

Future Fuels and Geopolitics: the Role of Biofuels

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Drivers new world energy system

1. Geology and geopolitics of fossil fuel
2. Rising CO₂ concentration in atmosphere
3. Options from new technology

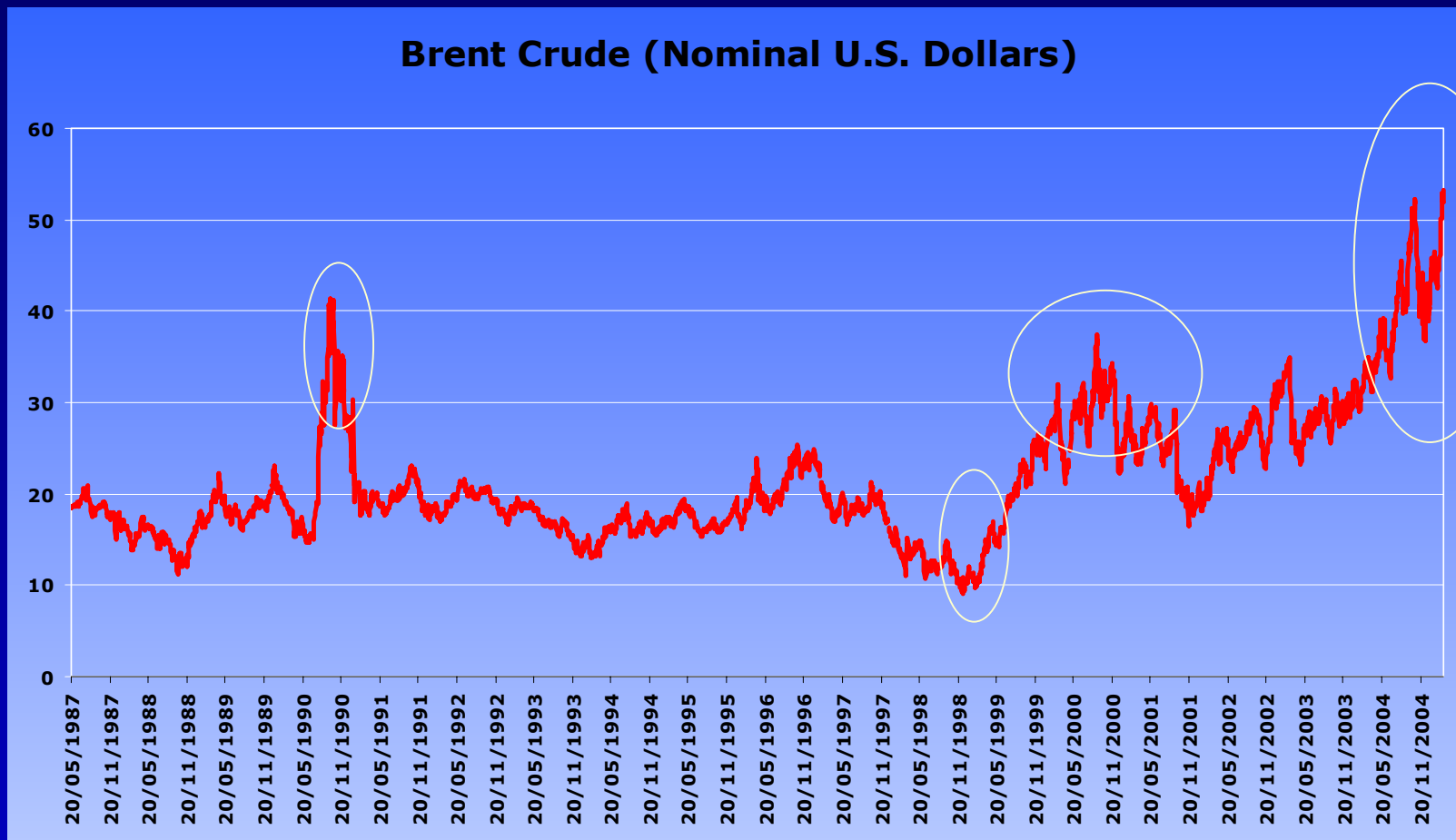
International energy agenda's

- Transition towards sustainability
- Transition towards “more market, less government”
- Securing energy supply
- Securing energy access for the poor

**Energy issues are global issues:
need for global discussions, but no global framework**

Development of the Oil Price (1987-2004)

Source: EIA



2004-2005: Tight markets

- Low investment in E&P:

low oil price in late 1990s now results in production capacity constraints

- Strong demand growth:

driven by China, India and U.S.

- Low spare capacity:

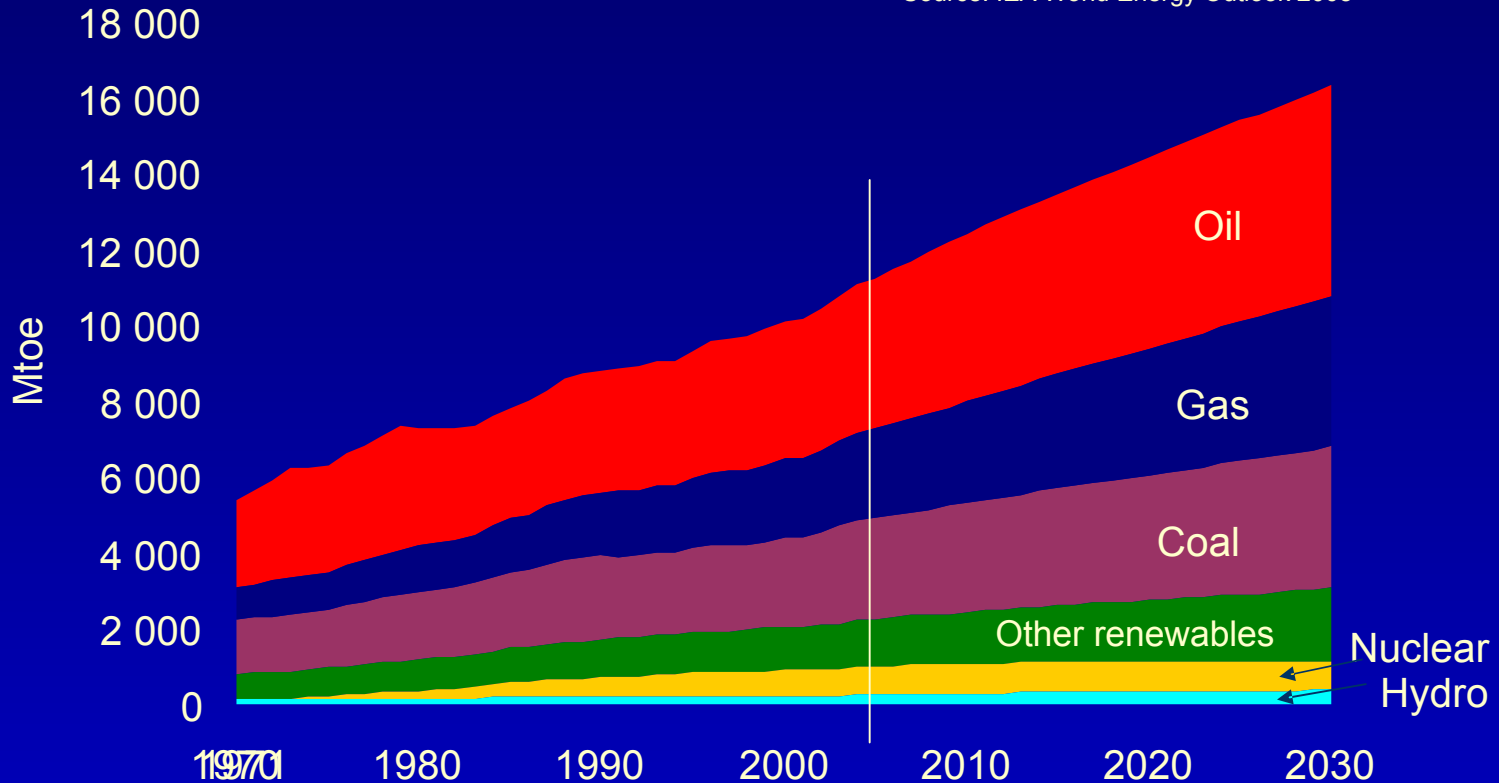
traditional swing capacity OPEC 2-3 mbd, but now close to 1 mbd compared to 83-84 mbd of supply

