Biofuels Markets
Congress and Exhibition

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Potential Role of Biofuels in Future Markets

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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

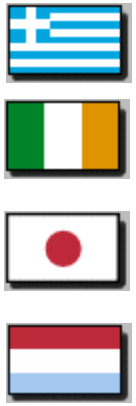
- Biomass for energy uses versus food production

Oil: How much is left to produce

(IEA World Energy Outlook 2008)

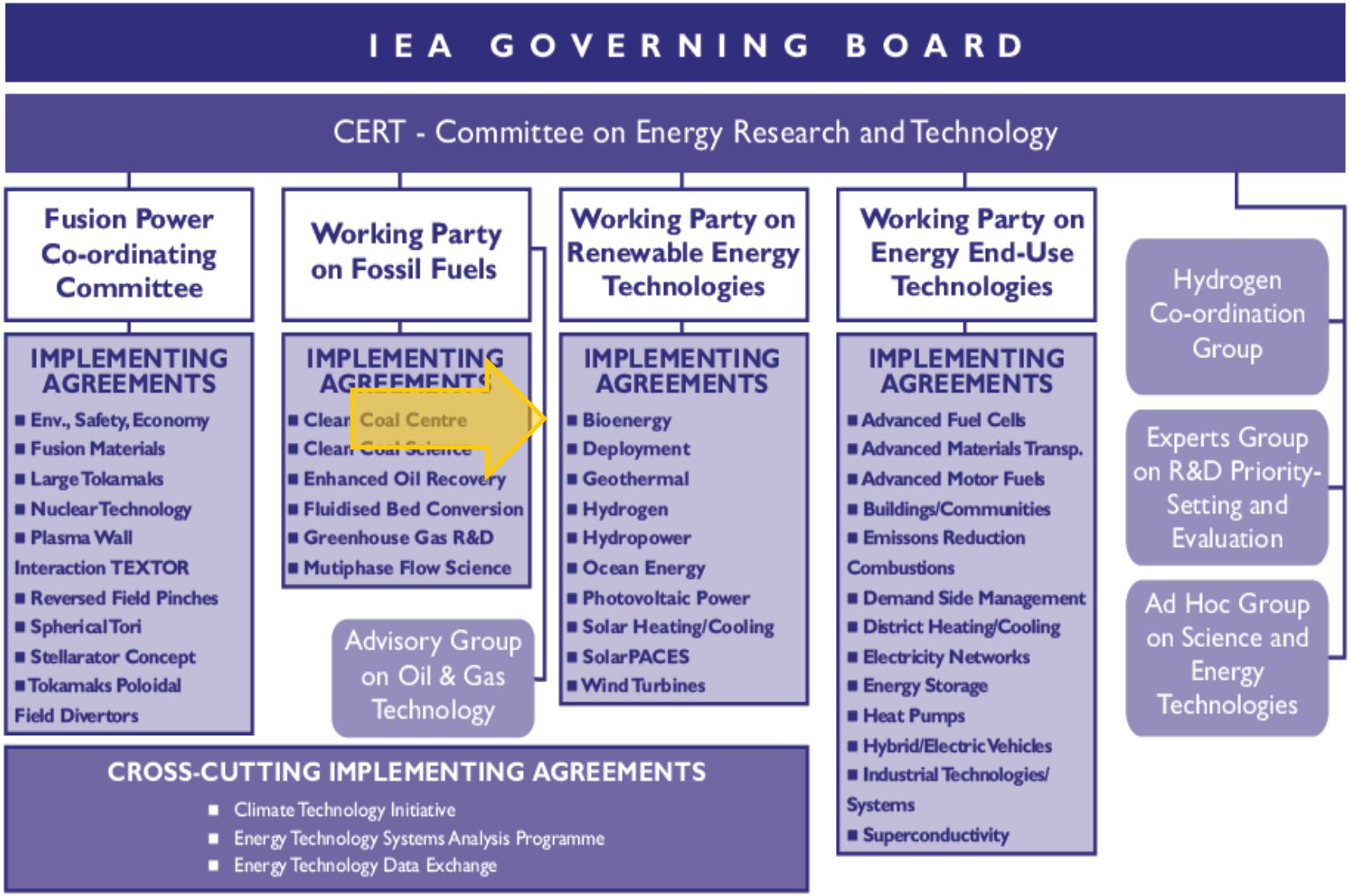
- The world is far from running short of oil. Remaining proven reserves of oil and natural gas liquids amount to about 1.2 to 1.3 trn barrels (more than total production since 1850).
- Long term potentially recoverable total oil resource base amounts to around 6.5 trn barrels.
- BUT
  - Future reserves 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



