

CEPAL

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# World Primary Energy Supply (2004)

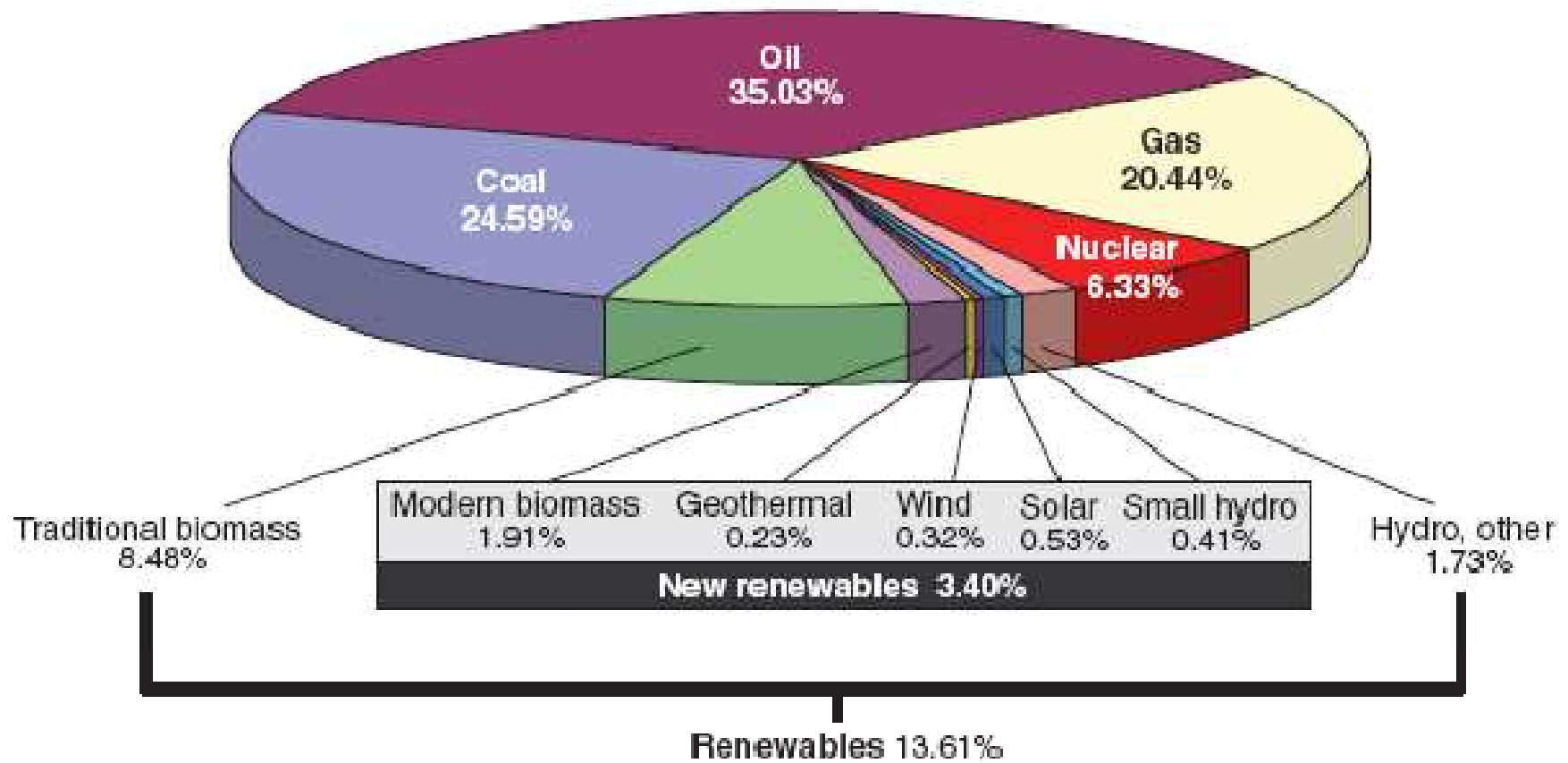


Fig. 1. World total primary energy supply 2004, shares of 11.2 billion tons of oil equivalent, or 470 EJ (15, 16).

# Problems with the present energy system

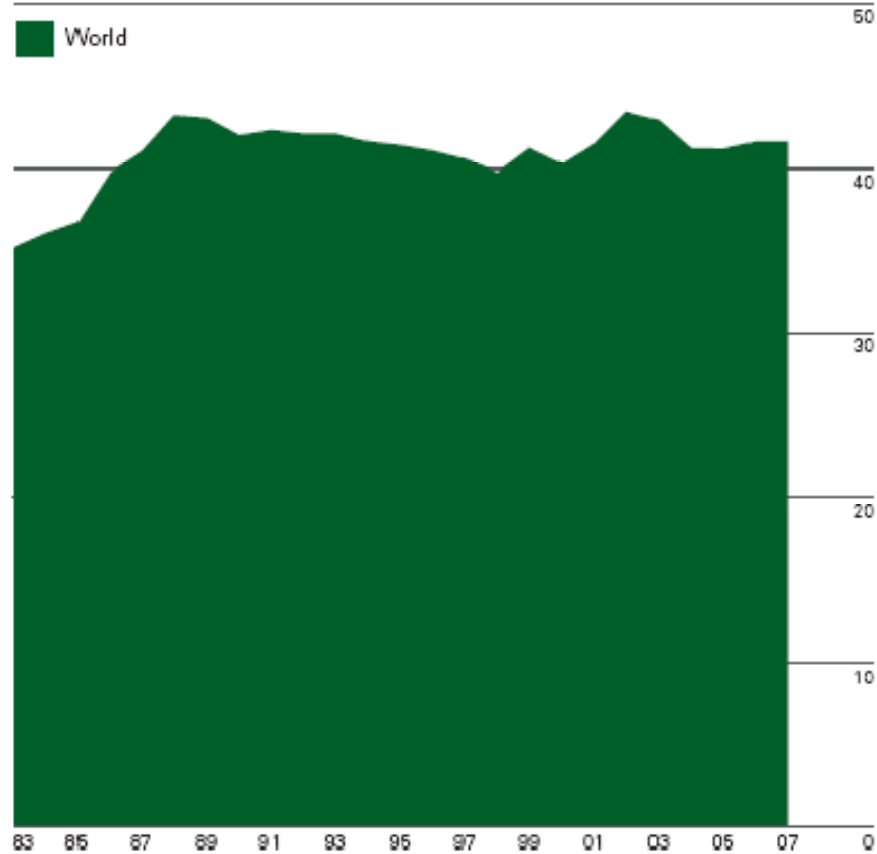
- i. Exhaustion of fossil resources
- ii. Security of supply
- iii. Environmental impacts