- Timing of some new production unclear:

West Africa, Saudi Arabia, Caspian

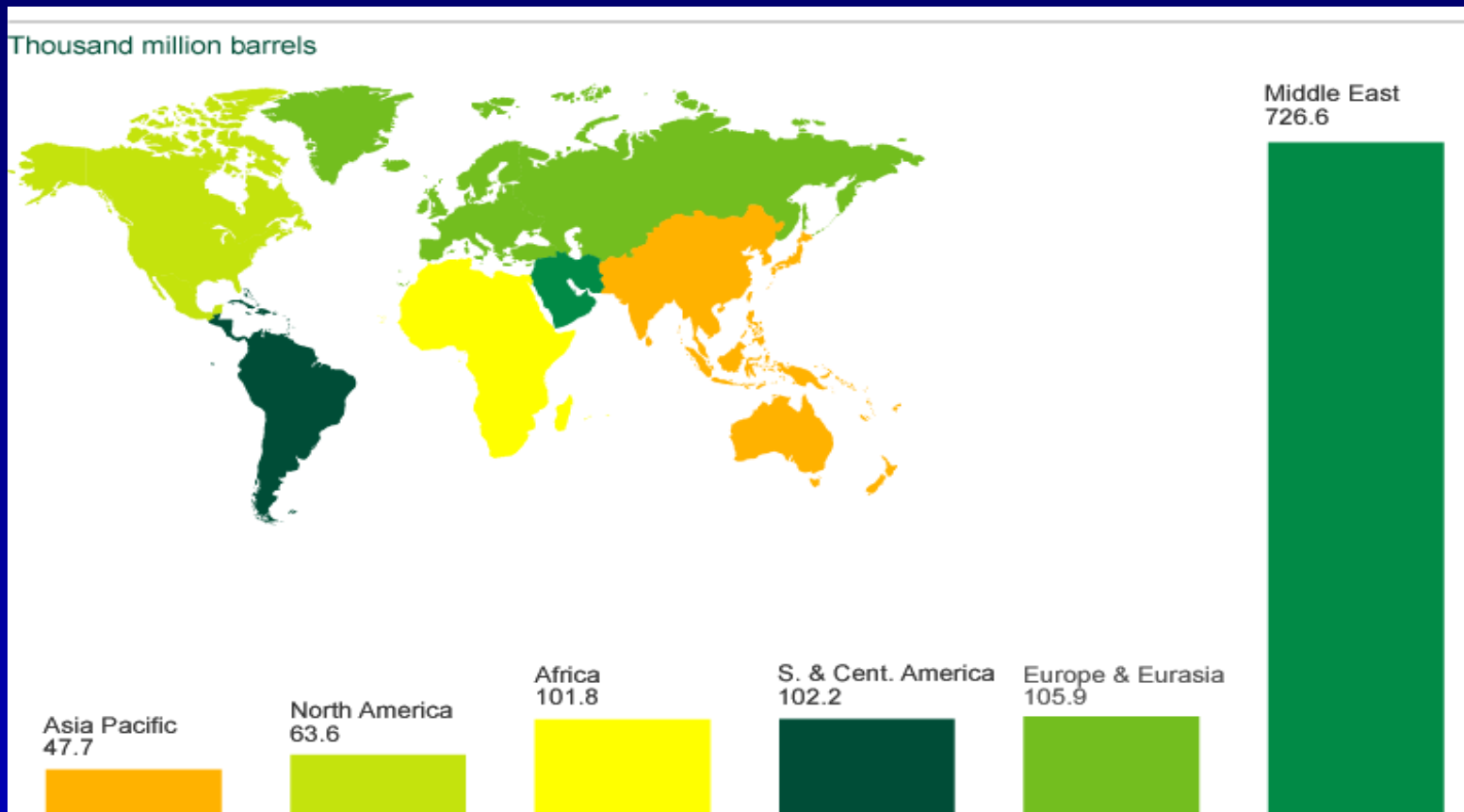
World Primary Energy Demand

Source: IEA World Energy Outlook 2005



Oil and gas together account for more than 60% of the growth in energy demand between now and 2030 in the Reference Scenario

World proved oil reserves, 2004



Source:
BP
Statistical review of
world energy
2004

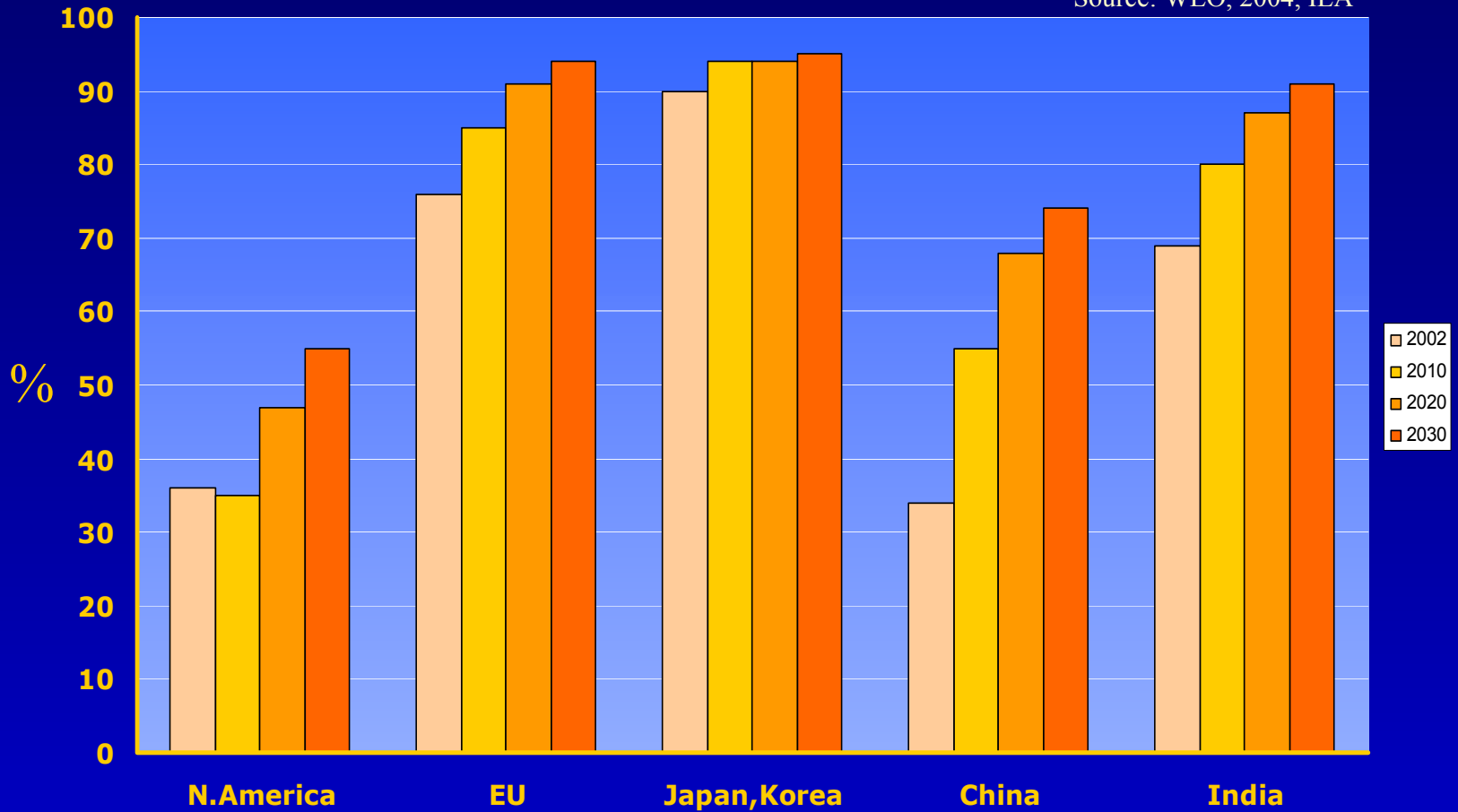
Five countries around the Gulf: Iran, Irak, Kuwait, Saoedi-Arabia and UAE contain 65% of the world proved oil reserves

Why is energy security important?

