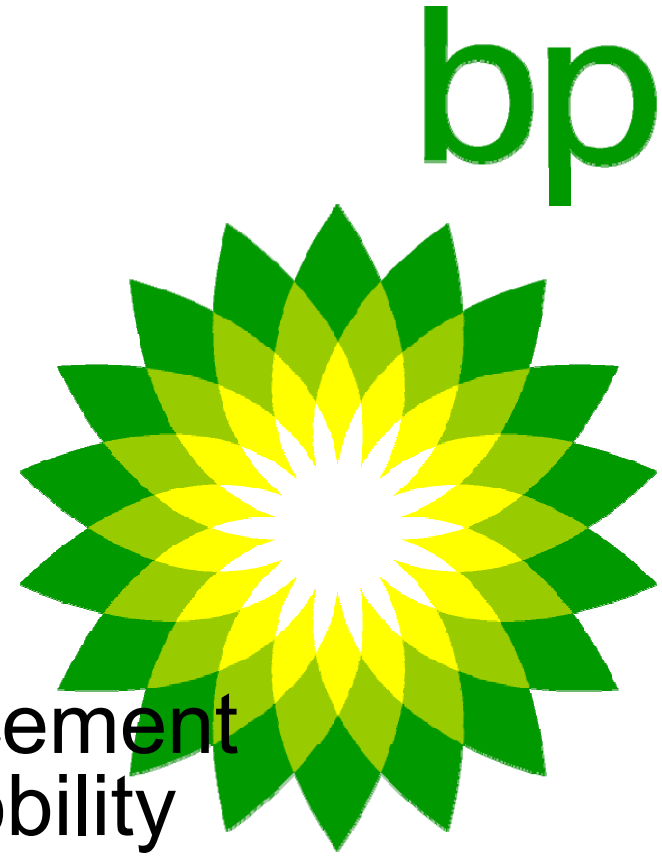


New Feedstocks and Replacement Fuels - Future Energy for Mobility

An Energy Company Perspective

August 23, 2006
DEER Conference
Detroit, MI

BP Global Fuels Technology
Dr. James Simnick, PhD

Outline

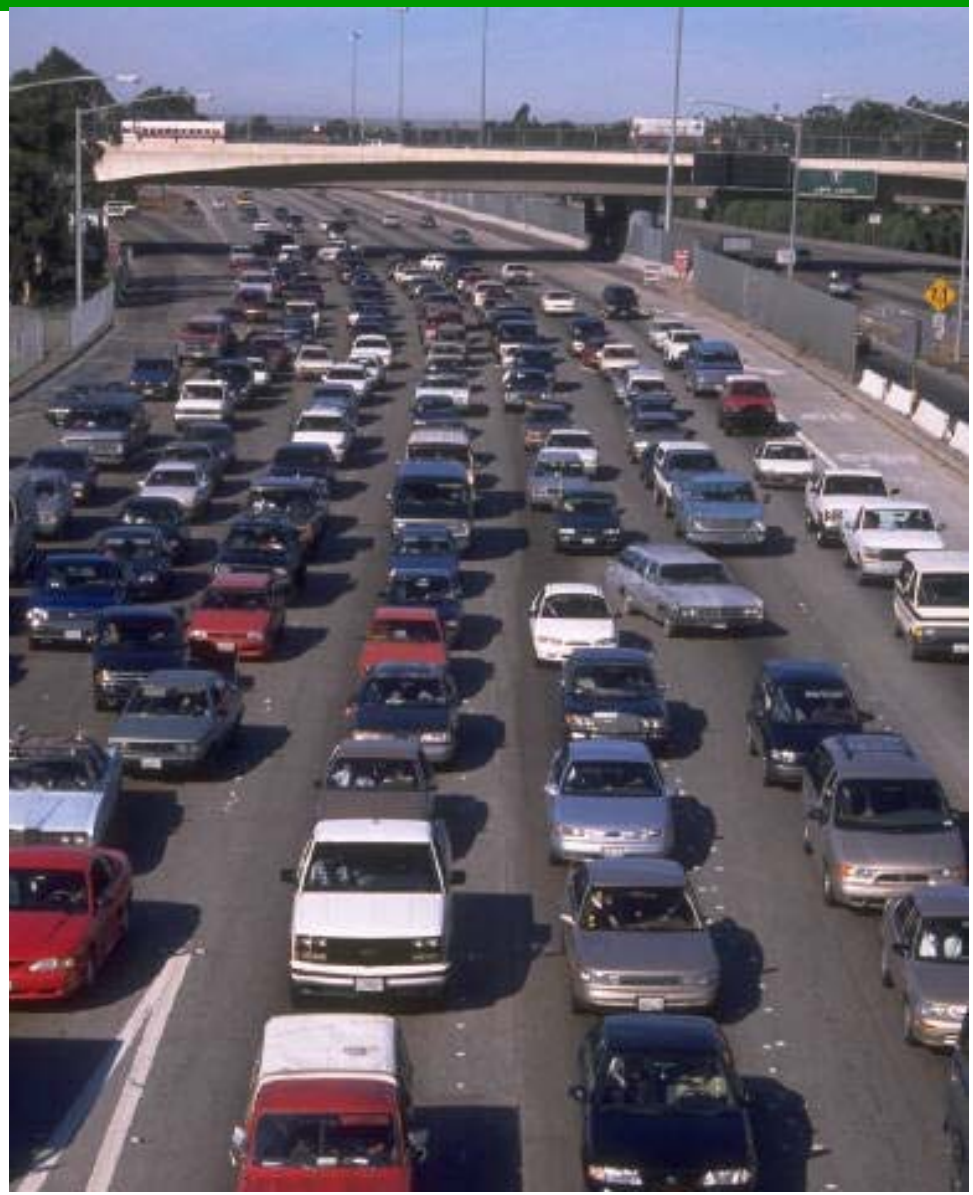
- Challenges for Fuels
- Energy Resources and Security
- Energy Options
- Pathways
- Biomass to Fuels
  - Short Term
  - Longer Term
- BP's Biofuels Activity
- Fuels Perspective

What are the challenges for fuels?

