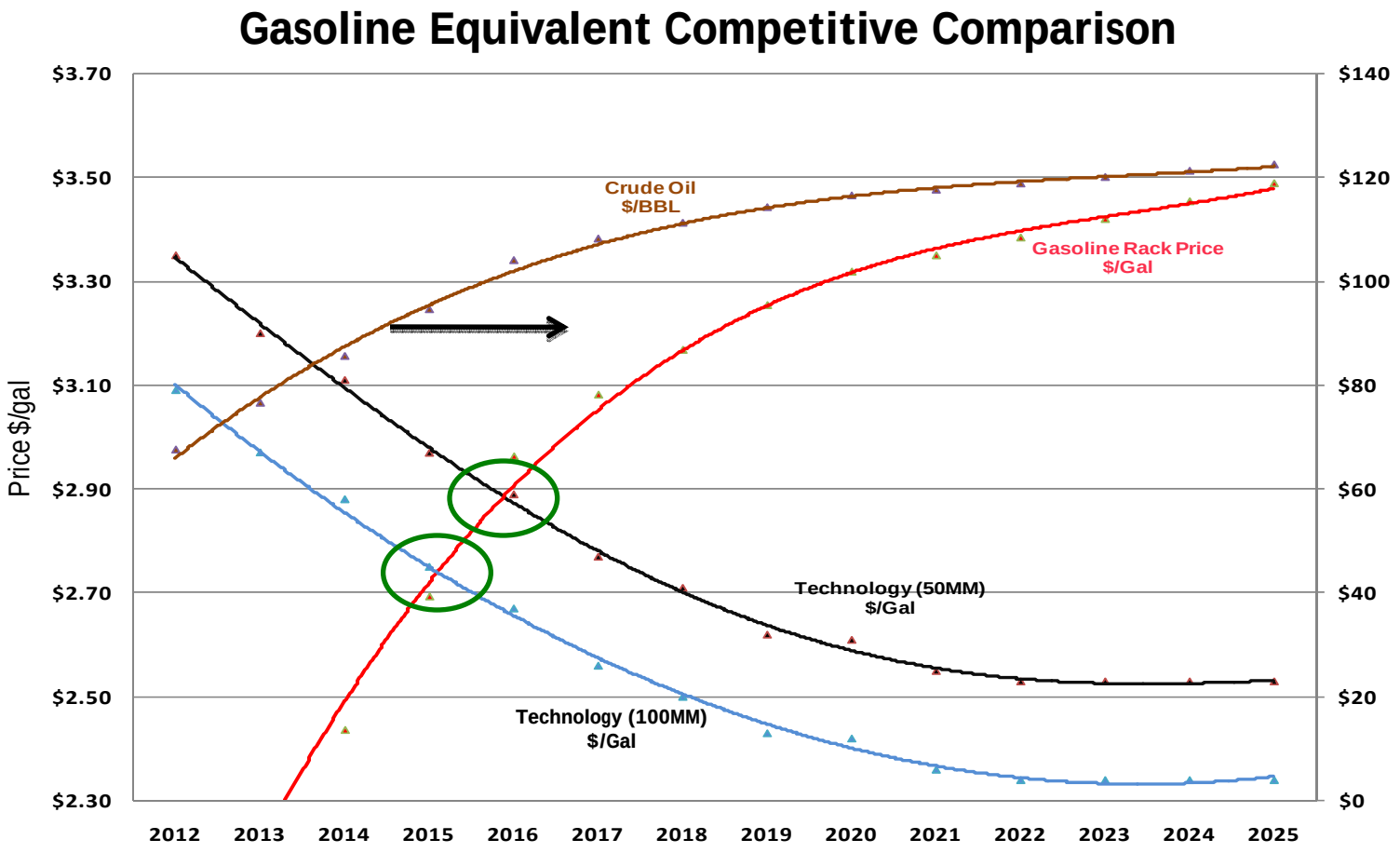
Technology Status – Key Metrics

Cobs to Ethanol

	Initial Introduction	Current Estimates	Commercial Scale
SELECT INPUT VARIABLES			
Enzyme Cost; Percent Reduction	100	70	22
CAPEX; ($ / Gal) (2008 Dollars)	$8+	$5 to $7	~$3 to $5
PROCESS RESULTS			
Total process yield; (Gal/T)	67	85	90
MESP; ($/Gal)	~ $3.00	~$2.00	~$1.50