## Fossil Fuels Consumption (2007)

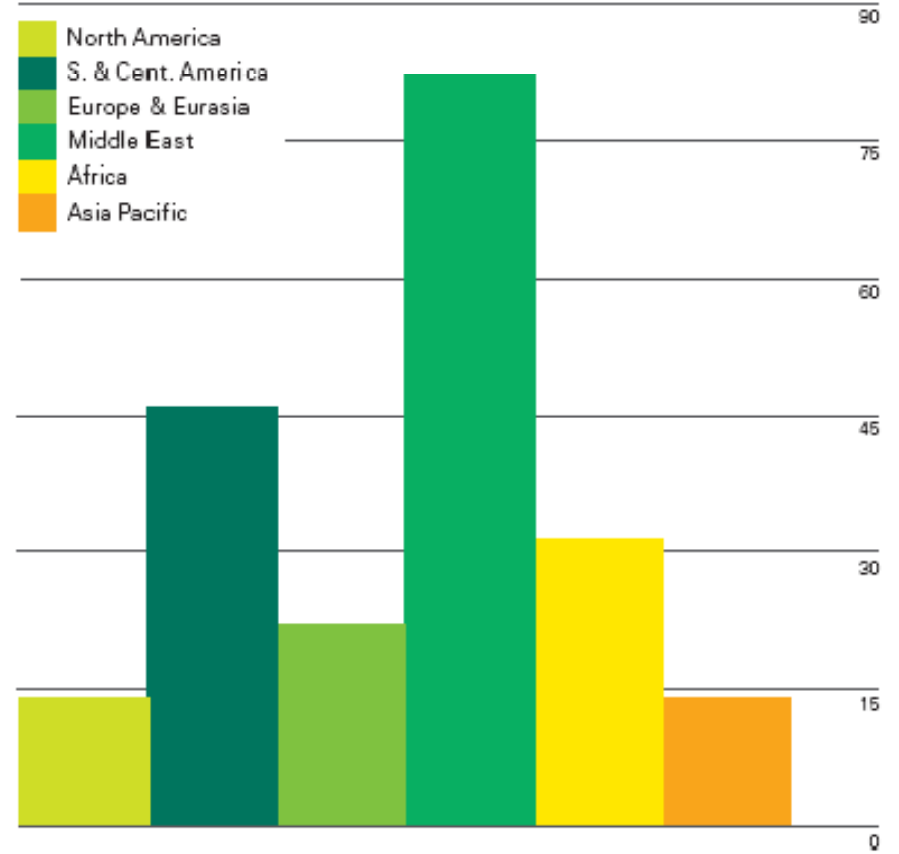
Source	Proved reserves (10 <sup>9</sup> toe)	Production in 2007 (10 <sup>9</sup> toe)	Ratio of proved reserves to production (years)
Oil*	168.6	3.95	45
Gas	160.0	2.65	69
Coal	430.0	3.18	452

\* Proved reserves of oil – Generally taken to be those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions.

## Reserves-to-production (R/P) ratios Years



## 2007 by region

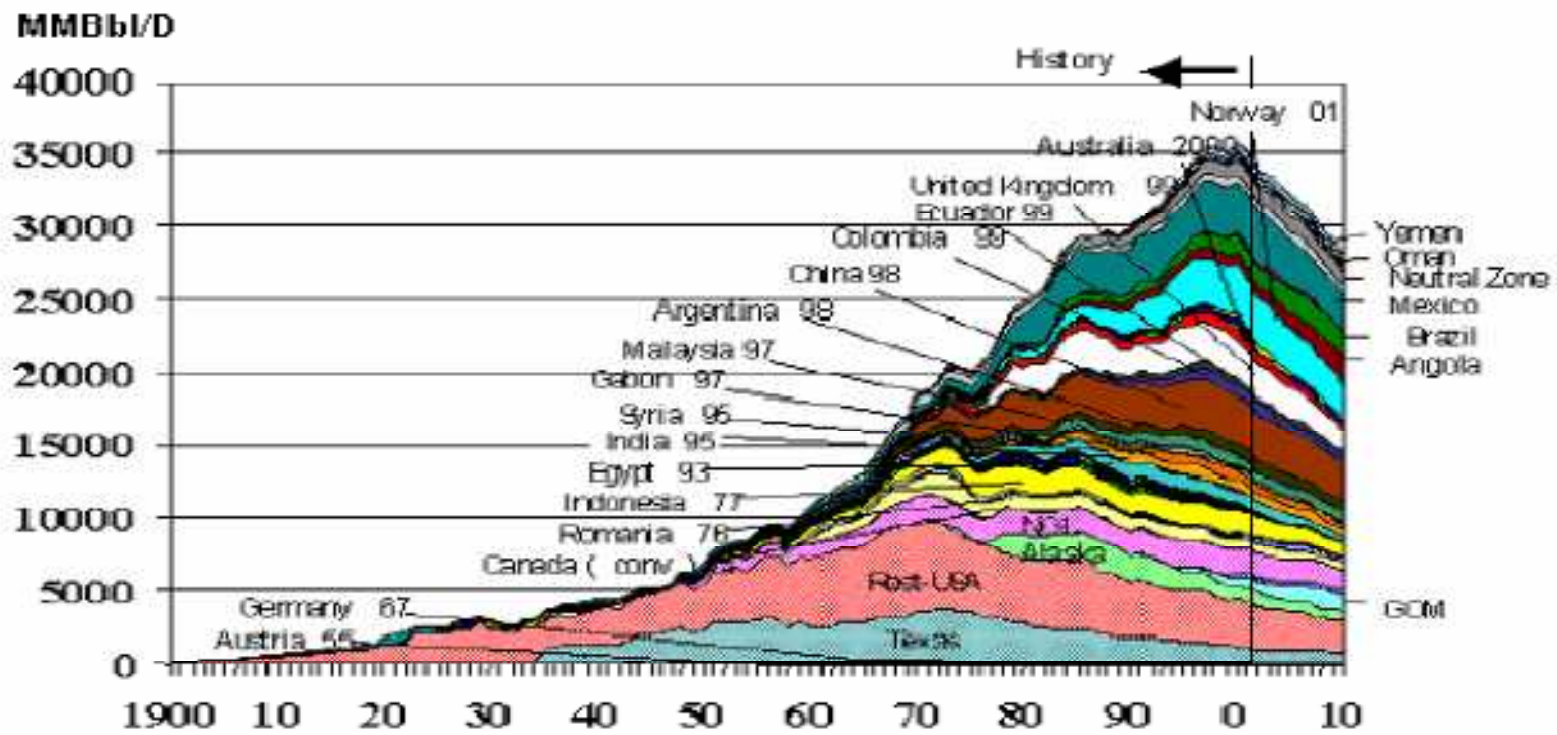


The world's proved oil reserves edged lower in 2007 and the R/P ratio of 41.6 years was unchanged in the face of declining oil production. The level of reserves fell by 1.6 billion barrels in 2007 due to declines in Mexico, Syria, Qatar and Norway, which were partly offset by increases in Brazil, Egypt and Russia.