Since 1975, more than 5 000 participants

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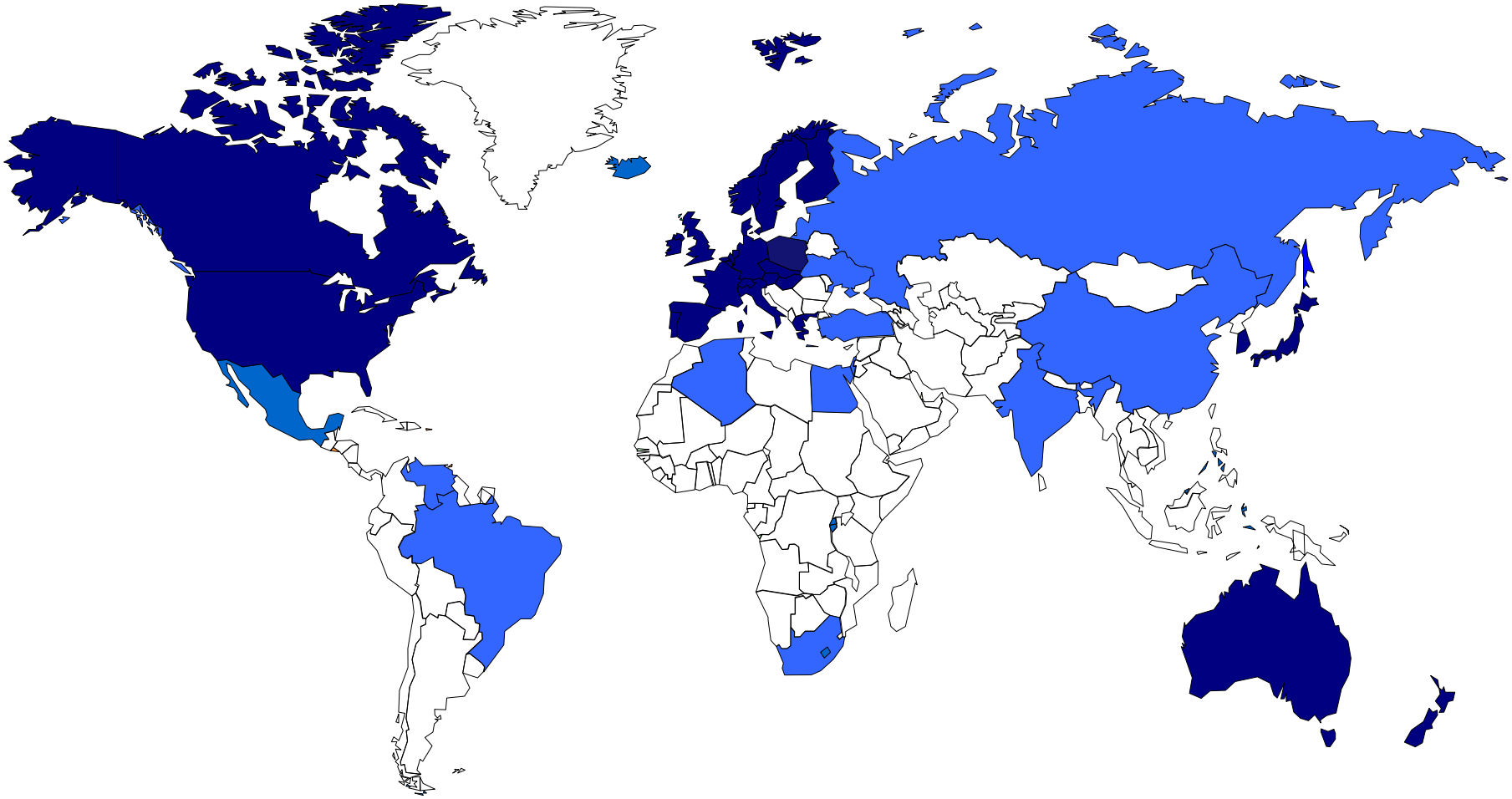
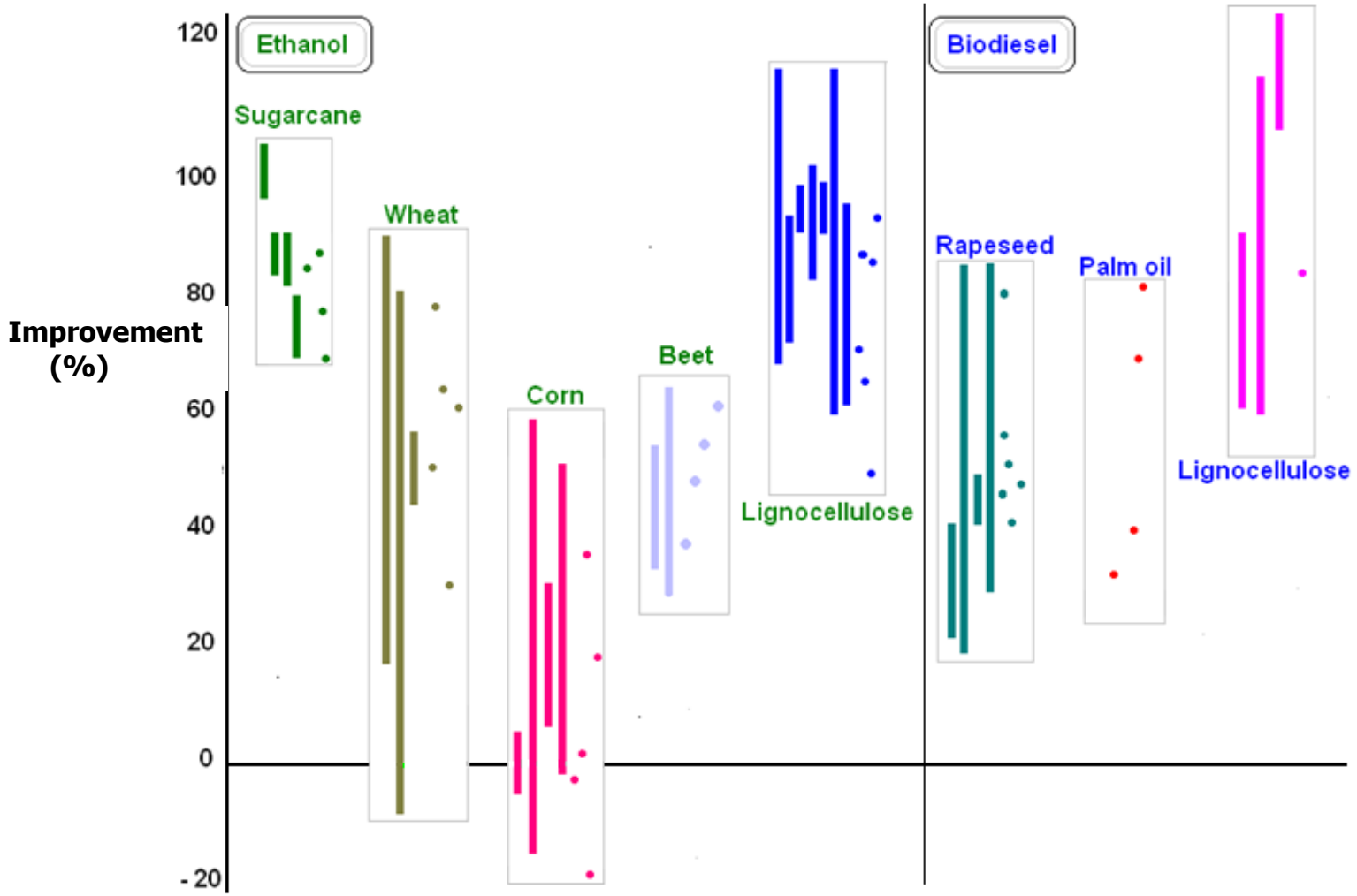
IEA's Global Energy Technology Co-operation



