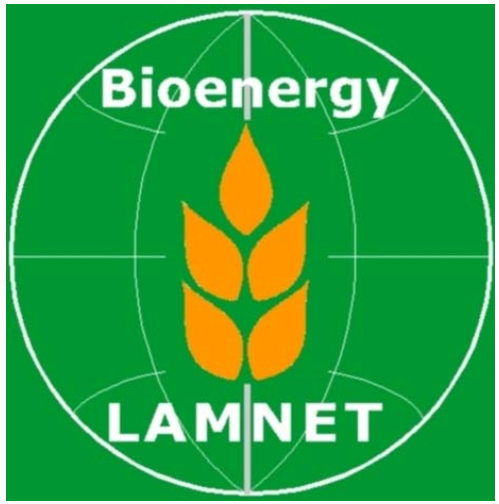
LAMNET

Latin America Thematic Network on Bioenergy

14 September 2004 - Ribeirão Preto



Energy for rural sustainable development

José Goldemberg, State Secretary for the Environment

São Paulo, Brazil

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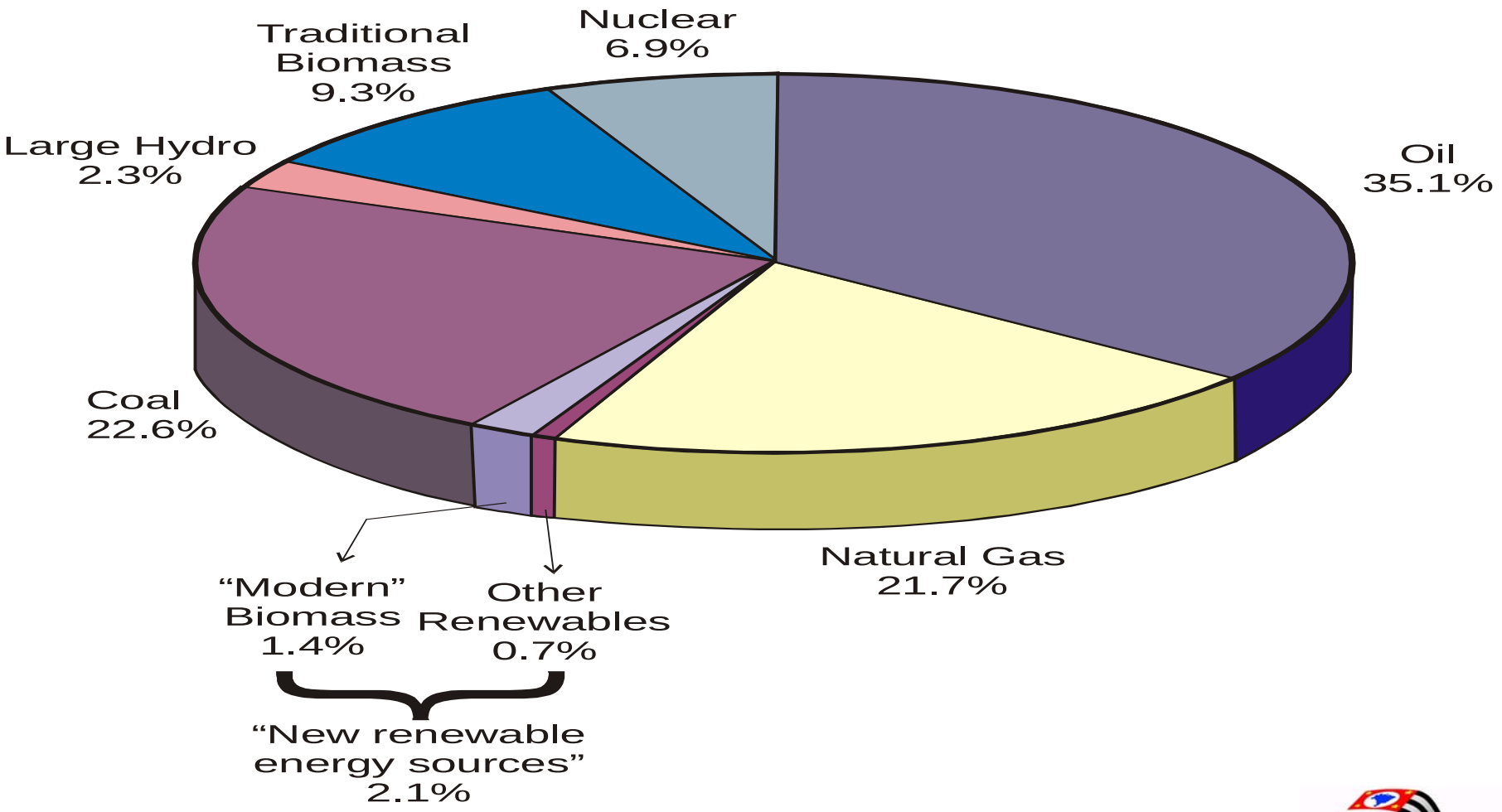
World Consumption of Primary Energy and Renewables, by Energy Type, 2001
Shares of total 418 EJ (9.99 Gtoe)



