

PECC Victoria Seminar

Energy transition: Making the most out of available resources

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Demand for energy, some scenarios for the future

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How much power does the world consume?



A composite image of the Earth at night makes the world's biggest power consumers stand out.

Max Dannenbaum/Stone/[Getty Images](#)

A new energy transition is necessary

- While the first and second industrial revolutions , largely based on the exploitation of coal and oil , opened a century and a half of global growth, a new energy transition is necessary .
- Today, two billion people left behind by the growth model , do not have access to energy.
- Moreover, this model still consumes more energy in conditions less sustainable. Energy resources to meet this consumption, which are 80 % of fossil fuels (oil, gas , coal) are both finite , unevenly distributed , tendentiously increasingly expensive and a leading cause of global warming.

Petroleum is not only energy
also a feedstock for chemicals manufacturing plastics...

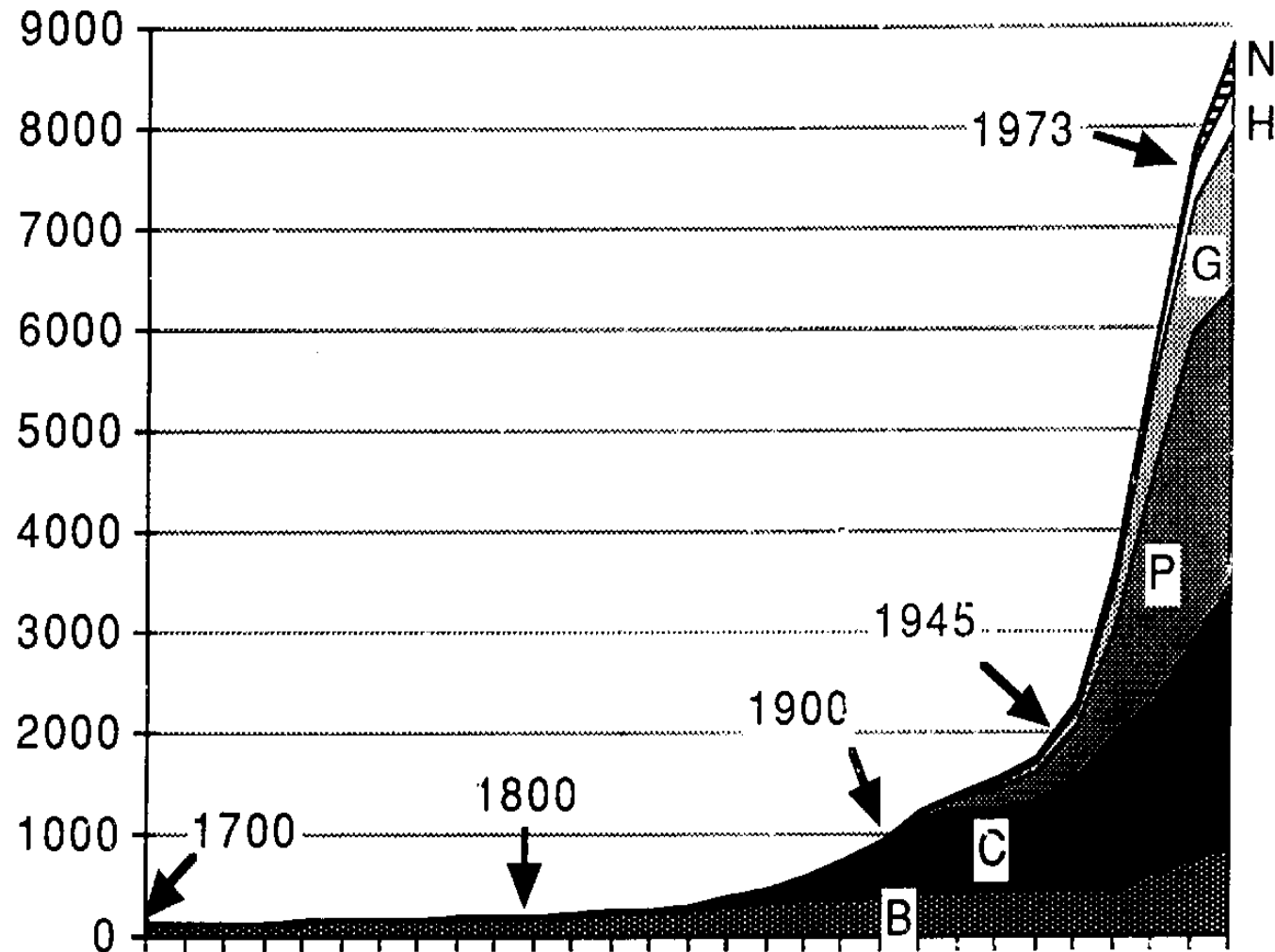


- Petroleum products help make crayons, like these pictured at a Pennsylvania Crayola plant.

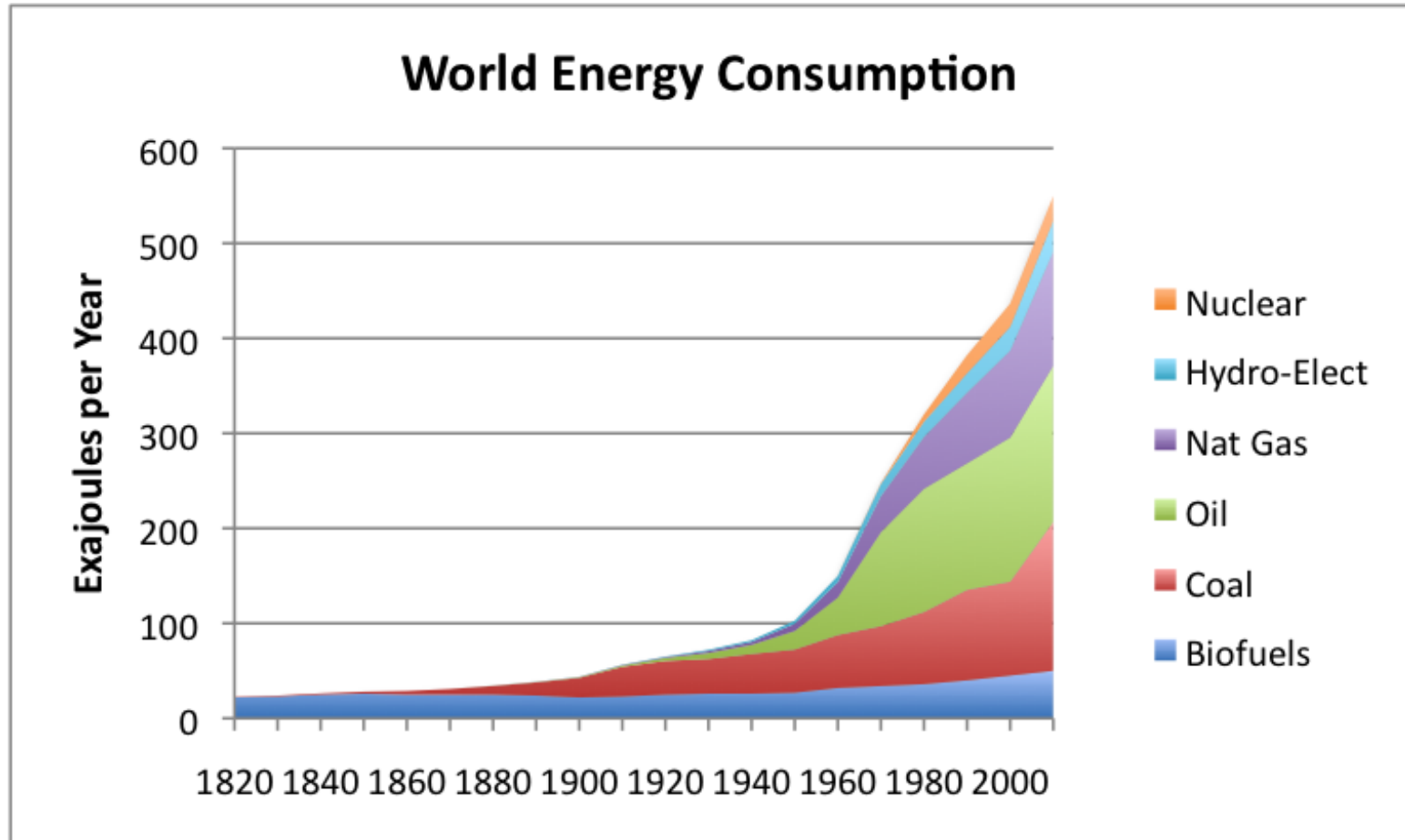
William Thomas Cain/[Getty Images](#)

