BP Biofuels

a growing alternative

Ruth Scotti
US Policy Manager

Advanced Biofuels for California's Transportation Sector

Sacramento CA, June 11, 2007

Introduction

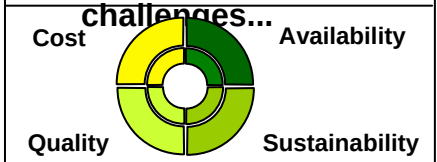
1 The long-term energy mix will change…

Regulatory Drivers
- Energy security
- Climate change
- Rural development

2 …with biofuels being a material component

Up to **30%** penetration by 2030

3 Today's biofuels face four main challenges...



4 …meaning industry growth is reliant on:

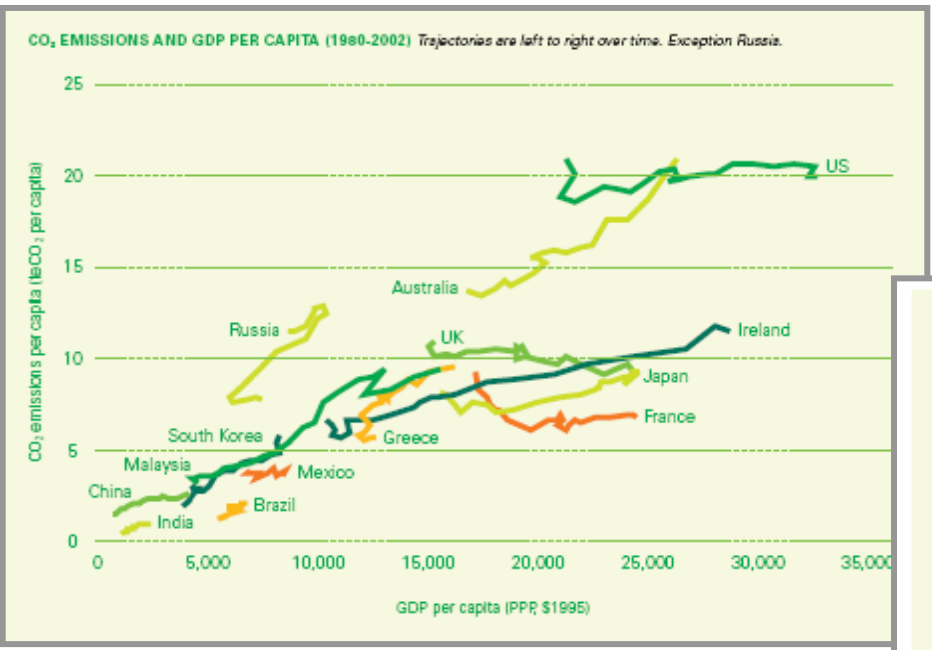
BP Biofuels
a growing alternative

1 The long-term energy mix will change…

Regulatory Drivers

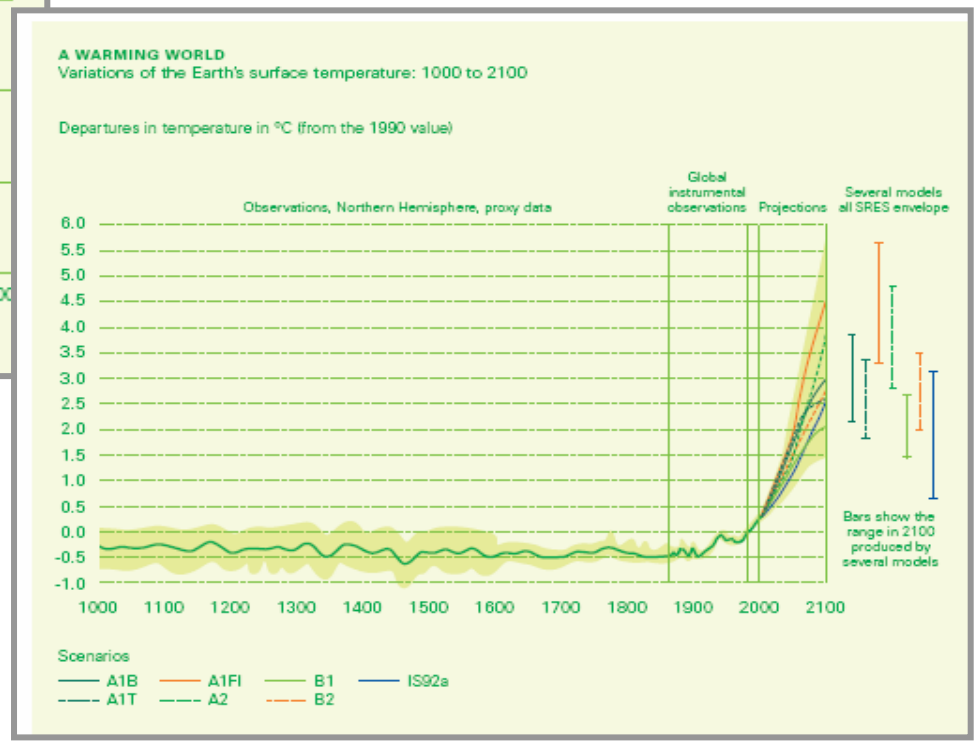
- Energy security
- Climate change
- Rural development

