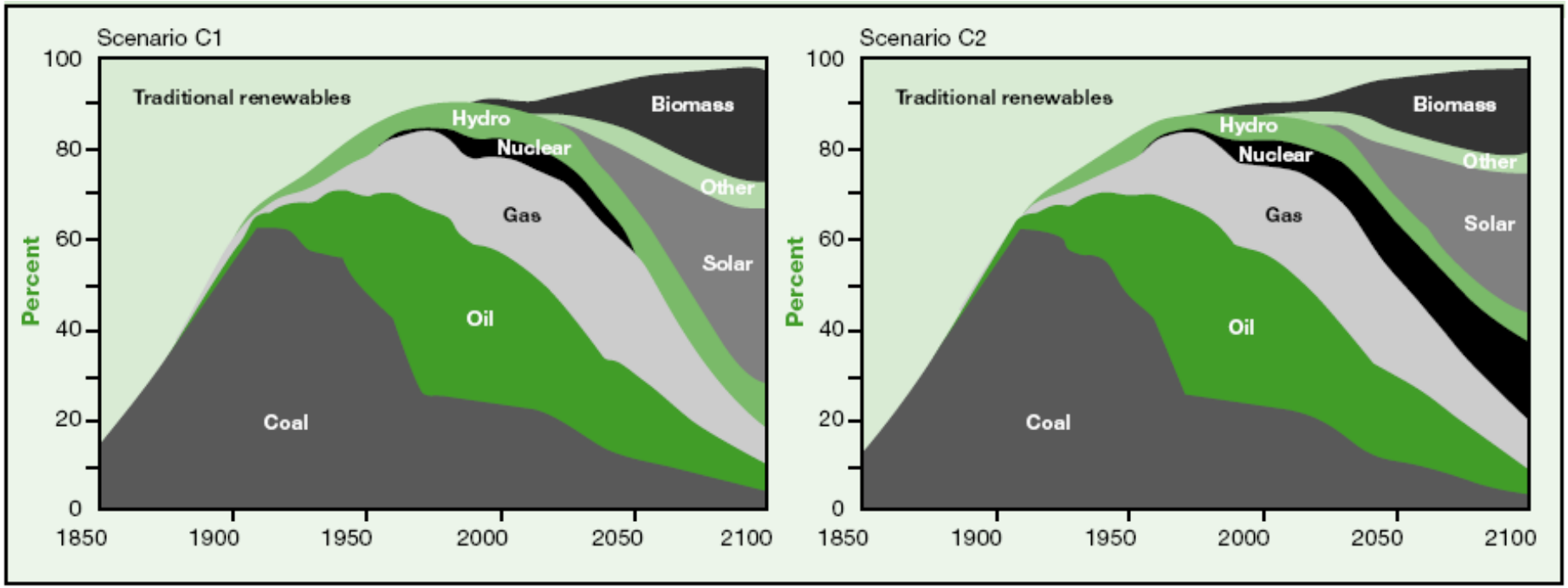
The role of biomass in the world's energy matrix

Prof. José Goldemberg

Primary Energy Shares, 1850–1990, and in Scenarios to 2100



World Primary Energy Supply (2004)