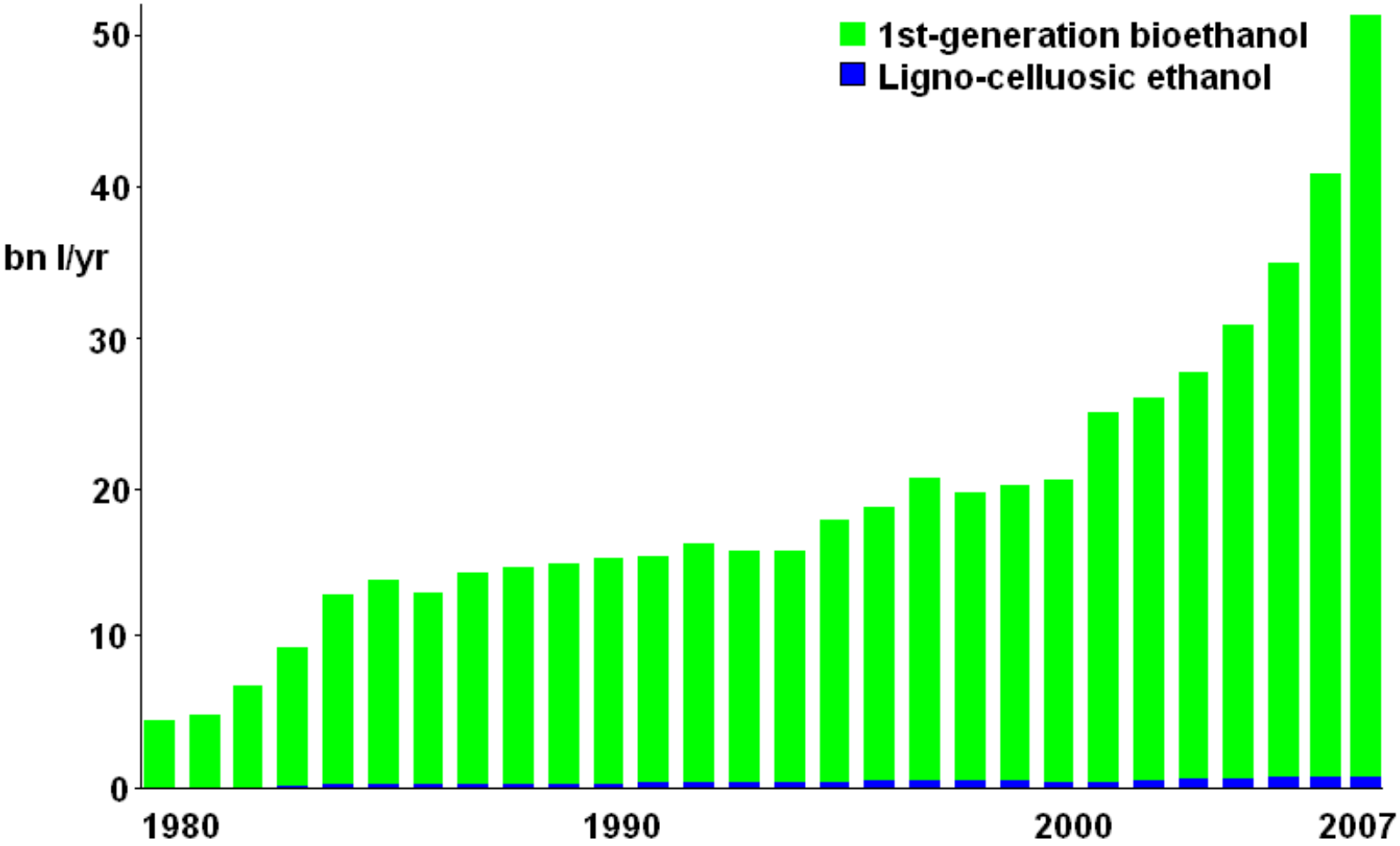
More than 5 000 participants from governments, industry and R&D community