Energy is at the heart of the world economy. World population growth continues rapidly. Economic development lifts energy usage.



GHG Emissions Per Capita

Temperature Changes



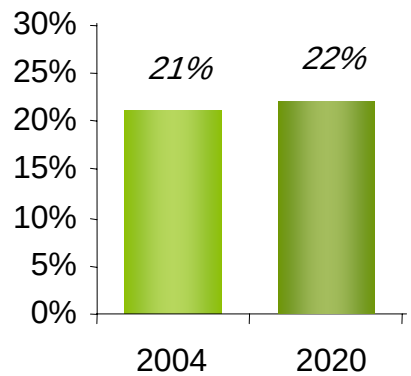
Source: UN IPCC Climate Change 2001; Synthesis Report. Summary for Policymakers

Given an increasing global energy demand, biofuels are the best supply side option for ground transportation

2 …with biofuels being a material component

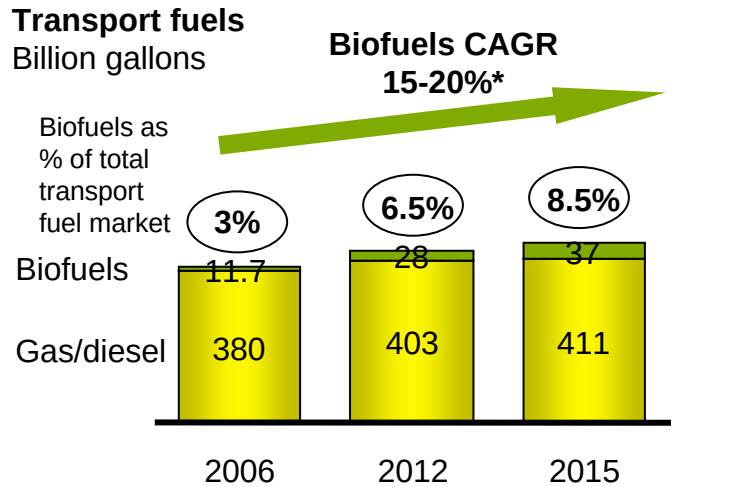
Up to **30%** penetration by 2030

Transport's Contribution to Total CO_2



Source: IEA World Energy Outlook, 2004

Biofuels represent ~40% of the predicted global growth in transport fuels

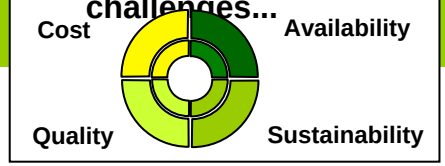


* Biofuels could reach 30% of the fuel pool by 2030

Source: Tecknon 2006, Team analysis

- Energy dependency and climate change will remain primary motivators for pursuing alternative and renewable transport fuels
- For ground transportation, biofuels are the best supply side option to meet both challenges in a material way by 2030. They also support rural development.