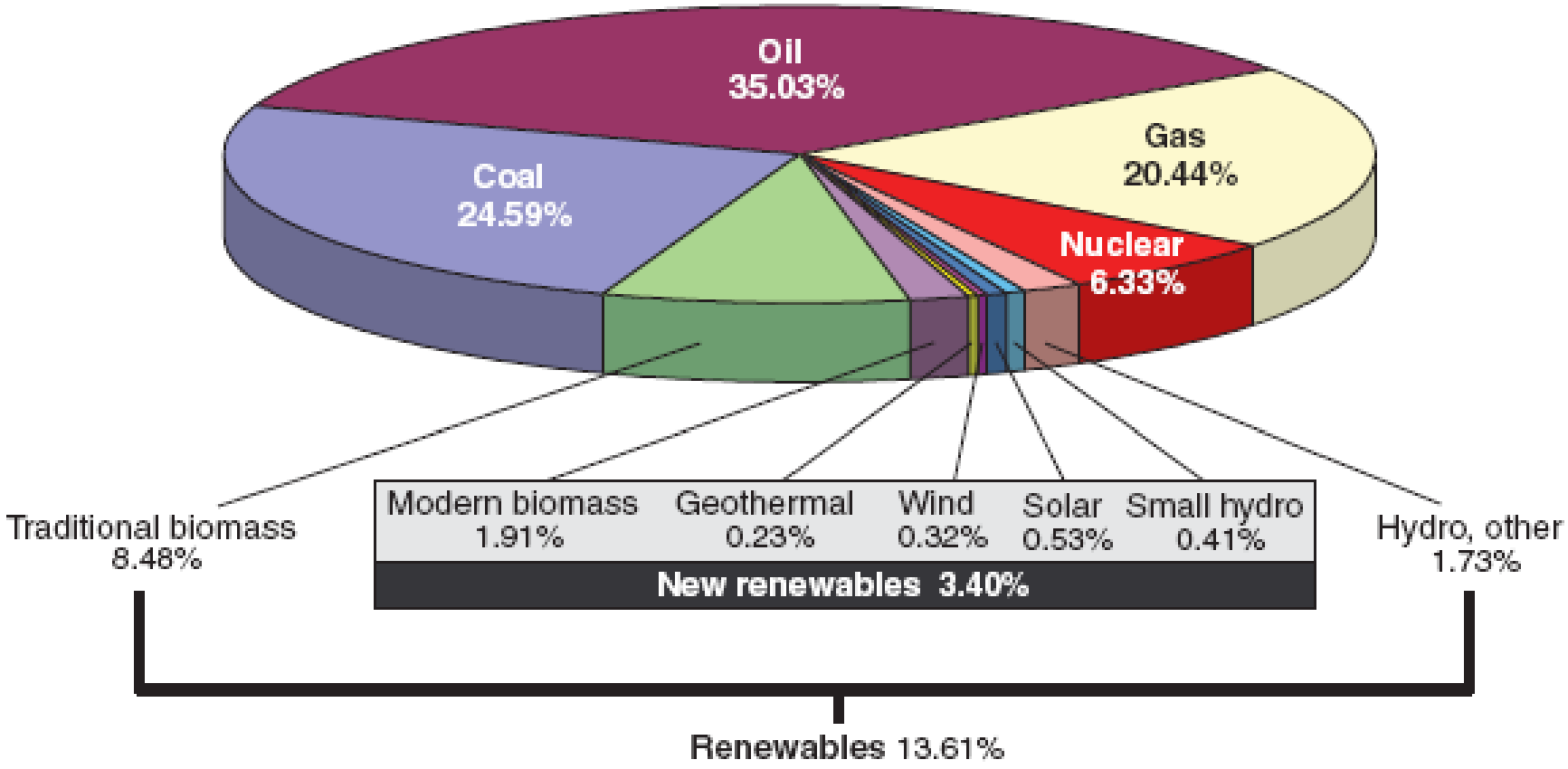