$50/T BIOMASS

Cellulosic Ethanol and Gasoline Trends



Price$/gal is energy equivalent and $50/ton biomass

The Challenges: Path to Commercialization

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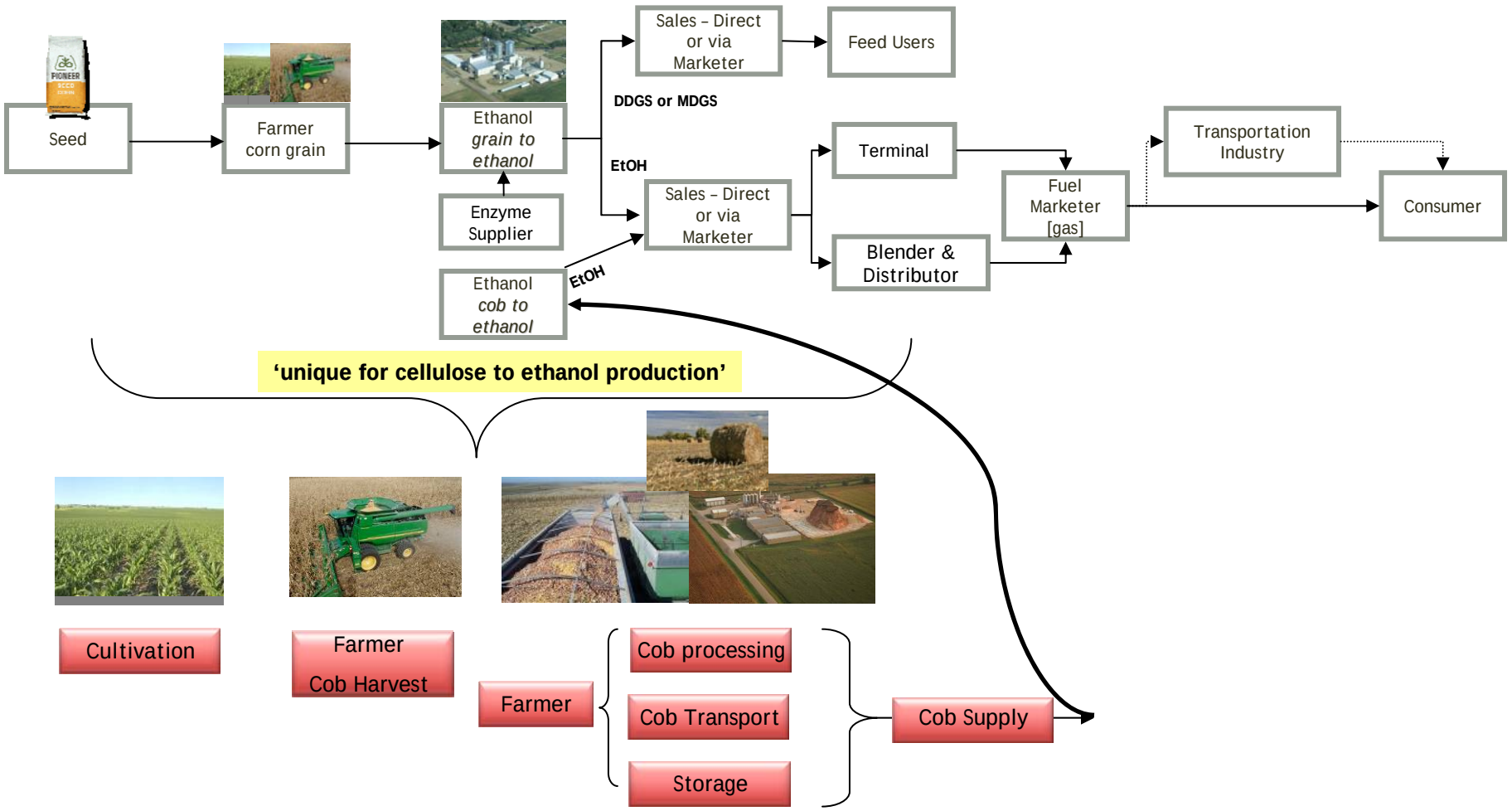
Value Chain Needs to be Organized