3 **Today's biofuels face four main challenges...**



From carbohydrates to hydrocarbons

- The biofuels industry is being created through the fusion of the two most important primary industries in the world – agriculture and energy

Petroleum Value Chain:

Exploration → Production → Transport → Refining → Blending/ Retail

Agricultural Value Chain:

Germplasm → Cultivation → Harvest → Process → Distribution

Biofuels Value Chain:

Germplasm → Cultivation → Harvest/ Transport → Processing/ Refining → Blending/ Retail



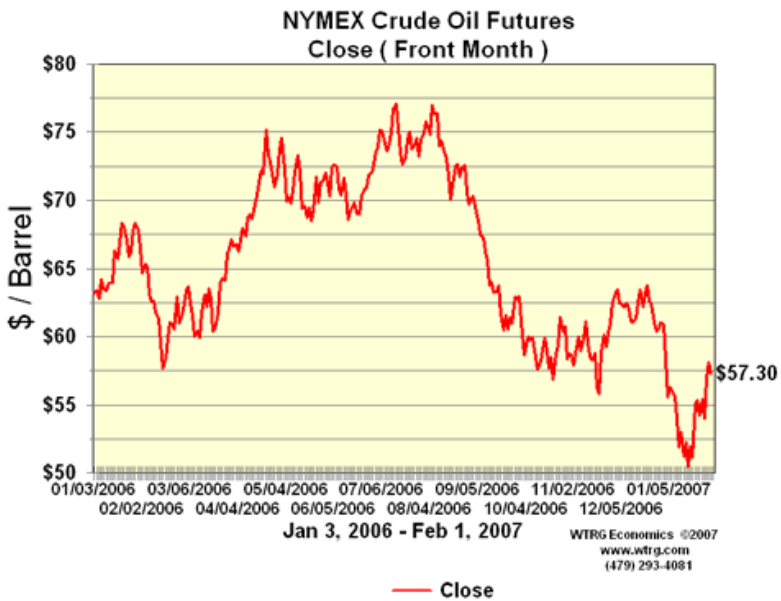


- But today's biofuels face 4 main challenges…

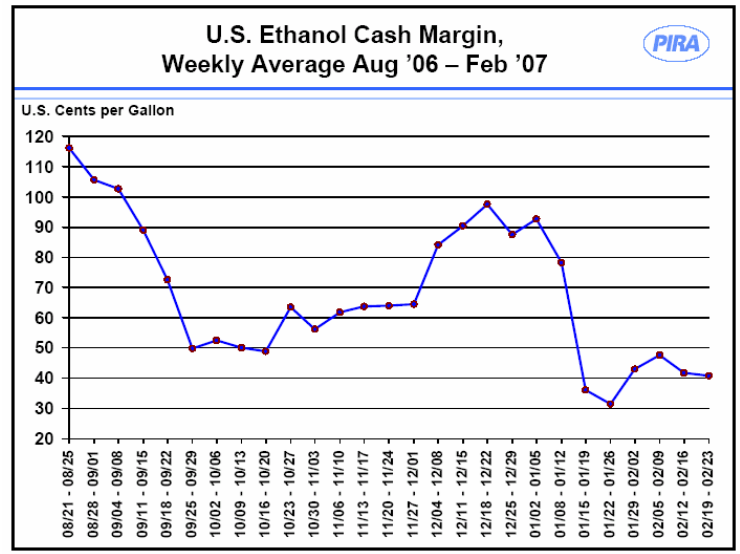
1

Cost: production economics are volatile, caught between feedstock costs and oil prices

CBOT Corn Futures – July 07 delivery ($/bushel)



ILLUSTRATIVE EXAMPLE – US ETHANOL

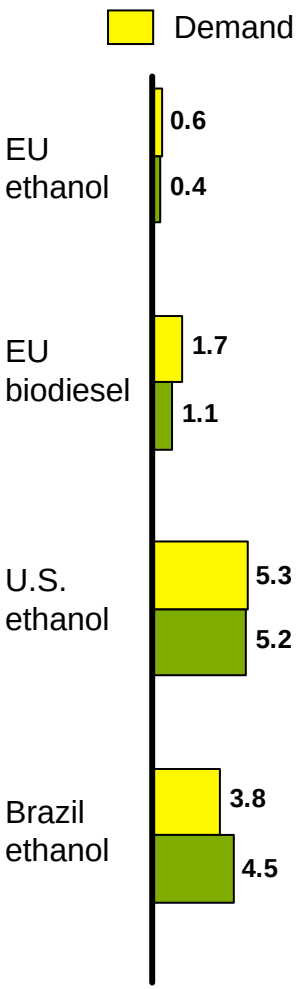


BP Biofuels a growing alternative

2a

Availability: biofuels currently represent 2-3% of the transport fuel pool. Today, feedstocks limit penetration to around 5-7%