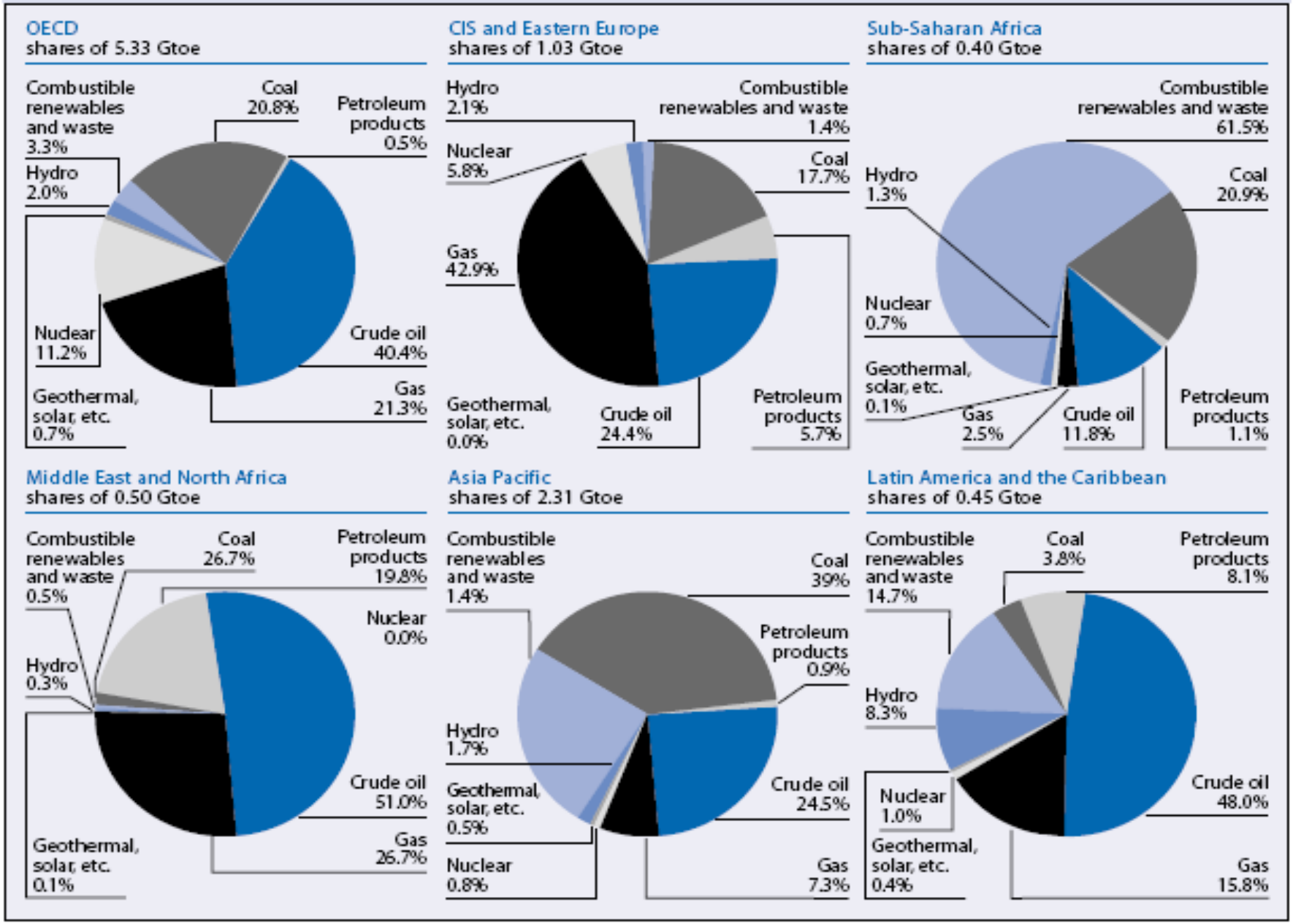


