



Centro Clima

CENTRO DE ESTUDOS INTEGRADOS SOBRE
MEIO AMBIENTE E MUDANÇAS CLIMÁTICAS

Aligning Climate Change and Sustainable Development Objectives in Brazil

Workshop “Developing Visions for
a Low-Carbon Society through
Sustainable Development”

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MAJOR FEATURES OF THE BRAZILIAN ECONOMY - 2002



- GDP of US\$ 500 billion
- Population of 174 million inhabitants
- GDP/cap of US\$ 2,800/y
- Surface: 8.5 million km²

GHG Emissions in Brazil

1st National Communication: Inventory of Brazilian GHG Emissions in 1990-1994

- CO₂ emissions from LULUCF = three times higher than emissions from the energy system
- GHG emissions from cattle raising activities: nearly equal to CO₂ emissions from fossil fuels

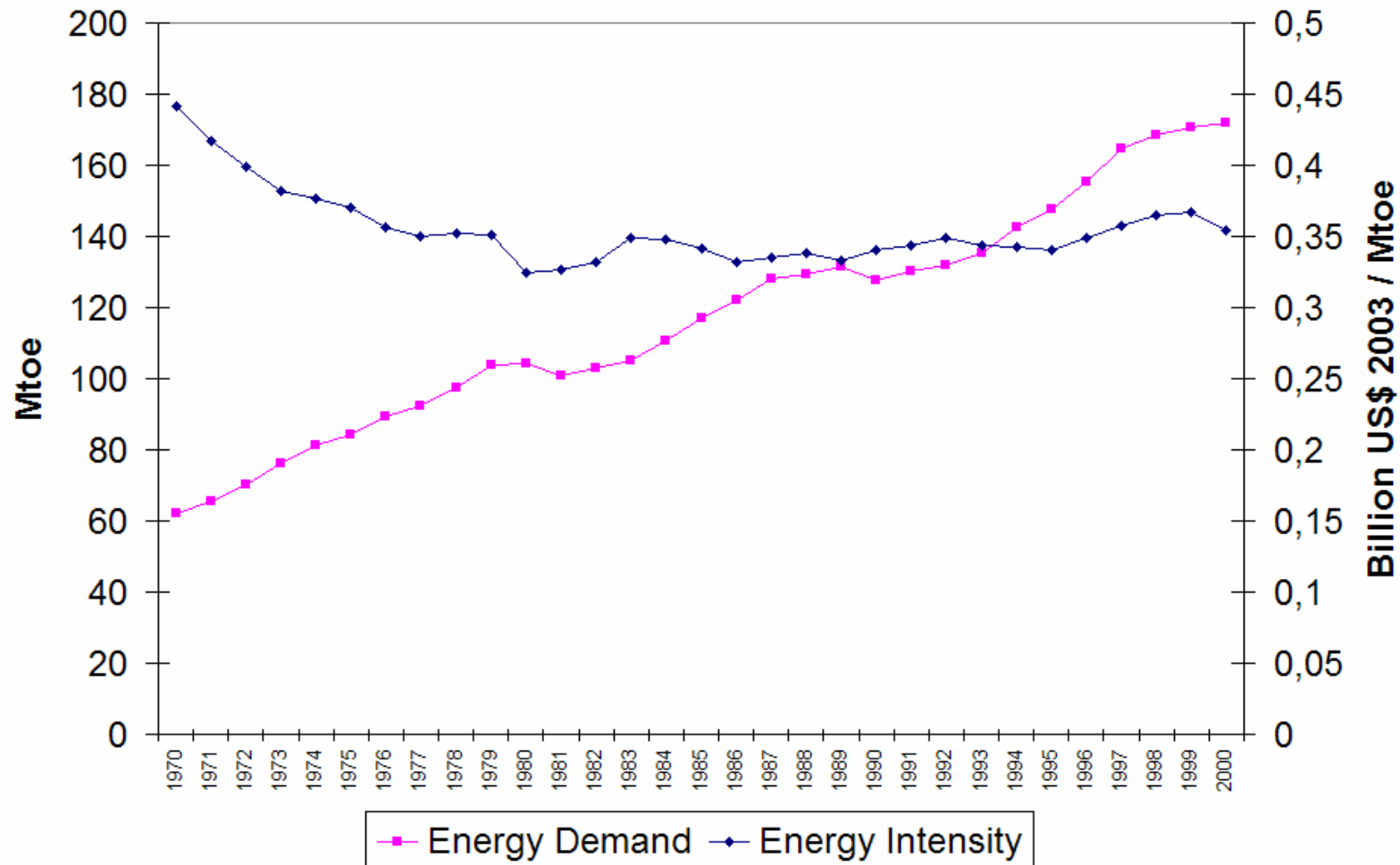
Medium and long-term prospects:

- CO₂ emissions from energy will be dominant

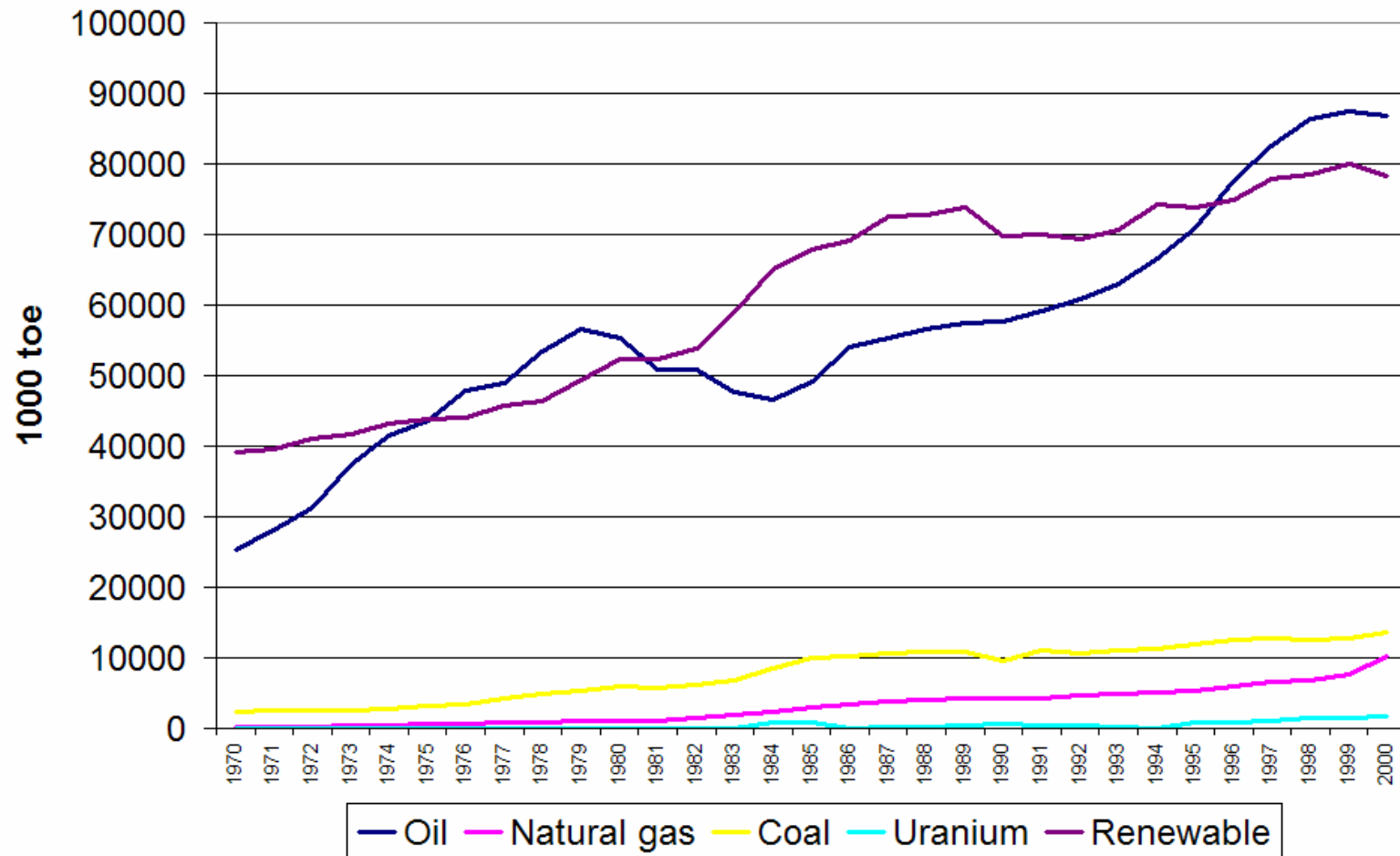
Challenges in Land-use Change Emissions

- Deforestation drivers go far beyond economic factors;
- Key drivers from social policies
 - Lack of access to land x agrarian reform
 - Governance:
land-use planning x enforcement of laws & regulations;
- How far will Amazon deforestation go?
- Huge potential for reforestation of degraded land (30 million hectares).