2006 current demand and production capacity (bn galls)



2006 to 2011

Europe constraints

- **Distribution** – need ethanol infrastructure for distribution, blending and retail
- **Ethanol –** max feedstock limit reached with 5.75% target.
- **Bio-diesel** – max limit from rapeseed will be 1.1ban galls short of target; B5 will limit further penetration

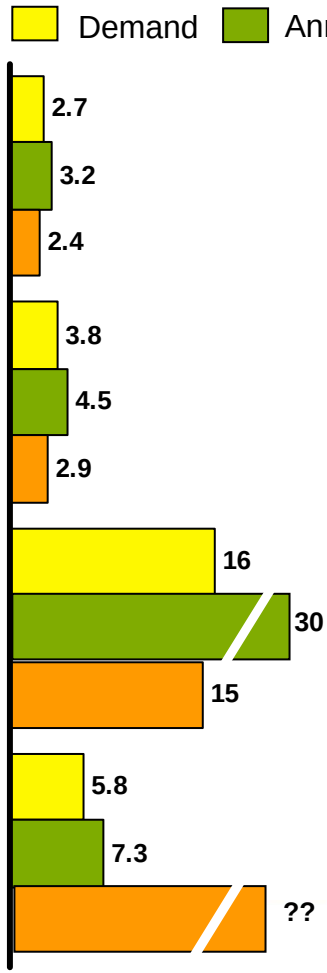
US constraints

- **Distribution** - rail car production capacity backlog of ~3 years
- **Growth** – limited by construction
- **Economics –** Increasing corn price will erode margin and limit growth to RFS and mandate volumes

Brazil constraints

- **Distribution -** Trucking is primary method, despite long distances and limited capacity resulting in high costs; limited port facilities
- **Risk management** – lack of paper market for hedging will limit exports

2011 predicted demand and maximum conventional feedstock supply (bn galls)



2011 forward

Europe constraints

- **Feedstock –** Limits include use of 50%set aside land and crop optimisation; Potential for 1.2 bn gall ethanol if cereal exports used; then LC required; increasing imports of veg oils for biodiesel
- **Capacity** – insufficient indigenous feedstock for announced capacity
- **Ethanol demand** beyond 10% - will require FFVs and E85 distribution