A point on our consumption Energy consumption

World energy consumption 1800-1995 (Mtep)



World energy consumption by source 1820-2000



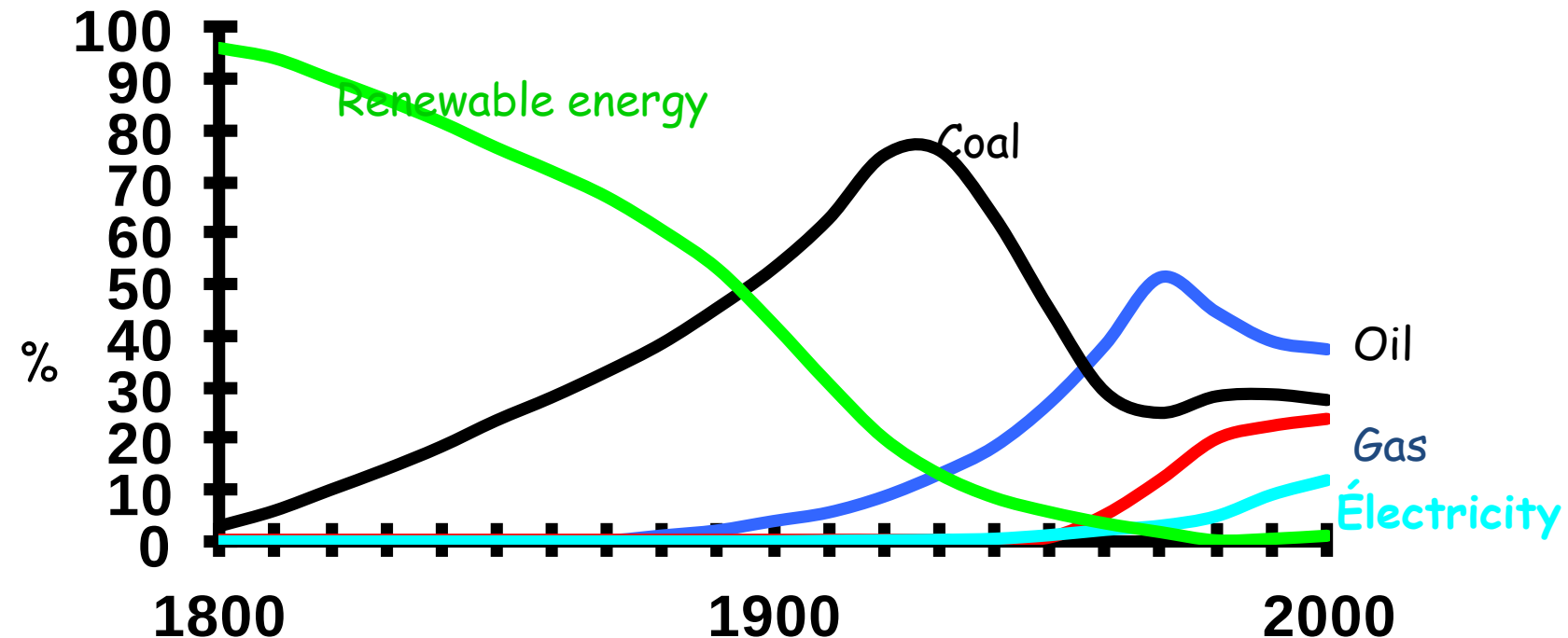
World Energy Consumption by Source, Based on Vaclav Smil estimates from Energy Transitions: History, Requirements and Prospects together with BP Statistical Data for 1965 and subsequent