US Cellulosic Potential – DDCE Feedstocks

	Tons/ Acre	BGY Under RFS	# 50 MGY Plants	Sq miles Required for feedstock
Cobs	.65	2	40	60,000
Switchgrass	10	6 (20*)	120	12,000
Sorghum	15	5 (30*)	100	6,250

*** DDCE estimates for market potential with increased Cellulosic ethanol demand**

Upstream Value Chain Formation

- Cob
  - Research in harvest, storage and transport
  - Challenges: Grower programs, densification, moisture issues
- Switchgrass
  - State of TN program - $30M for upstream development
  - Selected farmers received 3 year acreage based contract:
    - Incentive payment of $450 /acre /year for costs of production and opportunity costs
    - Alamo switchgrass seed & technical expertise
  - Total program expanding to ~6,000 acres

Conclusions

- Cellulosic ethanol is ready for commercial deployment
- Technical challenges have been largely met
- Remaining challenges are scale-up, investment & supply chain development
- DDCE is committed to the long haul and to building this industry
  - Demonstration Facility in 2009
  - 25 MGY Cob plant in 2012
  - 15 MGY Switchgrass plant in 2013

#3 An Advanced Biofuel - biobutanol

Deliver Innovations that Transform the Market

Downstream

Refinery & Pipeline

Compatibility

With

Existing Gas Refinery Infrastructure

Retail & Consumer

Uncompromised

Fuel Performance

Biobutanol the Advanced Biofuel

BP & DuPont announced June 2006

RENEWABLE FEEDSTOCKS

biobutanol

WORLDWIDE FUEL MARKETS

- **Powerful partnership**
- **Shared commitment**
- **Global reach**
- **Complementary capabilities**

Biobutanol Performance Advantages

BIOFUEL PRODUCTION

- **DIVERSE AGRICULTURAL FEEDSTOCKS**
- **UTILIZE ETHANOL PRODUCTION ASSETS**
- **SUPPORT AGRICULTURAL DEVELOPMENT**

REFINERY

PIPELINE

TERMINAL

- **LIMITED WATER ABSORPTION**
- **FUNGIBLE BLENDING**
- **LOW VAPOR PRESSURE**
- **UTILIZE EXISTING INFRASTRUCTURE**

RETAIL / AUTO INDUSTRY / CONSUMER

- **26% HIGHER ENERGY DENSITY THAN ETHANOL**
- **POTENTIAL FOR HIGHER BLEND LEVELS WITHOUT VEHICLE MODIFICATION (> 10%)**
- **NO INCREASE IN CO, HC, NOx EMISSIONS**

The Challenge: Competitive Biobutanol COM

The Feedstock

Corn, Wheat, Sugarcane, Cellulose

Converted to **Sugar** for Fermentation

$C_6H_{12}O_6$
Sugar

The Molecule

Butanol $C_4H_{10}O$

Incumbent Bioprocesses

ABE Process (Acetone-Butanol-Ethanol)