Well-to-wheel emission changes compared with gasoline or mineral diesel



Excluding land use change
Source: OECD 2008

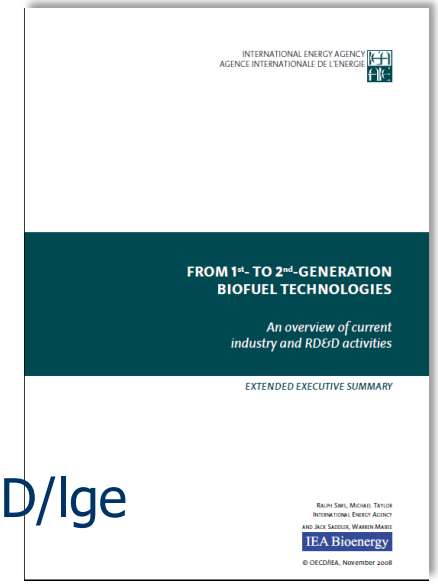
World ethanol production from 1st generation and ligno-cellulose



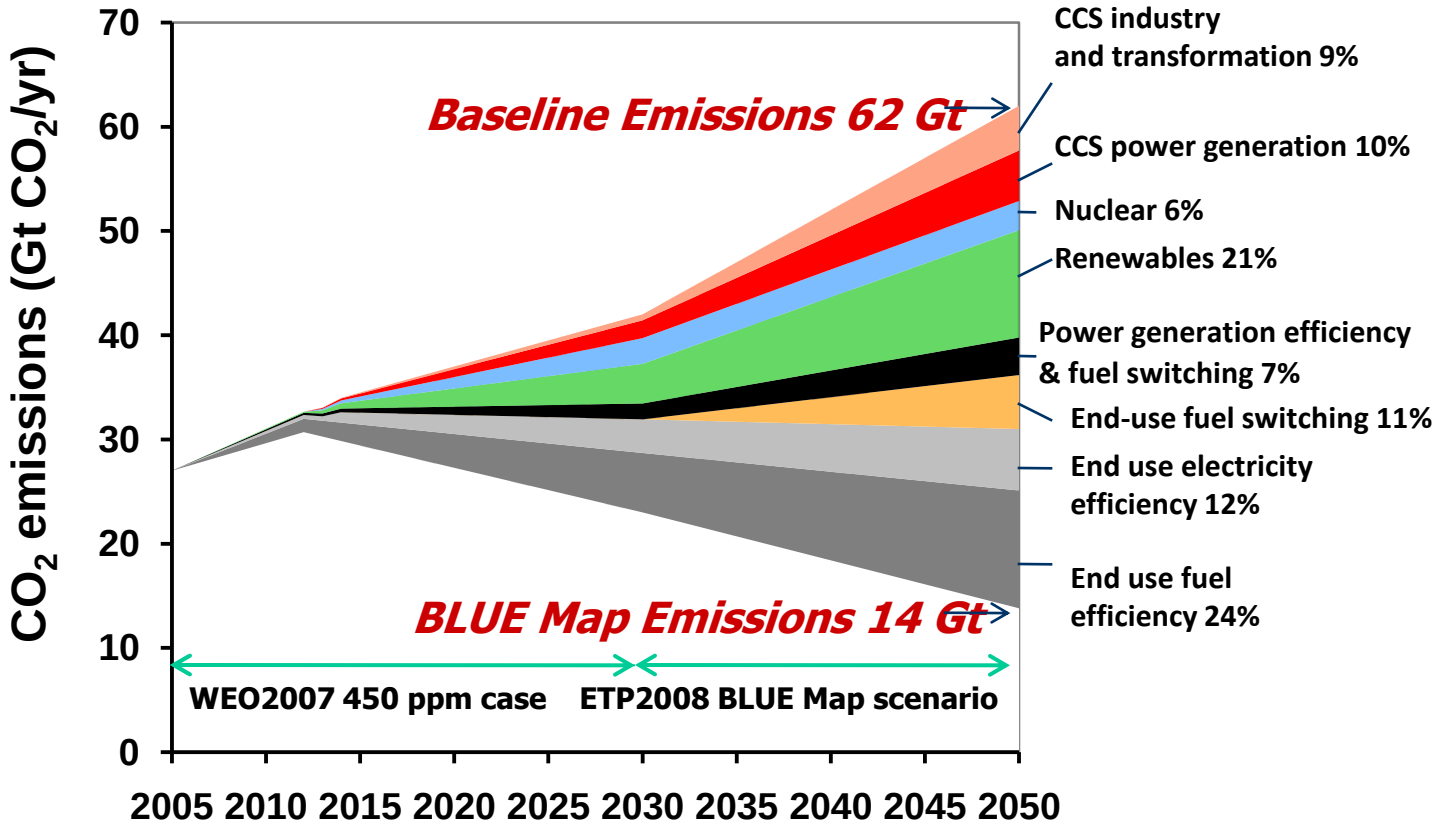
Source: Mabee and Saddler, 2007

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



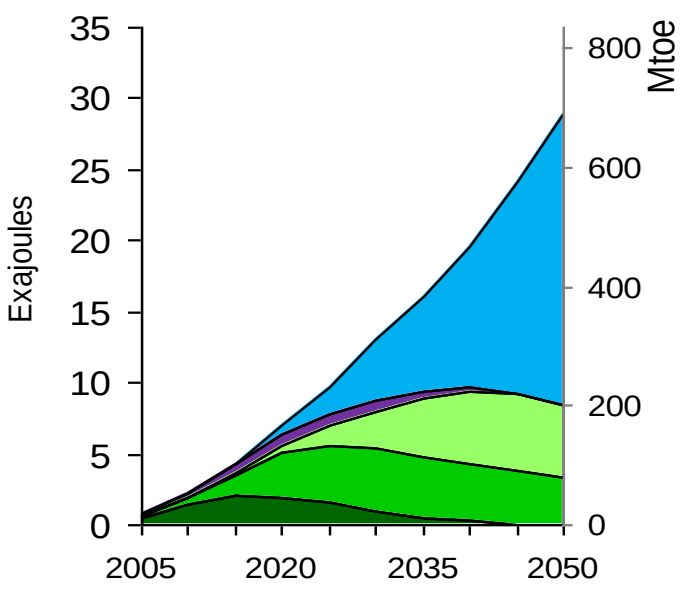
Climate Change Requests a New Energy Revolution