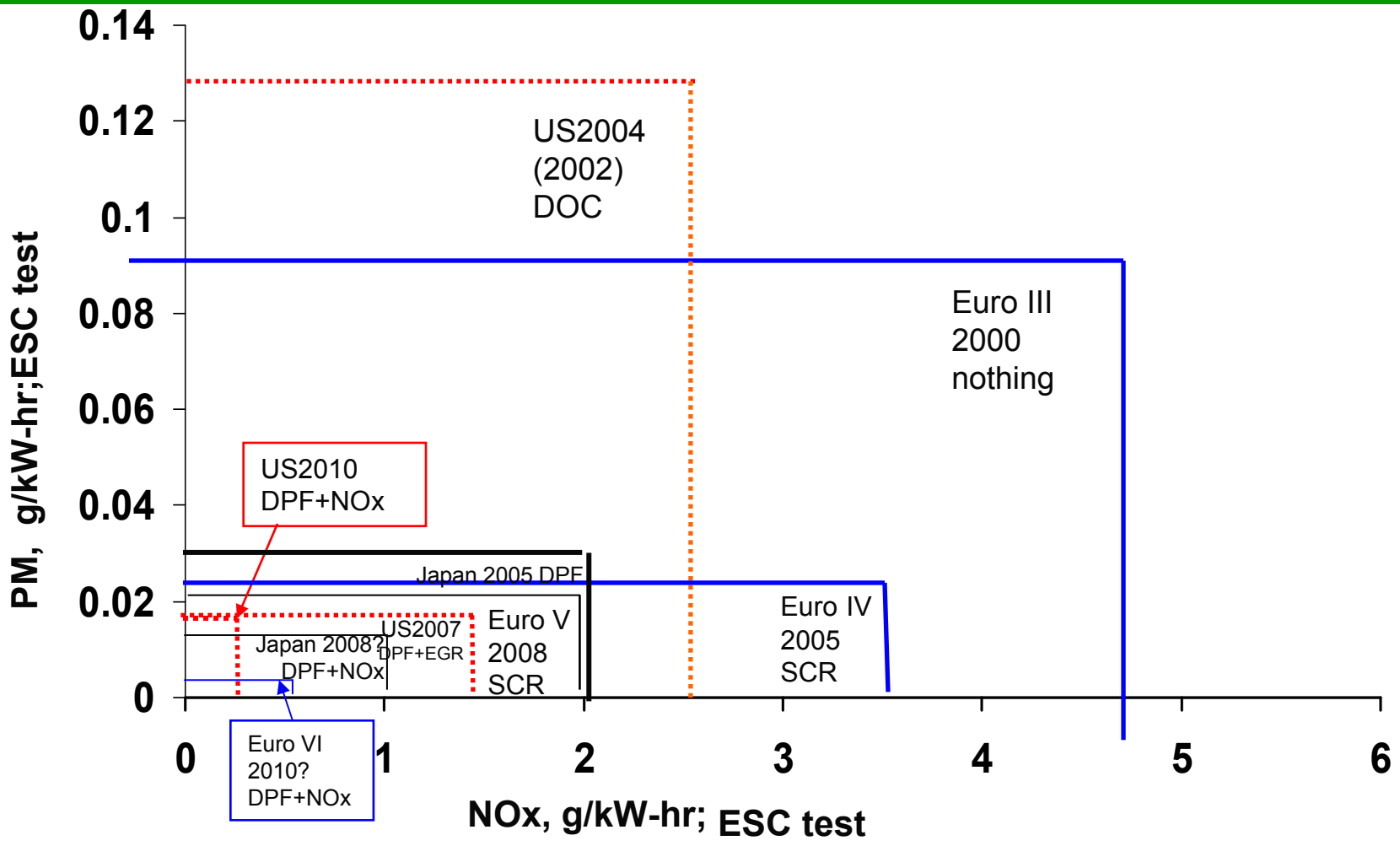
Three key drivers of sustainable mobility solutions

- Air quality – particularly in developing markets
- Energy diversification and supply security
- Climate change