$C_6H_{12}O_6$ Sugar → C_3H_6O Acetone + $C_4H_{10}O$ Butanol + C_2H_6O Ethanol

The New and Improved Bioprocess

Develop a cost effective route to biobutanol

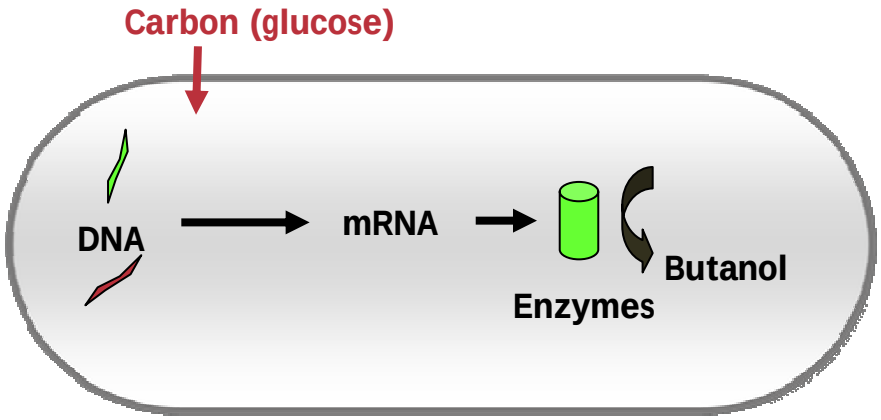
$C_6H_{12}O_6$ Sugar → $C_4H_{10}O$ Butanol

Biobutanol-Manufacturing

Biological Factory (Cell)

Approach:

Add genes (DNA) for production of biobutanol



Toolset

- Microbiology
- Molecular Biology
- Biochemistry
- Genomics/Bioinformatics
- Protein Engineering
- High Throughput Screening
- Fermentation

DuPont was First in World to Demonstrate Biobutanol via Synthetic Pathways – Patents filed 2005

Fermentation Metrics

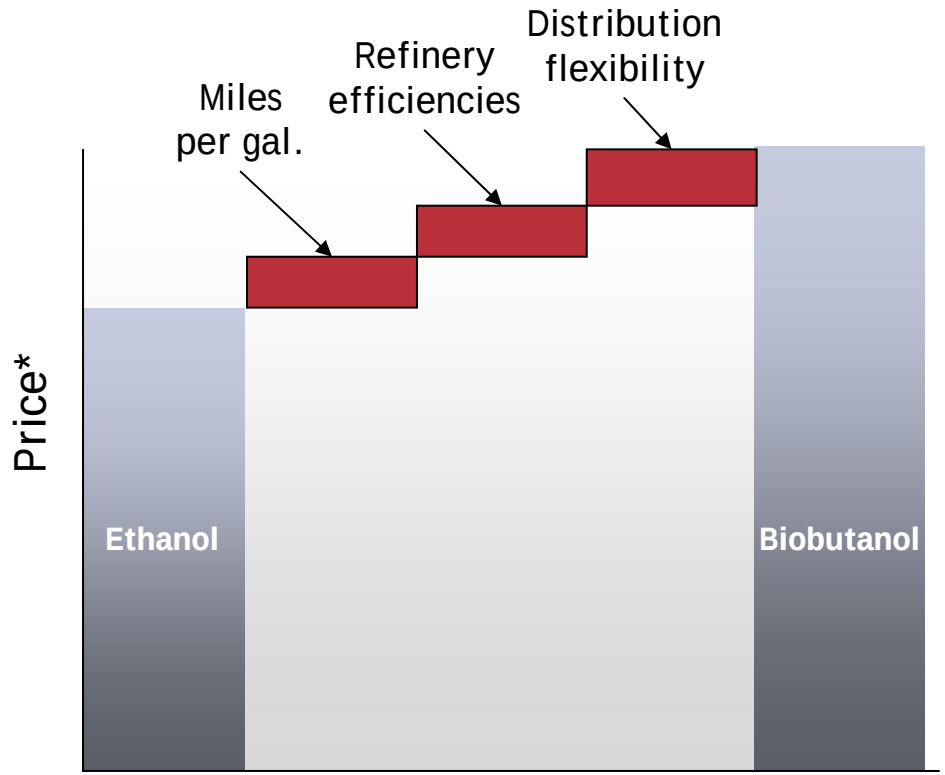
- Rate
- Titer
- Yield

Biobutanol – Value Proposition

Biobutanol delivers significantly improved logistics & fuel performance across the value chain