# Highlights of fossil fuel consumption

- Global oil consumption grew by 1,1% in 2007. Consumption growth was robust in oil-exporting countries.
- Gas consumption rose by 3.1% in 2007, slightly above the 10-year average. The US accounted for the largest incremental growth in both production and consumption.
- World primary energy consumption increased by 2.4% in 2007.
- Chinese share of world energy consumption growth in 2007 52%.

Figure 7. Non-OPEC, non-FSU Oil Production Has Peaked and is Declining (Ref. 17)



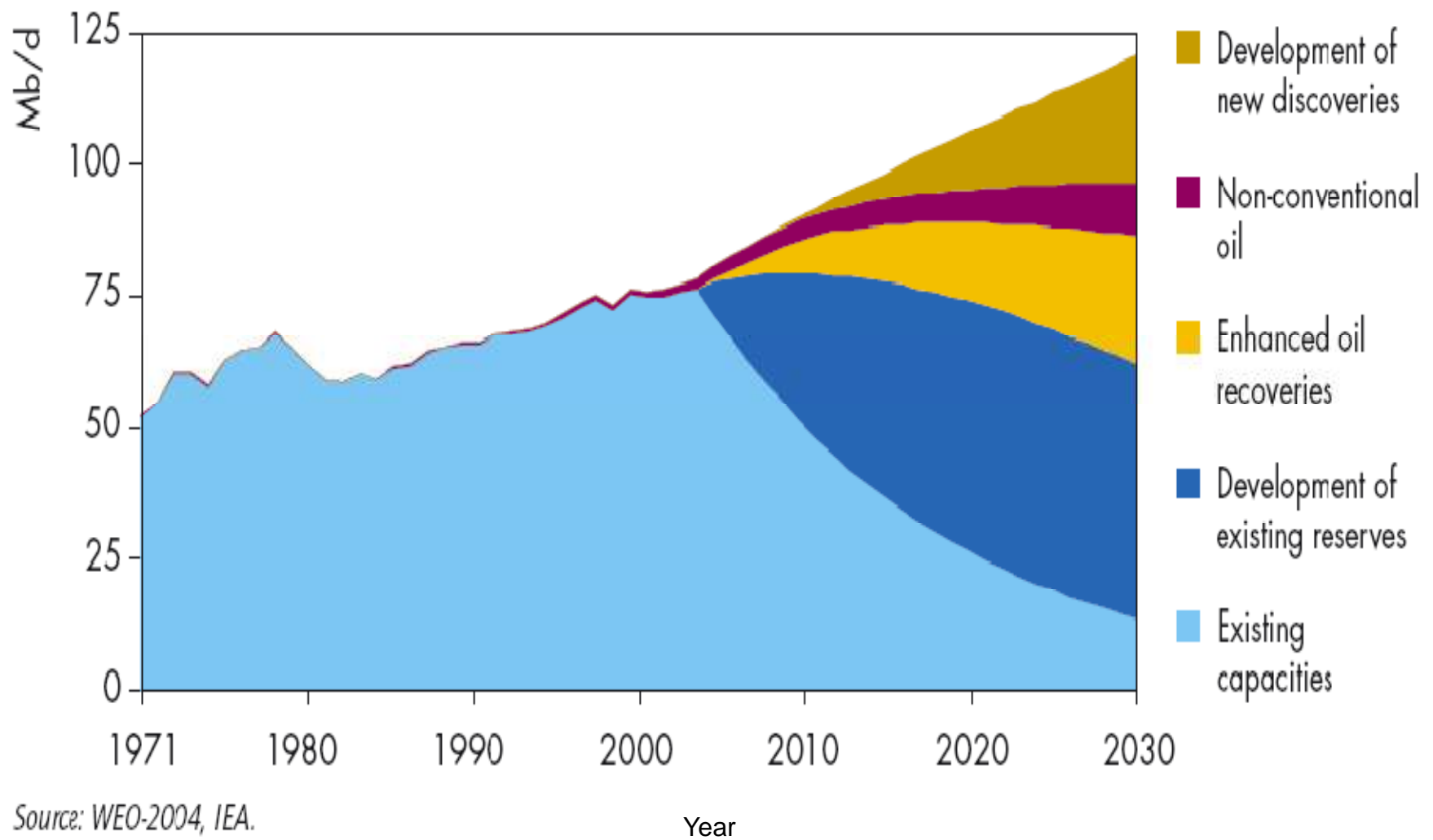
**Figure 1: Nominal commodity price indexes**