Population: 6.157 billions

Total energy use: 9.99 Gtoe
Per capita energy use: 1.65 toe per capita
Growth rate energy 1971 - 2000: 2.10 % per year
Growth rate energy 1996 - 2001: 0.3 % per year

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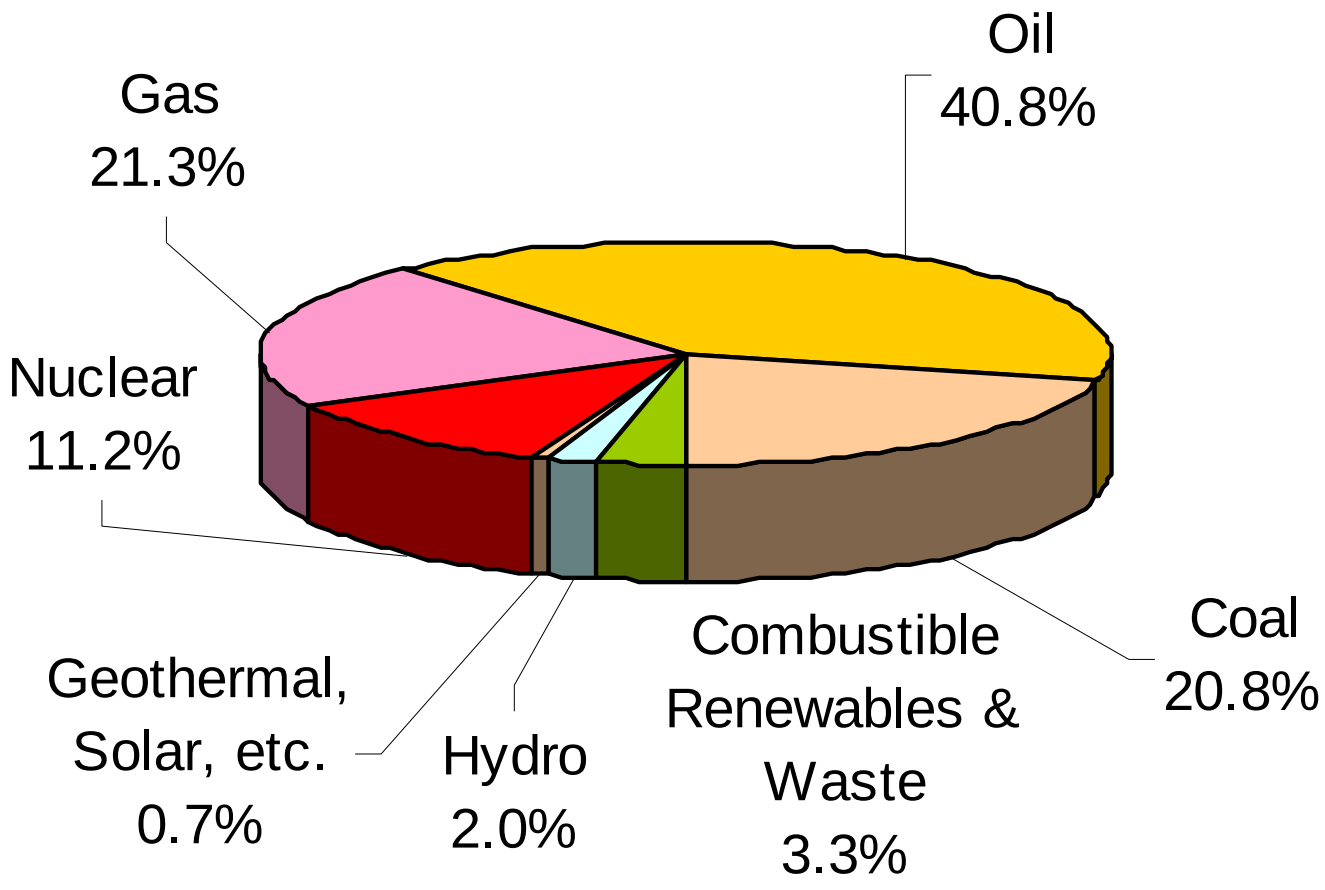
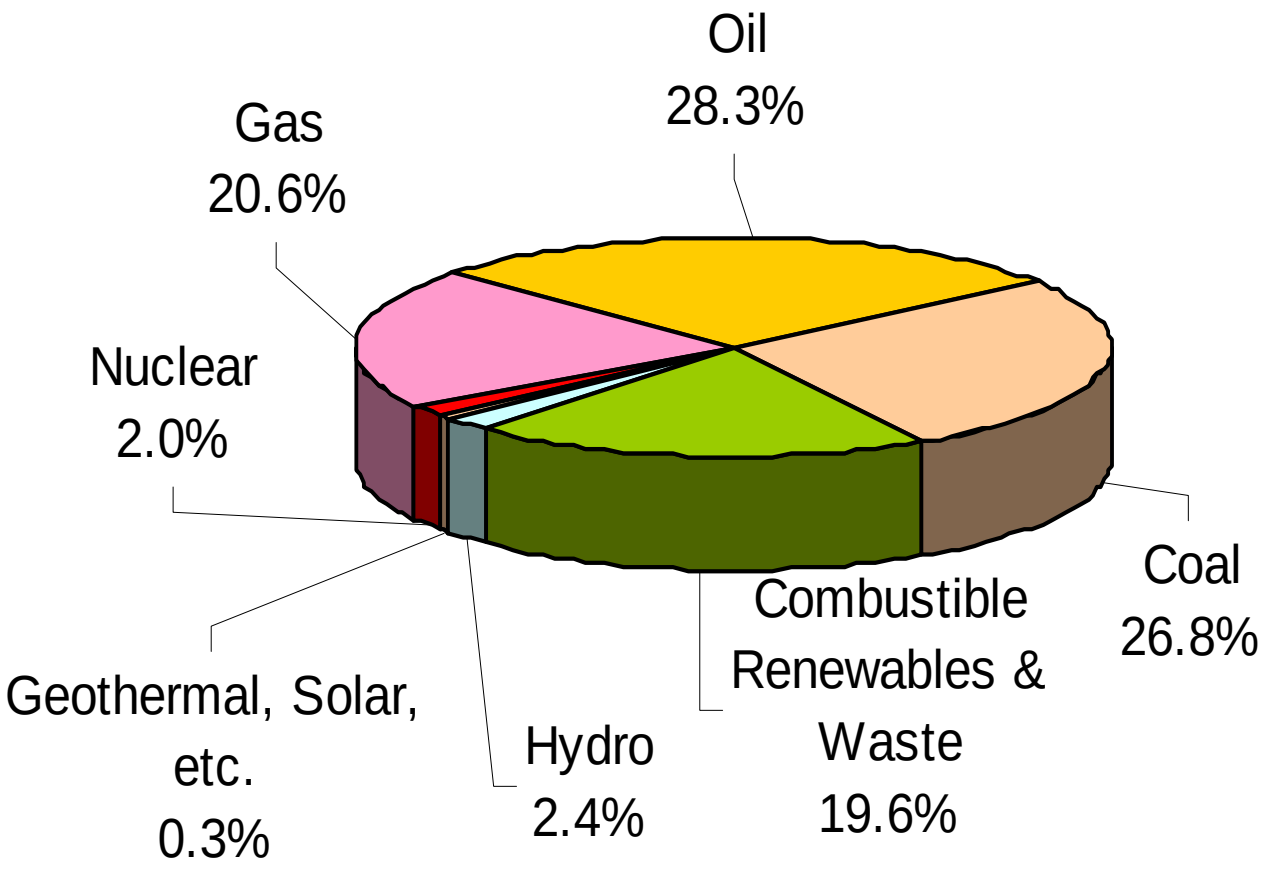
OECD
shares of 5.33 Gtoe



