AGENDA

1. View on the global biofuel market: drivers and potential demand
   1. Biofuel drivers
   2. View of the global supply and demand
2. BP’s global strategy in that market
   1. An integrated presence in the value chain
   2. A global presence
3. BP key challenges
The biofuel drivers

- Key drivers:
  1. Climate change (Europe, Japan)
  2. Energy security and diversification (China, India, US)
  3. Rural development and job creation (US, EU, Asia)
  4. Fight against poverty (African countries)

<table>
<thead>
<tr>
<th>Imported Energy Dependency Profile</th>
<th>Transport's Contribution to Total CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N America</strong></td>
<td>53% 64%</td>
</tr>
<tr>
<td><strong>EU</strong></td>
<td>81% 89%</td>
</tr>
<tr>
<td><strong>China</strong></td>
<td>47% 72%</td>
</tr>
<tr>
<td><strong>India</strong></td>
<td>66% 84%</td>
</tr>
</tbody>
</table>

Transport 2004 2020

Source: IEA World Energy Outlook, 2004

Biofuels are the best supply-side option

- Energy dependency and climate change will remain primary motivators for pursuing alternative and renewable transport fuels
- Various demand- and supply-side options will meet both challenges to differing degrees

Effectiveness at Tackling Climate Change

- High
- Low

Effectiveness at Tackling Energy Security

- High
- Low

Vehicle Efficiency (e.g., light weighting)

Carbon Free H₂ for Transport

Biofuels

Hybrids

Dieselisation

Enhanced Recovery

Ultra Deep Water

Arctic

GTL

Heavy Oil

Source: BP Energy Outlook, 2020
Role of biofuels in greenhouse gases reduction

- Transport energy demand is projected to double by 2050
- Transport comprises 21% of CO2 emissions
- A variety of technologies can reduce GHG emissions in the future
  - Vehicle efficiency
  - Biofuels and other renewable fuels
  - Demand reduction
- We see biofuels as a long term answer to energy security and climate change fight for transport. **SMP combined technology case**

Demand:
Biofuels could account for 30% of the total road transport by 2030

**Potential demand in 2020**
- Brazil: 12
- Africa: 1.5
- Asia: 11
- US: 12

<table>
<thead>
<tr>
<th>Region</th>
<th>Potential Demand</th>
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<tr>
<td>Brazil</td>
<td>12</td>
</tr>
<tr>
<td>Africa</td>
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<td>Asia</td>
<td>11</td>
</tr>
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<td>US</td>
<td>12</td>
</tr>
</tbody>
</table>

**Gigatons CO2 Equivalent GHGs**

- Reference Case Level (Road Transport)
- Increments
  - Diesel
  - Hybrids
  - Motors
  - Biofuels
  - Past Cells
  - Fuel Cells
  - Mix Shifting
  - 10% Fuel Economy Improvement
  - 10% Vehicle Travel Reduction (All fuel types)
Supply: Conventional Bio-Components

- Conventional biofuels are a positive first step in use of biomass
- GHG reductions modest, not all biofuels are equal
- Benefit rural economy
- Limitations:
  - Competing land use issues – food vs power generation
  - Not ideal fuel molecules: OEMs limit blending, handling/quality issues
- Ethanol issues:
  - Significant additional infrastructure costs due to Vapor Pressure
  - Success at scale requires ‘whole of market’ introduction

Next generation biofuels

- Next generation bio-components can provide higher energy content and GHG reductions
- Energy content:
  - Corn yields 240 gallons an acre; sugarcane 440 gallons per acre
  - Sunflower 75 gallons per acre; jatropha 140-220 gallons per acre; palm oil 450 gallons per acre
  - Opportunities to explore woody crops, straw, residues etc.
  - Liquid/fuelicinic conversion offers prospect of using entire plant – up to 1200 gallons
- GHG benefits:
  - Biofuels can offer GHG emissions reductions of 20% to 90%, depending on feedstock and conversion process
  - Goal should be in upper end of range through high energy feedstock, less intensive cultivation crops, low carbon conversion processes
BP strategy

- BP’s strategy is to participate throughout the global biofuels value chain, focusing on the following activities:
  1. Secure large scale access to sustainable feedstocks in new geographies;
  2. Acquire lowest cost biofuel production facilities in demand markets;
  3. Develop and commercialise advantaged biofuel products, including biobutanol and biodiesel made from sustainable feedstocks.
BP strategy in that space

- Formed a new Biofuels business unit. From 5 people in June 2006 to 60 people today.
- Strategy: control the value chain (integrated player), shape a global presence (in conventional and emerging markets).