commodity price indices, 2000=100

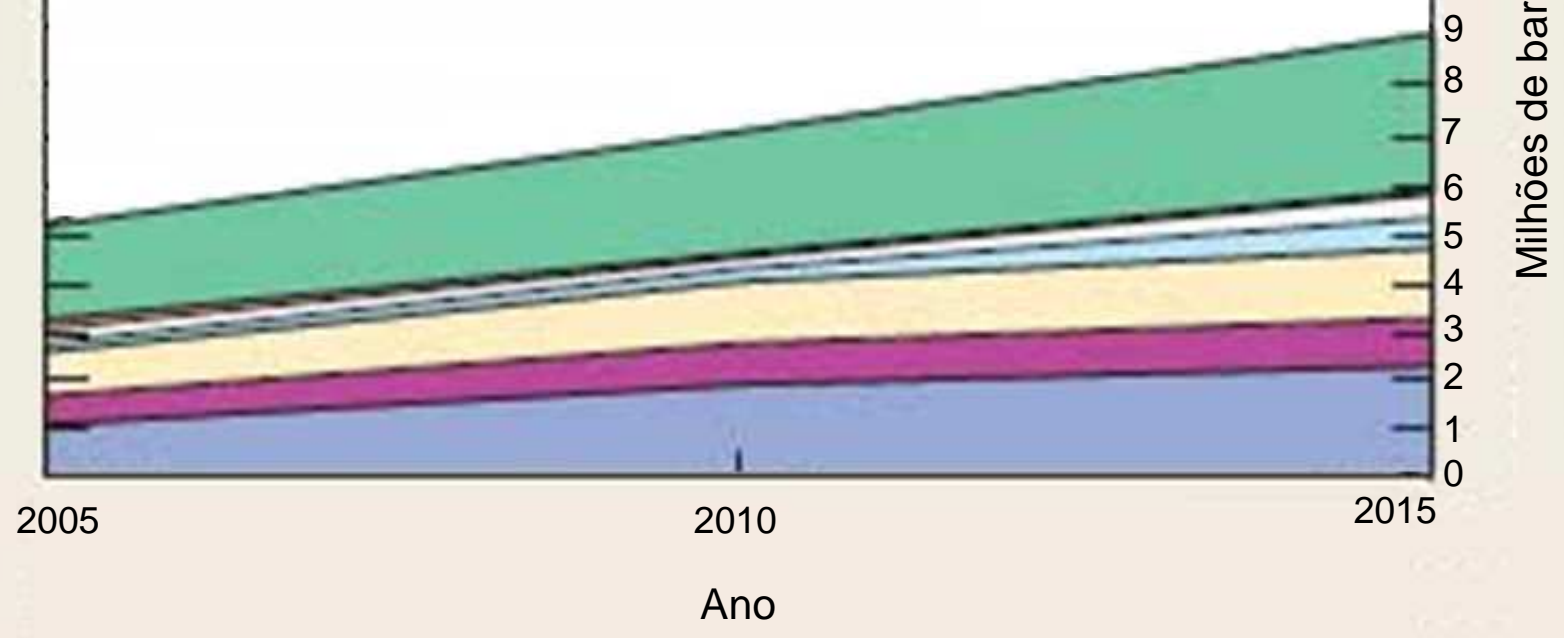


Source: DECPG Commodities Team.

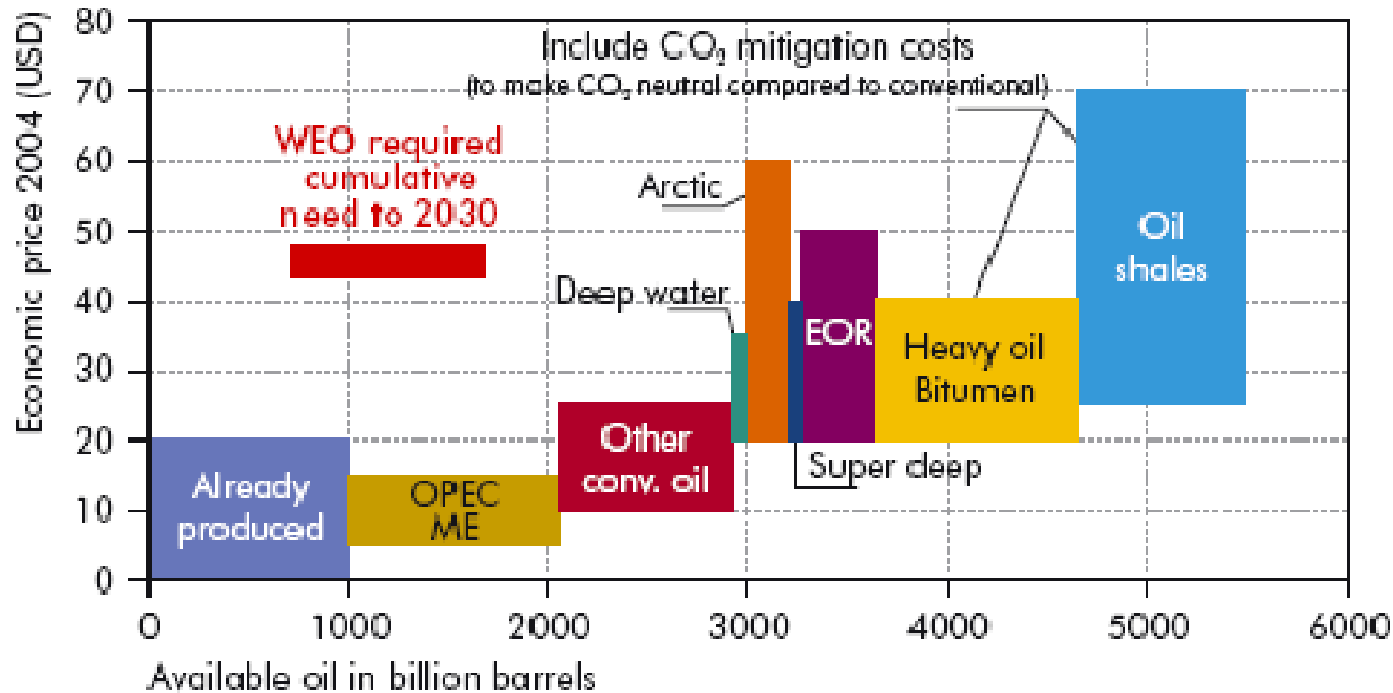
\* Uses DECPG aggregation based on export weights.



- Refinery gain
- Other
- Gas-to-liquids
- Coal-to-liquids
- Biofuels
- Ultra-heavy crude
- Oil sands