US constraints

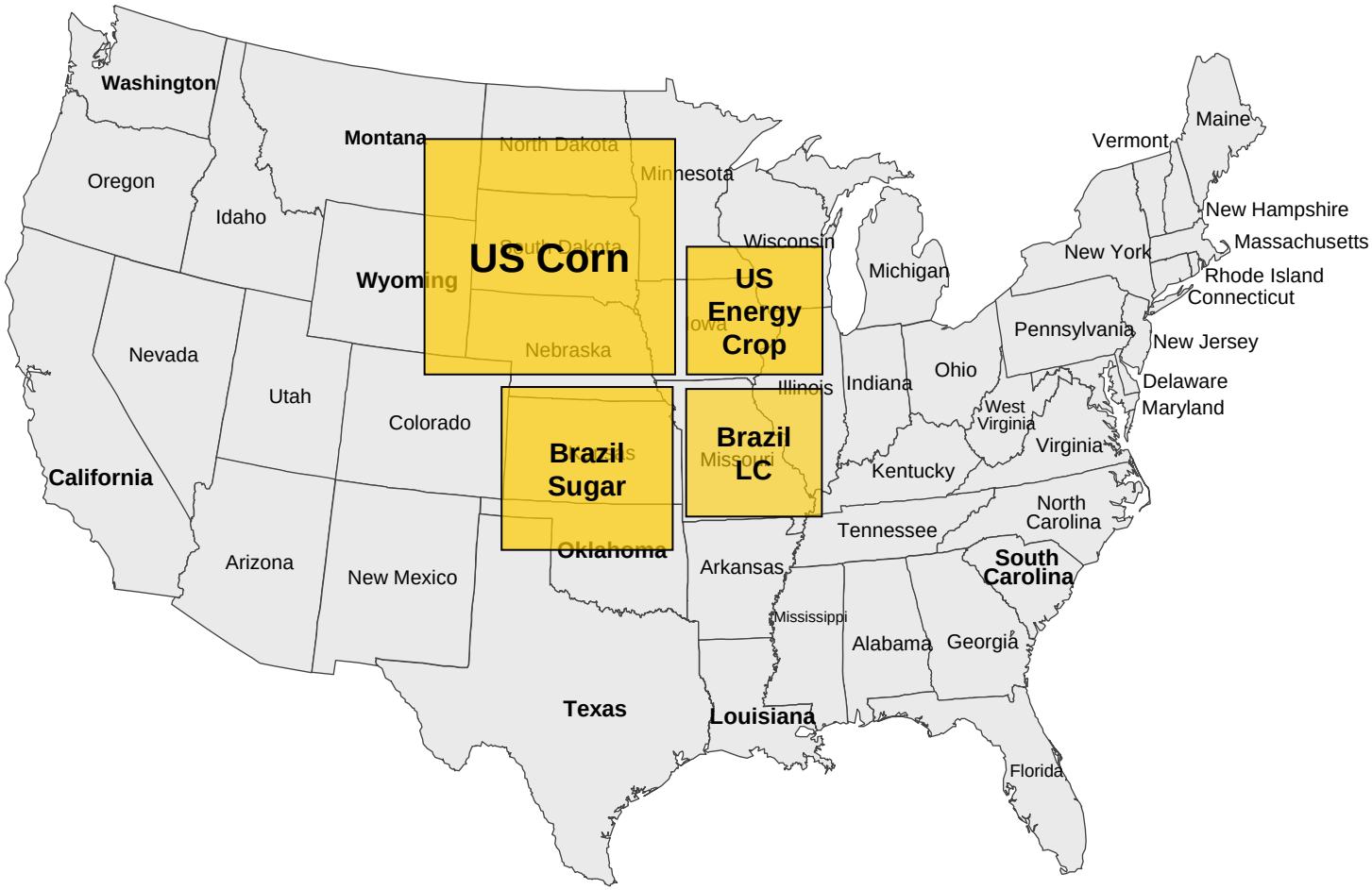
- **Corn supply – max** 15-17 gallons then LC technology needed
- **Distribution** – river barge limited reach, ageing infrastructure
- **E85/FFVs** – to exceed 15 bn galls (10% vol) will require E85 distribution priced at energy parity and FFVs

Brazil constraints

- **Trade Policy –** Tariffs in demand markets will limit investment in exports
- **Domestic markets** – rapid growth in FFV's limit export volumes

2b

US example: land area required to replace 30% of the 2006 gasoline market



2006 US gasoline market =140 bn galls.

30% v/v replacement adjusted for lower energy content of ethanol

BP Biofuels a growing alternative

3

Quality: conventional bio-components are essential to build the industry. We should not stop with the molecules we have.

	Ethanol – gasoline component	FAME - diesel component
Fuel performance characteristics	– High octane (favors good performance) but… – High blend vapor pressure – Energy content approximately 1/3 lower than conventional gasoline – Water affinity and risk of phase separation when blended with gasoline	– Sulfur and aromatic free – Higher cetane value and improved lubricity properties vs. diesel – Low temperature and stability/deposit formation issues – Energy content 15% lower than conventional diesel
Consumer attractiveness	• Energy content and water affinity mean that ethanol is not a good premium gasoline component	• Stability and energy content mean that FAME is not an ideal component for premium diesel
Blending limitations	• Corrosive effect as well as performance issues such as fuel economy limit the content of ethanol in standard grade gasoline (US 10%v/v, EU 5%v/v)	• Typically limited in standard grade diesel (e.g., 5%v/v max. Europe) • OEM concern over deposit formation in high pressure fuel injection systems used in modern diesel passenger vehicles
Supply chain implications	• **Poor** – can only be blended at the terminals, ethanol-containing blends cannot be moved by pipeline or ship and implies a segregated distribution network • **E85 –** issues around dispenser certification (safety)	• **Moderate** – low concentration blends (up to 5%) treated as fungible in many markets; higher blend levels may have impacts on pipeline contamination

4

Sustainability: fundamental to an enduring industry is the avoidance of harmful environmental and social impacts