Renewable energy has dominated the history of humanity

19th century wood, water, wind, animal traction, slaves

19th century coal, steam

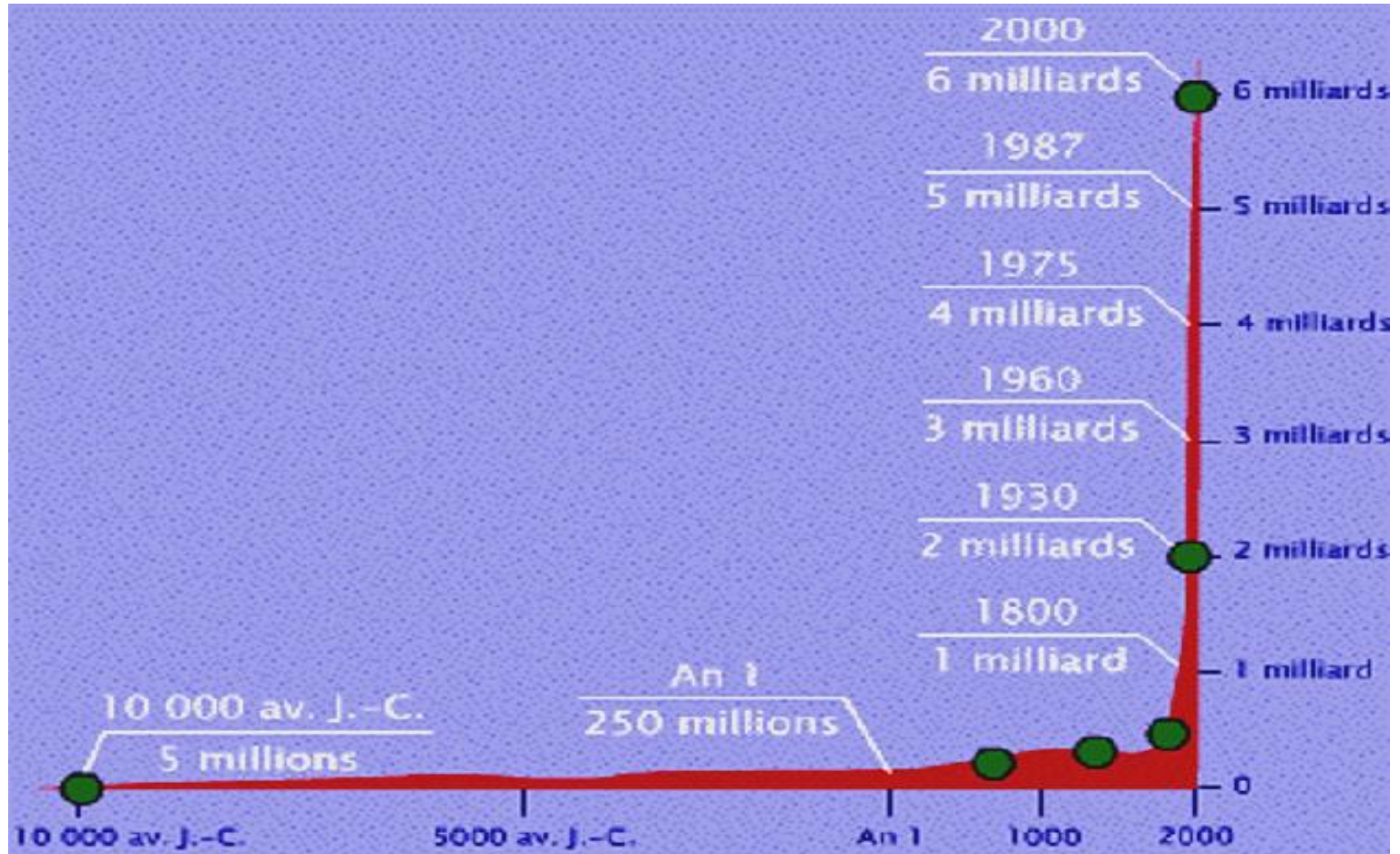