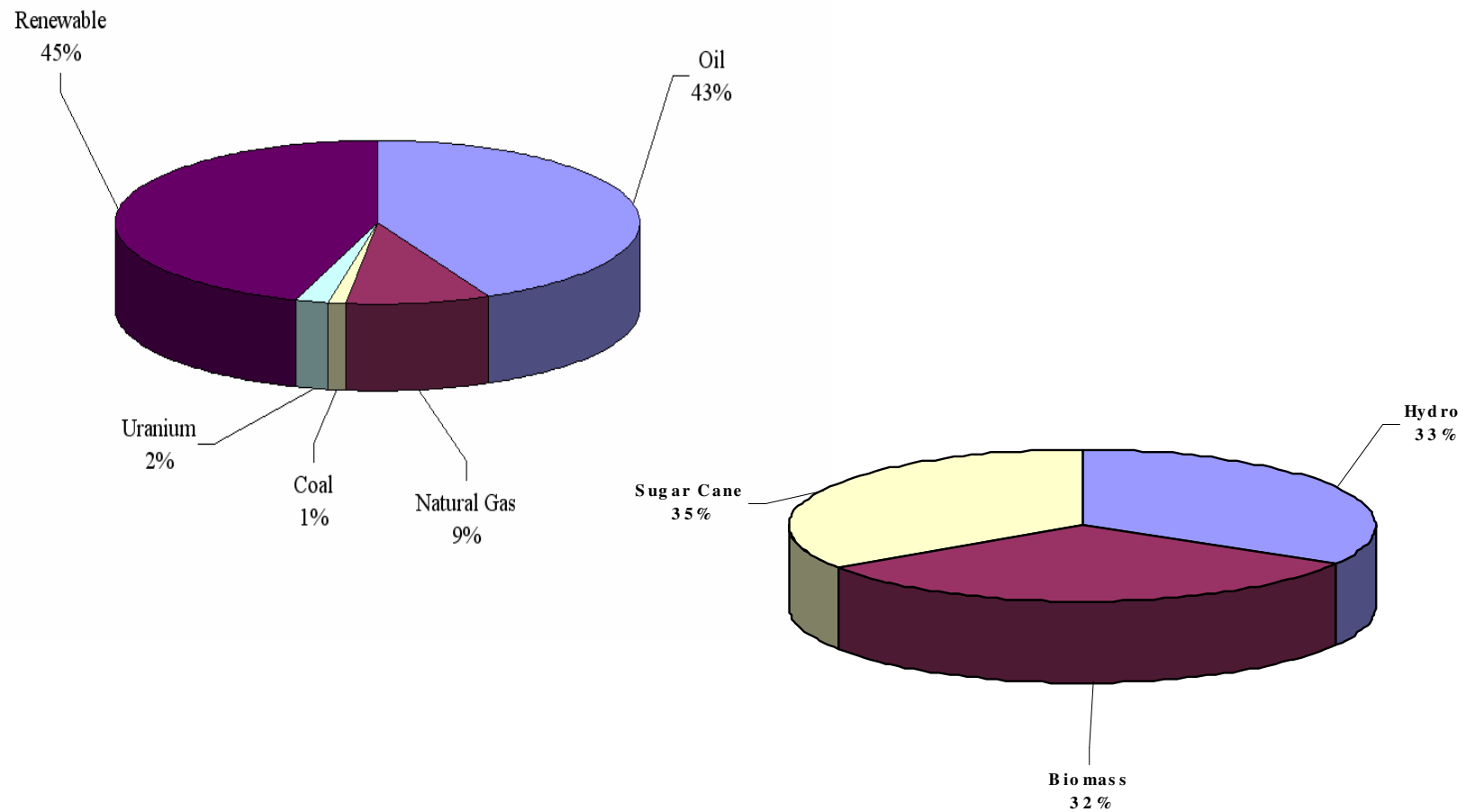
Energy demand and Intensity



Domestic Energy Supply



Primary Energy Consumption 2002

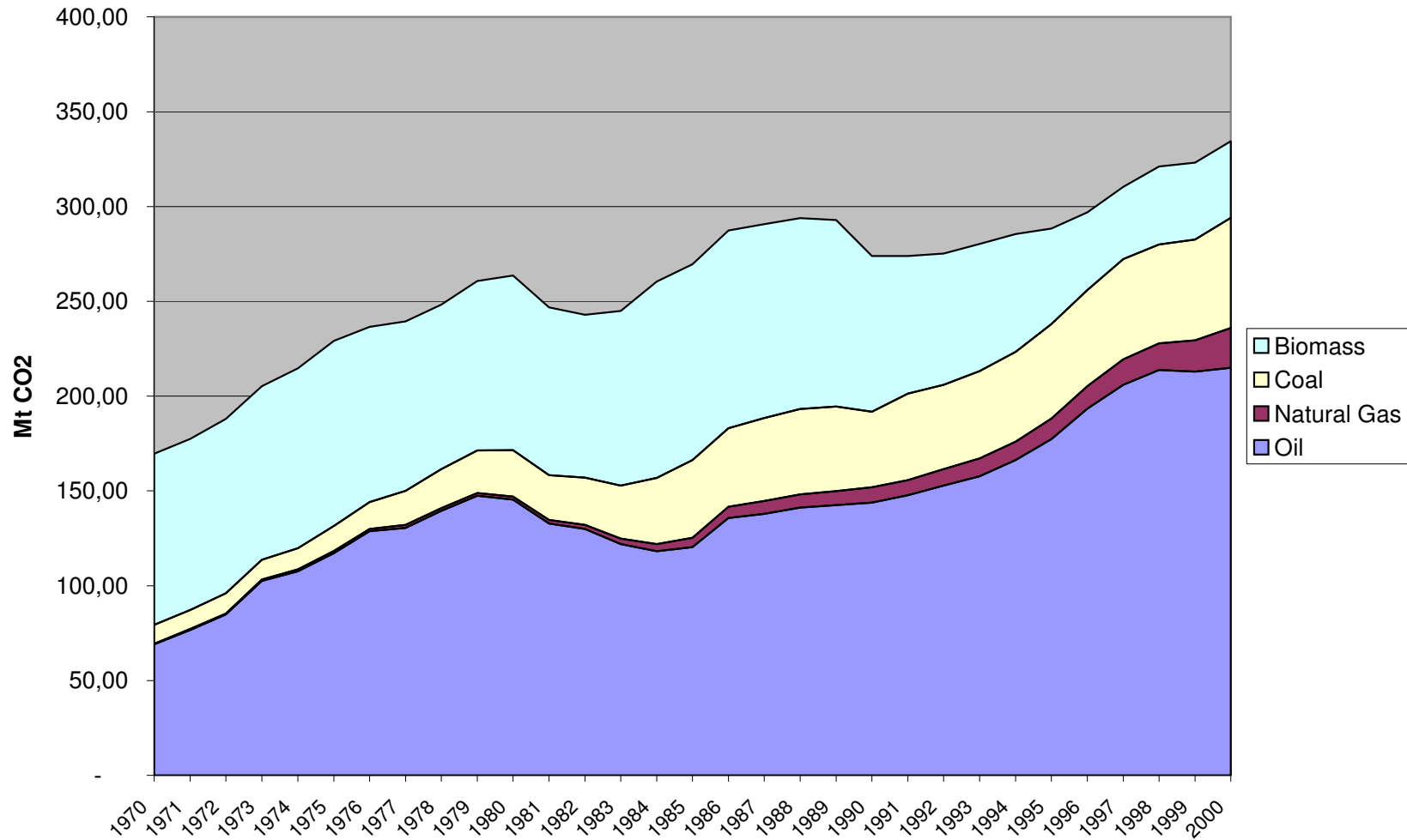


Domestic Energy Supply (DES) 2002

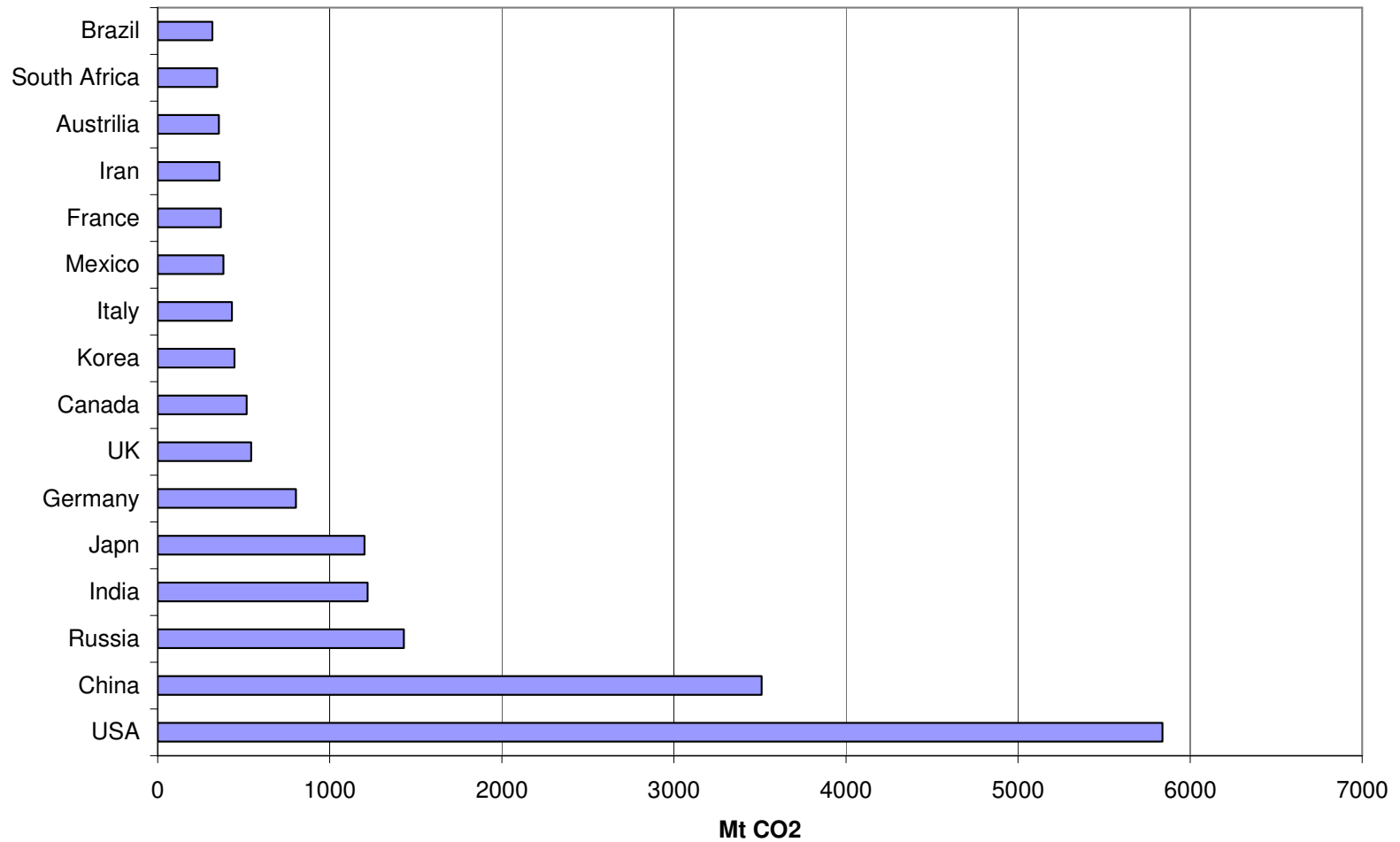
	Brazil	OECD	World
tCO ₂ / toe of DES	1.7	2.34	2.36
Renewable energy / DES	41%	6%	14%
Losses* / DES	10%	27%	26%
Import Dependence	14%	45%	-