- Energy is the backbone of our economies
- Import dependency is increasing
- Imports of oil (and gas) increasingly comes from a small number of countries
- Transition to other fuel mix takes time

Oil Import Dependence

Source: WEO, 2004, IEA

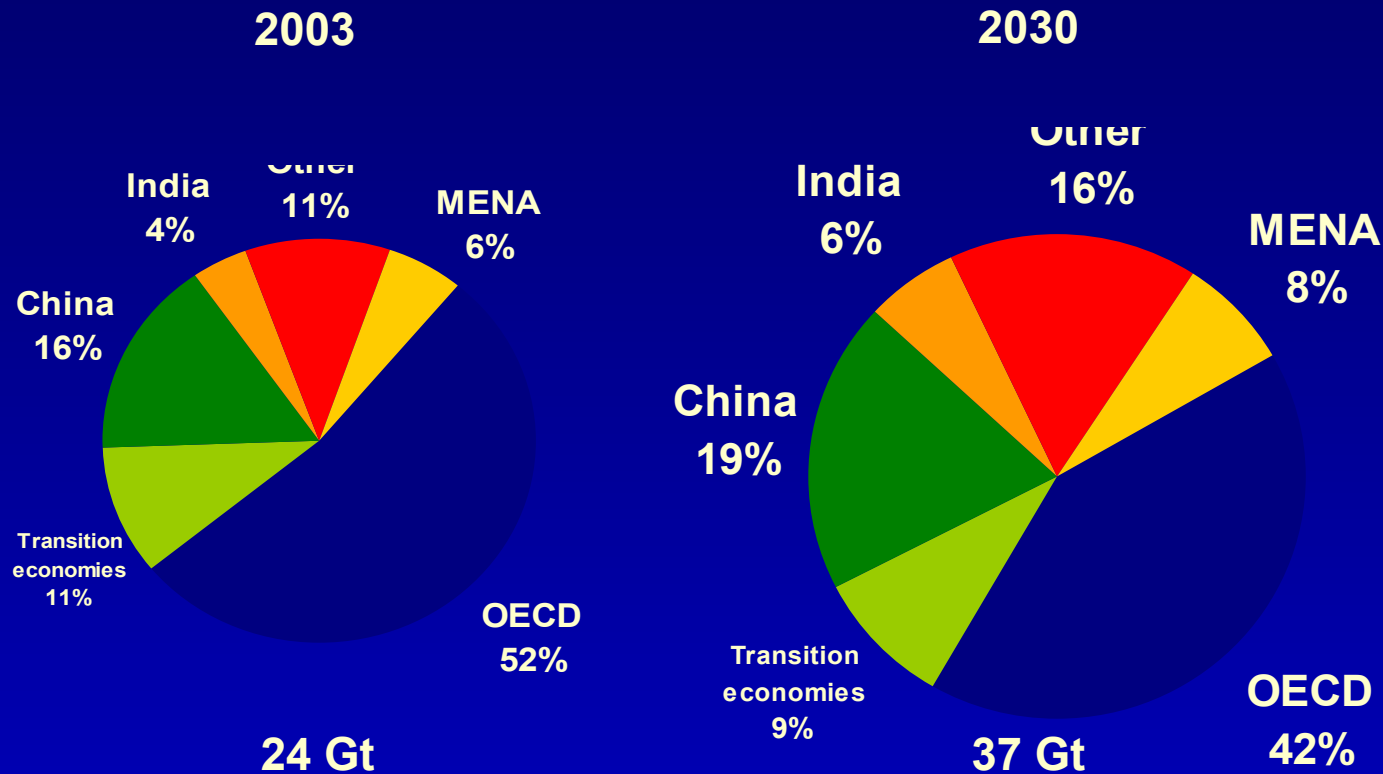


Security of supply concerns

- Decreasing indigenous supplies
- Increasing imports
- Choke points in trade routes
- Competition with other consumer countries
- Limited ability to diversify and produce indigenous sustainable energies
- Concerns about political stability producing nations

Energy-Related CO₂ Emissions by Region

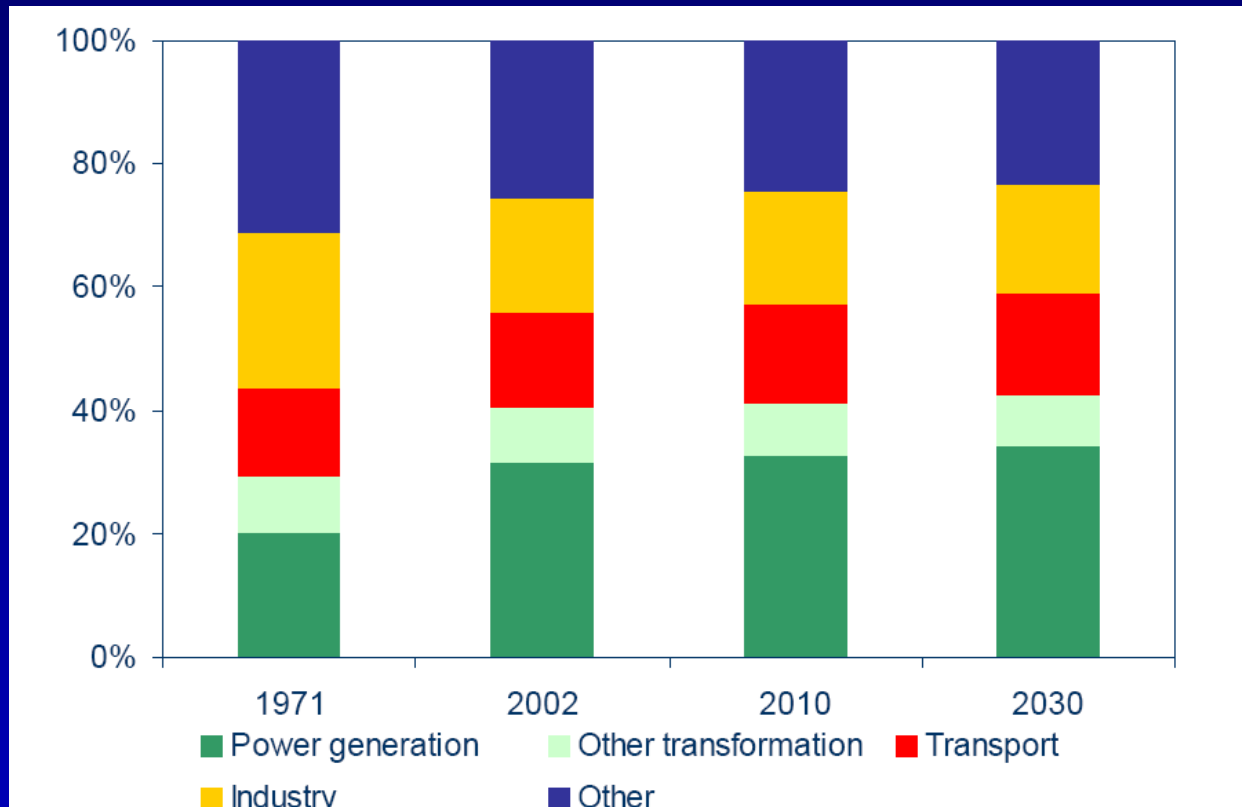
Source: IEA World Energy Outlook 2005



Global emissions grow by just over half between now and 2030, with the bulk of the increase coming from developing countries