Economics & customer preference set the pathway



Heavy-duty diesel highway regulations force PM & NOx control

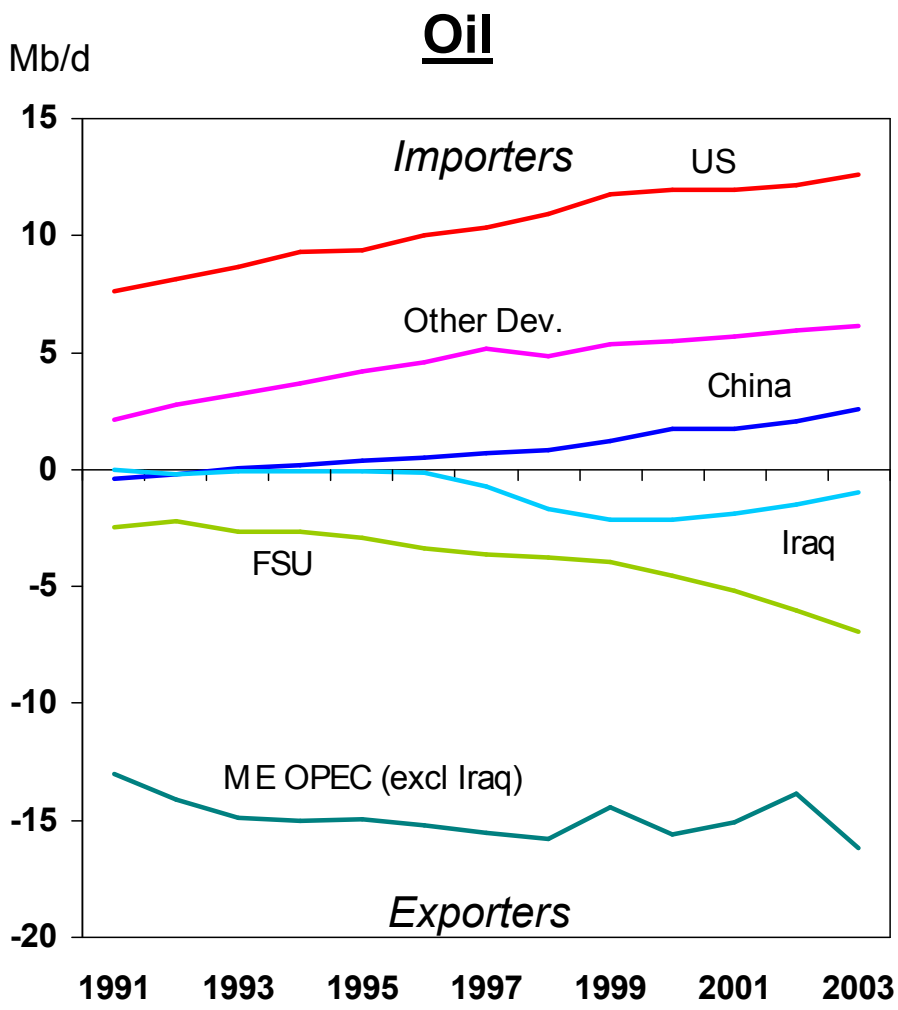


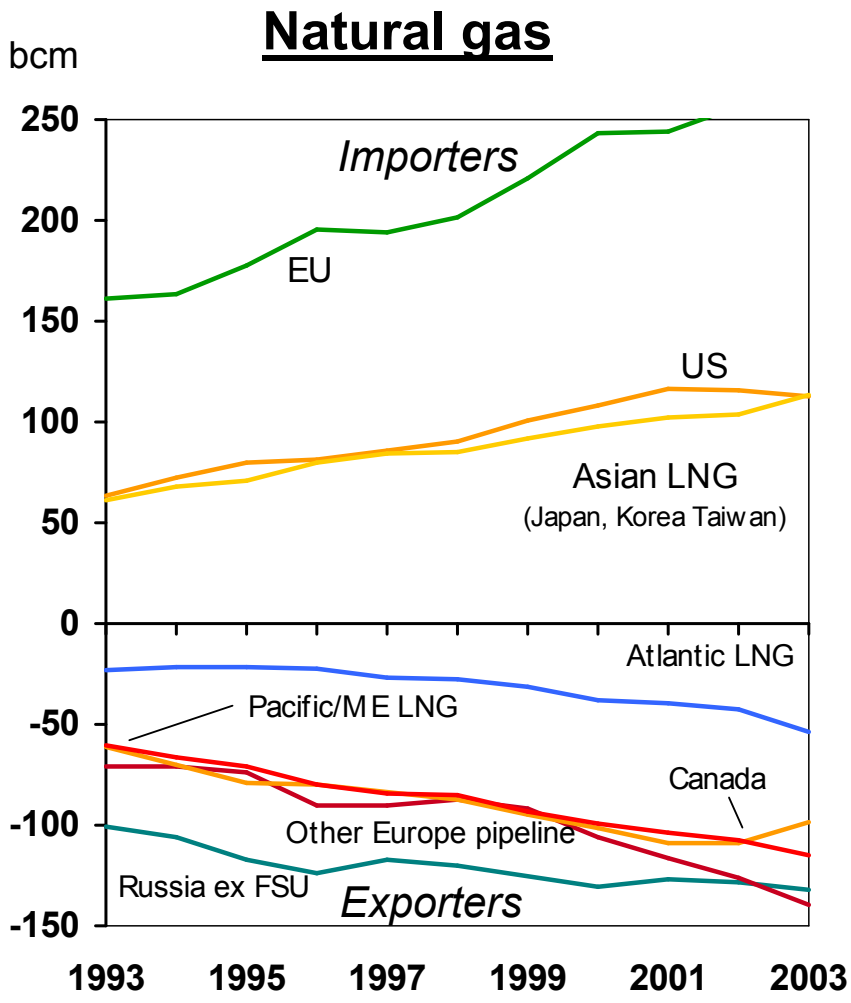
From Corning, Inc.

Energy resources & security of supply

- Transport sector dependent on oil
- Oil availability sufficient out to ~2030
- Gas reserves somewhat more geographically dispersed than oil
- Huge coal reserves aligned with demand centers
- Renewables have large theoretical potential and generally more dispersed
- Regional drivers vary widely (LAQ, Security, GHG)