* Distribution, Transmission and Conversion

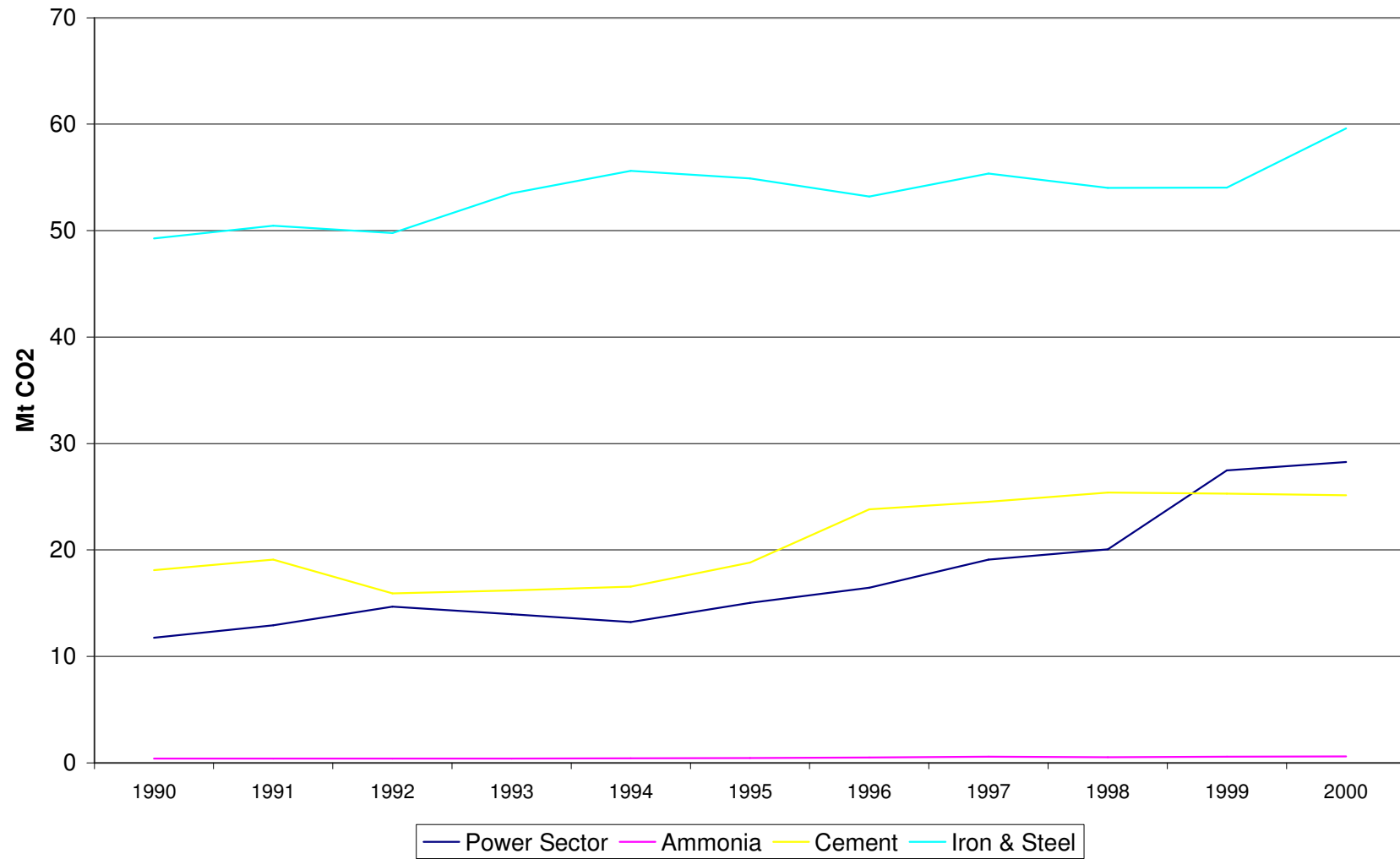
CO₂ Emissions from Energy



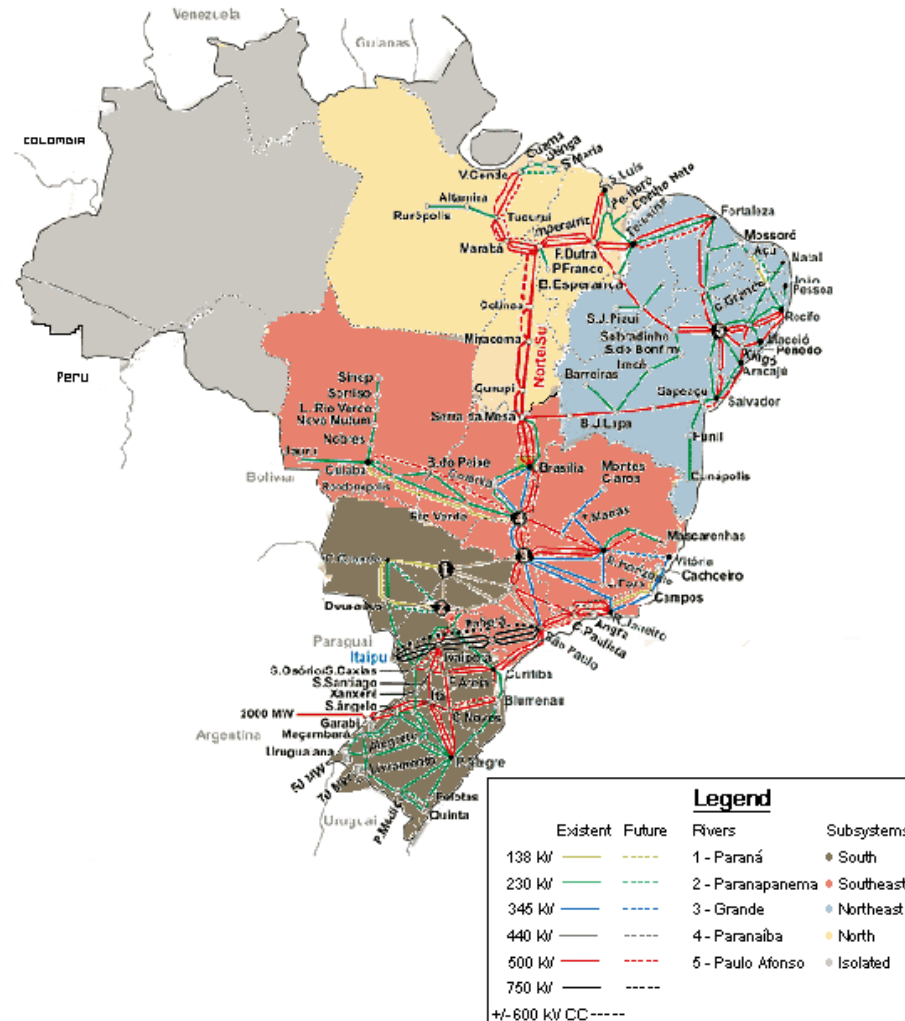
CO2 Emissions from Energy - 2002



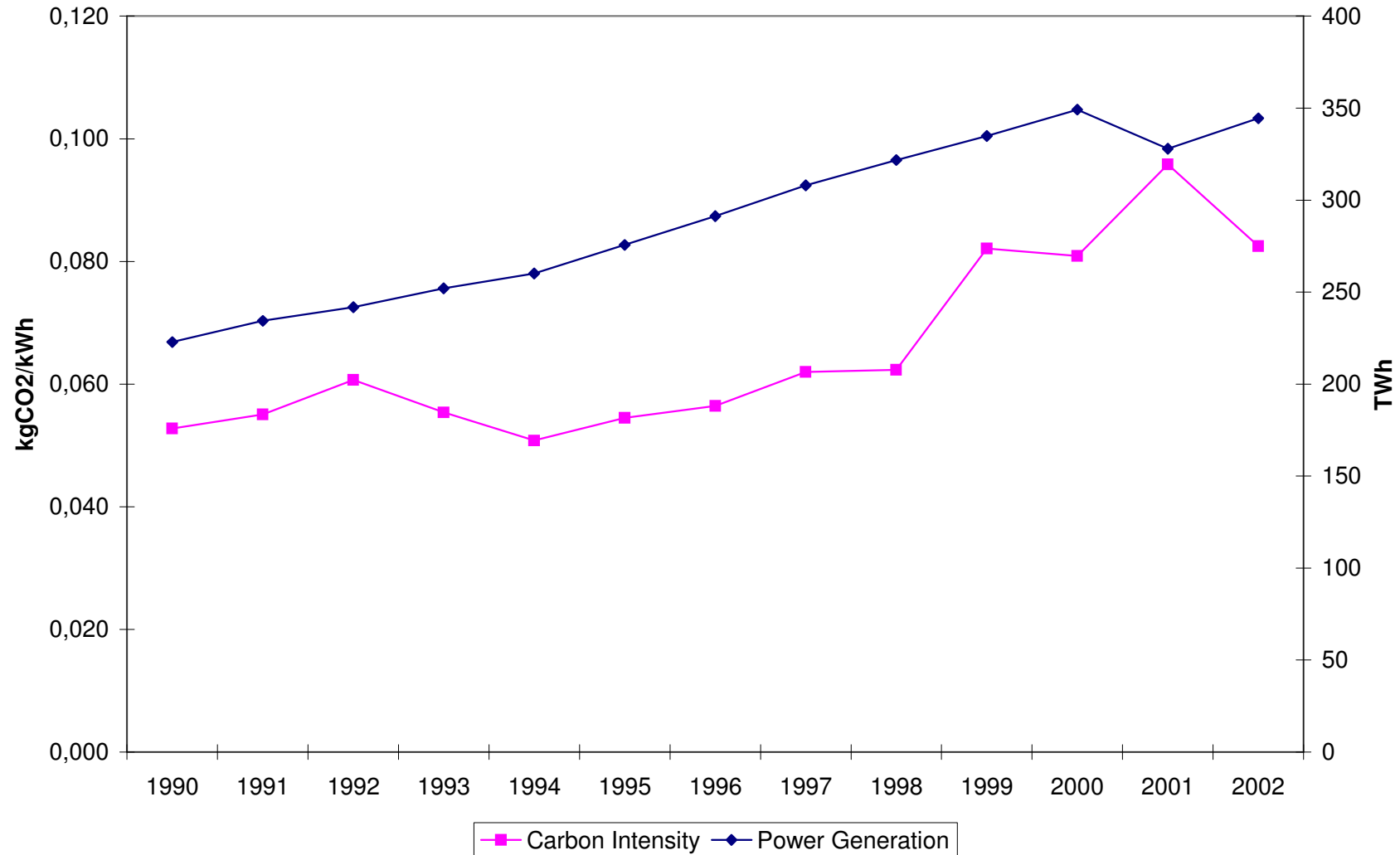
Sectoral Emissions



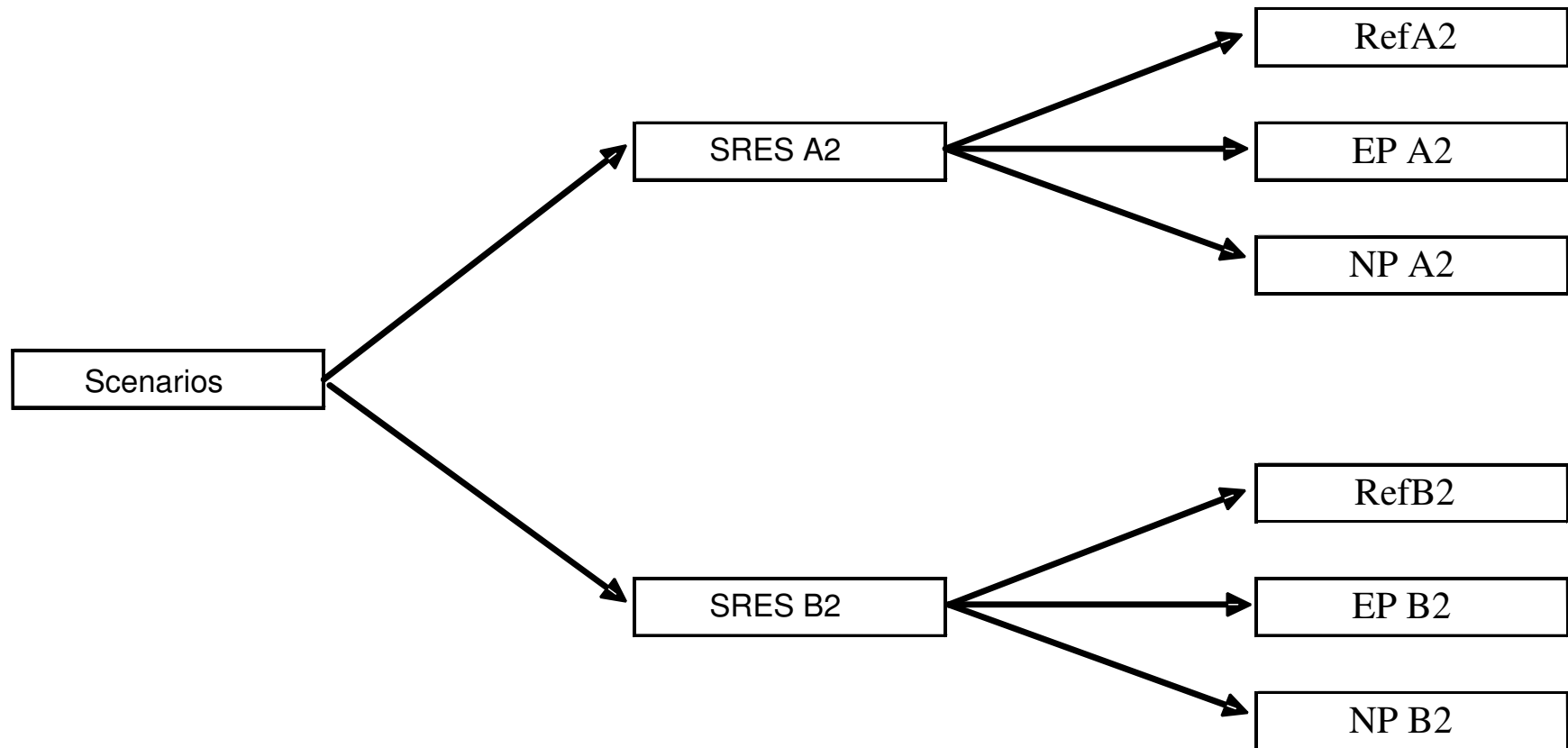
Brazilian Electrical System



Carbon Intensity



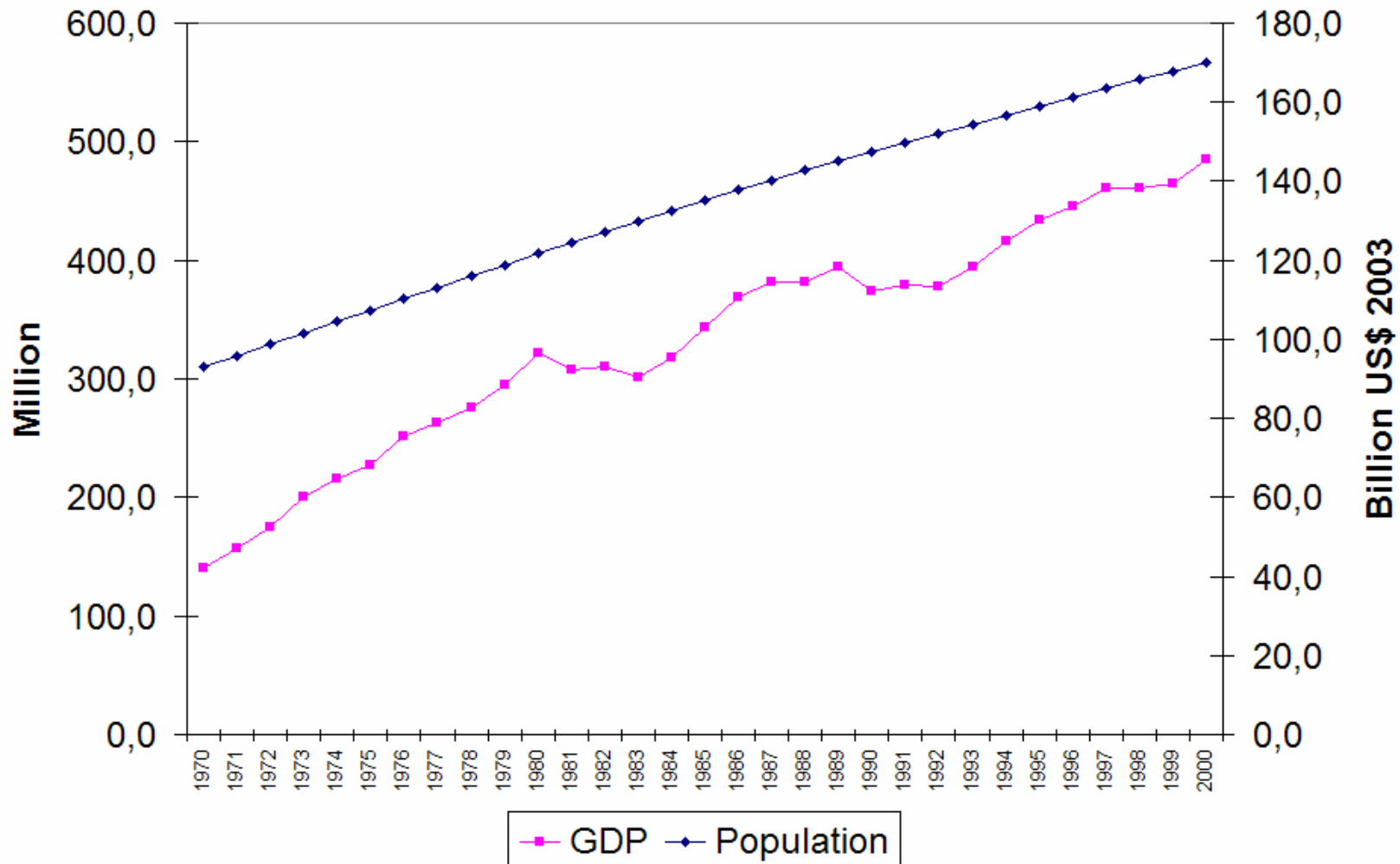
Scenarios



Driving Forces

- Demography
- Economy
- International Oil Price
- Technology
- Energy Policy

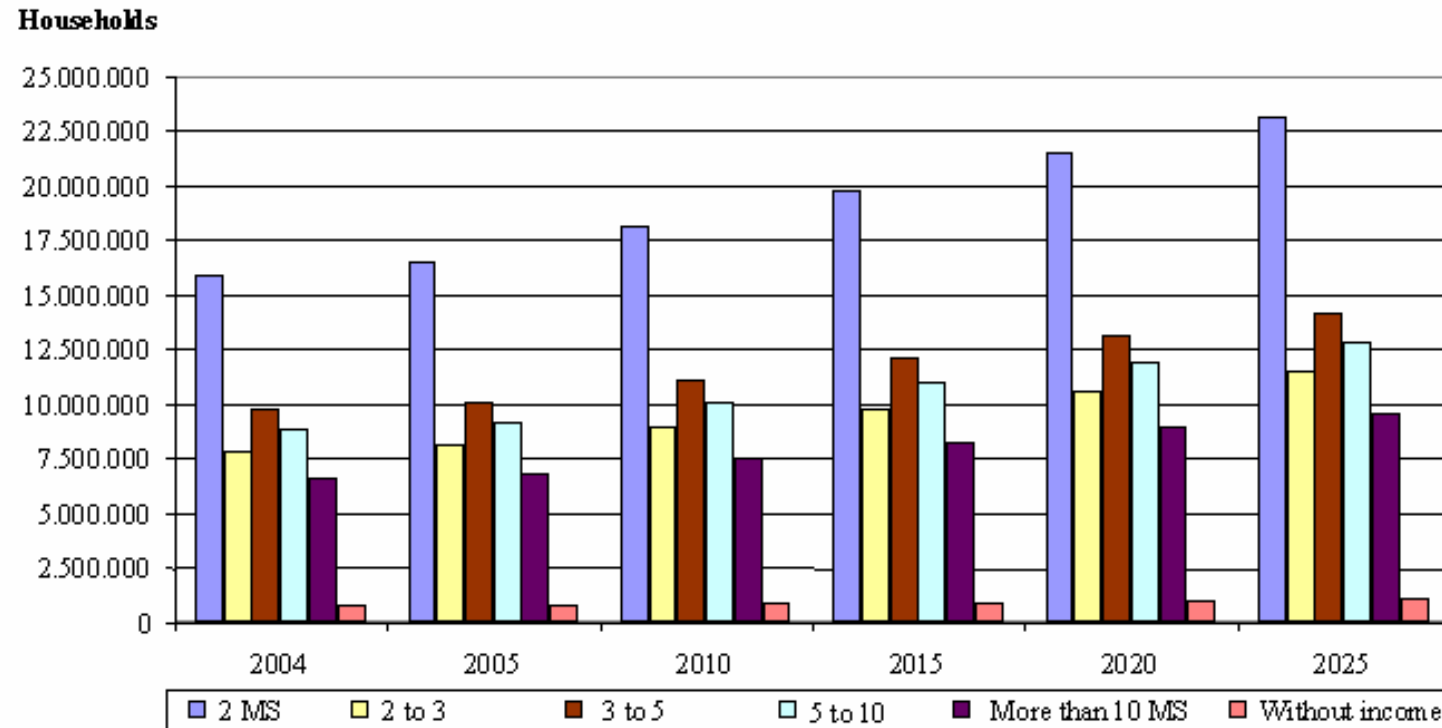
GDP and Population



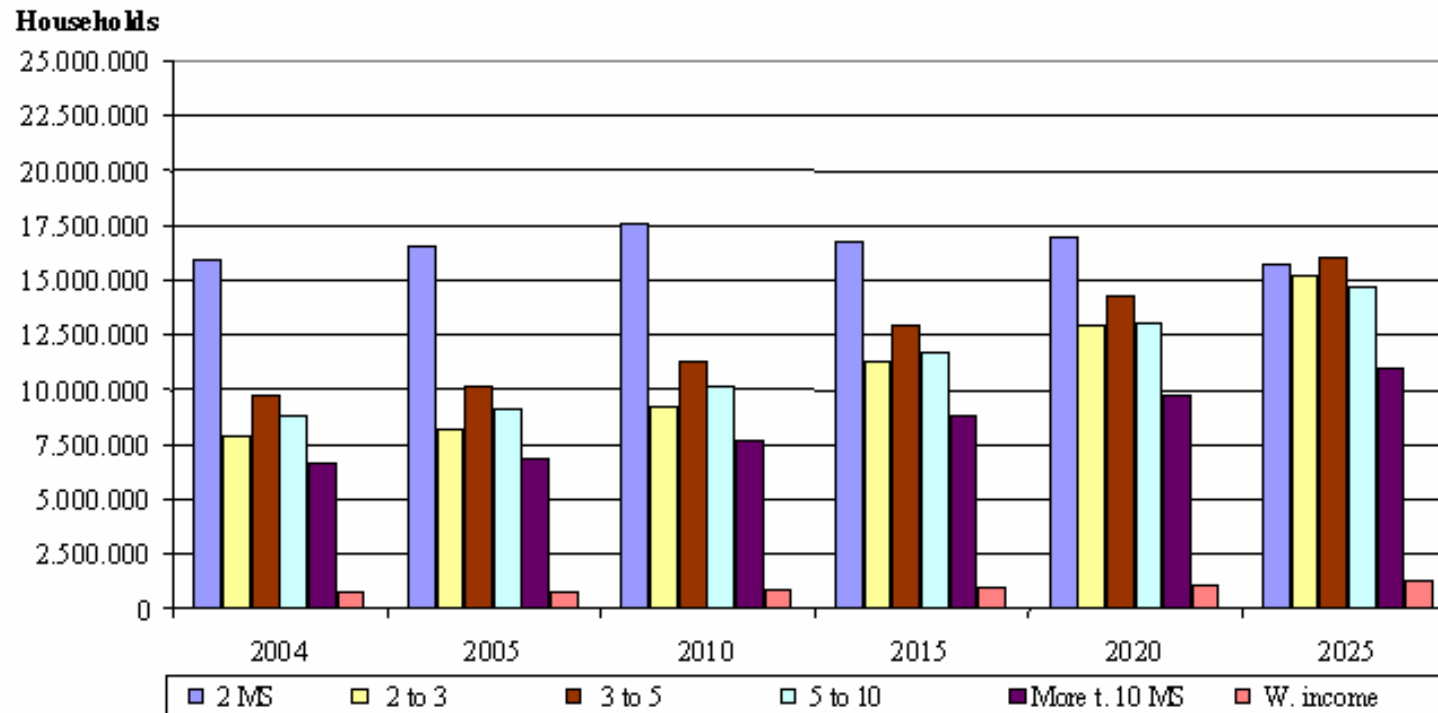
Demographic Indicators

	unit	2000	2005	2010	2015	2020	2025
population	million	171.28	185.71	198.47	210.19	220.89	230.77