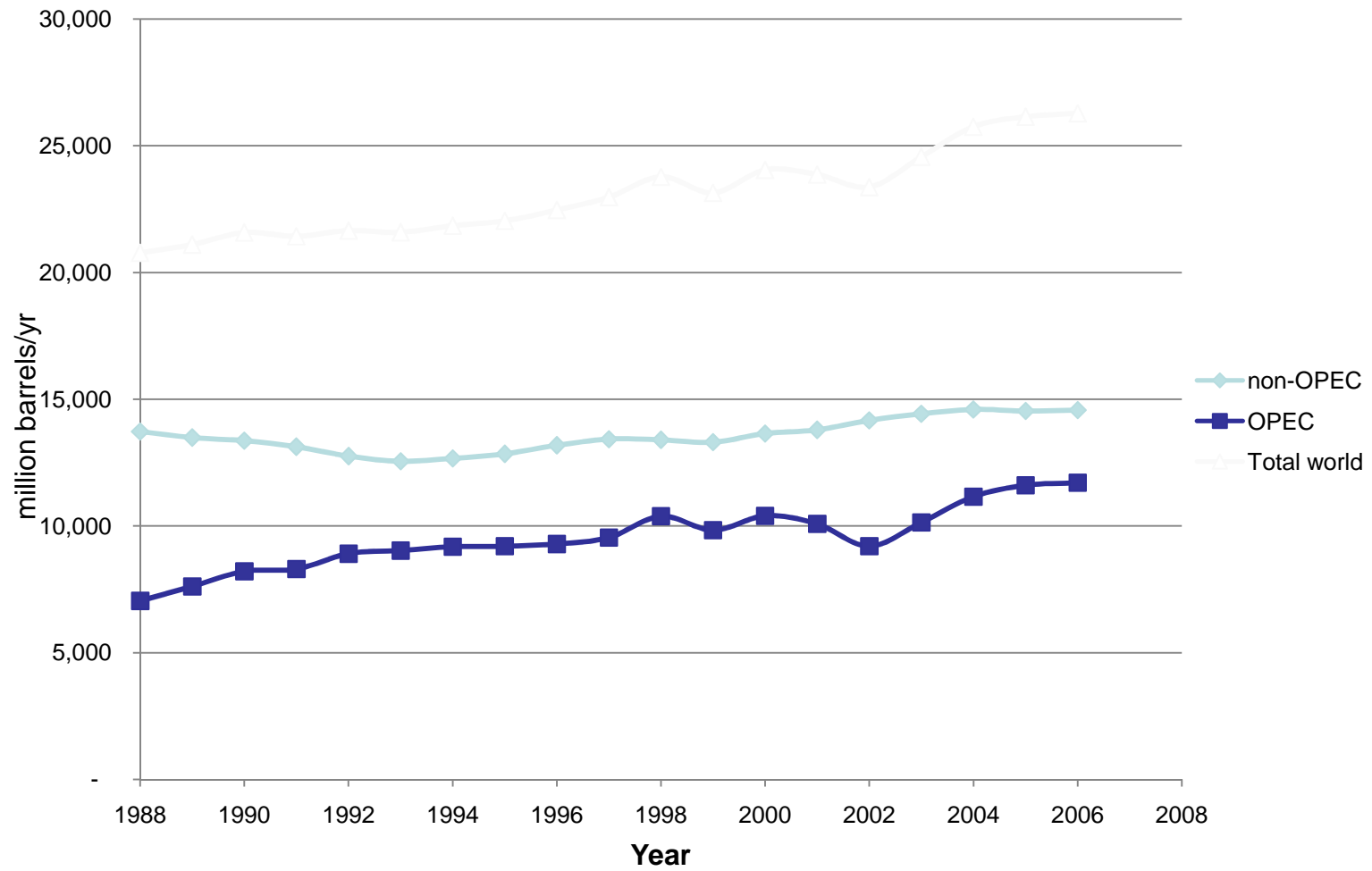
**Figure ES.1 • Oil cost curve, including technological progress: availability of oil resources as a function of economic price**



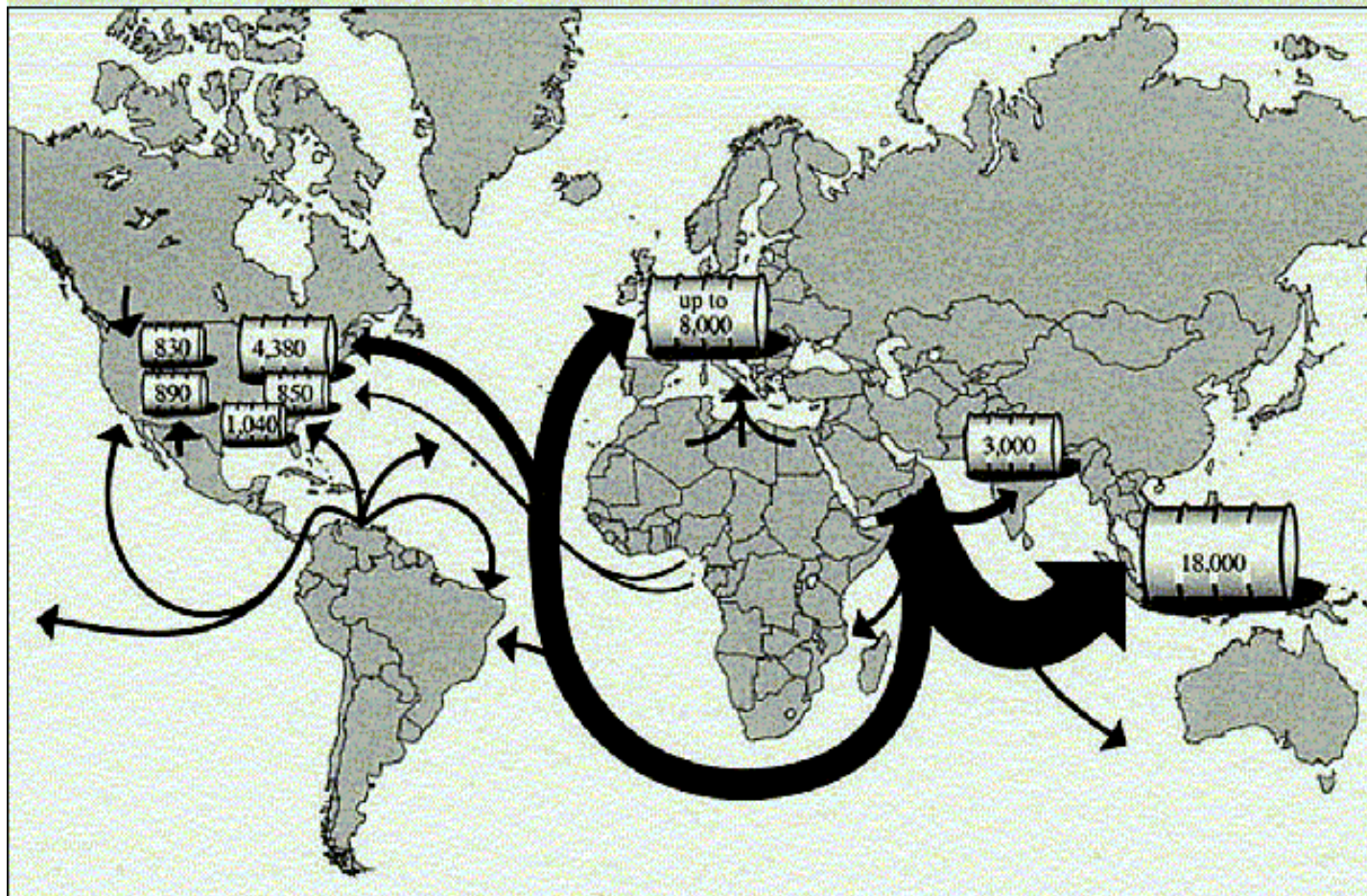
The x axis represents cumulative accessible oil. The y axis represents the price at which each type of resource becomes economical.

Source: IEA.