Attributes → Value Added Pricing

- **Lower Distribution Costs**
- **Higher Blending Value and Higher Blend Levels**
- **Infrastructure compatibility**
- **Higher energy density (26%)**
- **Greater compatibility with existing engine designs and other materials**
- **Synergistic with Ethanol**



* Normalized ethanol price / Graph illustrates sources of value / Not to scale

Biobutanol – Value Proposition

Break through the "Blend Wall" which is the point where regulatory obligations for ethanol blending exceeds what can be sold in the marketplace

- Barriers to breaching the blend wall
  - Permissible blend levels in fuel
  - Capabilities of existing car park
  - Retail infrastructure

Options for breaking through the blend wall --

Fuels

- Increased blend levels for all vehicles
- Increase blend levels for some vehicles
- Increased E85 sales
- Biobutanol

Vehicles

- Extend warranties on existing vehicles
- Increase capability of new vehicles
- Increase FFV sales
- Biobutanol

Retail

- Recertify existing retail kit
- Replace/Upgrade existing kit
- Install E85 Pumps
- Biobutanol

Biobutanol Commercialization Strategy

- Scale-up technology from lab to demonstration plant to commercial production
- Work with biofuel producers, regulators, policy makers, and OEMs to qualify and accelerate global adoption of biobutanol
- License biobutanol technology to other companies
  - Ethanol plant conversion to biobutanol production
  - Greenfield biobutanol plants
- Enable supply chain and distribution network for biobutanol product globally