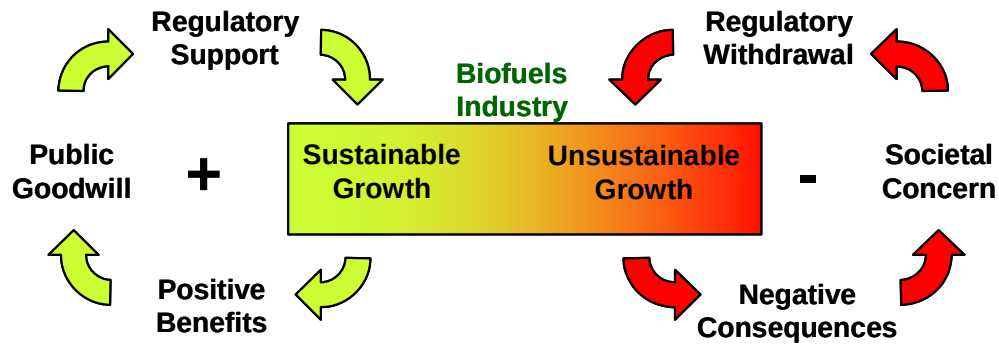
Issues (not exhaustive) include:

- Land rights, including economic and physical displacement
- Placing stress on the world's limited water resources
- Biodiversity
- Deforestation – the destruction of High Conservation Value Forest (HCVF)*
- Child and forced labor and other employment abuses
- Planting on peat soils
- Community conflict issues
- Effects of monoculture on local food production and local economies
- Pollution and environmental damage (water / soil / air), including related socio-economic impacts
- Net greenhouse gas balances resulting from land use change

* HCVF is technically defined according to principles defined by the WWF

4 …meaning industry growth is reliant on:

How regulators can help grow a sustainable biofuels industry



- Market-based regulations that balance environmental, energy security and rural development goals that face communities around the world
- Encouragement of innovation at all stages of the value chain. It is important that regulation does not pick winners but instead allows the market to find solutions
- Policy that is geared to emissions reductions or the quantity of fuel energy replaced – rather than mandated volumes of a particular product.
- Regulatory mechanisms which apply equally to all and which maintain flexibility – for example avoiding fixed per gallon mandates.
- Supporting guidelines for sourcing from sustainable and responsible production routes

How technology has a major role to play

4 …meaning industry growth is reliant on:

Challenges	Technology Solutions
1 Cost	A Lignocellulosics
2 Availability	B Energy Crops
3 Quality	C Plant Modification
4 Sustainability	D Advanced Conversion

BP Biofuels
a growing alternative

- Shaper of an emerging industry
- Leadership position in the industry

BP is committed to the sustainable growth of the biofuels industry

- Dedicated Global Biofuels Business Unit
- Distinctive Positions
  - **Advanced Technologies & Molecules**
    Energy Biosciences Institute
    Partnership with DuPont to develop biobutanol
  - **Feedstock Availability**
    Non-food crops grown on marginal land (e.g. Jatropha)
  - **Sustainability**
    The promotion of industry standards for biofuels sourcing and production (similar to Equator Principles)

Summary

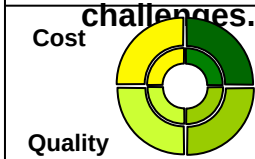
1 The long-term energy mix will change…

Regulatory Drivers
- Energy security
- Climate change
- Rural development

2 …with biofuels being a material component

Up to **30%** penetration by 2030

3 Today's biofuels face four main challenges…



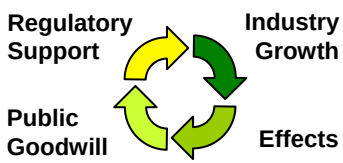
4 …meaning industry growth is reliant on:

BP Biofuels
a growing alternative

- Shaper of an emerging industry
- Leadership position in the industry

Growing a positive environment…

Creating a virtuous circle, not a vicious one



Materialize…

…and winning within that environment

Presence across the value chain

Enduring alliances and partnerships

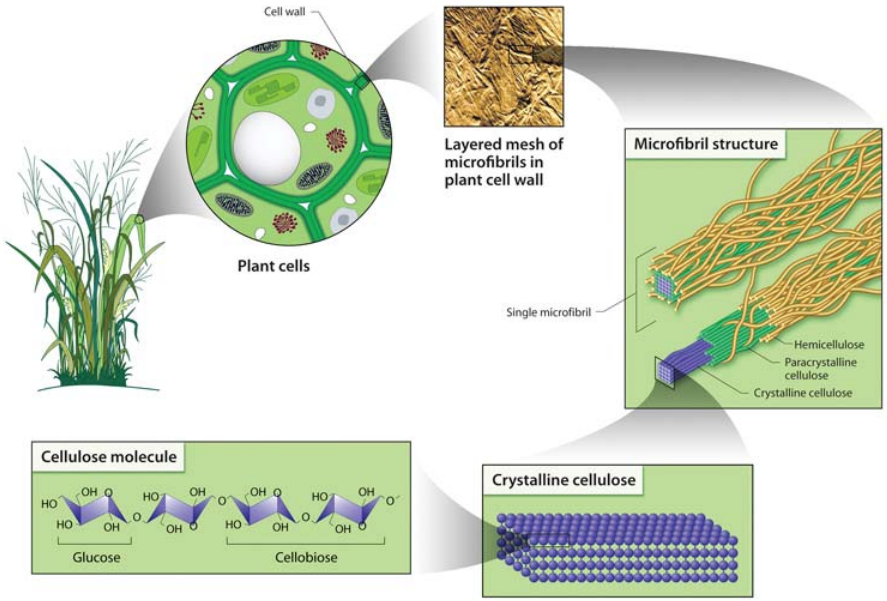
Geographically diversified asset portfolio

Advantaged over a series of time horizons

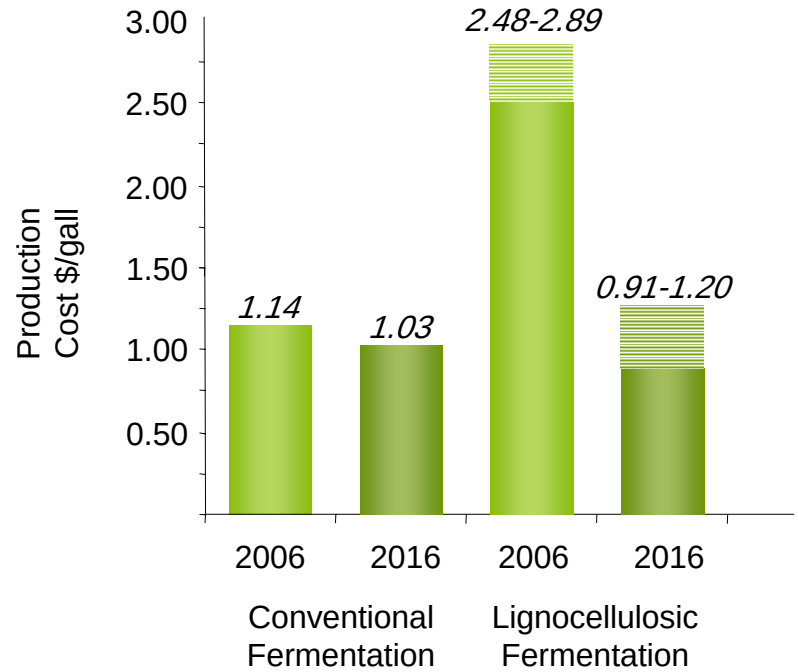
…and monetize

Backup Slides

Lignocellulosics: 25-100% yield improvements* in 5-10 years. Brazilian sugarcane will remain competitive (economics & GHG)



ILLUSTRATIVE EXAMPLE – US CORN



* Corn example: 25% (fibre only); 100% (stover), with 50% of stover must remain in field to preserve ecosystem

Energy crops: non-food crops grown on marginal land reduce competition with food, especially in developing countries

BP Jatropha Nursery Plantation, Andra Pradesh State, India

BP Biofuels a growing alternative

Plant modification: improving economics and addressing sustainability by reducing the input intensity

- Current generation technology can be input intensive e.g.
  - Water usage for plant growth
  - Acid usage in first generation lignocellulosic conversion
- Opportunities:
  - Genetically modified plants which are less thirsty
  - Plant decomposition triggered by UV-light

Advanced conversion: developing better quality molecules which can also increase penetration

- Next generation biofuels offer advantages over conventional biofuels (e.g. ethanol)
- Benefits:
  - Not corrosive – can use in higher concentrations
  - Low water affinity – no risk of phase separation; can pipeline
  - Easier to blend – no RVP issues
  - Higher energy content – better for the environment; better for the consumer (fewer fills)