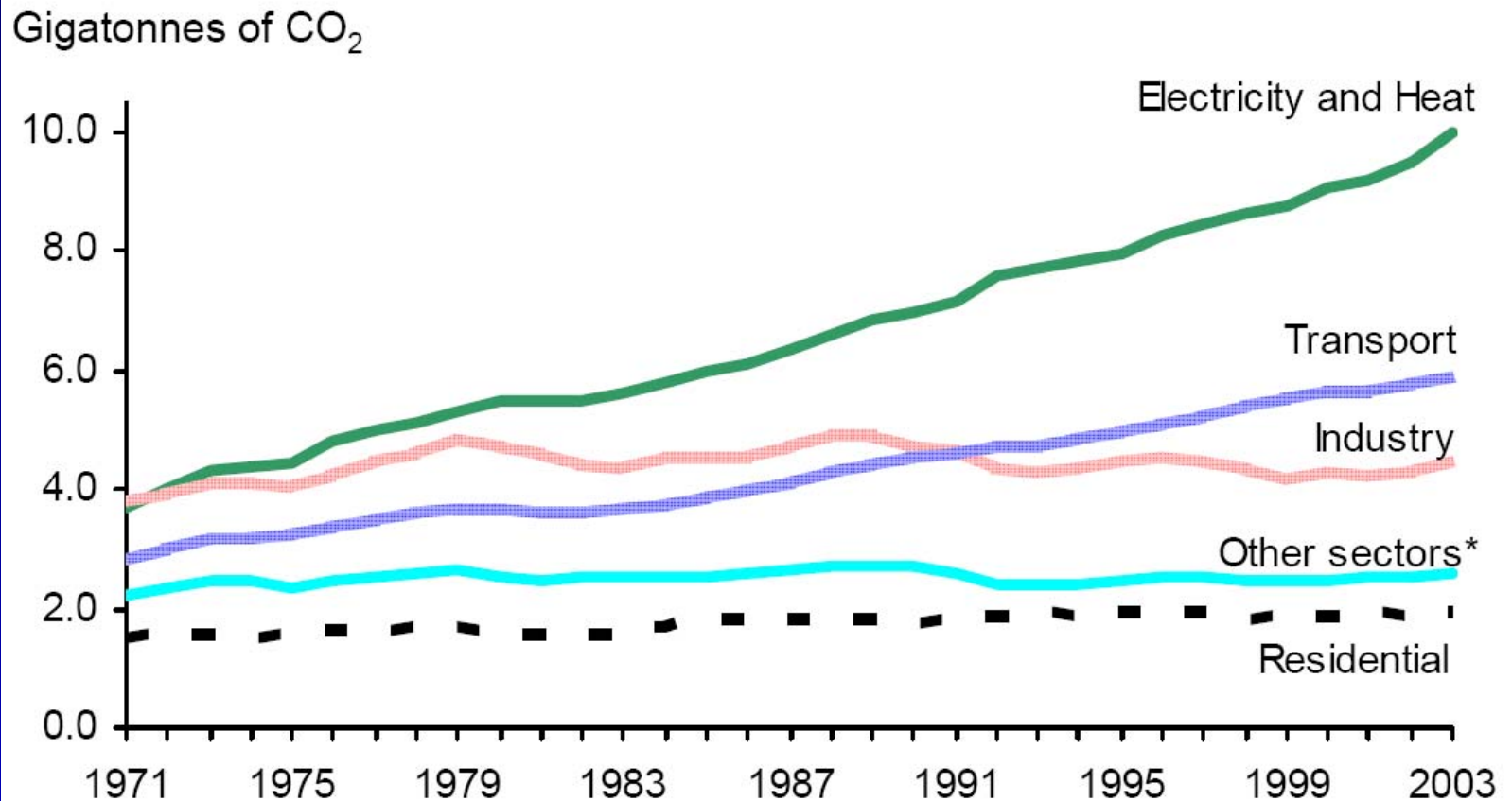
World Primary Energy Demand by Sector

Source: IEA World Energy Outlook 2004



The transport and power-generation sectors will absorb a growing share of global energy

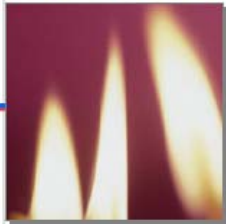
World CO2 Emissions by Sector



Ref. IEA, 2005

Options for change - enabling technologies

Emission reduction



A further shift to natural gas



Nuclear power



Renewables



Bio-products



Carbon capture and storage

Energy conservation and efficiency



Mass transportation



Road transport



Buildings



Low energy appliances



Doing things differently

Ref. Shell, 2005

The Energy Market

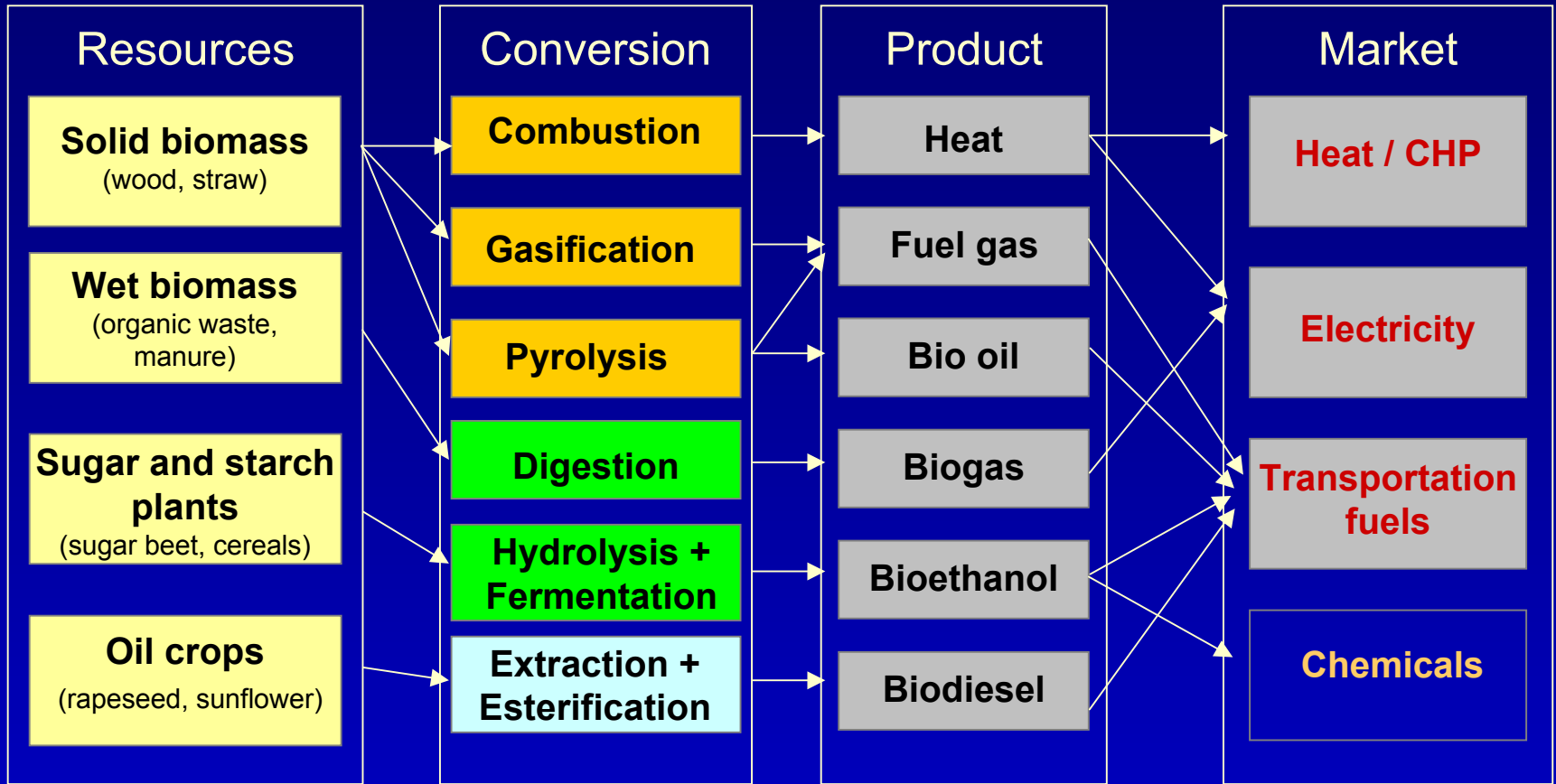
- Largely dependent on fossil fuels
- Increasing demand
- Reserves concentrated in a few countries
- GHG emissions increasing
- Transportation sector almost exclusively petroleum-based and growing