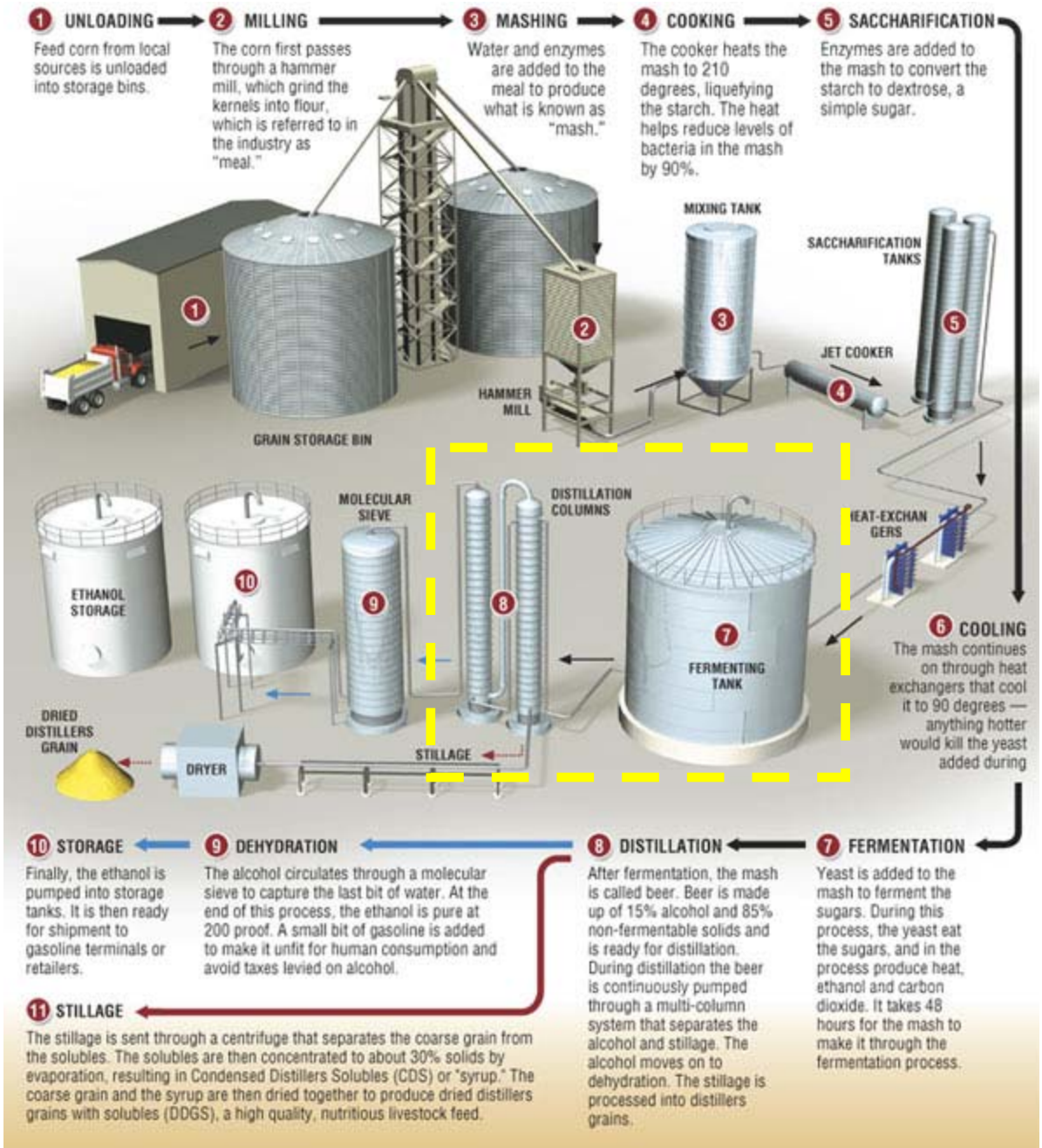
Conversion to Biobutanol

Key Modification Areas:

- *Fermentation*
- *Distillation*

using…

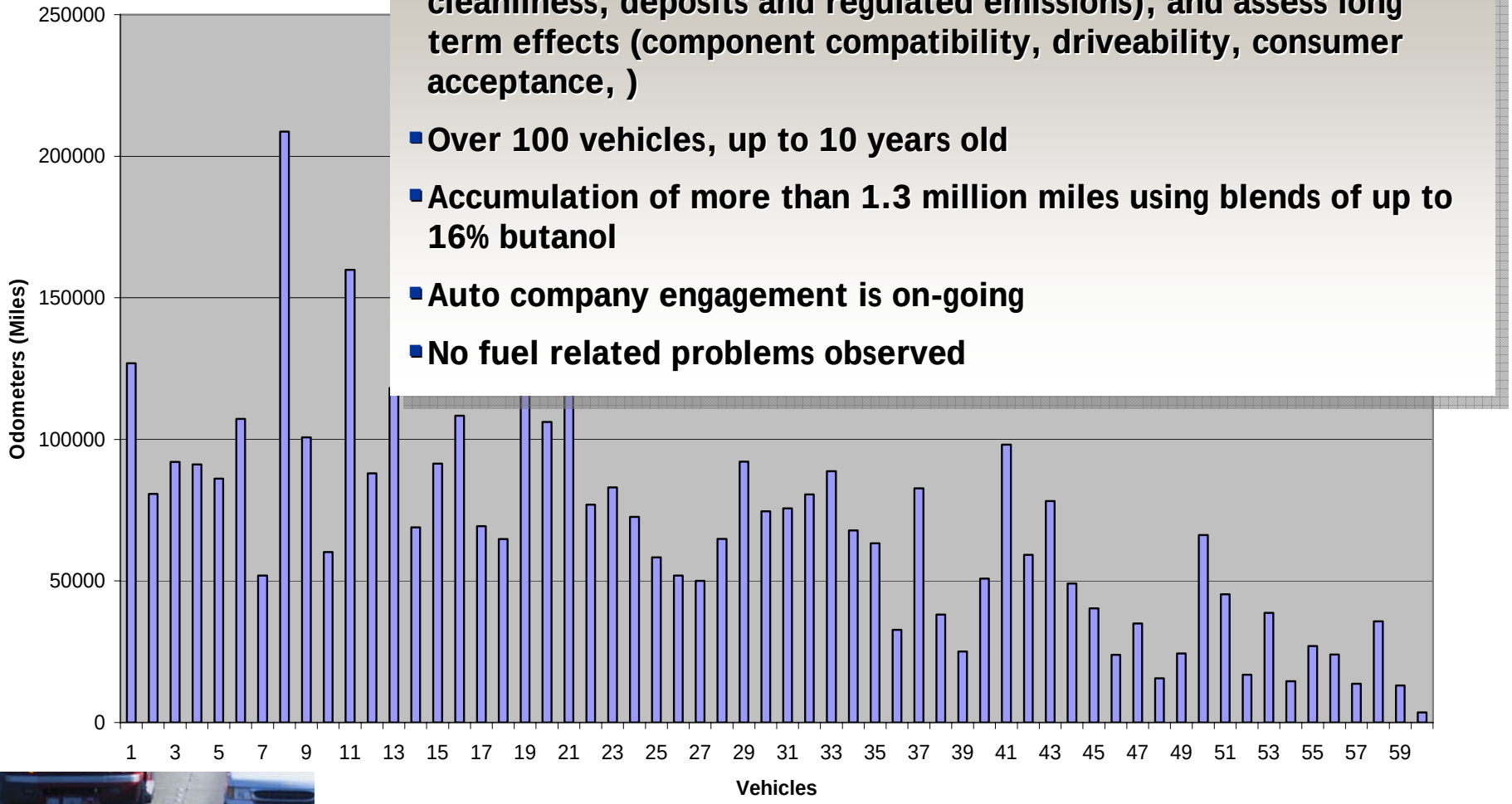
- *Standard equipment*
- *New microorganism*
- *New operating procedures*