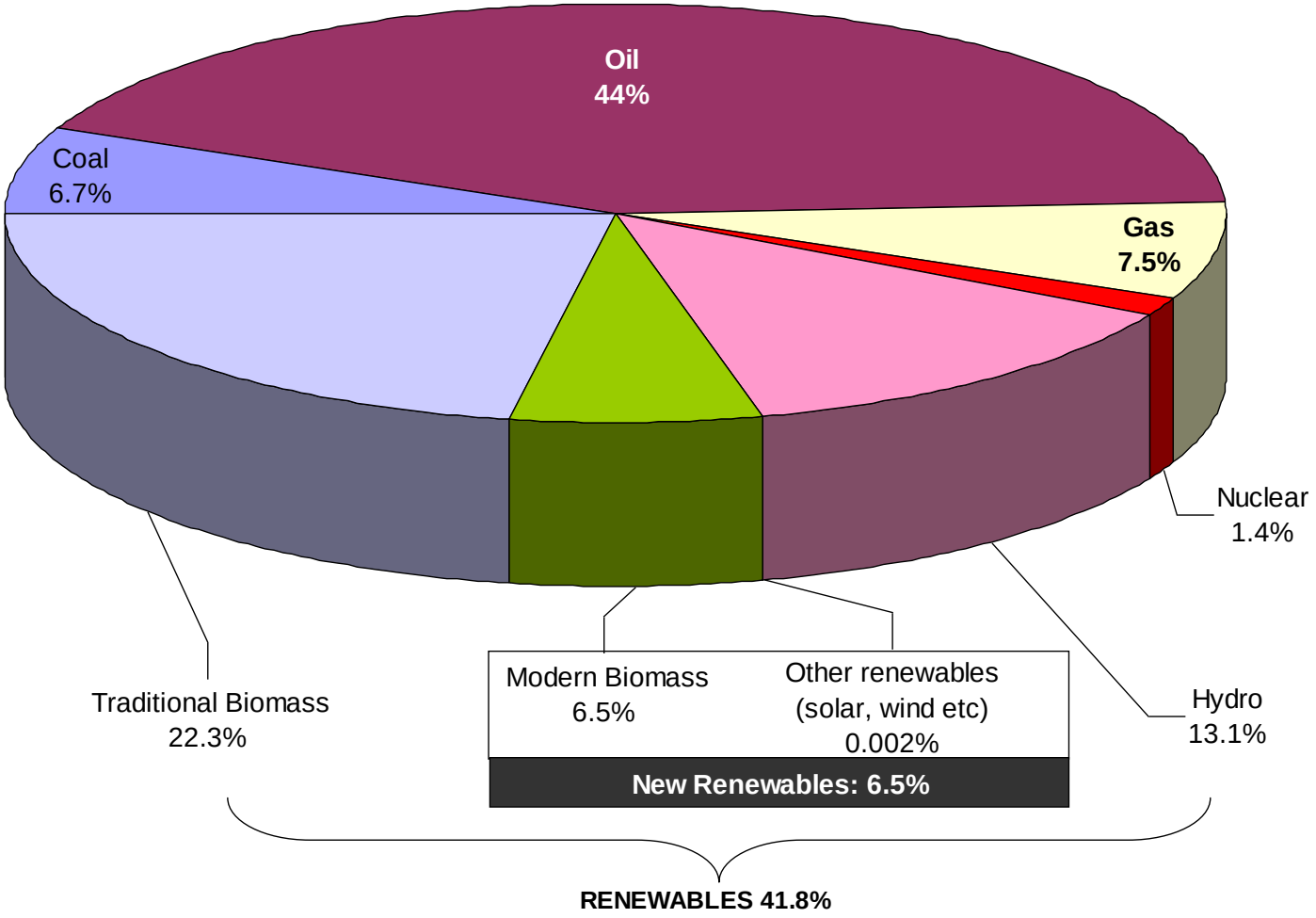
Fig. 1. World total primary energy supply 2004, shares of 11.2 billion tons of oil equivalent, or 470 EJ (*15*, *16*).