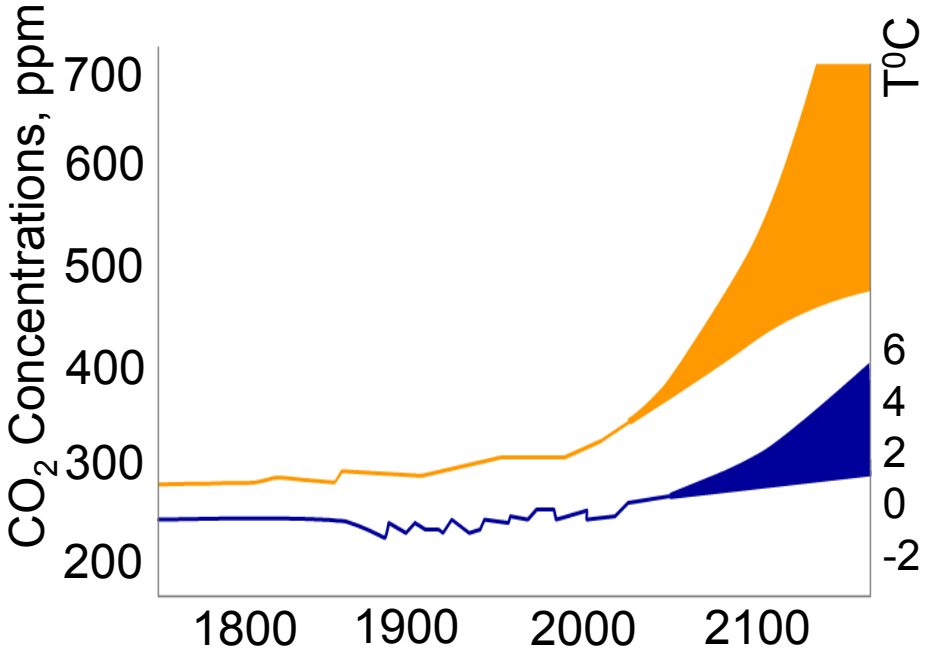
energy security - import dependence





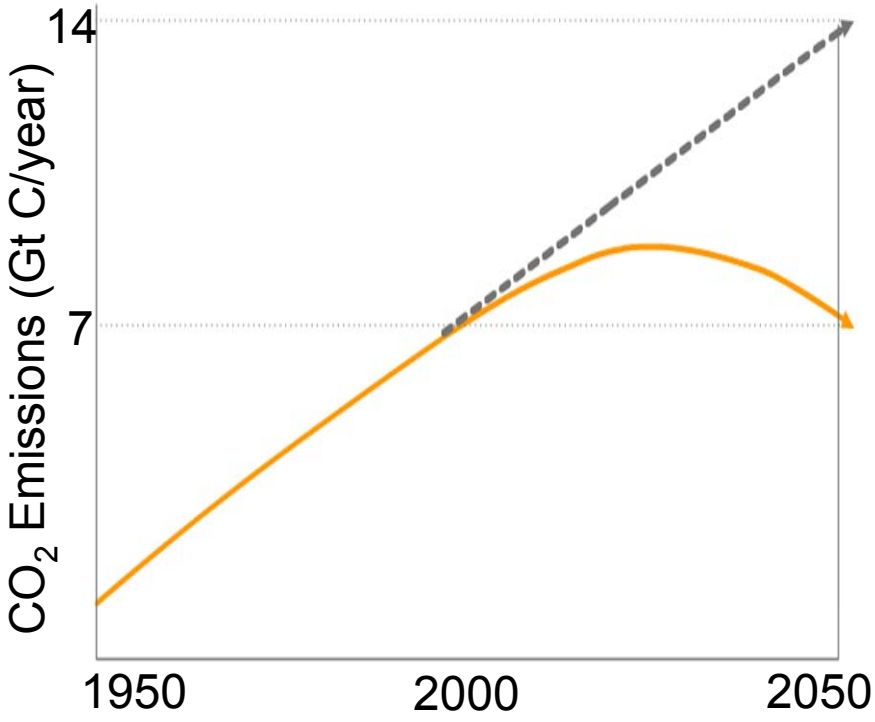
Climate change and GHGs

Projection of CO_2 and Temperature to 2100



Global CO_2

Global Temperatures



Business as usual world CO_2 emissions growth scenario

A world growth trajectory leading to stabilisation

Source: Based on data from the Intergovernmental Panel on Climate Change

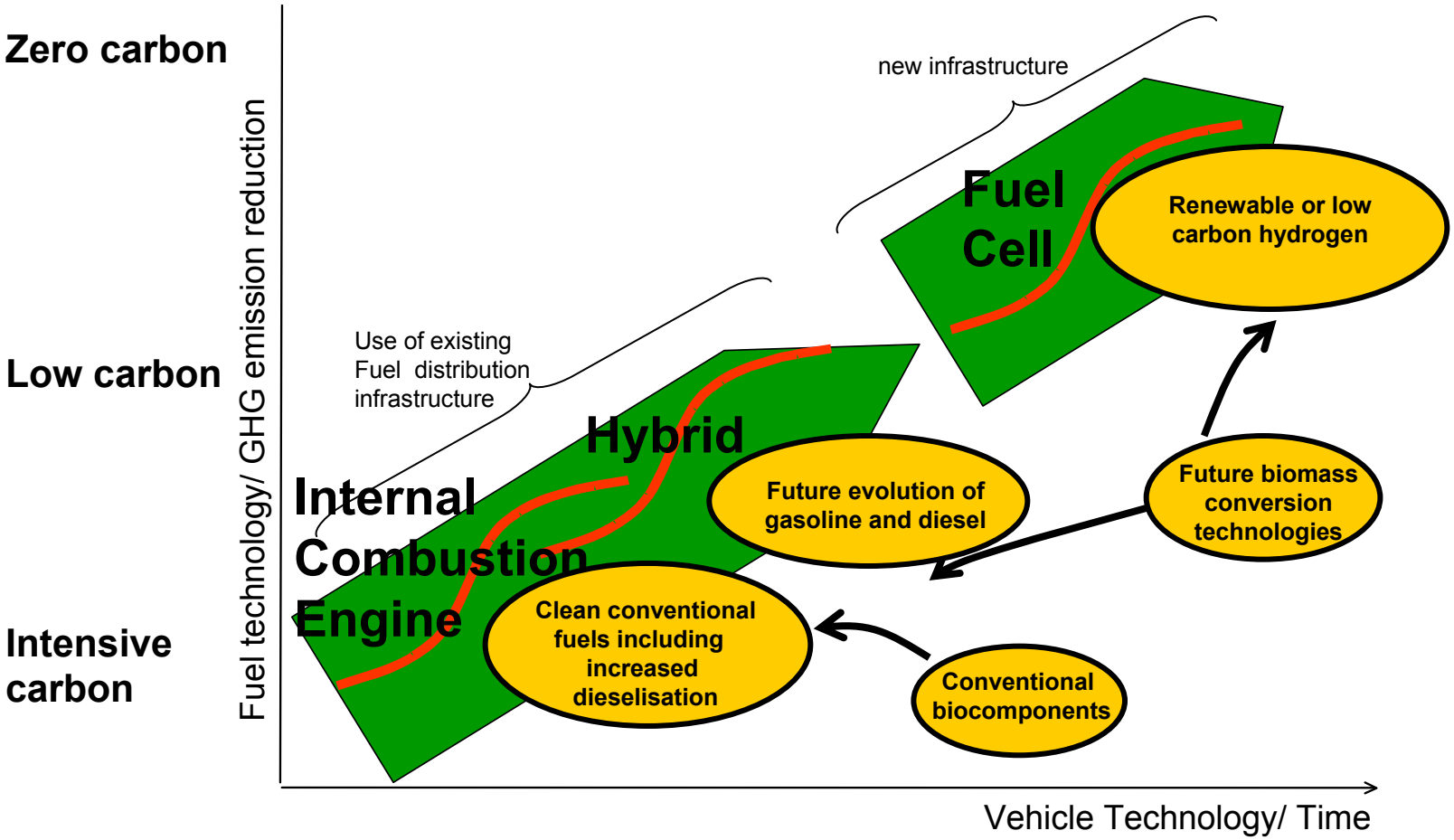
Options beyond Peak Oil

- Heavy Oil / Tar Sands
  - 300 billion barrels Canadian resource with current economics