capita/household		3.83	3.5	3.4	3.3	3.2	3.1
households	million	44.78	53.06	58.37	63.7	69.03	74.44
potential of labor force	[%]	47.35	48.14	48.56	48.94	49.36	49.53
particip. of labor force	[%]	90.65	90.65	90.65	90.65	90.65	90.65
active labor force	million	73.53	81.04	87.37	93.25	98.84	103.63
rural population	million	33.35	33.84	35.64	37.31	38.74	39.86
urban population	million	137.93	151.87	162.83	172.88	182.15	190.91

Income Distribution in A2



Income Distribution in B2



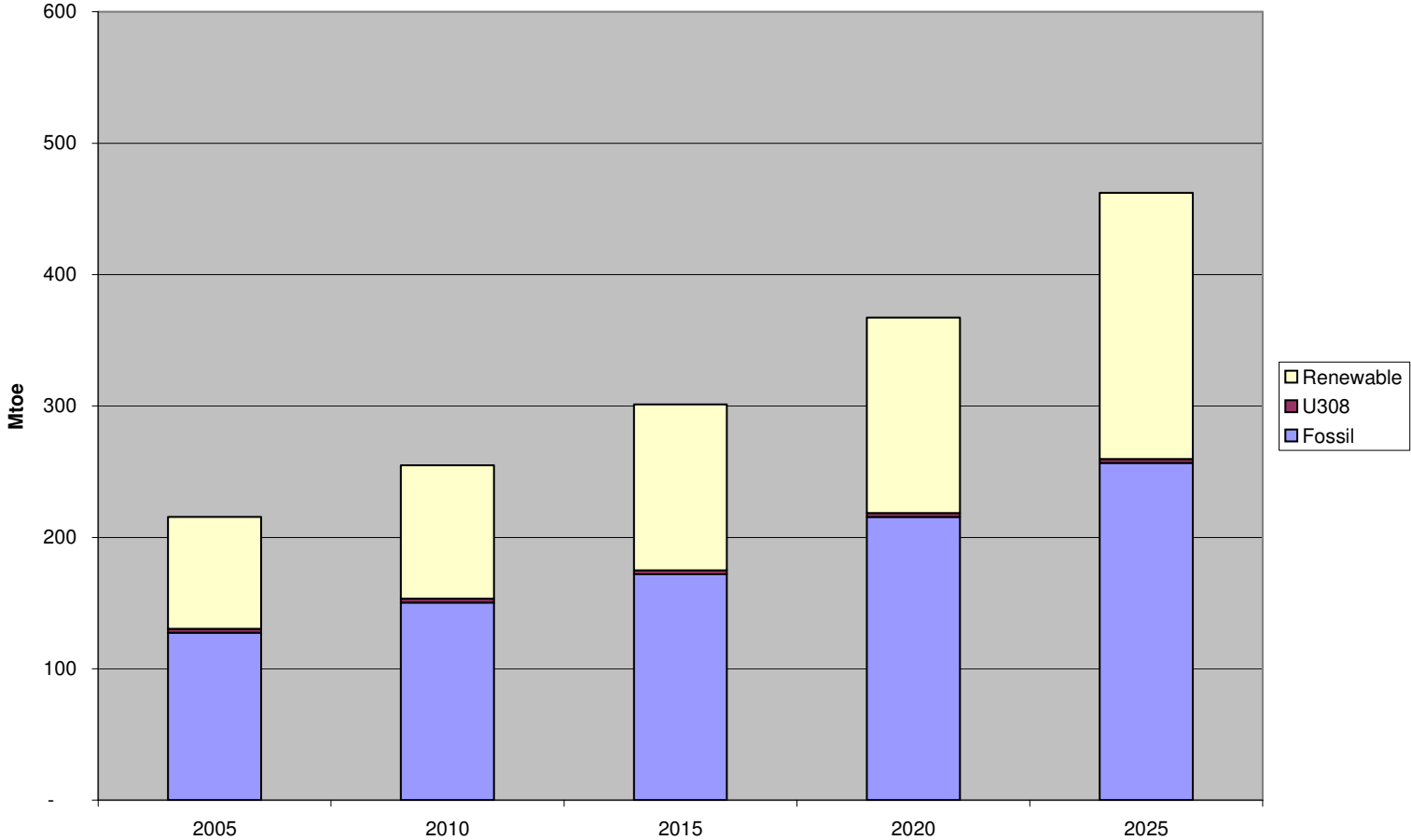
Structure of the economy in A2

	2000 US\$	2000	2005	2010	2015	2020	2025
GDP	10 ⁶ ppp	1,150.78	1,365.08	1,682.02	2,057.47	2,509.24	3,060.23
GDP/cap	10 ⁶ ppp	6.72	7.35	8.48	9.79	11.36	13.26