1. FEEDSORBS:
   1. Prepare the future: Invest $500 M in Energy Bioscience Institute, in partnership with Berkley, to investigate new crops alternative (LC, algae, etc...)
   2. Focus on non food crops:
      - Finance the TERI project in India around jatropha in 2006
      - D1-BP fuel crops limited: JV with D1 oil last week, plant 1 million ha of jatropha worldwide

2. ADVANCED MOLECULE: Butanol
   1. Partnership with DuPont and BS on introduction of biobutanol into the UK
   2. Announced last week the construction of an ethanol plant in the UK, $400 M investment, with a demonstration plant of butanol (Hull), 110 millions galons

3. CONSUMER BEHAVIOUR: Launched targetneutral in the UK as a consumer education, non-profit programme that gives motorists the chance to ‘neutralize’ the CO2 emissions from their driving

Biobutanol: a next step

- Advanced biofuels respond to all drivers - deliver on GHG, security of supply & support agriculture sector
- Biobutanol has a number of attractive properties:
  - Produced from same feedstocks as ethanol with minimal process modifications
  - Easily blended into gasoline
  - Can use existing fuel infrastructure without major modification
  - Potential to be used at higher blend concentrations than ethanol in unmodified vehicles
  - An energy content closer to that of gasoline than ethanol – reducing the impact on fuel economy for the consumer

- Biobutanol is complementary to ethanol and can enhance the performance of ethanol blends in gasoline
- Second generation biofuels are expected to be even less carbon intensive because they will be manufactured using non-food crops (lignocellulosic) and with a different processing technology
BP’s biofuels activity

**Europe**
- First major to introduce 5% FAME blend in Germany
- Across Europe, ETBE replaces MTBE
- Targetneutral UK launch August 2006, Germany introduction during 2007
- Hull ethanol plant in UK

**Asia**
- Round table sustainable Palm Oil

**US**
- Largest user of Ethanol in gasoline
- 20 new markets added in 2005
- Biodiesel to small number of B20, evaluating more widespread customer offer
- EBI Institute University
- E85 introduction in select markets by end of 2006

**India**
- $9.4M project of Jatropha "oil bearing crops" for diesel fuel

**ANZ**
- Supplying Ethanol to retail sites in QLD
- Renewable diesel via tallow

BP uses around 10% of the bio components produced globally

Summary

- High yield, low cost feedstock supplies will be critical to low cost production at scale
- Meeting the evolving needs of society and contributing to a sustainable environment
- Advanced conversion routes and molecules to overcome conventional biofuel limitations
- Delivering fuel performance characteristics that are valued by consumers
- The development of responsible legislation

Summary (Feedstock, Sustainability, Technology, Customer Preferences, Legislative Framework)
Supply and demand: what could the main trade flows look like in the future...

BP new challenges

- Biofuels contribute to global warming
- Biofuels starve the poor
- Biofuels destroy primary forest
- Biofuels have a negative GHG impact
- Biofuels damage the car engine...

- BP wants to do sustainable biofuels (economic, social, environmental)
- Need to think about "what is the right way" to produce biofuels
  1. Food vs fuel: what should be a good approach for this debate?
  2. Agronomy: what is the best land to use to grow these crops and where? Which crop?
  3. Sustainability: water use and management, advice?
  4. Business model: what is the best business model to operate in those countries?
  5. Policies: What is the ideal policy environment, where should we target to land
Food vs Fuel
Key questions...