  - 1 trillion barrels ultimate Canadian resource
  - Venezuelan deposits comparable magnitude
- Shale Oil
  - US Resource Base 1.2 trillion barrels
  - Renewed DOE and Shell publicity
- Fischer Tropsch Liquids
  - 1 Million BSD announced Gas to Liquids Projects in Qatar
  - Wyoming / Rentech study of Coal to Liquids ($40 / bbl)
  - China: Fischer Tropsch or DiMethyl Ether from Coal

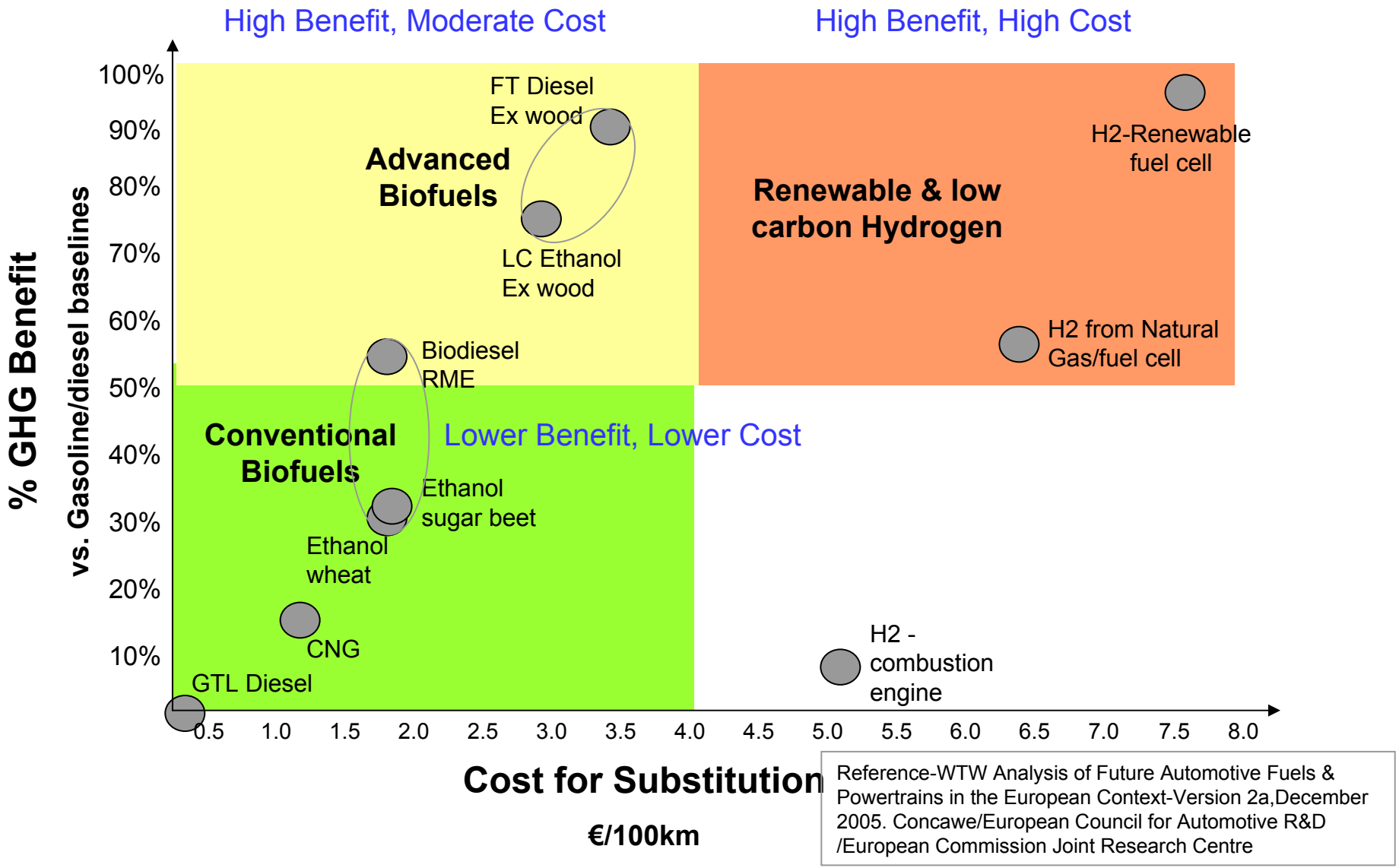
Renewable Fuels Options

- Biomass
  - Direct conversion to liquids
  - Gasification
- Food Crops
  - Sugar Based Ethanol
  - Oil Based Biodiesel
- Renewable Hydrogen