FIGURE 7. PRIMARY ENERGY USE IN VARIOUS REGIONS, BY ENERGY SOURCE, 2001



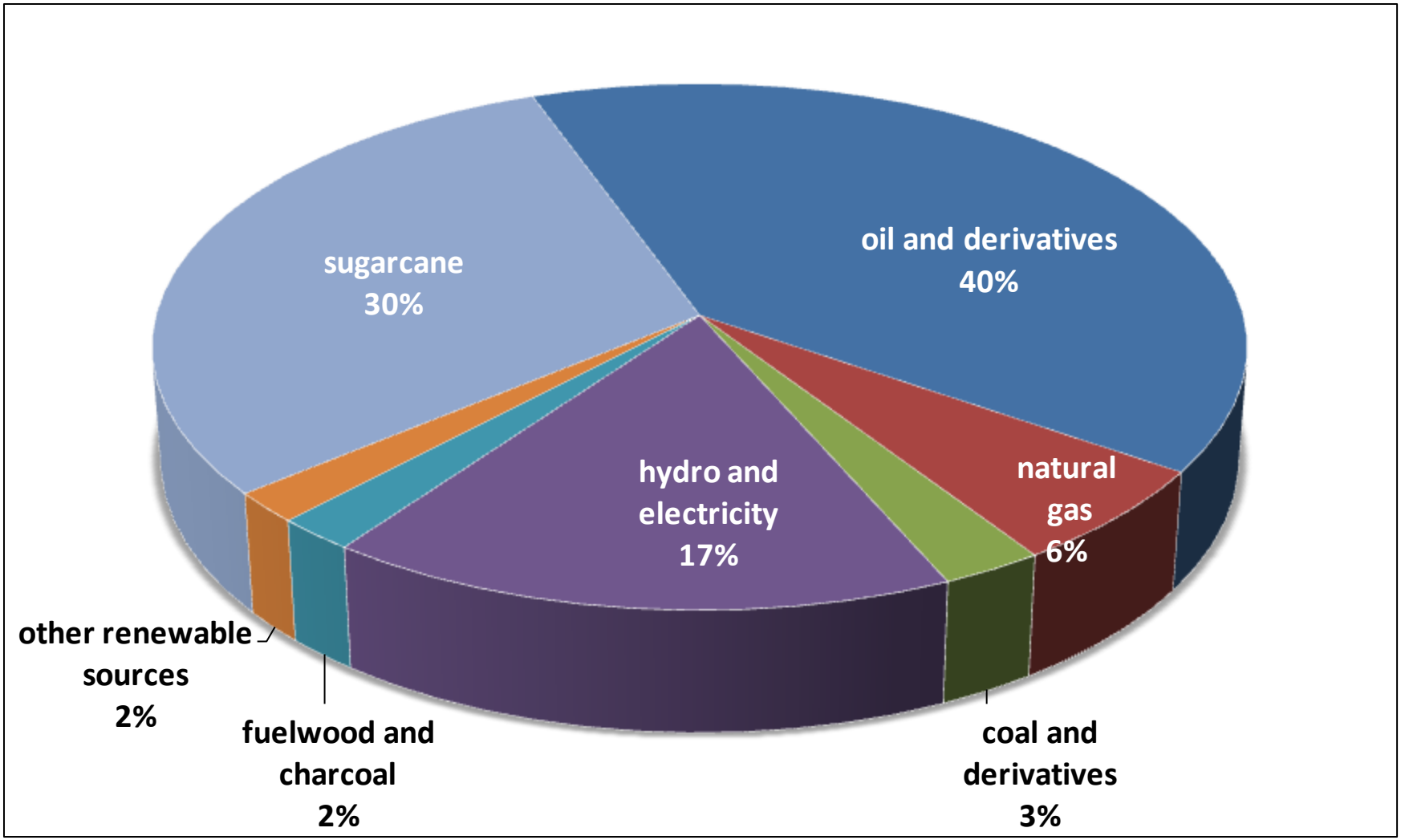
Source: IEA, 2003c.