- There is a global concern over the impact of biofuels on food prices and security
- BP believes that this is a true concern (corn in the US), but could may be be mitigated by:
  - Choice of crop: Try to avoid the use of food crops
  - Markets regulation: supply and demand law…
  - Technology: Develop LC crops
  - More arable land: Using set aside land in developed country (Europe), develop remote arable land with infrastructures
- Biofuels could be an opportunity to reduce food pressure in developing countries, where the shortage is often due to a market failure:
  - Build infrastructure, irrigation, roads, etc…
  - Higher paying jobs, safer working practices, healthcare and education could participate to development
- Question:
  what is FAO position on this Food vs Fuel issue? (veg oils and sugar crops)
  What could be the impact of biofuels on developing countries?
  How to do biofuels for good?

Best business model for farmers

- Plantation vs small holders vs block farming:
  - What is the best/recommended business model to operate in Africa?
  - How to deal with relocation?
### Farming sweet sorghum vs. sugar cane

<table>
<thead>
<tr>
<th><strong>Sweet Sorghum</strong></th>
<th><strong>Sugar Cane</strong></th>
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<tbody>
<tr>
<td><strong>Climate</strong></td>
<td></td>
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<tr>
<td>- Suitable for semi-arid and tropical climates</td>
<td>- Tropical or subtropical climate</td>
</tr>
<tr>
<td>- Drought tolerant</td>
<td>- Soil fertility and productivity significantly affect cane production</td>
</tr>
<tr>
<td>- Tolerates some degree of salinity, alkalinity and poor drainage</td>
<td>- Propagation from cuttings, requiring around 6,000 kg/ha</td>
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<tr>
<td>- Propagated from seeds, requiring 4-7.5 kg/ha</td>
<td></td>
</tr>
<tr>
<td><strong>Water consumption (m³), per year</strong></td>
<td><strong>Grains and sweet stalks</strong></td>
</tr>
<tr>
<td>- 8,000* - 12,000</td>
<td>- Grains can be used for food or feed (2-2.5 tons/ha)</td>
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<tr>
<td></td>
<td>- Silage the extraction suitable for forage for cattle</td>
</tr>
<tr>
<td><strong>Harvest rhythm</strong></td>
<td><strong>Biomass yield tons/year</strong></td>
</tr>
<tr>
<td>- At least twice yearly (4.5 months crop)</td>
<td>- 92</td>
</tr>
<tr>
<td></td>
<td>- 5,000-5,600*</td>
</tr>
<tr>
<td><strong>Yield</strong></td>
<td><strong>Ethanol yield litres/hectare/year</strong></td>
</tr>
<tr>
<td>- Sugarcane processed to sugar/ethanol</td>
<td>- 50</td>
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<tr>
<td></td>
<td>- By product bagasse burned for fuel, generating about 288 MJ of electricity/ton of cane</td>
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<tr>
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<td>- 5,000** - 36,000</td>
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*assuming two crops per year, different figures found, the latter figure is with irrigation, ** Brazil figure

Source: Websearch, UNEP, Biofuels KIP, University of Zambia

### SWEET SORGHUM VS SUGAR CANE?

- **PROS**: Good yields, less water required, less photosensitive, less dependant over land quality, animal feed…
- **CONS**: window of harvest, no experience over pests, diseases…

**QUESTIONS**:  
What is FAO view on sweet sorghum vs sugar cane, particularly in Africa?  
- Potential  
- Food benefits  
- Development impact  
- Food security  
- Best places to grow…
D1-BP fuels crops limited

- DEAL : JV 50/50
- CROP : Jatropha Curcas, obj : 1 Million ha in Africa, South America, India, Asia. First availability 2008
- INVESTMENT : $160 m on five years
- MANAGEMENT : Managed plantations on owned or leased land, contract farming or seed purchase agreements
- MARKETS : meet domestic market requirements, surplus exported to European market, expected to be short
For ethanol, some conventional feedstock will remain competitive in the ligno-cellulosic world, particularly sugar cane.