Biofuels

- Biofuels are only one application of primary biomass...
- Ethanol and Biodiesel are the main biofuels
- Advantages: production domestic, less GHG emissions
- Supply and demand do only partly coincide geographically
- Policy developments in many countries

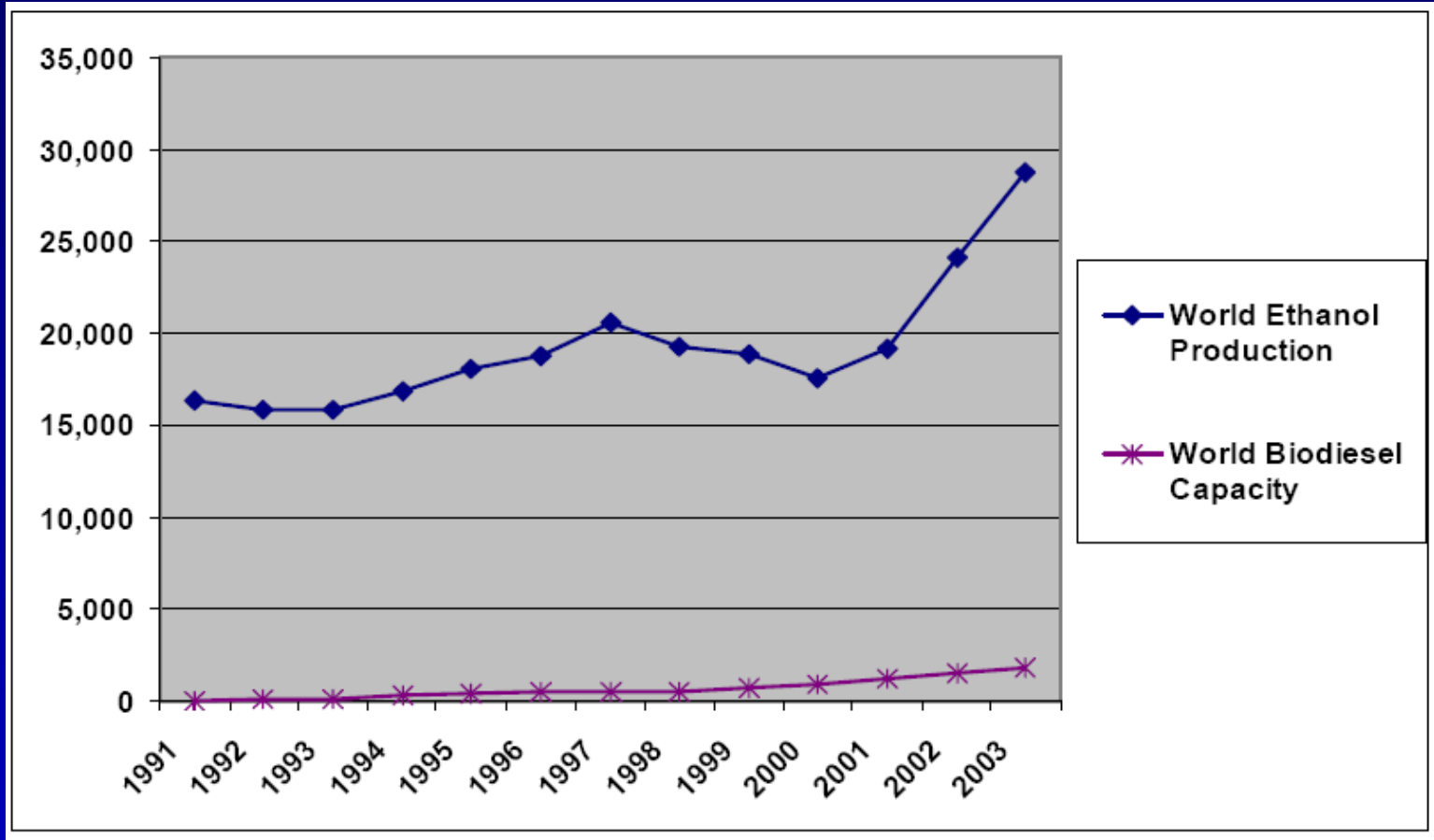
Biofuels are just one application of biomass...