Agriculture	10 ⁶ ppp	88.16	105.15	124.93	148.14	173.99	202.66
Industry	10 ⁶ ppp	328.92	396.95	521.44	675.88	869.17	1,112.87
Energy	10 ⁶ ppp	82.36	109.7	136.09	166.67	202.66	245.12
Services	10 ⁶ ppp	651.34	753.3	899.55	1,066.77	1,263.43	1,499.58

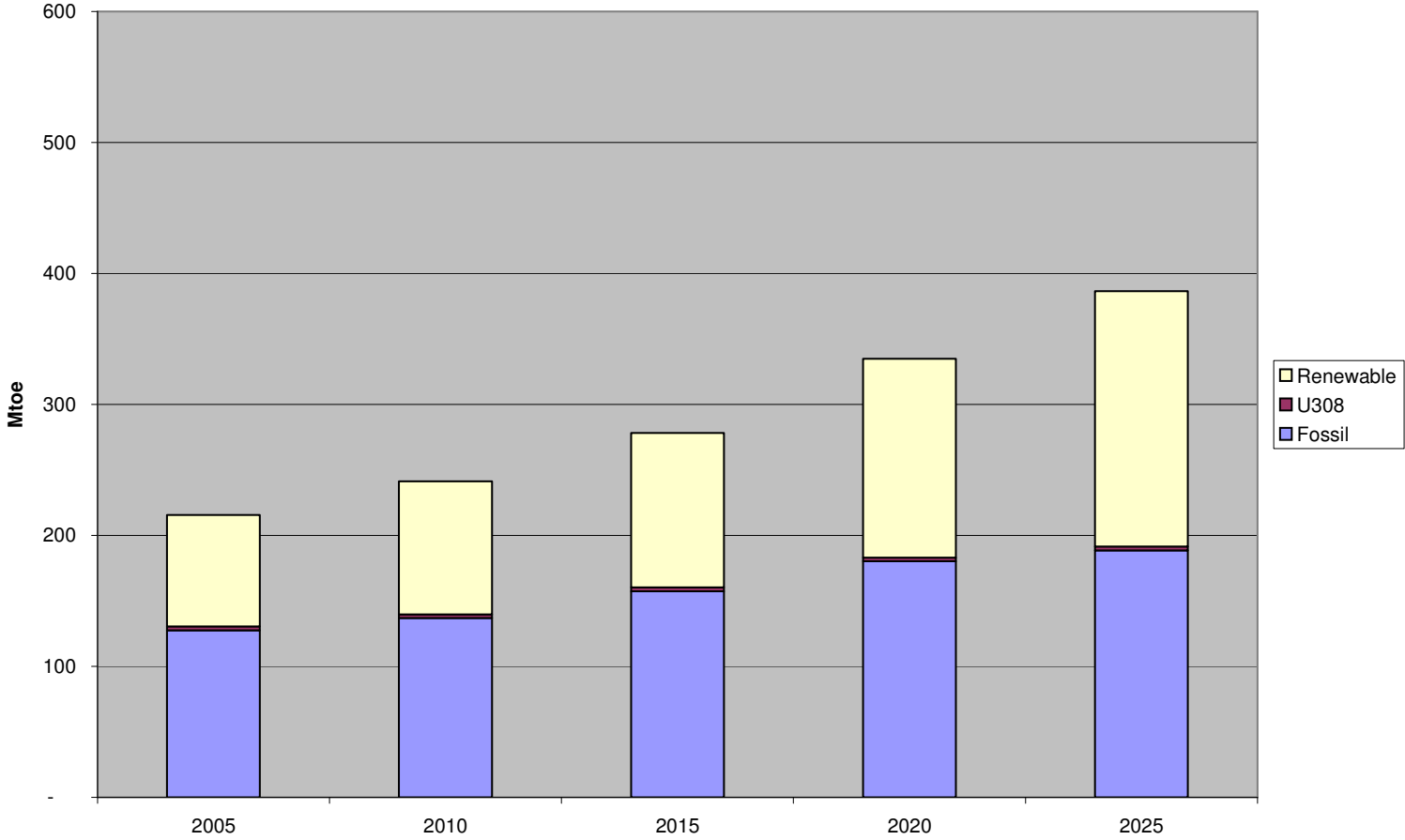
Structure of the economy in B2

	2000 US\$	2000	2005	2010	2015	2020	2025
GDP	10 ⁶ ppp	1,150.78	1,365.08	1,682.02	2,057.47	2,509.24	3,060.23
GDP/cap	10 ⁶ ppp	6.72	7.35	8.48	9.79	11.36	13.26
Agriculture	10 ⁶ ppp	88.16	115.29	143.05	167.86	189.46	209.19
Industry	10 ⁶ ppp	328.92	371.03	472.69	607.83	736	865.83
Energy	10 ⁶ ppp	82.36	110.18	140.16	173.76	197.42	213.38
Services	10 ⁶ ppp	651.34	768.59	926.12	1,108.03	1,386.36	1,771.83