non-OECD
shares of 4.68 Gtoe

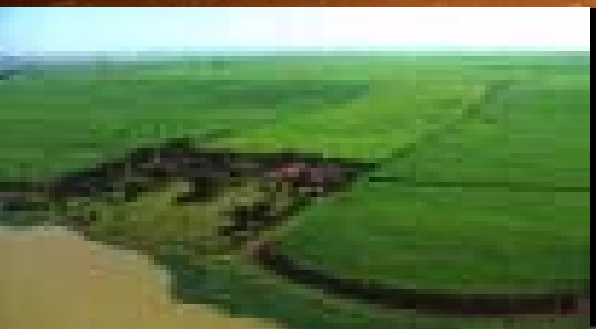


World Energy

- $40-60 billion/yr with energy infrastructure
- $1.5 trillion/yr with direct energy purchasing
- even more in consumption infrastructure
- **small positive shifts in such values have strong influence on sustainable development**
- there are 3 possible approaches: new technologies; energy efficiency; or renewable sources

Traditional biomass

Modern biomass



Ethanol propelled bus

February, 2002

Advantages of new renewables

- enhance diversity in energy supply markets
- secure long-term sustainable energy supplies
- reduce atmospheric emissions (indoor, local, regional and global) and deforestation
- improve life conditions eg. pumping water
- create new employment opportunities in rural communities offering possibilities for local manufacturing and
- enhance security of supply since they do not require imports that characterize the supply of fossil fuels.