Biobutanol Commercialization Strategy

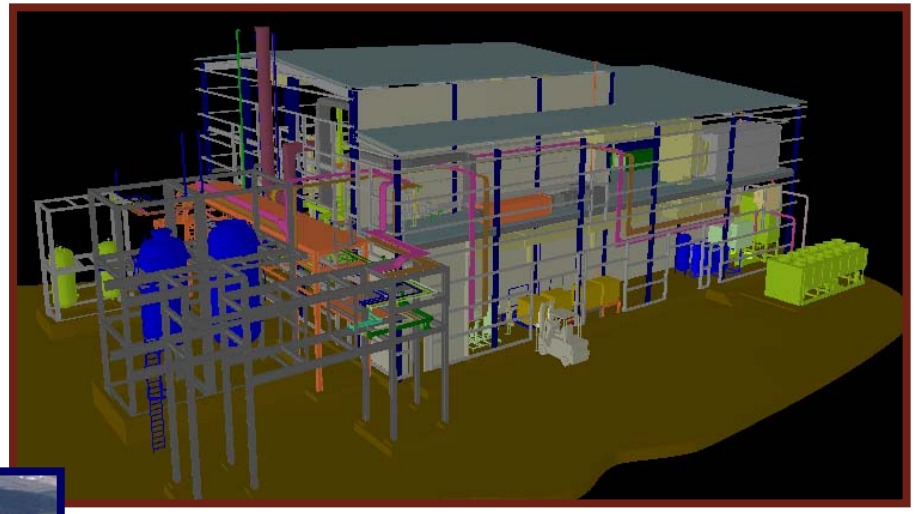
Large Fleet Vehicle Testing

- Key objectives are to identify key performance issues (engine cleanliness, deposits and regulated emissions), and assess long term effects (component compatibility, driveability, consumer acceptance,)
- Over 100 vehicles, up to 10 years old
- Accumulation of more than 1.3 million miles using blends of up to 16% butanol
- Auto company engagement is on-going
- No fuel related problems observed