Brazilian Primary Energy Supply (2004)



Brazilian total primary energy supply, shares of 205 million tons of oil equivalent, or 8.6 EJ.
Source: IEA, 2006

São Paulo State Primary Energy Supply (2005)

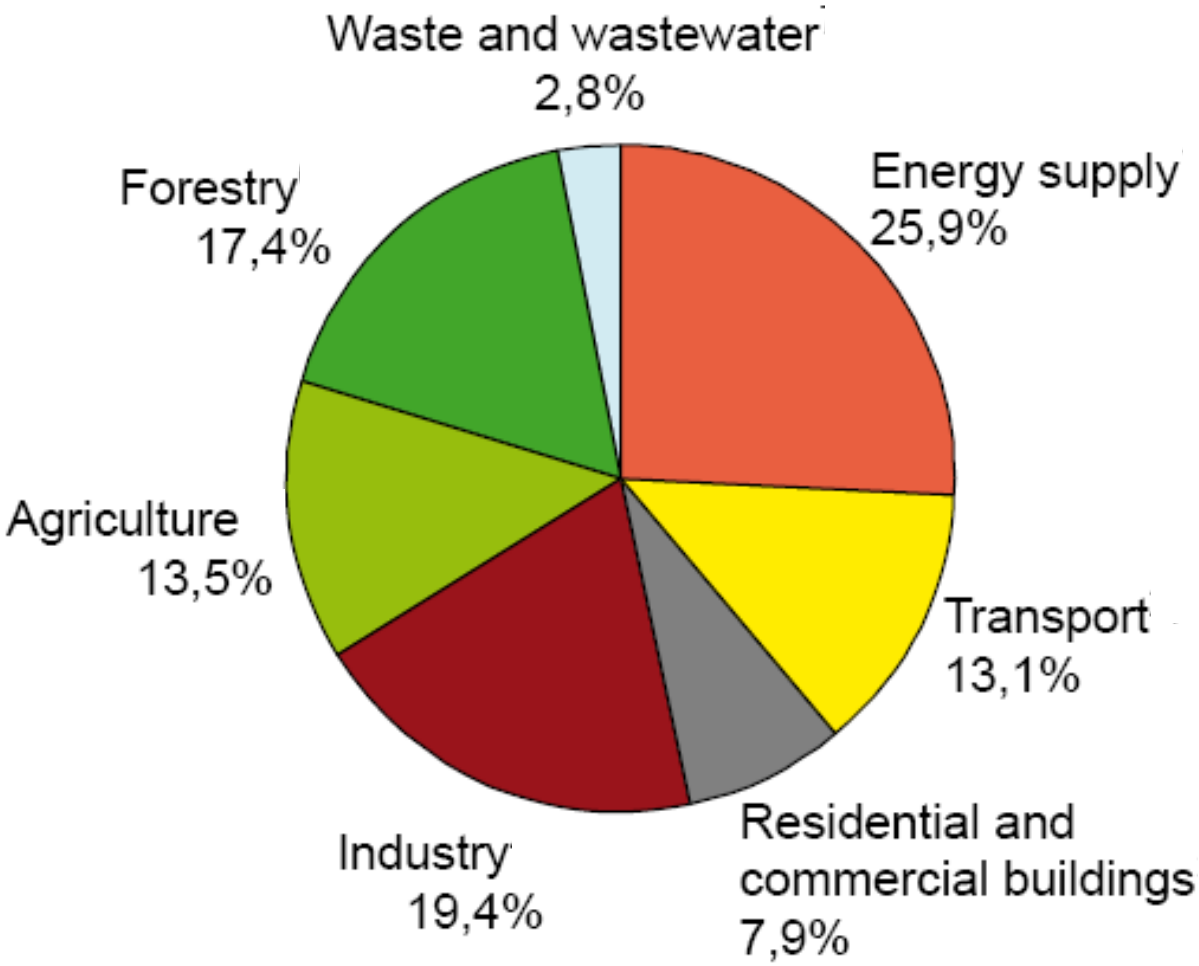


Source: São Paulo State Energy Balance, 2006

EMISSIONS FROM TRANSPORTATION

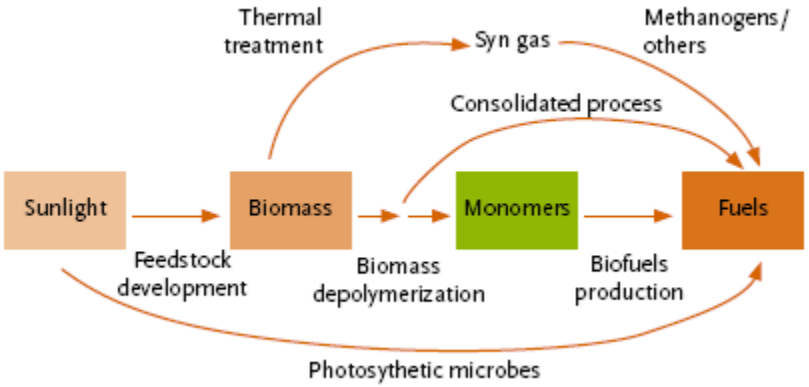
- More than 70 per cent of all carbon monoxide (CO) emissions;
- More than 40 per cent of nitrogen oxides (NOx) emissions;
- Almost 50 per cent of total hydrocarbons (HCs);
- Around 80 per cent of all benzene emissions; and
- At least 50 per cent of atmospheric lead emissions.
- 14% of all greenhouse gas emissions to the atmosphere and 19% of the CO2 emitted