Sector	Jobs (person-years)/ Terawatt-hour
Petroleum[1]	260
Offshore oil[1]	265
Natural gas[1]	250
Coal[1]	370
Nuclear[1]	75
Wood energy[1]	1000
Hydro[2]	250
Minihydro[3]	120
Wind[3]	918
Photovoltaics[3]	7,600
Ethanol (from sugarcane)[2]	4,000

Sources: ***(1)*** *G. Grassi "Potential Employement Impacts of Bioenergy Activity on Employement" Proceedings of the 9th European Bioenergy conference Vol. I, pp. 419-423 Eds. – P. Chartier et al. Elsevier, Oxford (1996).* ***(2)*** *L. C. Carvalho and A. Szwark "Understanding the Impact of Externalities, Case Studies" Brazil International Development Seminar on Fuel Ethanol December 14, 2001 Washington D.C.* ***(3)*** *Perez, E. M. "Energias Renovables, Sustentabilidad y Creacion de Enpleo: Una Economia Impulssionada por el Sol", ISBN:84-8319 – 115 –6 pp. 270, 2001.* ***(4)*** *Quoted in M. Renner, "Working for the Environment: a Growing Source of Jobs", Worldwatch Paper 152 (Sept. 2000) Worldwatch Institute.*

Ethanol - advantages

1- Renewable

2- Less pollutant

3- Performance

4- Oil import substitution

5- Job generation

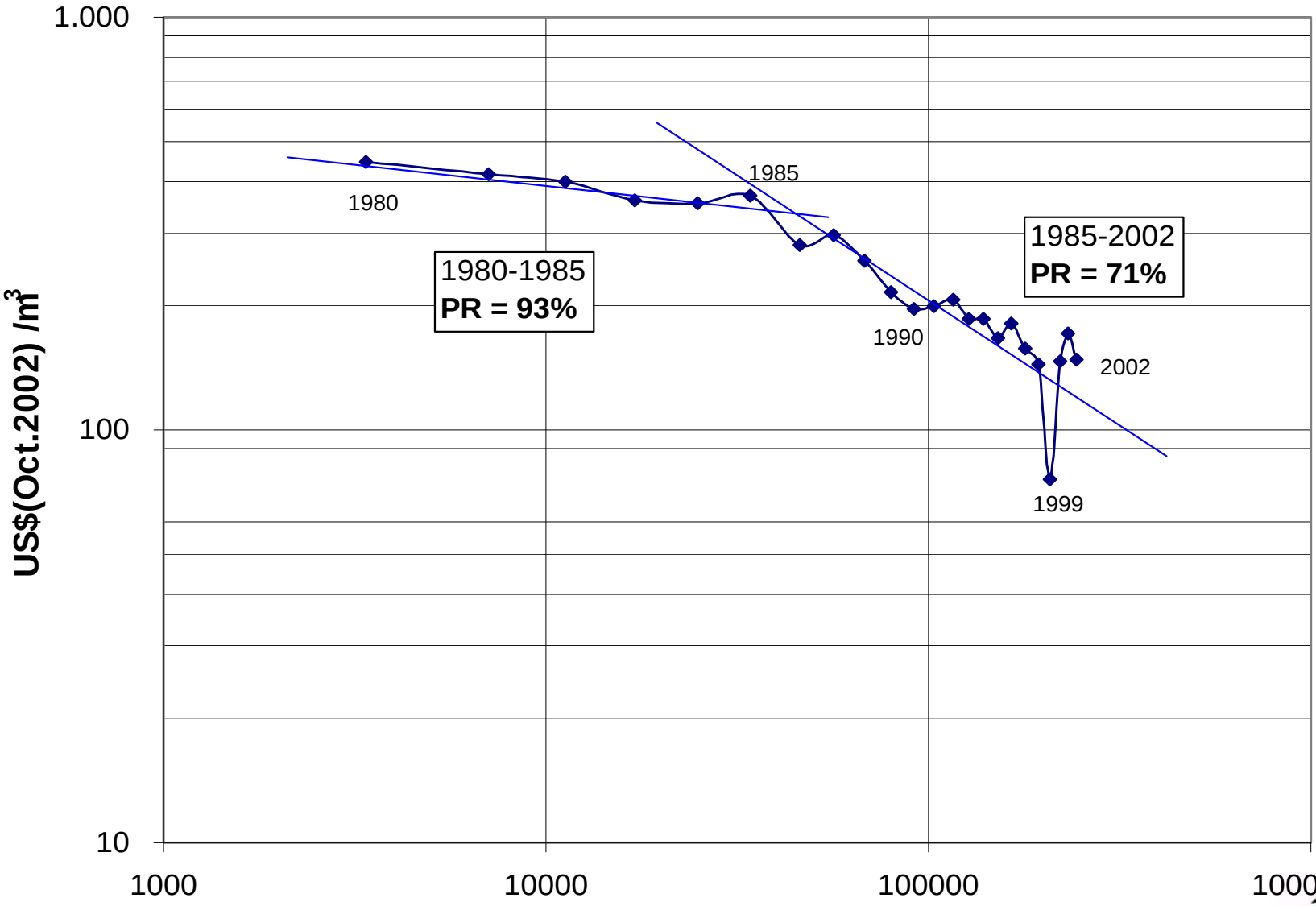
6- Free market choice with FFVs

The Brazilian PROALCOOL

- ethanol from sugarcane established during 70´s oil crises
- sound positive environmental, economic and social aspects
- the most important biomass energy program in the world
- sugarcane productivity improved 6x from 1970 to 2002
- 16 Mm^3 ethanol by 2003

PROALCOOL

- mid 1970´s - late 1980´s:
  - subsidised by government to replace oil
  - Petrobrás guaranteed purchase
  - incentives to agriculture (1980-85)
  - alcohol price set at 59% of gasoline
- 1990´s - today
  - competitive without subsidies
  - price 70% of gasoline (break-even 80%)
  - free market and new impulse with flex-fuel vehicles



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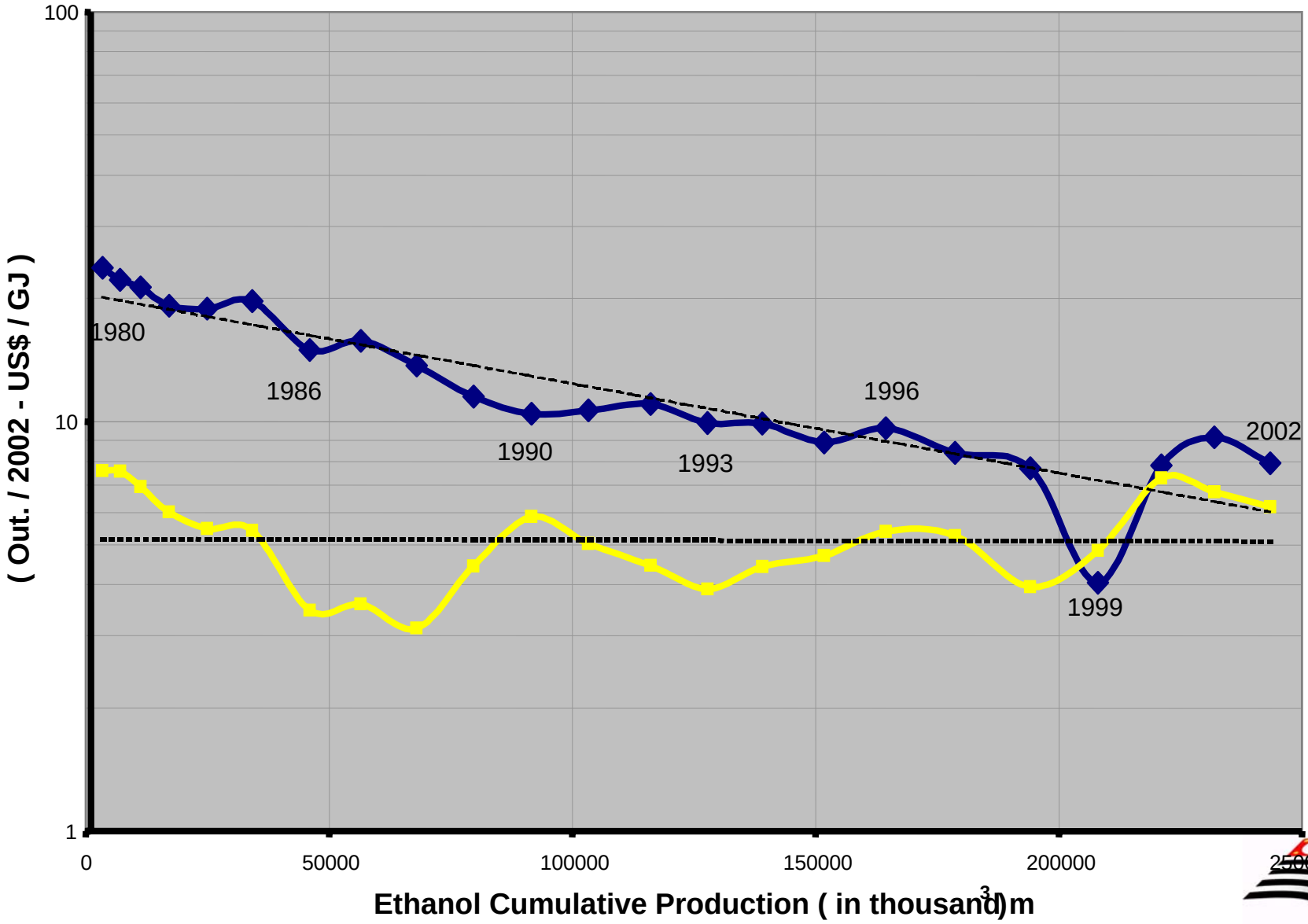
Ethanol international competitiveness