BP fuels pathway to the future

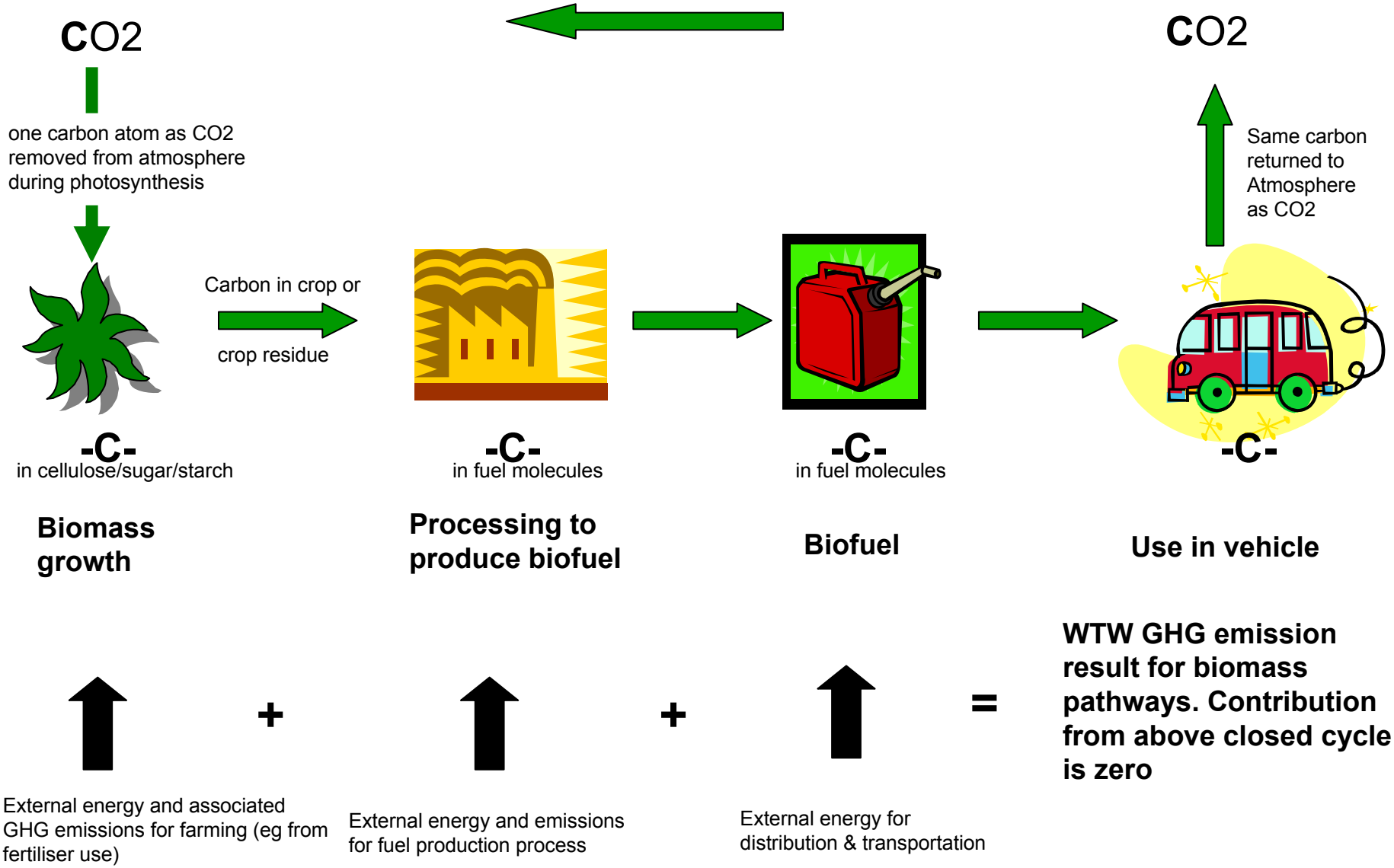


WTW GHG Benefit vs. Cost



Reference-WTW Analysis of Future Automotive Fuels & Powertrains in the European Context-Version 2a,December 2005. Concawe/European Council for Automotive R&D /European Commission Joint Research Centre