GHG emissions by sector in 2004



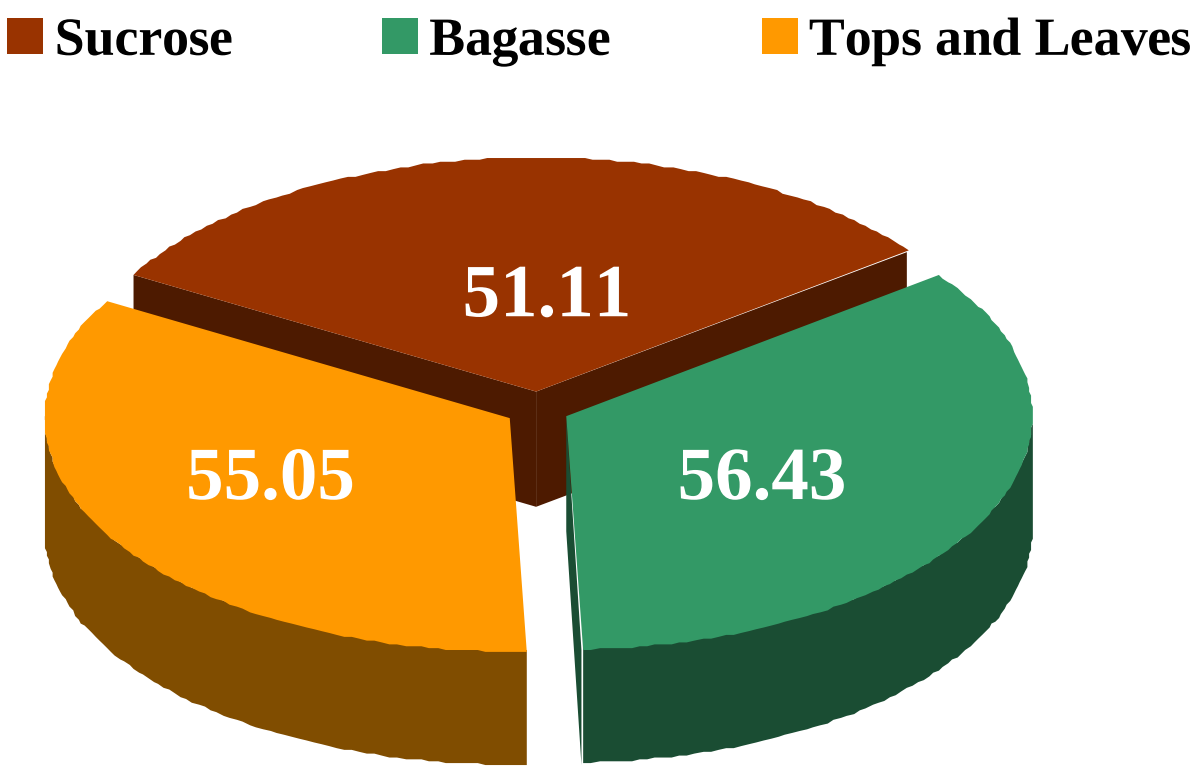
Source: IPCC, 2007

Potential pathways for biofuels production



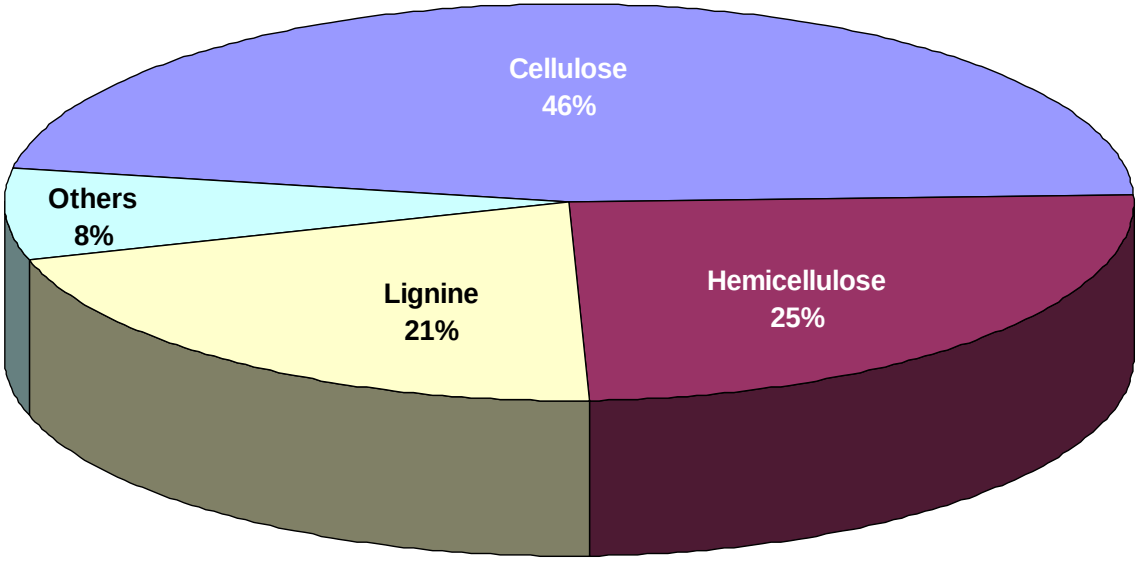
Energy Contained in 1,000 tons of Sugar Cane