Source: Eubia, 2005



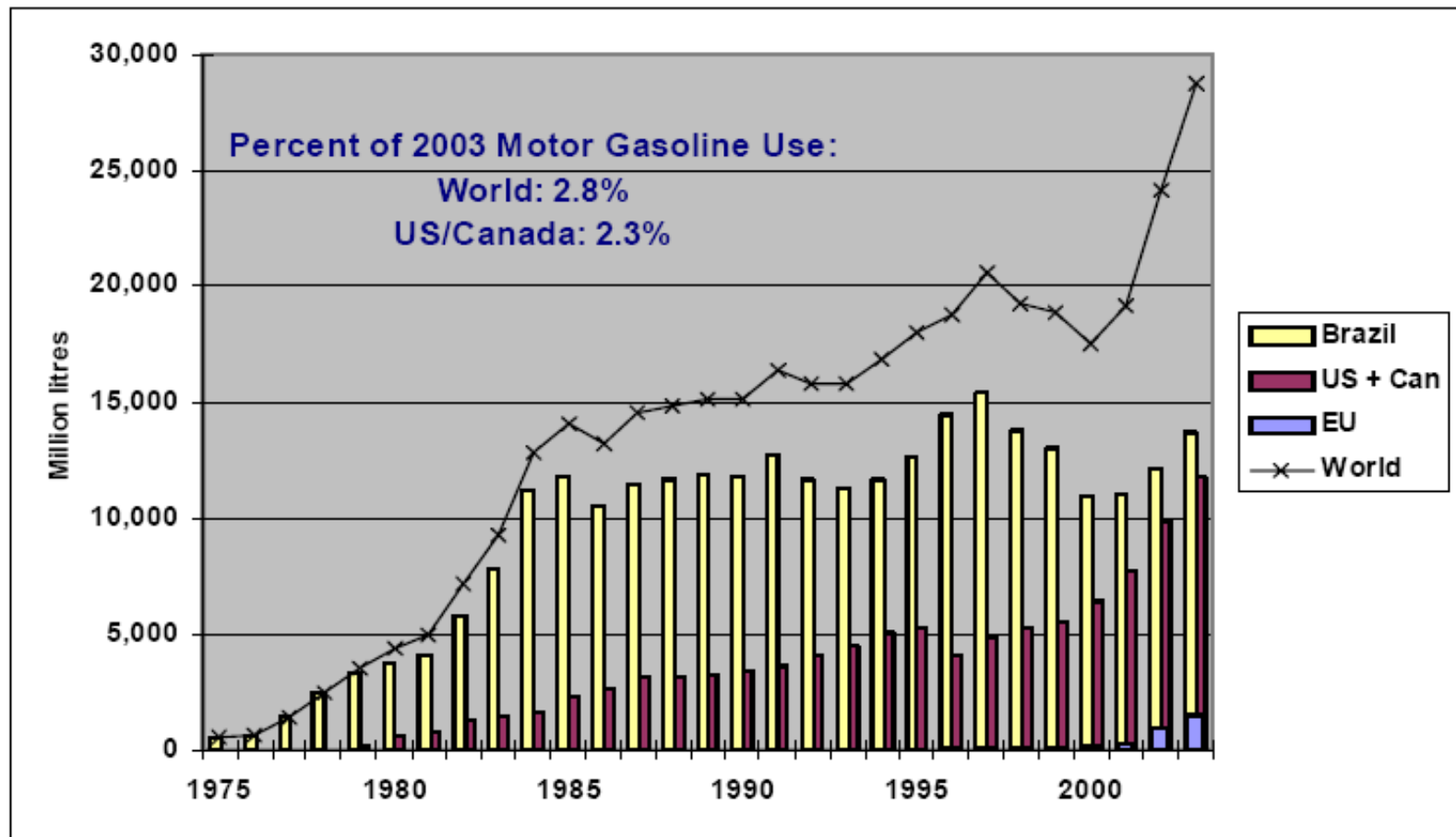
Worldwide Biofuels Production

Million litres



Source: F.O. Lichts (2003)

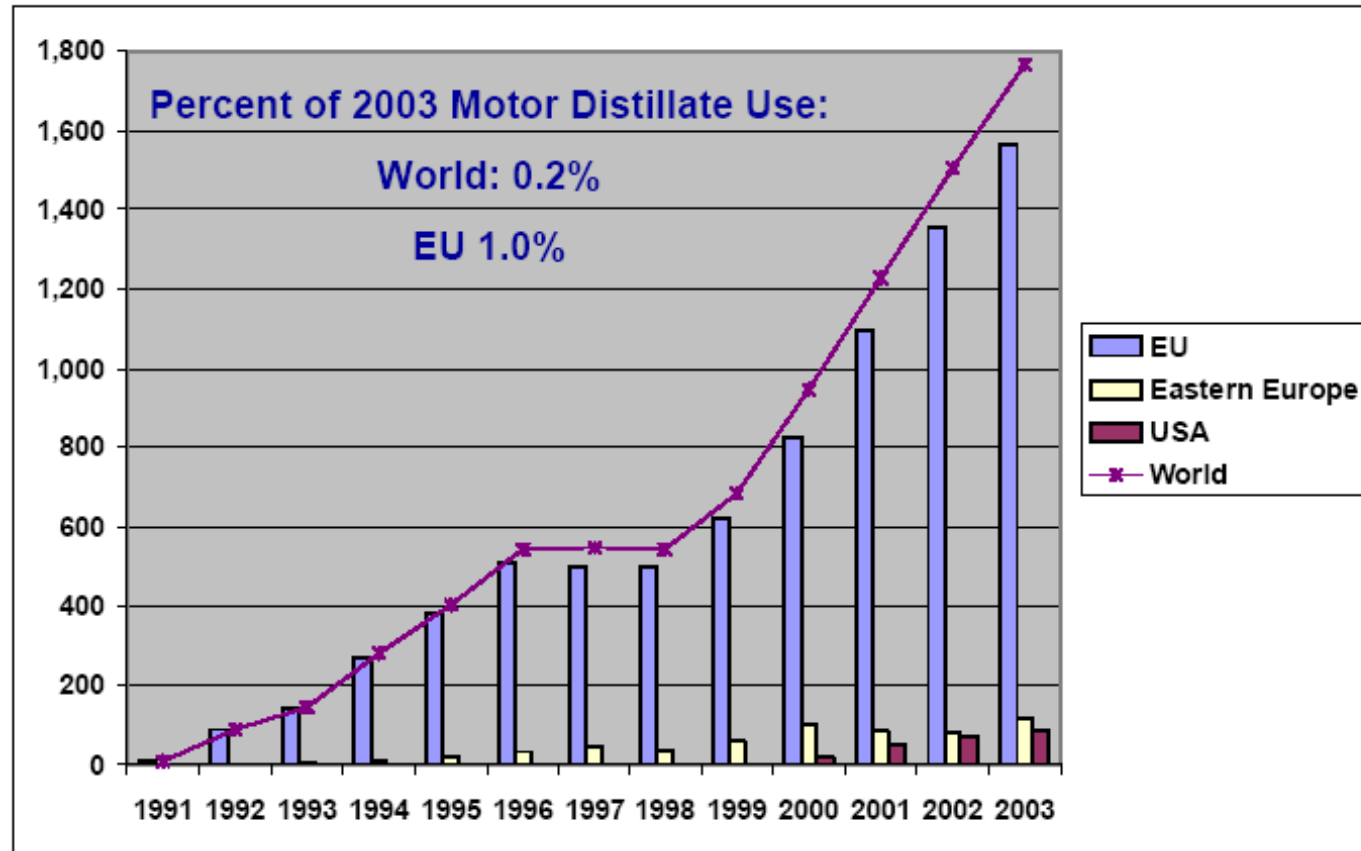
Ethanol Production



Source: F.O. Lichts (2003)