Biofuels Overview - the carbon cycle



Biofuels – Pathways

sugar & starch crops

Ethanol for gasoline

oil crops

Esters for diesel

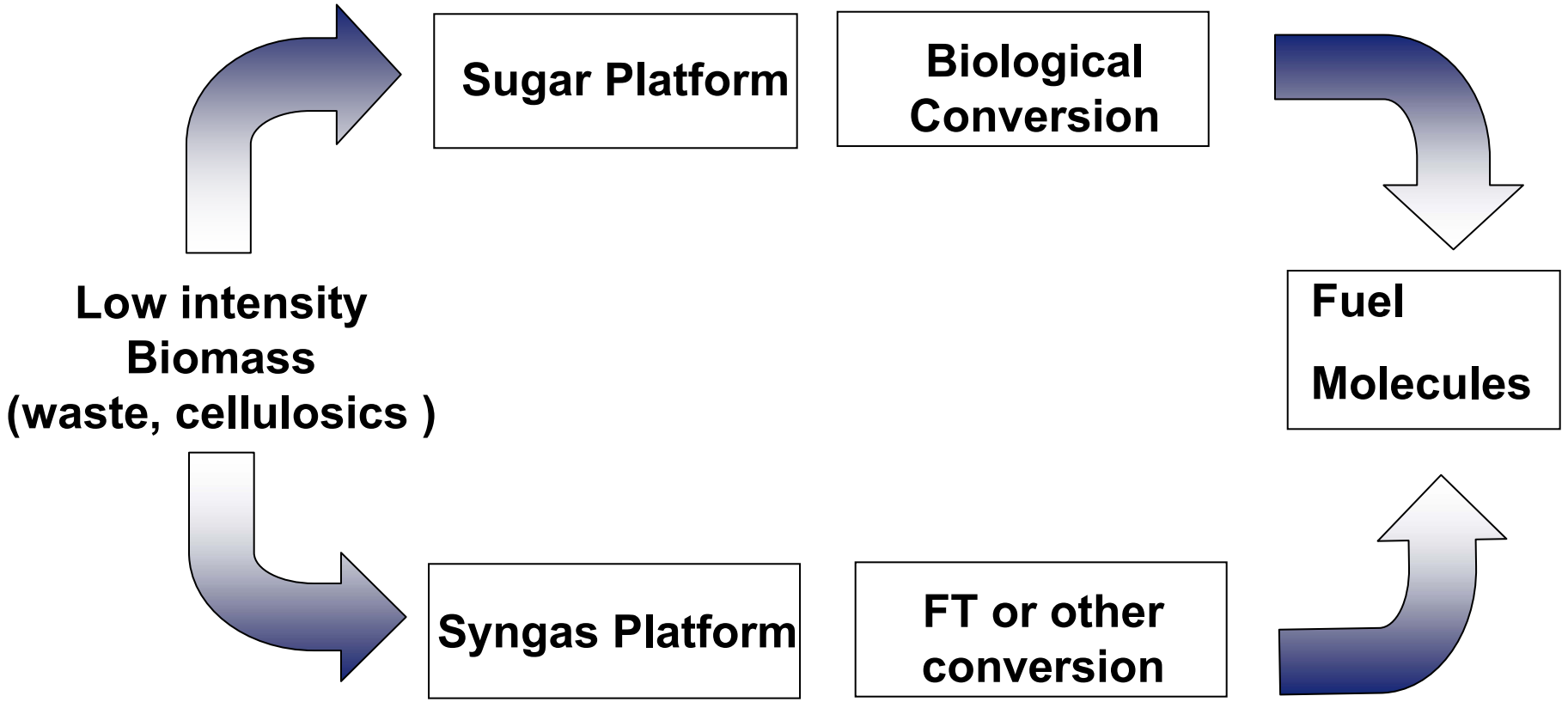
Lignocellulosics etc.