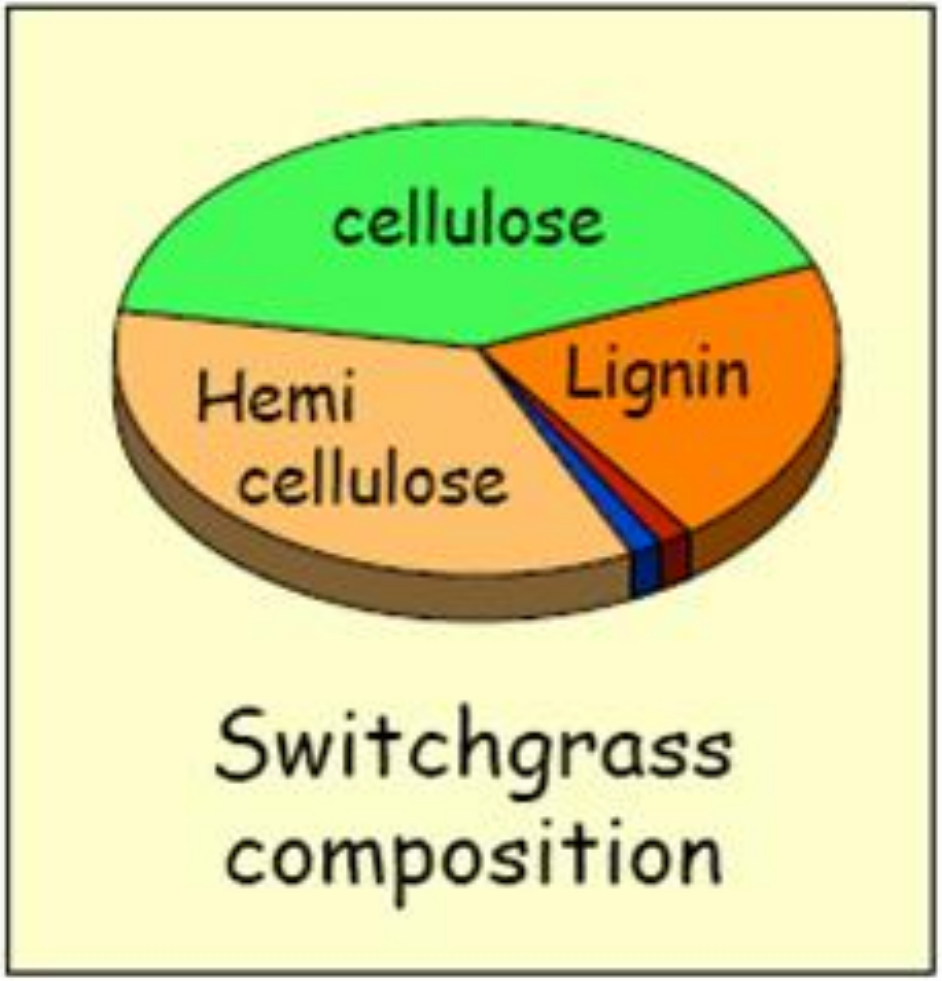
(in tons of oil equivalent)



Fonte: Nastari, Lisbon, 2000

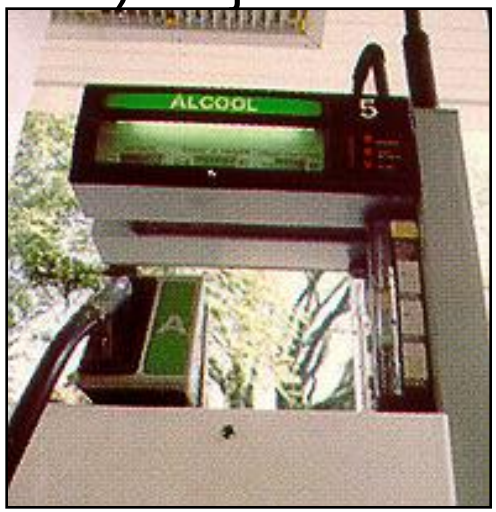
Composition of sugarcane bagasse




cellulose
Lignin
Hemi
cellulose
Switchgrass
composition

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

MYTHS ON BIOFUELS

i. biofuels are leading to deforestation
ii. biofuels are causing famine in the world
iii. biofuels do not reduce greenhouse gas emissions
iv. biofuels are only viable in “niches” (such as Brazil)