Biodiesel Production

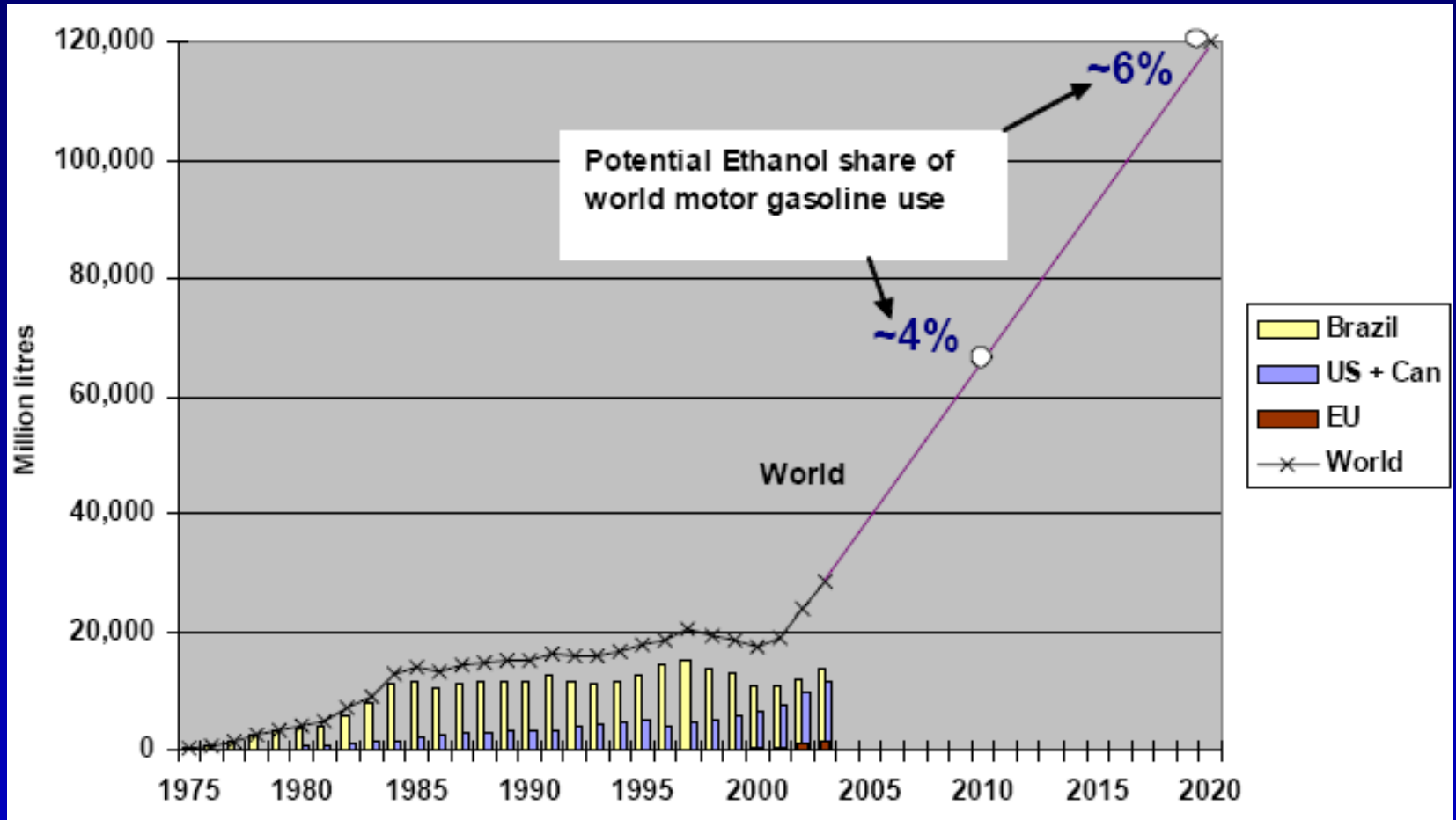
Million Litres Capacity (actual production trends are somewhat lower)



Source: F.O. Lichts (2003)

Possible Future Biofuels Use

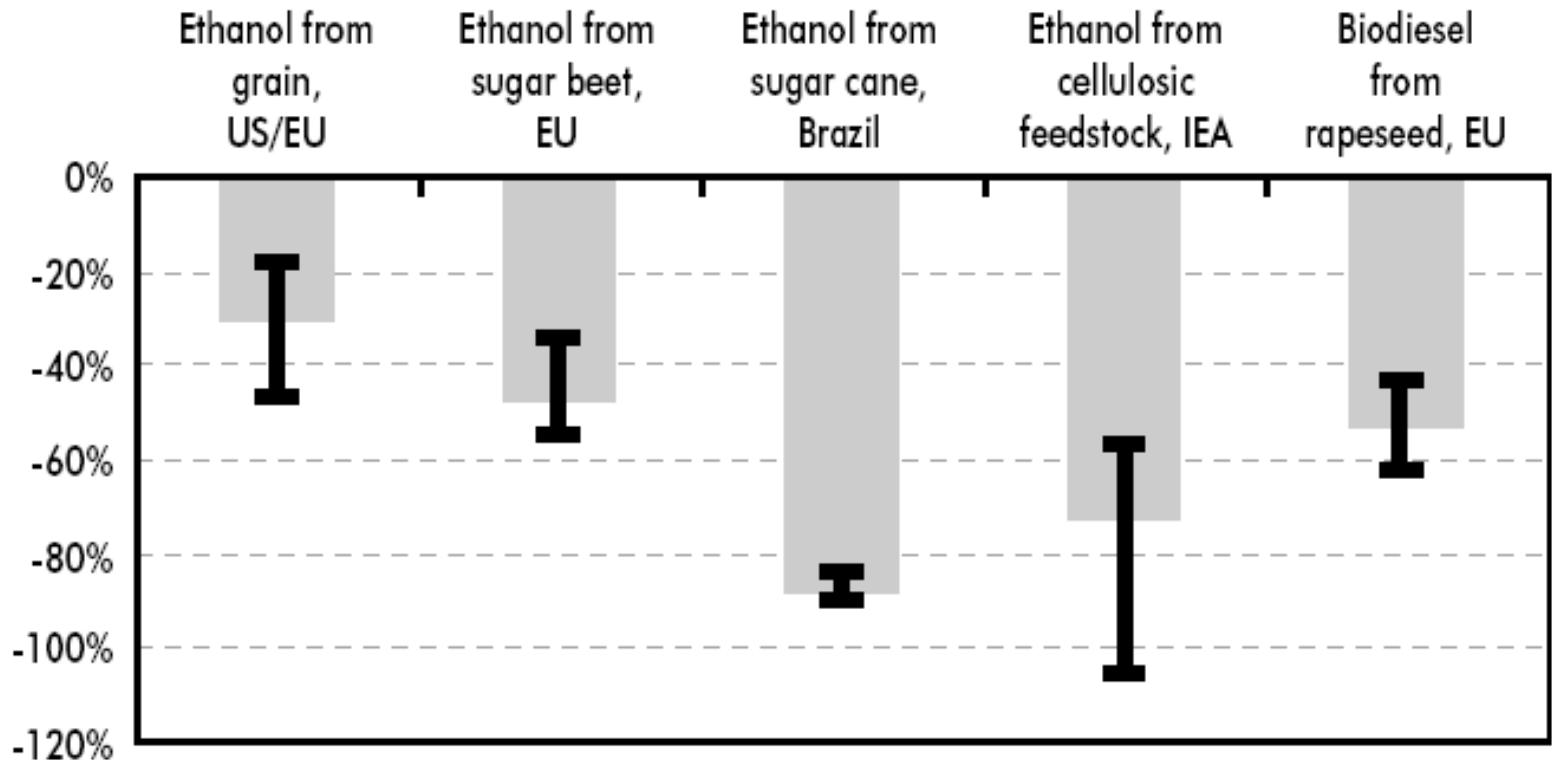
Source: IEA Projections, 2004



Main advantages:

(1) CO2 Emission reduction

Source: IEA, 2004



Main advantages:

(2) Domestic Production Capacities

Regional biomass potentials for 2050, based on four different IPCC scenarios

(Present world energy consumption ca. 400 EJ/year, largest potentials per category high-lighted)

(EJ/year)	Potential at abandoned agricultural land	Potential at low-productive land	Potential at 'rest' land
USA	18 – 46	0 - 1	0 - 19
South America	1 – 56	1	1 – 32
Sub-Sahara Africa	4 - 68	0	0 – 56
Western Europe	9 - 15	0	0 – 4
Eastern Europe	8 - 9	0	0
Former USSR	47 - 97	1 – 3	2 – 27
East Asia	7 - 79	1	1 – 22
Oceania	17 - 32	0	0 – 21
World	129 - 409	5 – 9	6 - 243

Source: Hoogwijk et al., RIVM & Copernicus Institute, 2004

Present regional policies ... many developments

- Targets set, e.g.
 - EU: 2% biofuels in 2005, 5,75% in 2010
 - US: 5% ethanol by 2012
 - China: 5% ethanol in five provinces
- Trade deals, e.g.
 - Japan & Brazil: 150 million litres imported in 2004, new deals signed
- New production capacity planned, e.g in China, Japan, Brazil, Canada, Malaysia, Thailand, Philippines, ...

Drivers for an International Biofuels Market

'Drivers for an International Biofuels Market'

*Stephan Slingerland, Lucia van Geuns and Wilbur Perlot
(Clingendael International Energy Programme)*

DISCUSSION PAPER

Factors driving the Biofuels Market

- Supply Security & Risk Abatement Strategies
- Future Emission Reduction Agreements
- Interaction with New Parties and Policies
- Multilateral Certification



Geopolitical factors

- Biomass Prices
- Oil Prices
- Technological Development



Economic factors

Supply Security Considerations

Diversification:

from oil producing regions ...