## World crude oil production by region, 1988–2006

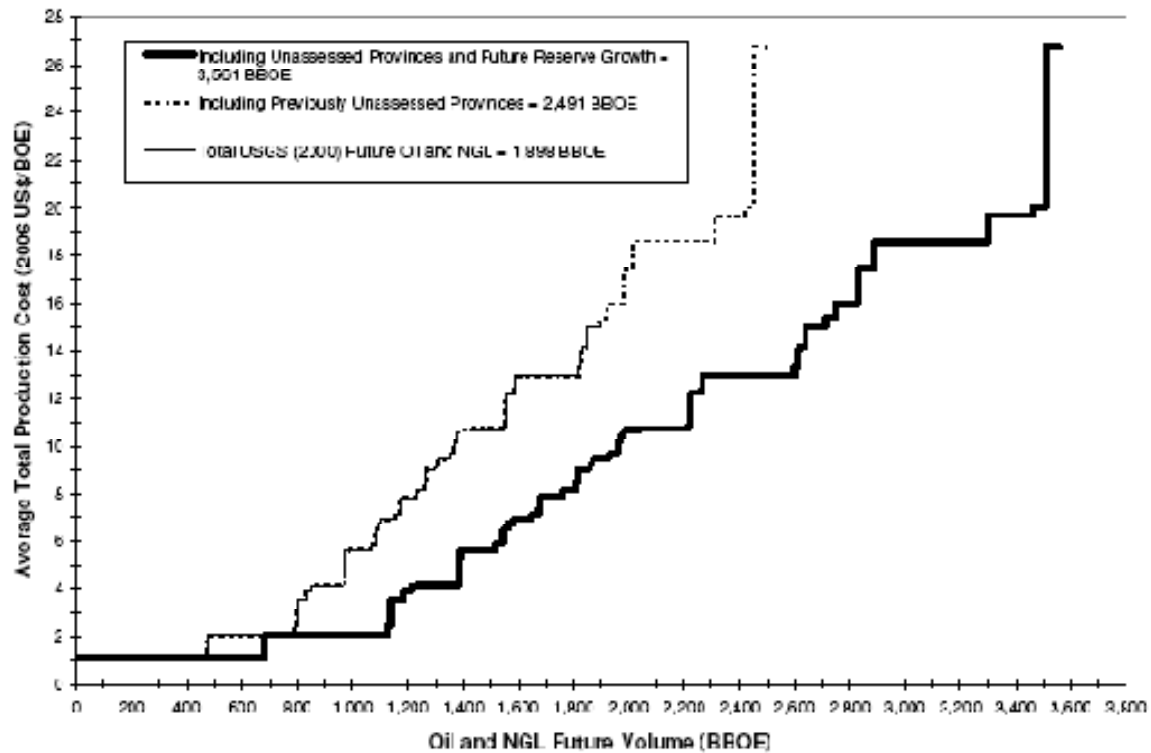


# Fluxos de petróleo



Source: Kemp and Hawkins, 1997.

**Figure 3. Global Cumulative Long Run Availability Curves for Conventional Oil and NGL**



# Technological Options

- **More efficient use of energy, especially at the point of end use in buildings, transportation, and production processes.**
- **Increased reliance on renewable energy sources.**
- **Accelerated development and deployment of new energy technologies – particularly next-generation fossil fuel technologies that produce near-zero harmful emissions, but also nuclear technologies if the issues surrounding their use can be resolved.**

# IPCC recommended measures to mitigate greenhouse effects

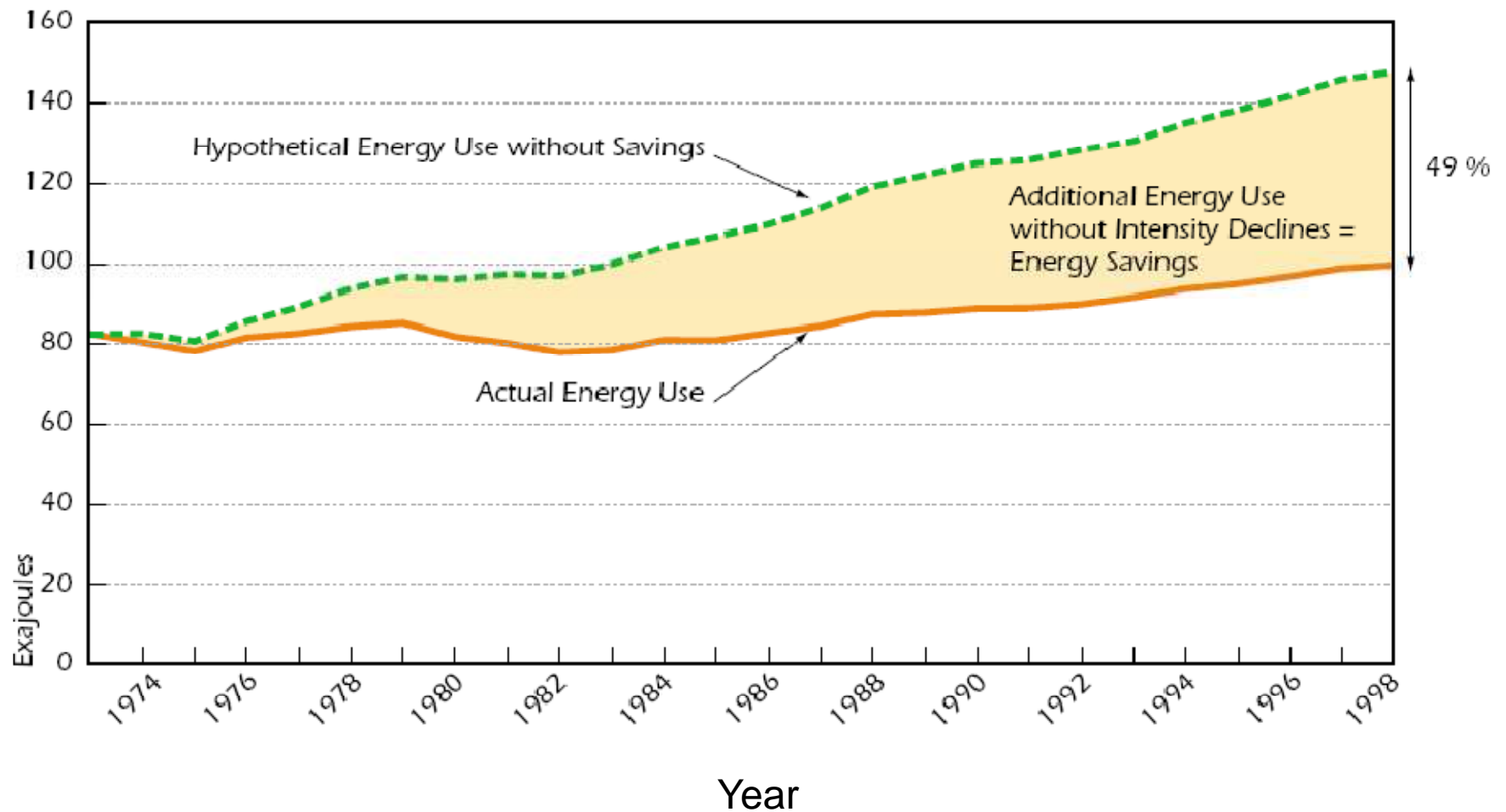
Energy production	<ul style="list-style-type: none"> <li>i. Energy efficiency</li> <li>ii. Renewable energies, nuclear (?)</li> <li>iii. New technologies (carbon capture)</li> </ul>
Transportation	<ul style="list-style-type: none"> <li>i. More efficient vehicles</li> <li>ii. Hybrid vehicles</li> <li>iii. Public transportation</li> </ul> <p style="text-align: right;"><b>BIOFUELS</b></p>
Building	More efficient air conditioning, lightning and domestic appliances
Industry	More efficient equipment
Agriculture	Best agricultural practices
Forestry/ Forests	<ul style="list-style-type: none"> <li>i. Reducing deforestation</li> <li>ii. Reforesting</li> </ul>
Waste Management	<ul style="list-style-type: none"> <li>i. Landfill methane recovery</li> <li>ii. Sewage treatment</li> </ul>