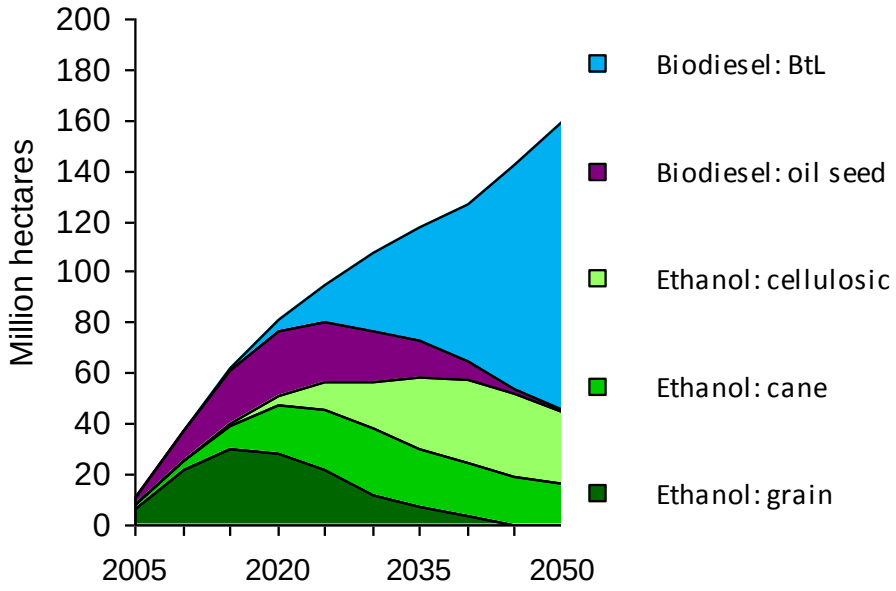


Source: **IEA – Energy Technology Perspectives 2008.**

Biofuel shares and land use
ETP 2008 BLUE Map Scenario

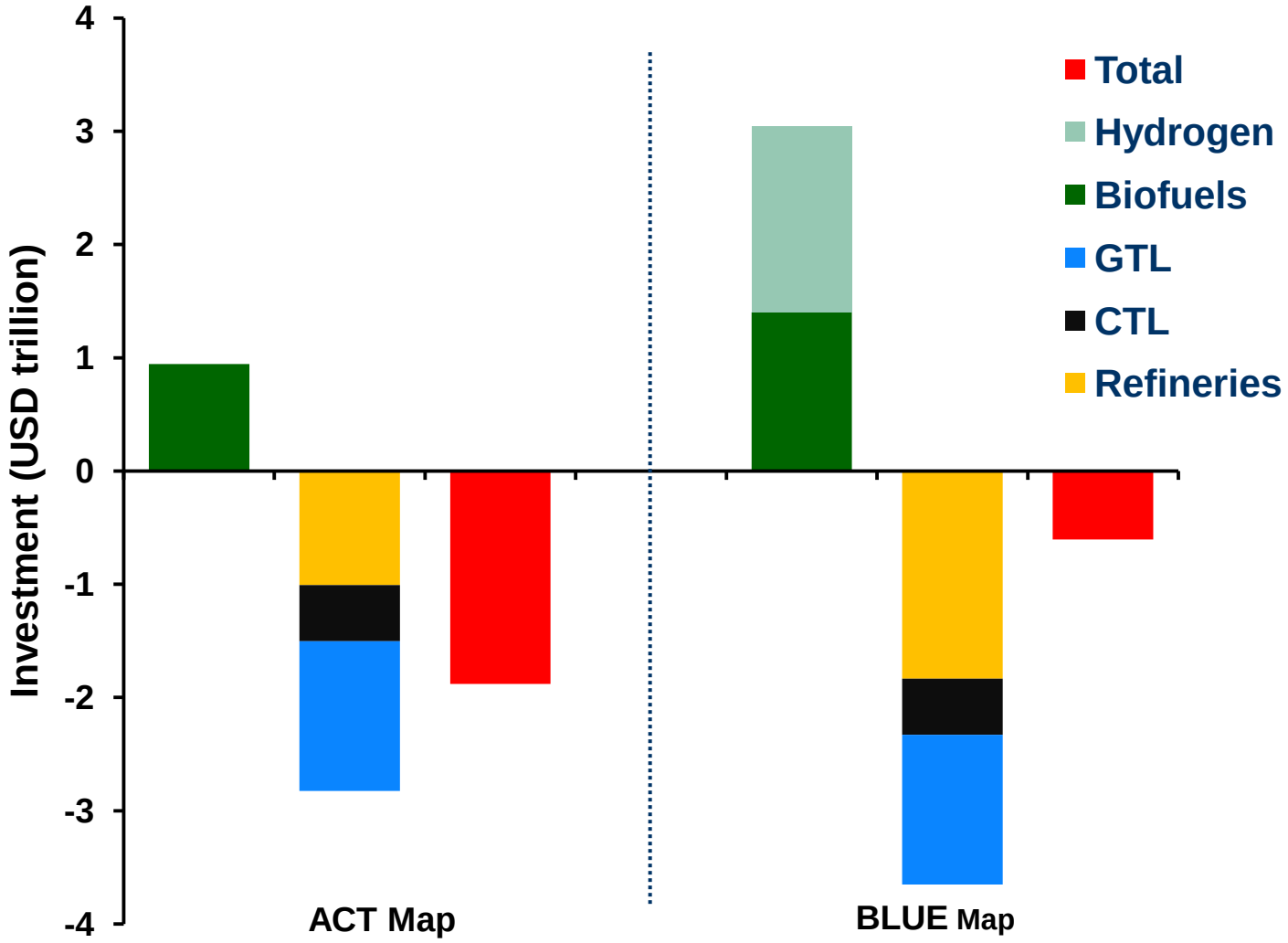
- 690 Mtoe/yr (29 EJ/yr) in 2050 → 160 Mha land
  (13 200 Mha world total land area, 1 500 Mha used to produce arable crops)
- Share of total transport fuel
  - Currently 1 %
  - 26% by 2050