Other blend components or precursors

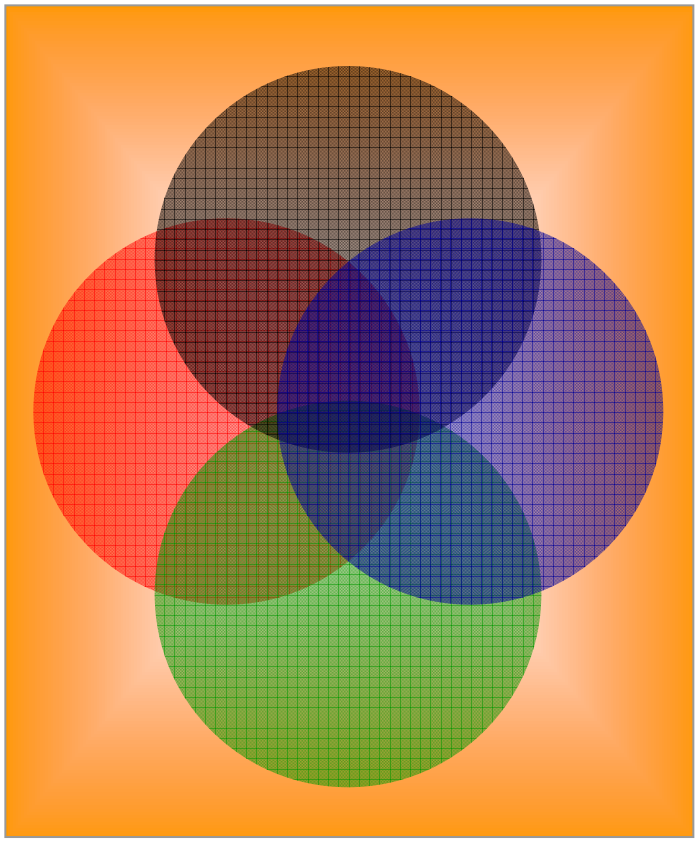
Further conversion

Superior Fuel Molecules

Two technologies look to offer greatest promise

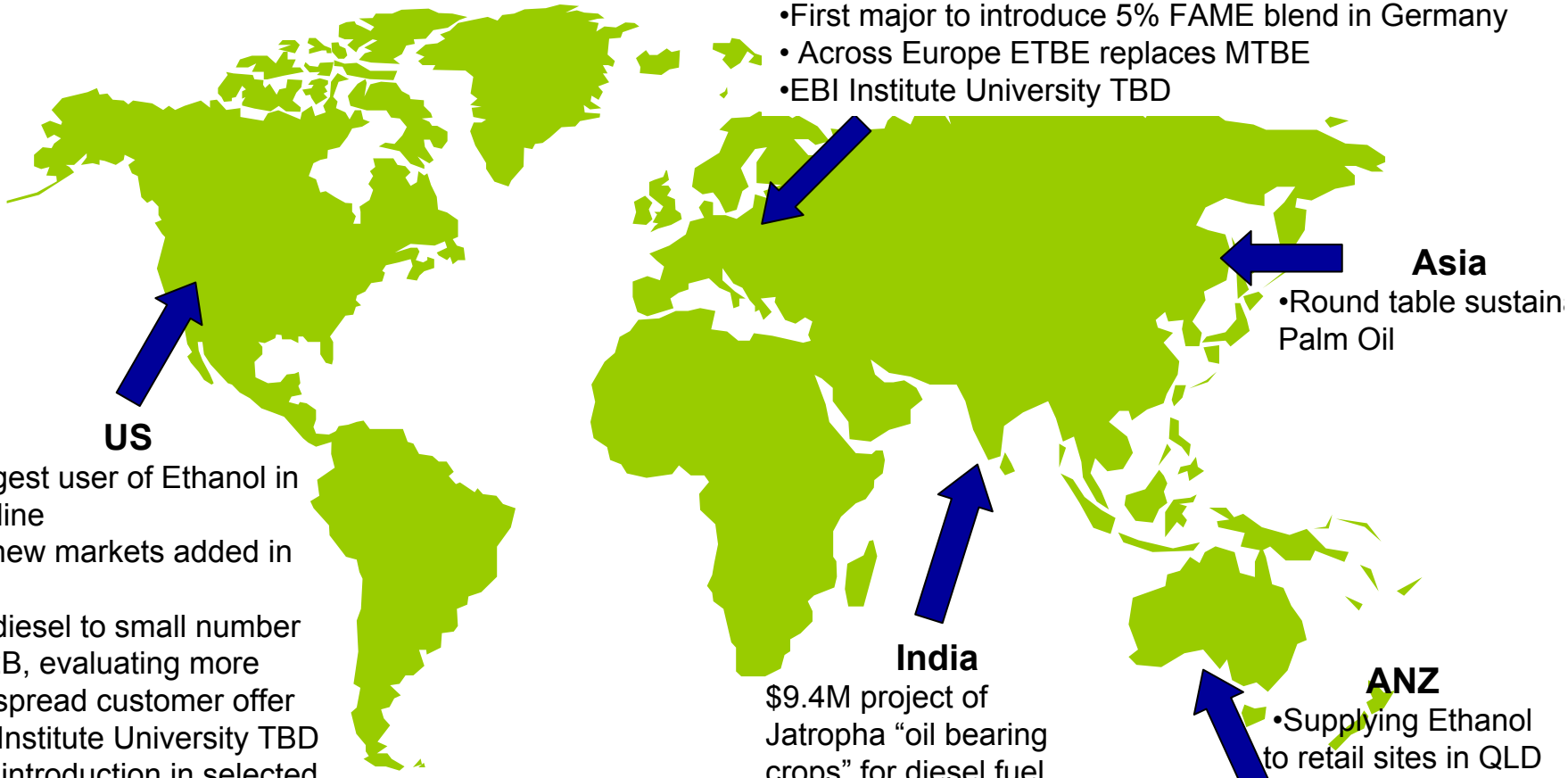


What is needed?



- ✓ Fuels that can be produced from domestic, renewable resources in high volume and reasonable cost.
- ✓ Fuels that can be used in existing vehicles and existing infrastructure
- ✓ Fuels that offer good value to consumers
- ✓ Fuels that meet the evolving demands of vehicles

BP's Biofuels Activity



Europe
- British Sugar plant in UK for biobutanol production
- First major to introduce 5% FAME blend in Germany
- Across Europe ETBE replaces MTBE
- EBI Institute University TBD

Asia
- Round table sustain
Palm Oil

US
- Largest user of Ethanol in gasoline
- 20 new markets added in 2005
- Biodiesel to small number of B2B, evaluating more widespread customer offer
- EBI Institute University TBD
- E85 introduction in selected 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's New Biofuels Business

- Formed a new Biofuels business in June
- Announced plans to invest $500 M in new Energy Biosciences Institute to provide a pipeline of biofuels technology for the business
- Will partner with science company DuPont to develop advanced biofuels-the first introduction is biobutanol.
- BP & DuPont collaborating with British Sugar to convert an ethanol fermentation facility to produce biobutanol
- Initial production targeted in the UK during 2007

Fuels Perspective

- Need consumer's acceptance
  - Reliable, consistent, convenient
  - Cost-Effective
  - Quality & Fit for Purpose

- Societal Requirements
  - Energy efficient, wells-to-wheels analysis
  - Low carbon/no carbon, reduce GHG
  - Impact on environment
    - Air
    - Water
    - Soil
  - Safe
  - Infrastructure
  - Vehicle requirements
    - Systems Approach
    - Fuel + Vehicle + Engine + After treatment

Public Policy Framework

- **Focus on goals**
  - Give the market room to develop innovative solutions
- **Emphasize solutions that can be used in existing vehicles and delivered through existing infrastructure**
  - These will provide the quickest results at the lowest cost
- **Make room for innovation**
  - Yesterday's molecules may not be the best answer for today's vehicles
  - Research can produce improved solutions for tomorrow – but only if they are allowed room to compete in the marketplace

Conclusion

- BP sees an exciting and challenging future
  - Continuous improvement in conventional vehicles, engines & fuels
  - New opportunities in Alternative Fuels
    - Biomass based
    - Sugar & Gasification
    - New Molecules
  - Route to hydrogen
    - Work with USDOE and European Governments
  - Customer requirements