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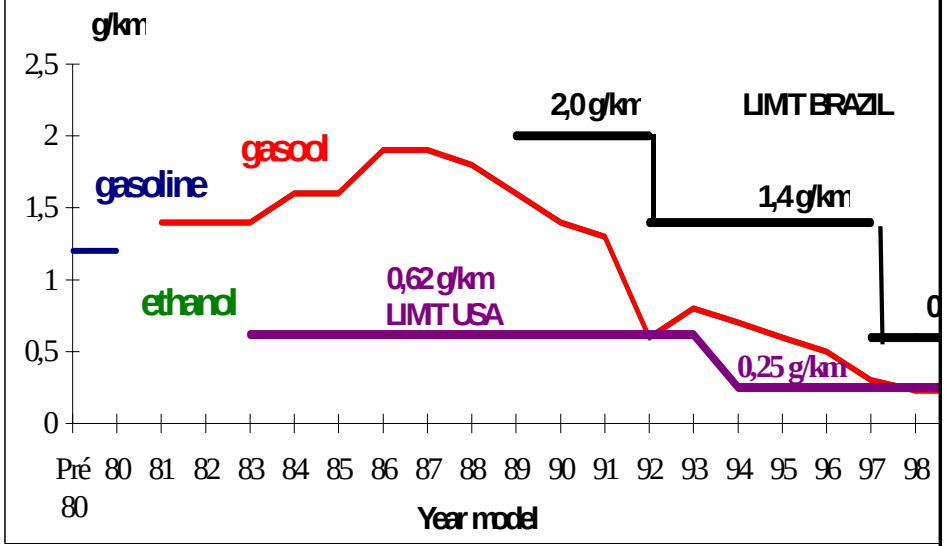
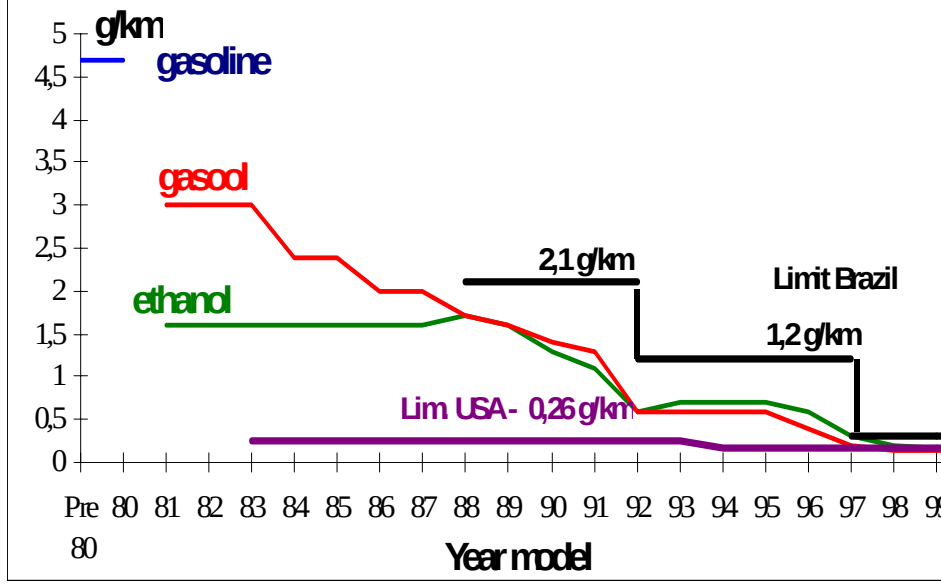
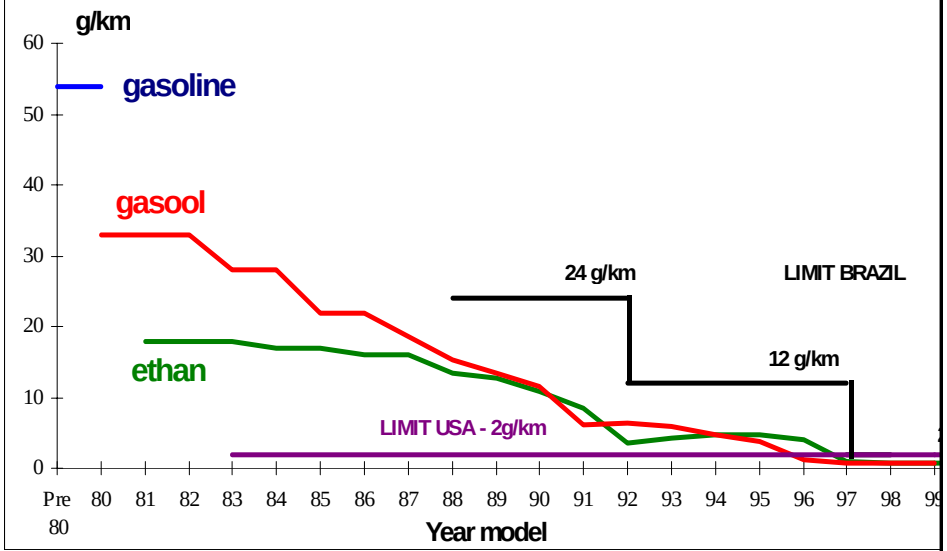
NOx