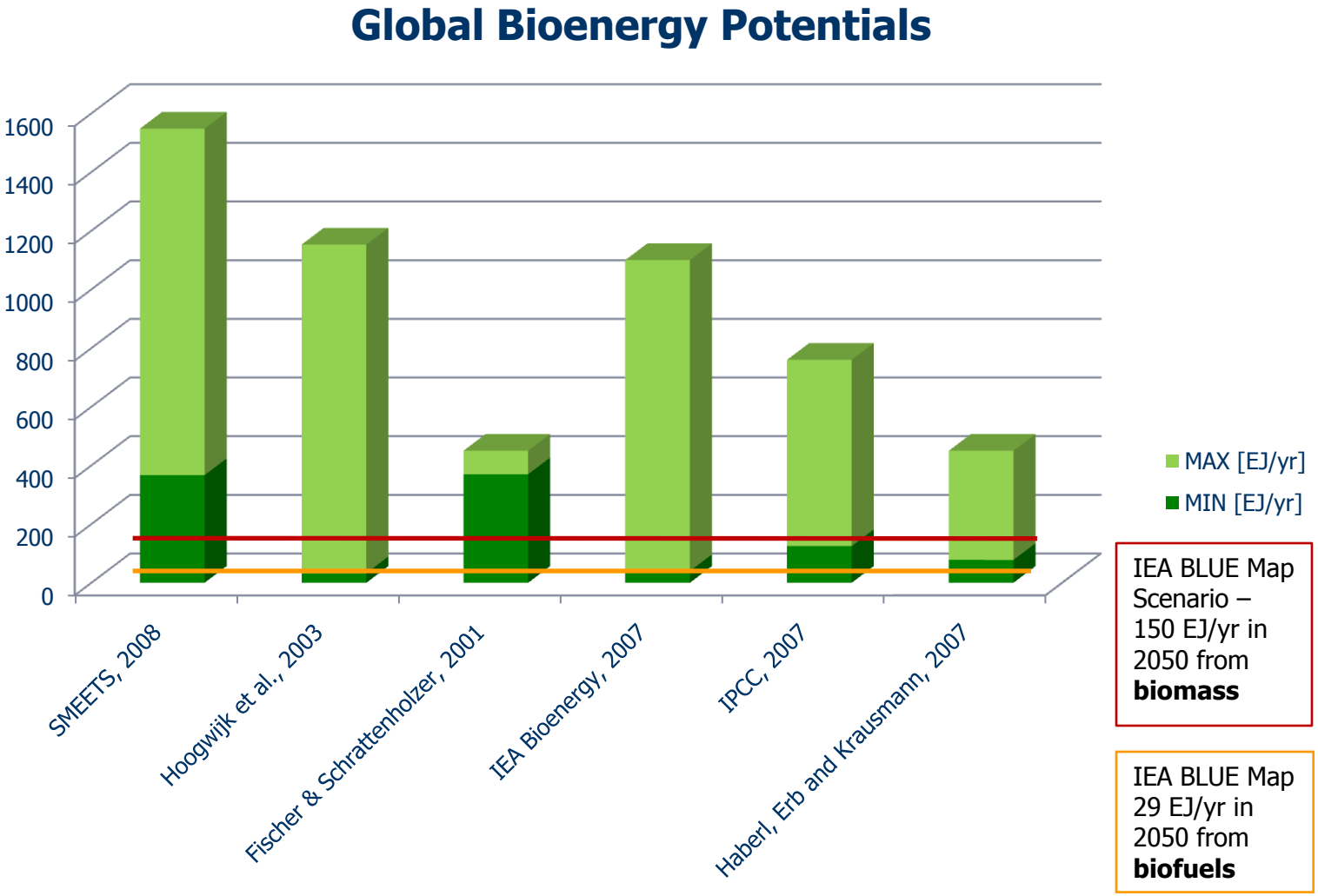
Source: **IEA – Energy Technology Perspectives 2008.**