Domestic Energy Supply Existing Policies A2



Domestic Energy Supply Existing Policies B2



Conclusion: Additional Policies

- Energy efficiency in industry and transport
- Natural gas in industry + residential and commercial sectors
- Hydropower potential to be tapped
- Ethanol: domestic production + exports
- Biodiesel in transport sector
- Renewable power generation in remote areas (access to electricity for rural population)

Ethanol Program

- largest commercial application of biomass for energy production and use in the world;
- Successfully showed technical feasibility of large-scale sugarcane ethanol production and use to fuel car engines;
- 2 million cars running on ethanol (peak of 4.4 million in 1993) + flex-fuel cars => 4.6 billion liters/year + 6.4 billion liters/year for gasohol (25% anhydrous ethanol + 75% gasoline);

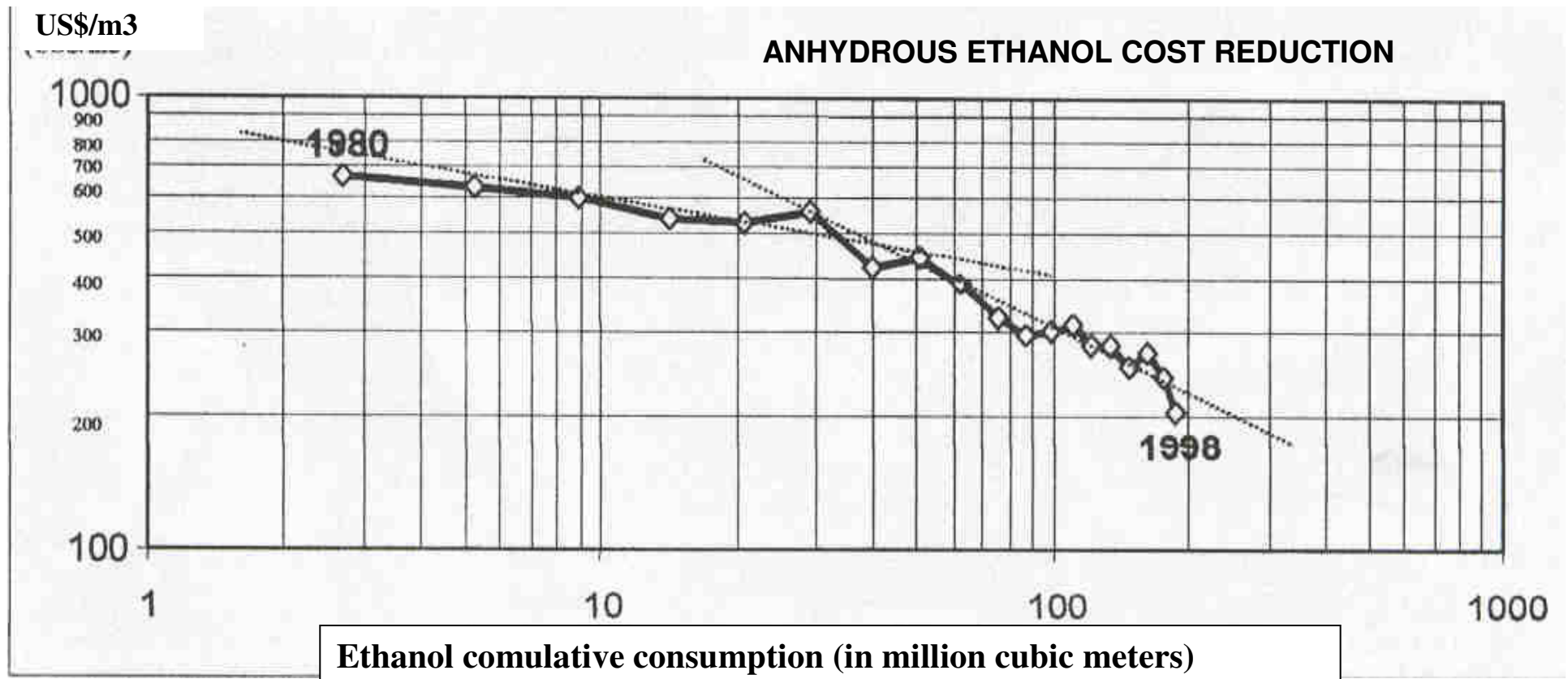
Ethanol Program

- Sugar cane bagasse use as an industrial fuel and for power generation has been growing;
- Surplus of electricity to be injected in the grid;
- Foreign exchange savings;
- 720,000 direct jobs and more than 200,000 indirect jobs in rural areas;

Ethanol Program

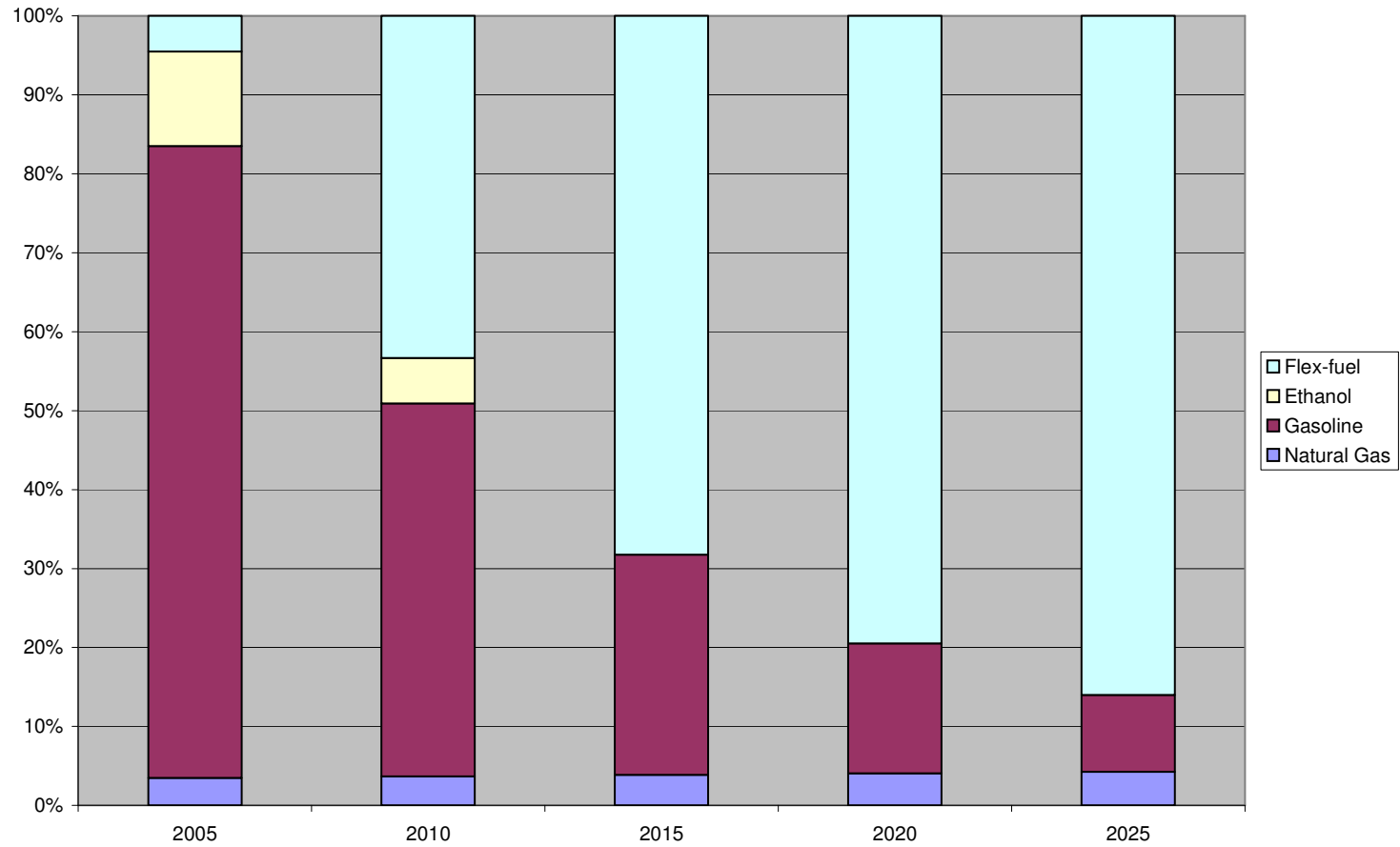
- Curbing the increase of local air pollution;
- Mitigation: 6 to 10 million tons of carbon/year since 1980;