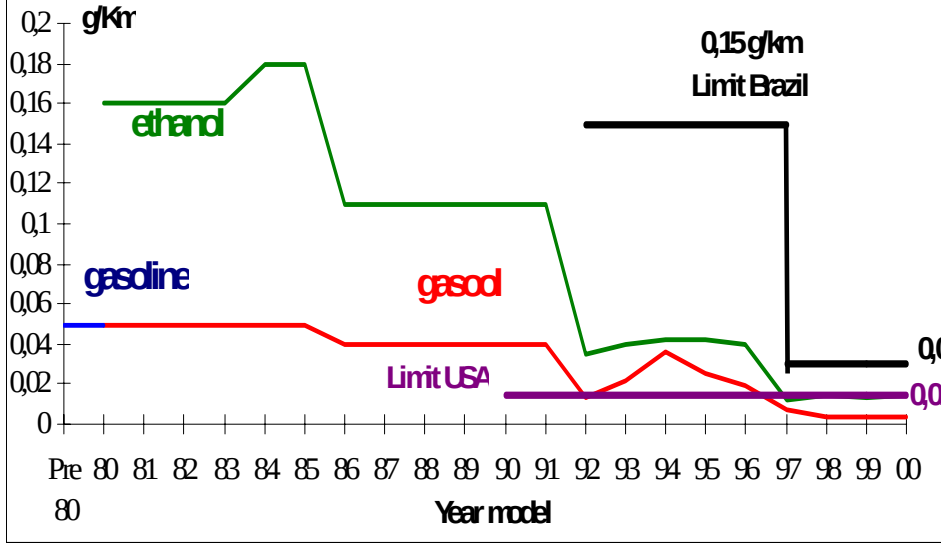
Hydrocarbons



CO



ALDEHYDES



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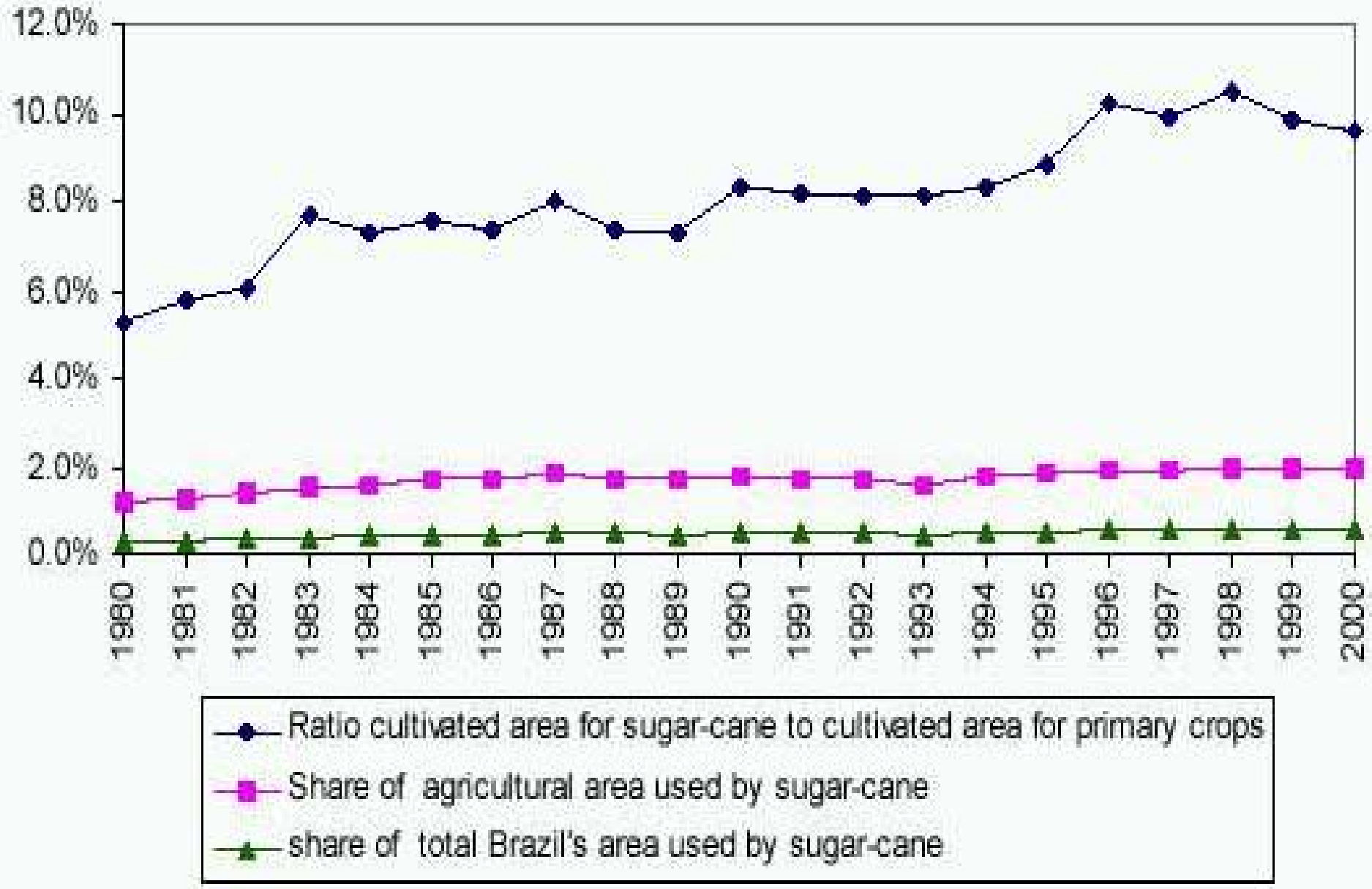
Carbon emissions

Combustível	Fator de emissão de carbono (t C/TJ)
Gasolina	18,9
Diesel	20,2
Óleo Combustível	21,1
GLP	17,2
Carvão betuminoso	25,8
Gás natural seco	15,3
Etanol de cana (biomassa líquida)	0,57* (= 20,0 / 8,3)

Fonte: IPCC, *apud* IEA (2003) e (*) Macedo (2004).

Area covered by sugarcane in Brazil



Sugarcane in the World

2001	Agri-cultural Area (million ha)	Sugarcane area harvested (million ha)	Area ratio Sugarcane/ Agricultural	Sugarcane production (million t)	Sugarcane production (t/ha)
World	5022	19,7	0,4%	1271	65
Brazil	263	5,0	1,9%	346	70
64 Low-Income Countries	1421	7,2	0,5%	437	61

Source: www.fao.org

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Biodiesel in Brazil

- a great promise for rural job creation, pollution abatement, carbon emissions mitigation, external debt relief
- ethanol route is natural choice in Brazil
- main oil alternatives: castor and soybean
- a major governmental program has started with B2
- challenges: (a) quality assurance for blending in diesel; (b) vehicle performance tests; (c) residues, by-products; (d) standards: biodegradability, hygroscopicity (storage), use in emergency stationary engines, corrosity in non-ferrous metals, except aluminium

More in

• José Goldemberg, Suani Teixeira Coelho, Plínio Mário Nastari, Oswaldo Lucon (2003) "**Ethanol learning curve- the Brazilian experience**", Biomass and Bioenergy, Vol 26/3 pp 301-304

• José Goldemberg, Suani Teixeira Coelho, Oswaldo Lucon (2003) "**How adequate policies can push renewables**", Energy Policy 32/9 pp. 1141-1146

• S. T. Coelho and J. Goldemberg, "**Alternative Transportation Fuels**", The Enciclopedia of Energy, under publication.

• José Goldemberg, "**The Case for Renewable Energy"**, for Bonn 2004 Global Conference on Renewable Energy http://www.renewables2004.de/en/cd/default.asp#tbp_list

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