Cumulative Additional Investment in Energy Transformation (2005-2050)

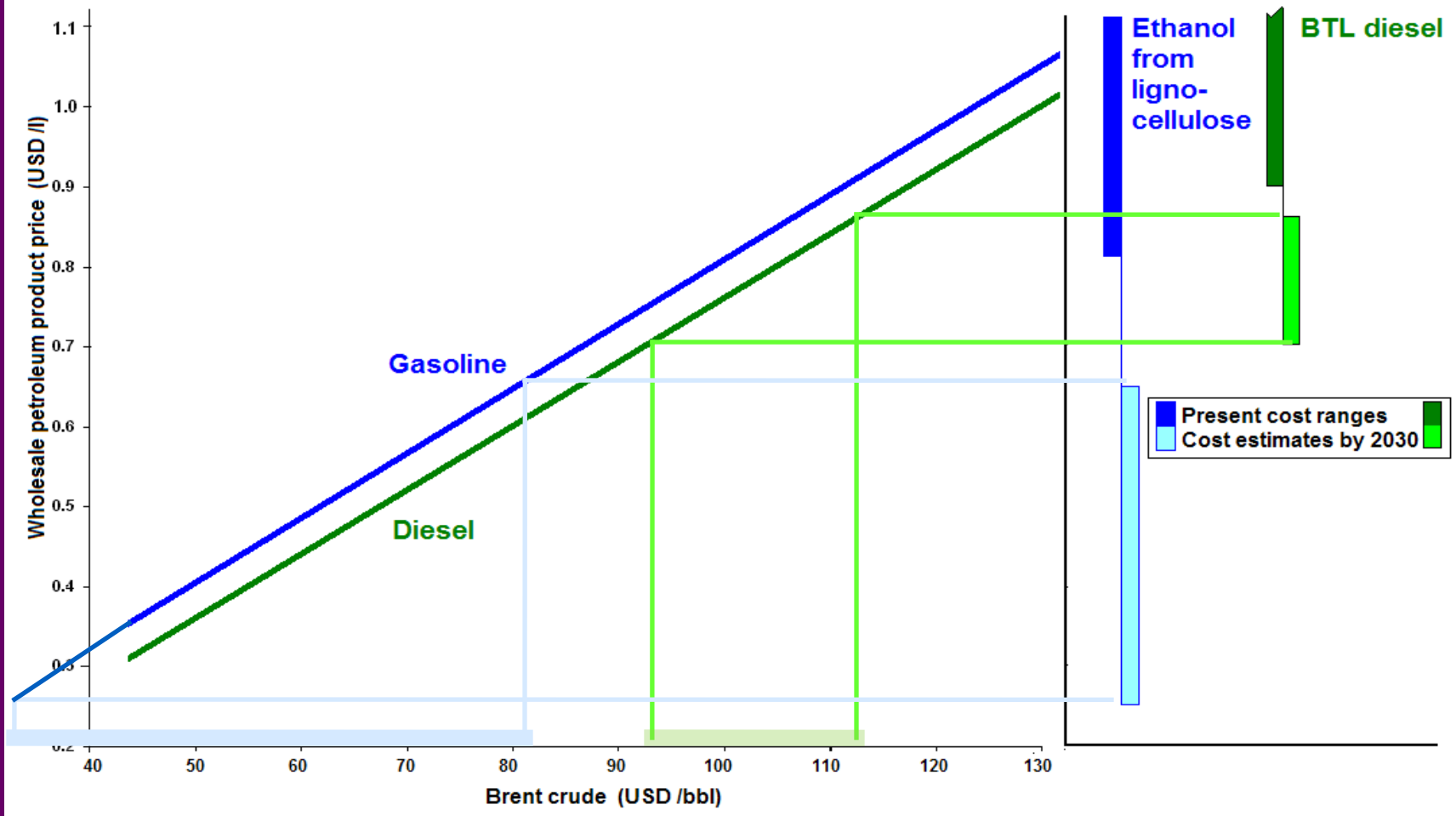


Source: **IEA – Energy Technology Perspectives 2008.**

Overview – Previous Studies



Production Cost Ranges for 2nd Generation Biofuels versus Crude Oil Price



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 CO_2 emissions
- Questions:

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