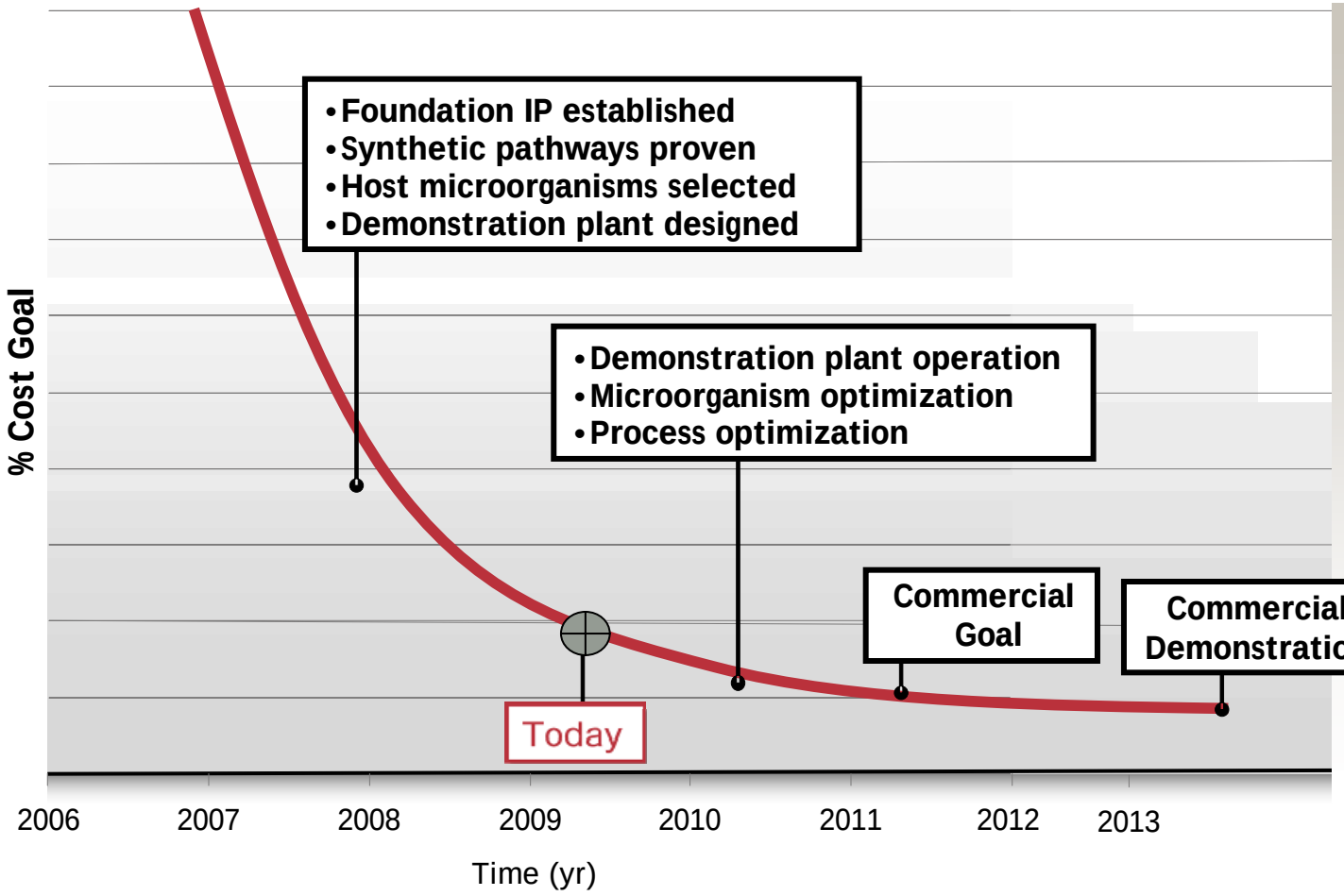
Biobutanol Technology Demonstration Plant

- Biobutanol demonstration plant sited on existing BP site at Kingston upon Hull in UK
- Completion in 2010



- Accelerate availability of commercial technology for scale-up to 50-100MM GPY
- Same site as 100 MM GPY ethanol plant

Biobutanol Process Performance & Commercial Demonstration



Metrics & Goals

2007 – superior to ABE process

2011 – cost equivalent to ethanol

Patents

Over 70 patent applications

- **Biology**
- **Fermentation process**
- **Chemical conversion**
- **End use applications**

Summary

DuPont Delivers Innovations that Transform the Market

Upstream

Feedstock

Cellulosic Ethanol

Downstream

Refinery & Pipeline

Retail & Consumer

PIONEER®
A DUPONT COMPANY

Biobutanol

Thank you!