... to domestic or developing countries ...



Supply Security Considerations

Question:

Will security of supply strategies of energy consuming countries stimulate a shift to biofuels?

... Future Climate Agreements...

Questions:

- 1) Will future international agreements include binding targets, and can biofuels contribute significantly to achievement of these targets?*
- 2) Should policy incentives for biofuels concentrate on present or future generations of biofuels?*
- 3) How can the most efficient route from primary biomass to end-use application be stimulated?*

Interaction with New Parties and Policies ...

Questions:



- 1) Will existing oil companies or new parties, e.g. the agricultural sector, be a main driver for biofuels investments?*
- 2) Will agricultural interests drive in particular national developments, or also an international market?*
- 3) How can negative effects on land-use as a result of biofuels production be prevented?*



... Multilateral Certification ...

IEA Bioenergy

Task 40

an international
research
collaboration
under the auspices
of the
International
Energy Agency

Martin Junginger
André Faaij
Copernicus Institute -
Utrecht University

Sustainable International Bio Energy Trade: securing supply and demand

Introduction

This leaflet introduces the work of an international working group dealing with international trade of biomass and bio-energy, its possibilities, implications and prospects. The working group is called Task 40, headed under the Bio-energy Agreement of the International Energy Agency.

Over the past decades, the modern use of biomass has increased rapidly in many parts of the world. In the light of the Kyoto greenhouse gas (GHG) reduction targets, many countries have ambitious targets for further biomass utilization. Also the recent increase of the oil price has strongly fueled the interest in bioenergy. For example, at an oil price of over sixty dollars per barrel, it is a very attractive option to drive on bio-ethanol or bio-diesel instead of fossil fuel-based transportation fuels. However, especially in developed countries domestic biomass potentials are often used to a high degree, though in some countries still untapped potentials remain. On the longer term, the pressure on available biomass resources will increase. Also, biomass produced in developed countries can be associated with high production costs. Without the development of biomass resources (e.g. through energy crops and better use of residues) and a well functioning biomass market to assure a reliable and lasting supply, the often ambitious targets for biomass use may not be met. The development of truly international markets for biomass may become an essential driver to develop biomass potentials, which are currently under-utilized in many world regions (see e.g. Smeets et al., 2004 (Figure 1) and Hoogewijk, 2004). This is true both for available residues as well as possibilities for dedicated biomass energy plantations or multifunctional systems such as agro-forestry.



Question:

Can an international certification system be introduced and maintained that prevents unsustainable biofuels production?

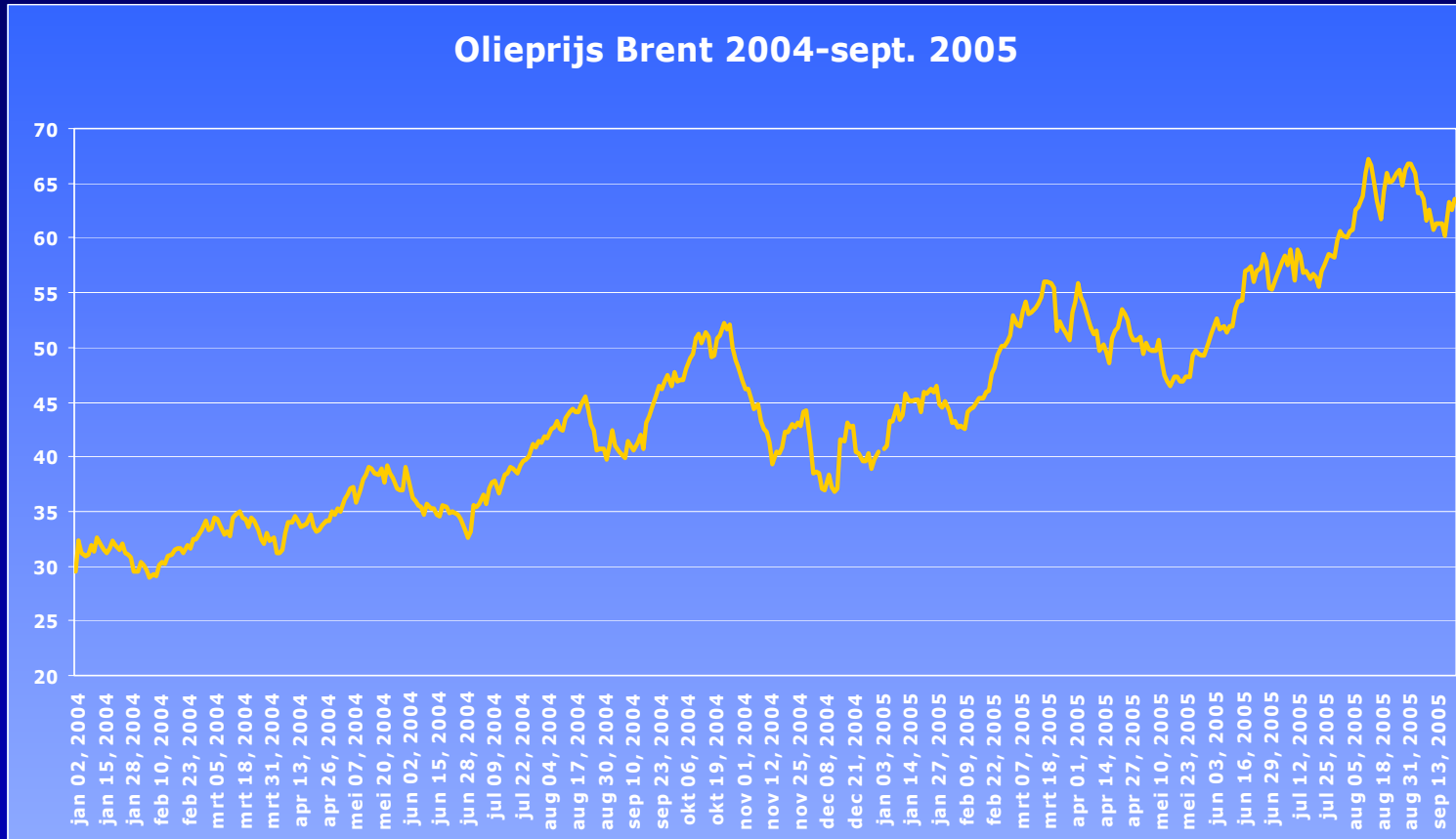
Prices of 1st Generation Biofuels, Petrol and Diesel in the EU

(Sources: MWV, 2005; Eubia, 2005)

	^{€/l} Euroct/lit
“Normal” petrol ¹⁾	47
Diesel ¹⁾	52
Biodiesel from Rapeseed	74
Biodiesel from Sunflower	74
Wheatbased Bio-ethanol	59
Beetbased Bio-ethanol	60

¹⁾ as of 18 October 2005

Oil Price Developments



Question:

Will oil-price developments make biofuels a relatively cheaper energy alternative on the long run?

Technological Developments ...

From first ..to second generation biofuels

Development of second generation biofuels based on woody biomass, Fischer-Tropsch diesel, might shift the balance towards economically competitive application of biofuels.

Question:

How can technological development in biofuels be stimulated most effectively?

Conclusions

- Fossil fuels dominant source of energy for decades
- Import dependency is increasing
- Imports of oil (and gas) increasingly comes from a small number of countries
- Transition to other fuel mix takes time
- An international biofuels market will develop, but pace and extent are uncertain



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Clingendael International Energy Programme
Biofuels Seminar, 9 December 2005