- Concerted efforts should be mounted to improve energy efficiency and reduce carbon intensity of the world economy, including the worldwide introduction of price signals for carbon emissions, with consideration of different economic and energy system in individual countries.
- Mechanisms must be introduced that encourage and assist developing countries in the introduction of efficient and environmentally friendly energy technologies as soon as possible. It is in the best economic and societal interest of these countries to “leapfrog” past the wasteful energy trajectory followed by today’s industrialized countries.

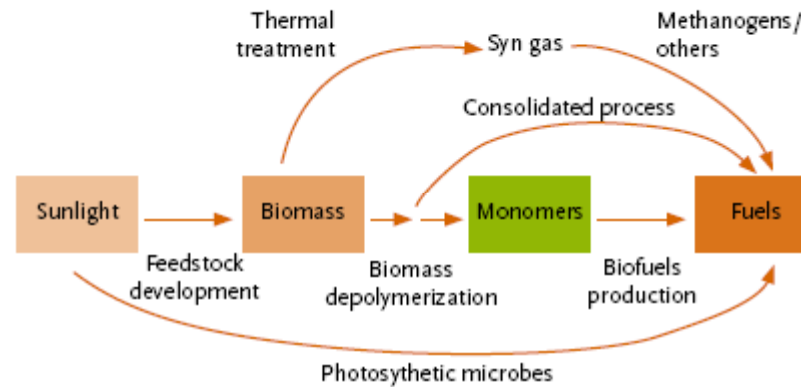
# **“LEAPFROGGING”**

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# Economia de energia na OECD (1973 – 1988)



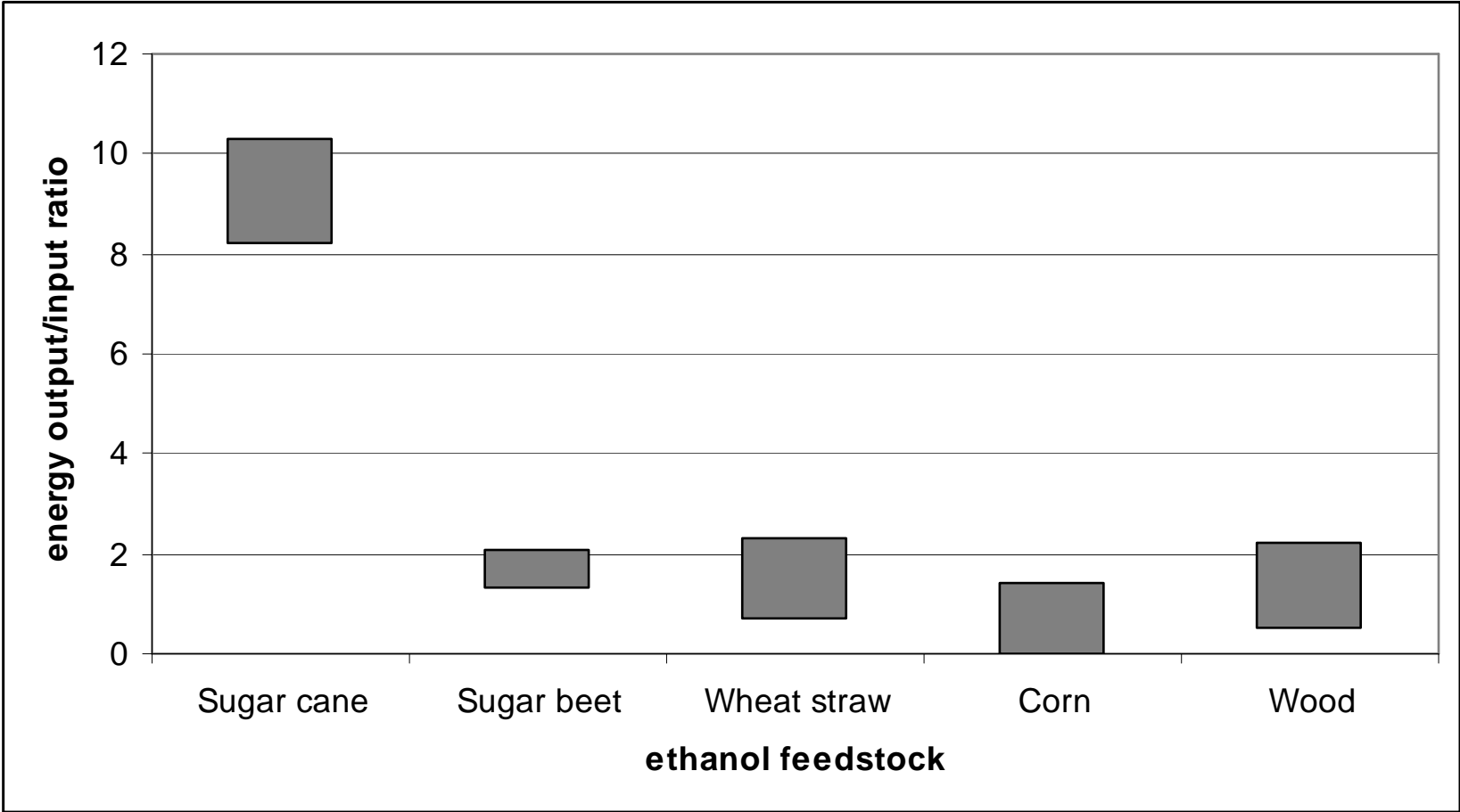
# Potential pathways for biofuels production