Productivity gains in ethanol production



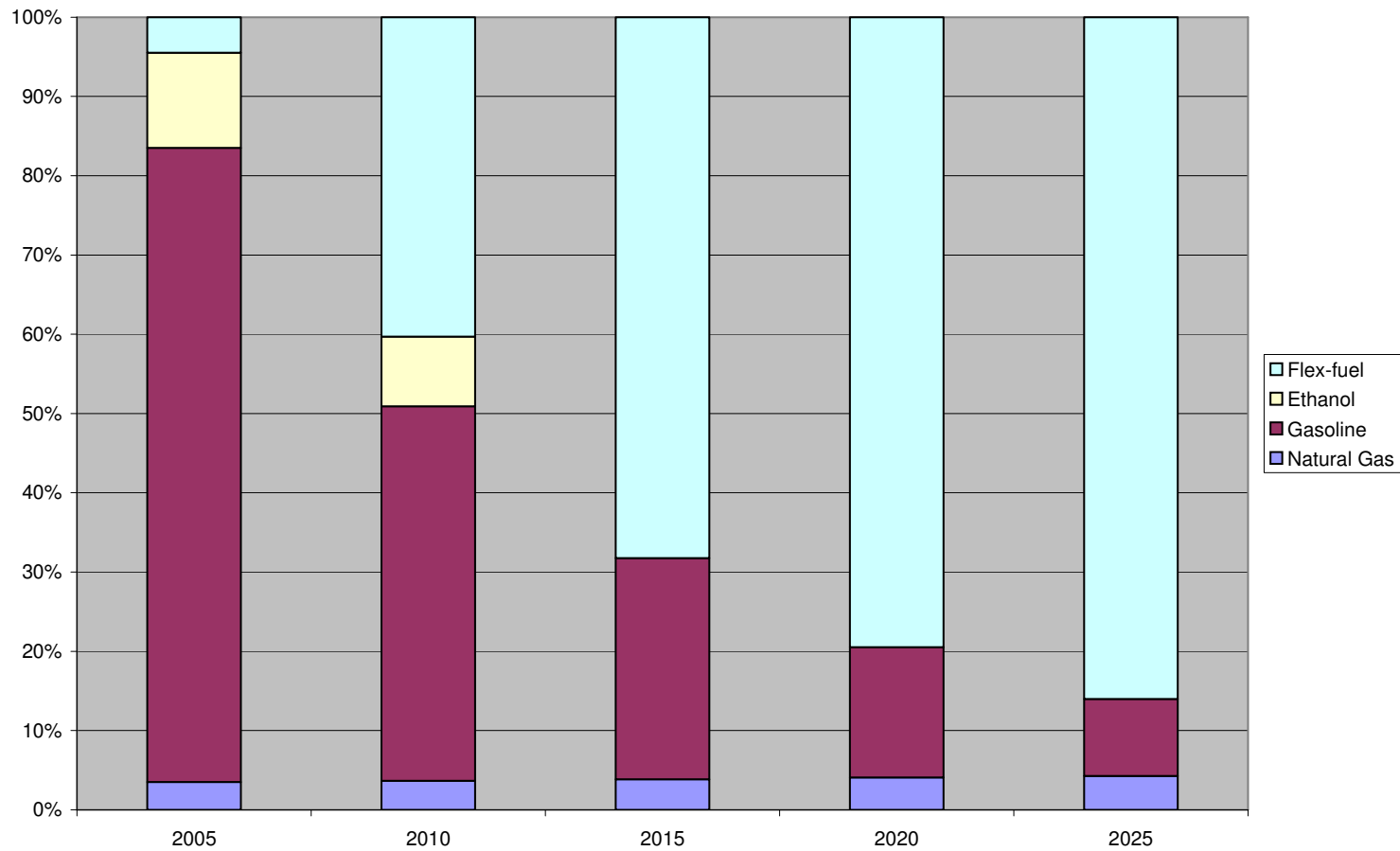
Light Vehicles Existing Policies

A2

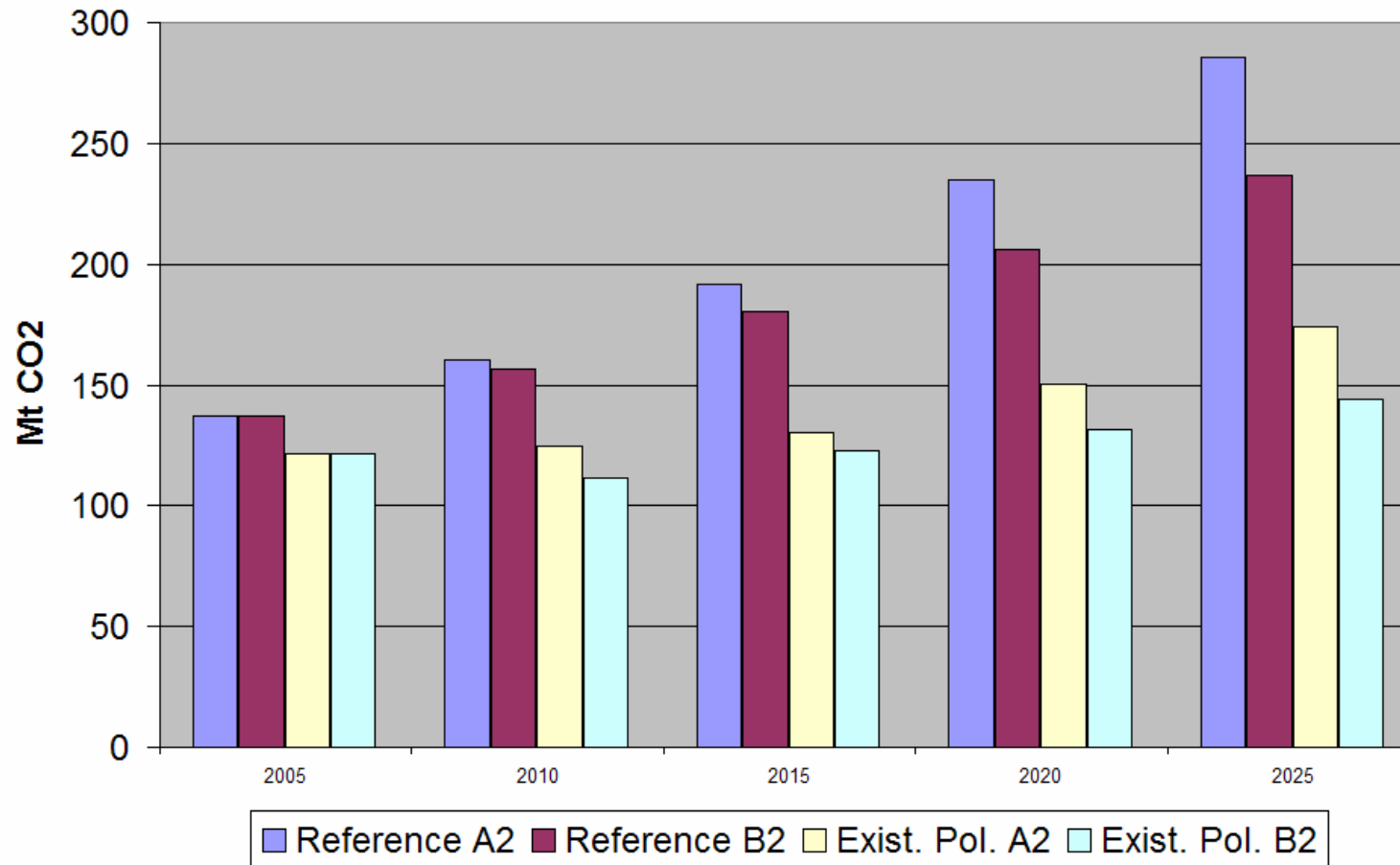


Light Vehicles Existing Policies

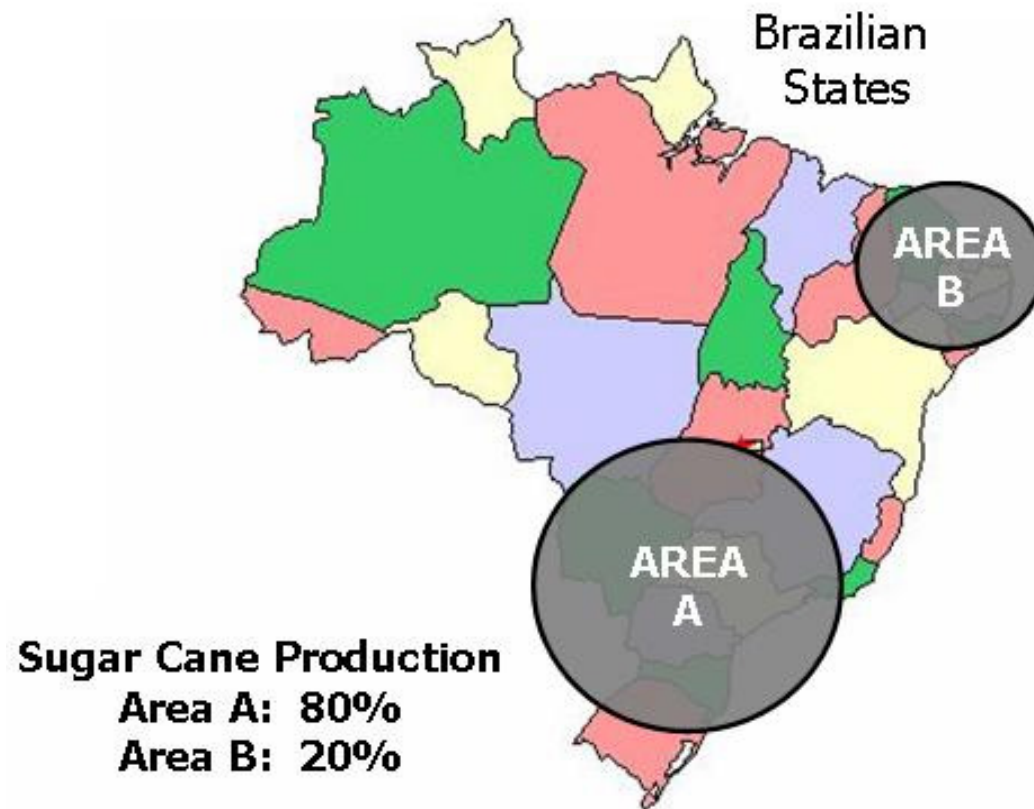
B2



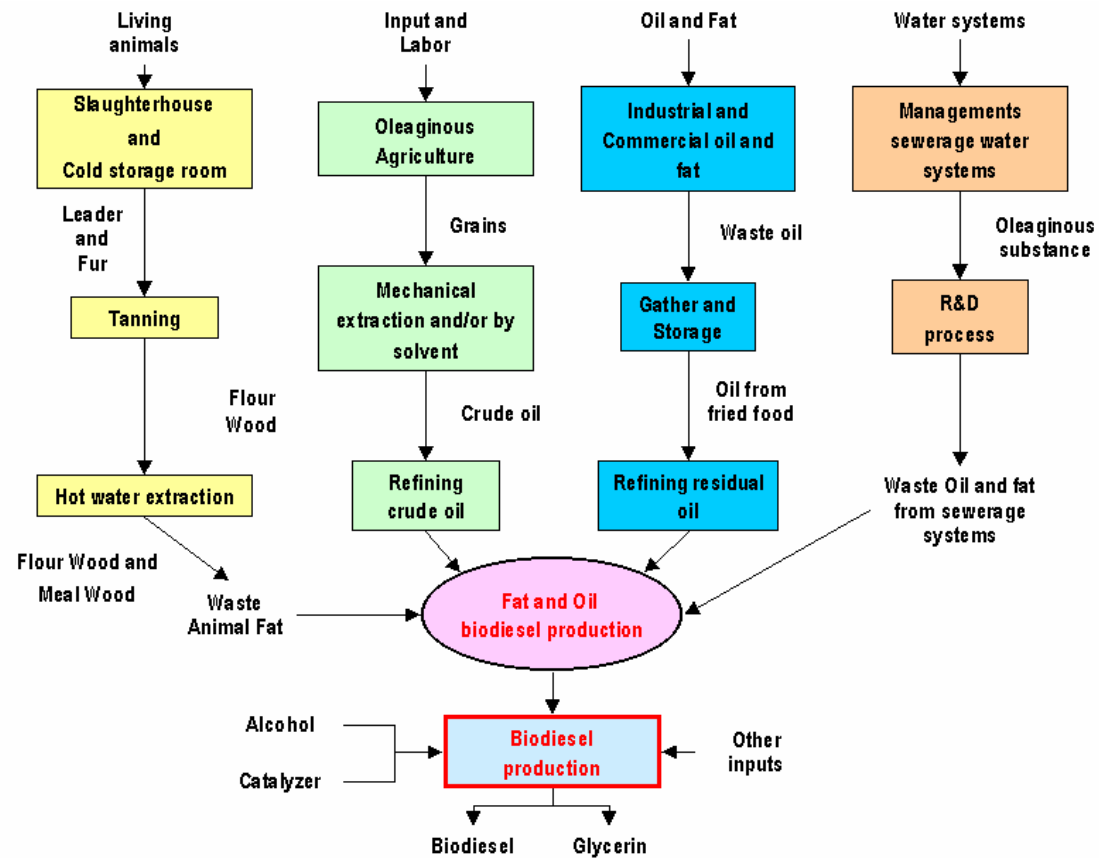
CO2 Emissions in Transportation Sector



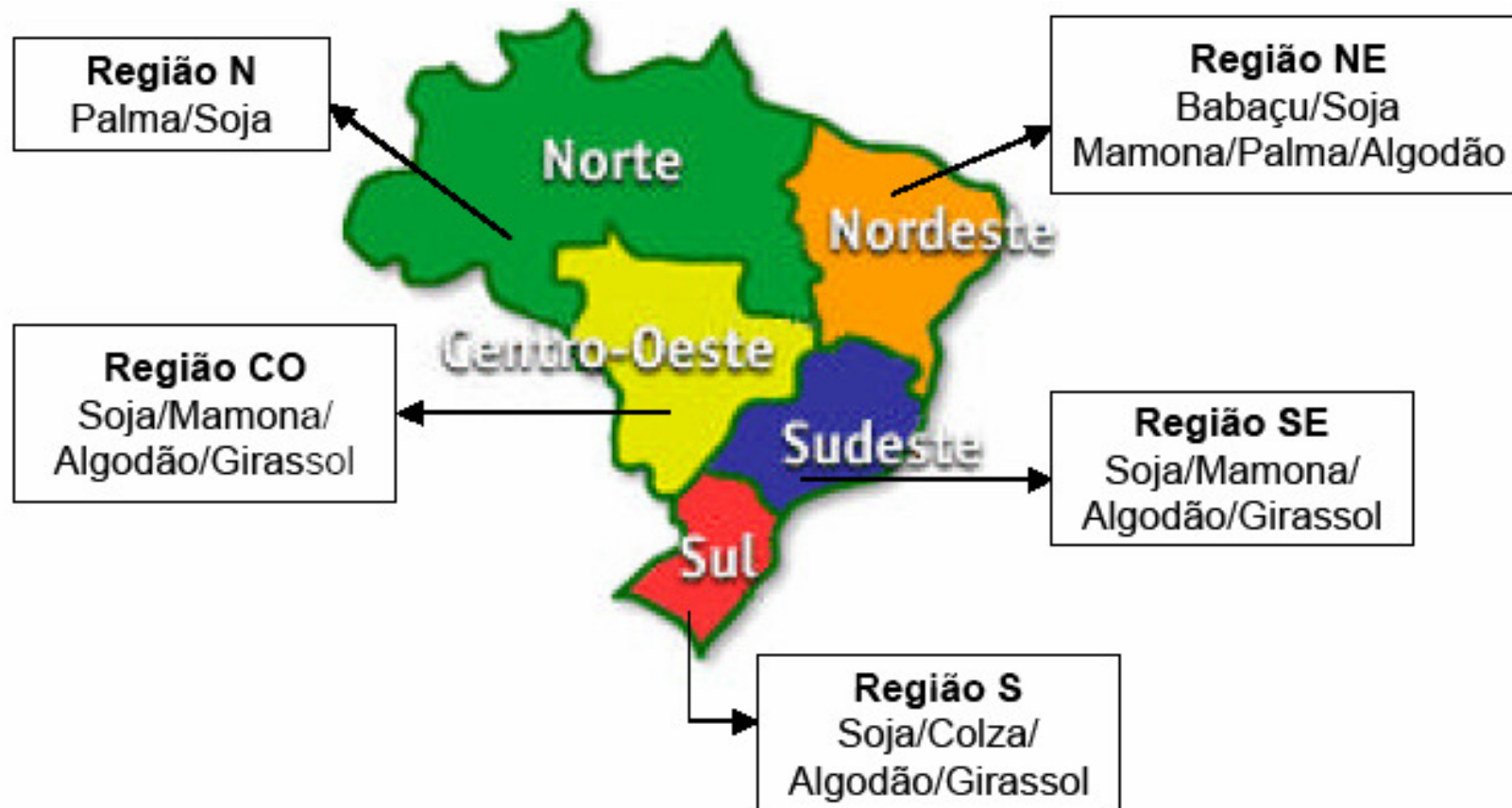
Sugar-Cane Production



Biodiesel Production



Biodiesel Inputs



BRAZILIAN BIODIESEL PROGRAM

- The recently launched Brazilian Biodiesel Program allows for using several different vegetal oils as raw materials (castor bean, soybean, oil palm, sunflower and others) for biodiesel production.
- The initial target is for 2% of biodiesel in the blend with regular diesel oil in 2006.
- Policy support: financial support, credit and R&D promotion to increase the efficiency and productivity of the biodiesel production.

DIESEL X BIODIESEL EMISSIONS

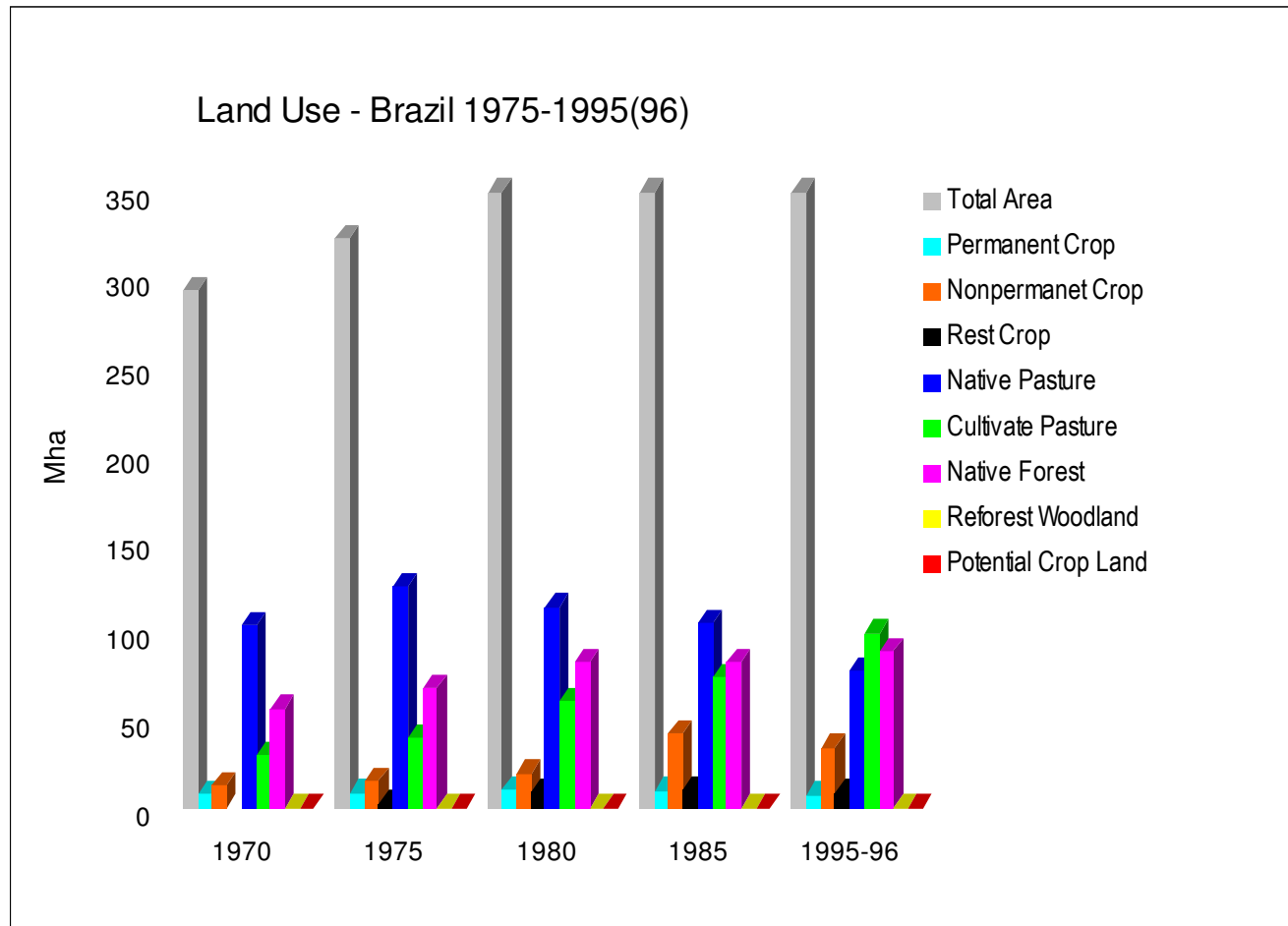
- Diesel - 2.70 kg CO₂/l
- Methyl ester (biodiesel) – 0.3 kg CO₂/l
- Ethyl ester (biodiesel) – nearly zero or 0.05 kg CO₂/l
(process uses renewable ethanol from sugarcane)

Emission Reductions	
CO ₂	78 – 100%
CO	50%
Sulphur	98%
Particulate matter	50%
Aromatics	30%

Relevance of Bioenergy in Brazil

- Share in total energy supply = 30% (2004);
- Main biomass energy resources: wood, charcoal, sugarcane bagasse, rice husks, ethanol from sugarcane, vegetal oils, biodiesel;
- Agricultural land availability:
 - Land used by agriculture sector: 50 million ha;
 - Land used by sugar cane crops: 5 million ha;
 - Estimated land for ethanol production: 2.5 million ha;
 - Total Brazilian agricultural land: 140 million ha (exclusive of land suitable for forest plantations);
 - Land still available for agriculture: 90 million ha.

Available Land



Challenges for expanding the use of modern liquid biofuels across the world

- Links between biofuels and international commodities markets (eg ethanol x sugar, biodiesel x castor oil, palm oil, soybeans): effects of price subsidies, WTO rounds, large scale bioenergy programs on international prices of feedstocks and final products.