Biofuels Markets
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Potential Role of Biofuels in Future Markets

Antonio Pflüger
International Energy Agency
Head, Energy Technology Collaboration Division
Today’s Energy Challenges

- If no action is taken, by 2050 (Source: IEA, ETP 2008):
  - Coal demand would almost triple (+192%)
  - Gas demand increase by 138%
  - Oil demand grow by 65% and
  - Import dependency of most countries would further increase
  
  - CO$_2$ emissions increase by 130%
    IPCC: Cutting by half necessary to prevent dangerous global warming

- Biomass for energy uses versus food production
Oil: How much is left to produce
(IEA World Energy Outlook 2008)

• The world is far from running short of oil. Remaining proven reserves of oil and natural gas liquids amount to about 1.2 to 1.3 trn barrels (more than total production since 1850).

• Long term potentially recoverable total oil resource base amounts to around 6.5 trn barrels.

• BUT
  - Future reserves growth will depend, to a large extent, on increases in recovery (35% recovery rate on average today, 1% increase would add 6% to proven reserves)
  - Decline rates of oil fields accelerate
  - Immediate risk of oil supply comes from lack of investment where it is needed

• Investment (including R&D) will be decisive for future fuel supply → more petrol / more biofuels?
The IEA’s role:

• Created in 1974
• Integral part of members’ energy security
• Conducts policy analysis, compiles data
• Convenes expertise
• Assists in implementation
• Develops scenarios that address energy and climate change simultaneously
IEA Energy Technology Network

CERT - Committee on Energy Research and Technology

Fusion Power Co-ordinating Committee

Working Party on Fossil Fuels

Working Party on Renewable Energy Technologies

Working Party on Energy End-Use Technologies

IMPLEMENTING AGREEMENTS
- Env., Safety, Economy
- Fusion Materials
- Large Tokamaks
- Nuclear Technology
- Plasma Wall
- Interaction TEXTOR
- Reversed Field Pinches
- Spherical Tori
- Stellarator Concept
- Tokamaks Poloidal Field Divertors

IMPLEMENTING AGREEMENTS
- Coal Centre
- Clean Coal Science
- Enhanced Oil Recovery
- Fluidised Bed Conversion
- Greenhouse Gas R&D
- Multiphase Flow Science

IMPLEMENTING AGREEMENTS
- Bioenergy
- Deployment
- Geothermal
- Hydrogen
- Hydropower
- Ocean Energy
- Photovoltaic Power
- Solar Heating/Cooling
- SolarPACES
- Wind Turbines

IMPLEMENTING AGREEMENTS
- Advanced Fuel Cells
- Advanced Materials Transp.
- Advanced Motor Fuels
- Buildings/Communities
- Emissions Reduction
- Combustions
- Demand Side Management
- District Heating/Cooling
- Electricity Networks
- Energy Storage
- Heat Pumps
- Hybrid/Electric Vehicles
- Industrial Technologies/Systems
- Superconductivity

Advisory Group on Oil & Gas Technology

CROSS-CUTTING IMPLEMENTING AGREEMENTS
- Climate Technology Initiative
- Energy Technology Systems Analysis Programme
- Energy Technology Data Exchange

Since 1975, more than 5,000 participants
IEA’s Global Energy Technology Co-operation

More than 5 000 participants from governments, industry and R&D community
Well-to-wheel emission changes compared with gasoline or mineral diesel

Excluding land use change
Source: OECD 2008
World ethanol production from 1st generation and ligno-cellulose

Source: Mabee and Saddler, 2007
From 1st to 2nd Generation Biofuel Technologies

- Joint study of IEA and Bioenergy Implementing Agreement Task 39 (November 2008)

- Main messages:
  - Currently technical barriers for 2nd Generation biofuels-production remain
  - Production costs are uncertain ~0.80-1.00 USD/lge
  - For many years 2nd generation biofuels will probably not be fully commercial without significant governmental support
  - Considerably more RD&D is needed to ensure sustainable production of various feedstocks
  - Once proven, a steady transition from 1st to 2nd generation is assumed
Climate Change Requests a New Energy Revolution

Baseline Emissions 62 Gt

BLUE Map Emissions 14 Gt

Source: IEA – Energy Technology Perspectives 2008.
Biofuel shares and land use
ETP 2008 BLUE Map Scenario

- 690 Mtoe/yr (29 EJ/yr) in 2050 → 160 Mha land
  (13 200 Mha world total land area, 1 500 Mha used to produce arable crops)
- Share of total transport fuel
  - Currently 1%
  - 26% by 2050

Source: IEA – Energy Technology Perspectives 2008.
Cumulative Additional Investment in Energy Transformation (2005-2050)

Investment (USD trillion)

Source: IEA – Energy Technology Perspectives 2008.
Overview – Previous Studies

Global Bioenergy Potentials

- SMEETS, 2008
- Hoogwijk et al., 2003
- Fischer & Schrattenholzer, 2001
- IEA Bioenergy, 2007
- IPCC, 2007
- Haberl, Erb and Krausmann, 2007

IEA BLUE Map Scenario – 150 EJ/yr in 2050 from biomass

IEA BLUE Map 29 EJ/yr in 2050 from biofuels
Present and 2030 projection production cost ranges for 2nd-generation biofuels (USD / litre gasoline equivalent) compared with wholesale petroleum fuel prices correlated with the crude oil price over a 16 month period
Source: Based on IEA World Energy Outlook, 2006, section on biofuels
IEA Currently Takes a Closer Look at 2nd Generation Biofuels Potentials

- Promises of 2nd generation lignocellulosic biofuels
  - can use crop waste -> avoid competition between food production and biofuels production
  - Can help further diversification of supply
  - Low CO₂ emissions

- Questions:
  Substantive work already undertaken, but not yet fully understood and/or communicated
  - Are the efforts to develop this new technology worthwhile?
  - What could be the potential of 2nd generation lignocellulosic biofuels?