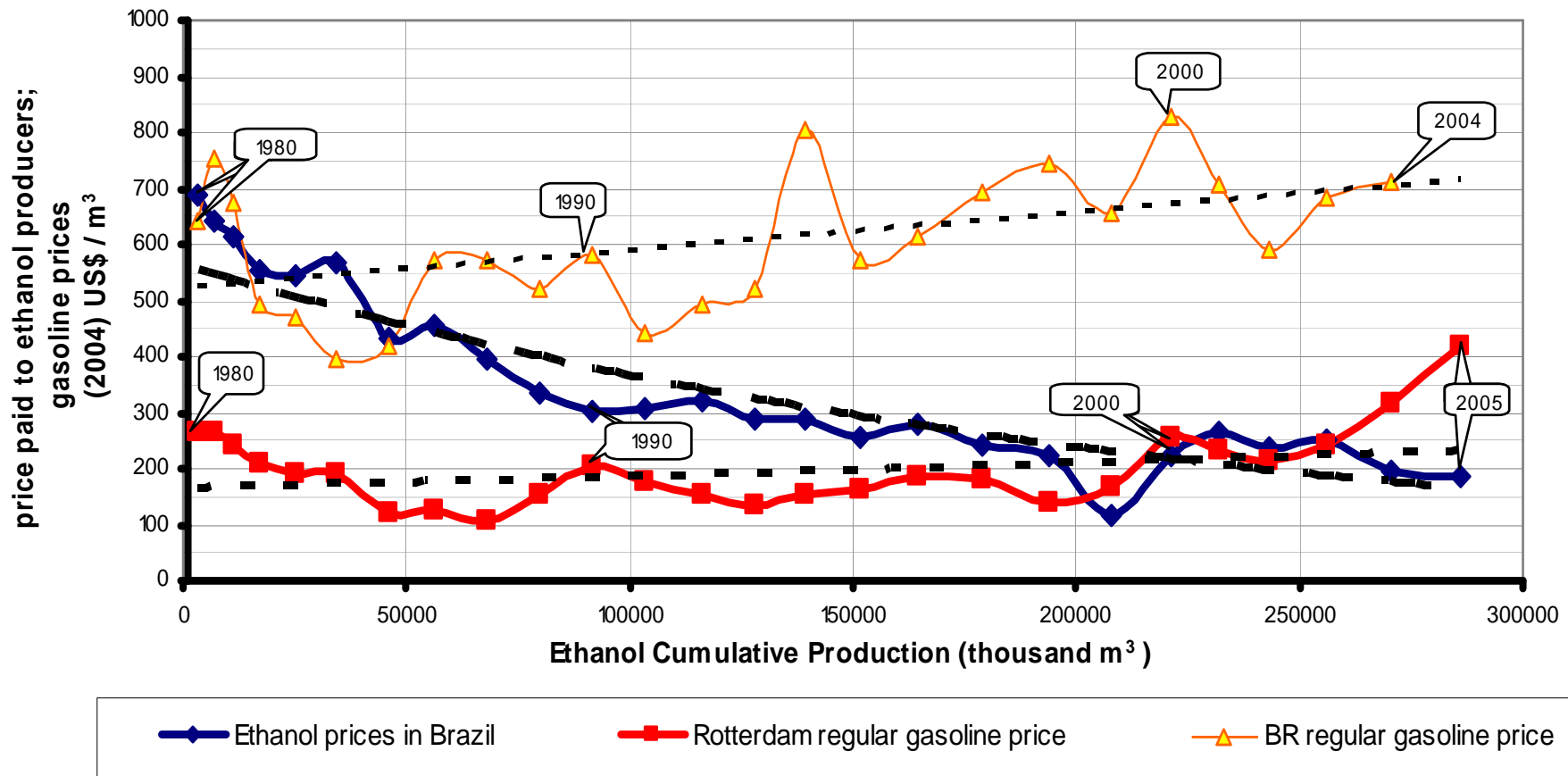
# Introduction - The Brazilian Alcohol Program

- The world's second largest commercial program on biomass
- Started in 1975 by Federal Government
- Decision from Brazilian Federal Government to produce ethanol in addition to sugar (from sugarcane): objective of reducing petroleum imports (Gulf War).
- High-octane fuel in vehicles, replacing lead and/or MTBE.
- 1,300,000 cars running on pure (hydrated) ethanol in Brazil
- 2,300,000 flex-fuel vehicles (both ethanol and gasoline, any blend)
- all gasoline blended with (anhydrous) ethanol: 20 to 26% of ethanol in volume basis – gasohol
- Presently - economically competitive to gasoline





# The Economic Competitiveness of Alcohol Fuel Compared to Gasoline



# Cost in €/100 liters

	<b>USA (corn)</b>	<b>Germany (wheat)</b>	<b>Germany (sugarbeets)</b>	<b>Brazil (sugarcane)</b>	<b>Rotterdam (gasoline)</b>
Total production cost*	39.47	54.97	59.57	14.48	20
Sale of by products	-6.71	-6.80	-7.20	-	
Government subsidies	-7.93	-	-	-	-
	24-83	48.17	52.37	14.48	20

\*Feedstock represent in all cases 50 to 70% of total production cost

# Main sugarcane producer countries (2006)

	Country	Area Harvested (hectares)	Sugar production (1,000 tons)
1	Brazil*	6,152,929	31,450
2	India	4,200,000	30,140
3	China	1,220,000	12,855
4	Thailand	936,227	6,720
5	Pakistan	907,300	3,615
6	Mexico	668,293	5,633
7	Colombia	425,734	2,445
8	South Africa	420,000	2,300
9	Australia	415,000	4,822
10	Cuba	397,100.00	1,150
11	Philippines	392,280.00	2,232
12	Indonesia	370,000.00	1,900
13	United States of America	363,450.00	3,438
14	Vietnam	285,100.00	
15	Argentina	284,639.00	2,440
	Total	17,438,052.00	

\* only 47% of the sugarcane area is used to produce ethanol

# Myths about ethanol

- on a life cycle basis biofuels do not reduce greenhouse gas emissions
- competition for land for fuel “versus” food is causing famine in the world
- biofuels are leading to deforestation of the Amazonia and other tropical forests
- biofuels are only viable in “niches”; the Brazilian experience is unique
- only subsidized production of biofuels is possible
- Biofuels are incompatible with existing fleets
- 2nd generation technologies will take a long time to reach large scale