20th century oil, gas, hydro, nuclear



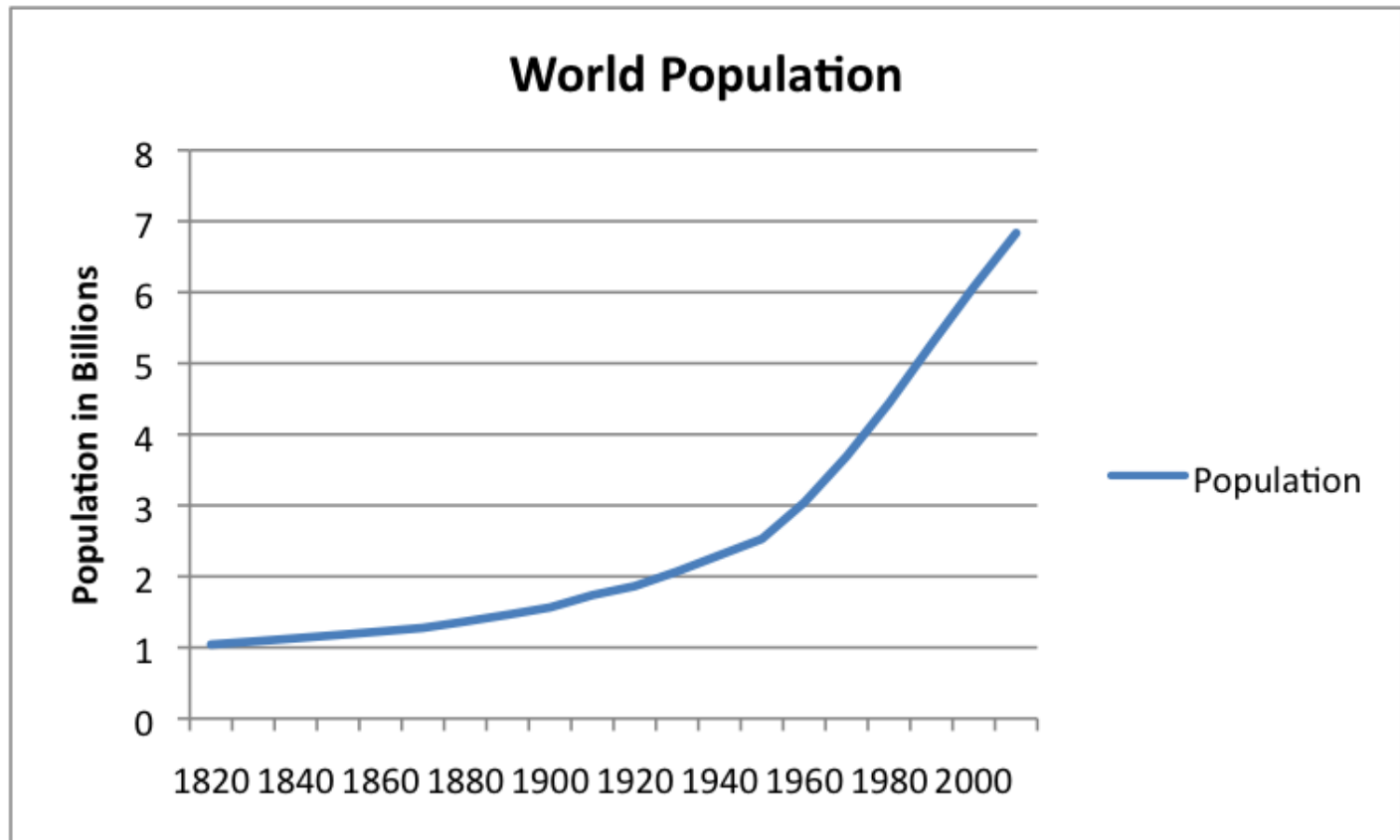
Can we go back to renewable energy?

And have power when you need it and not when it is available

World population BC-2000

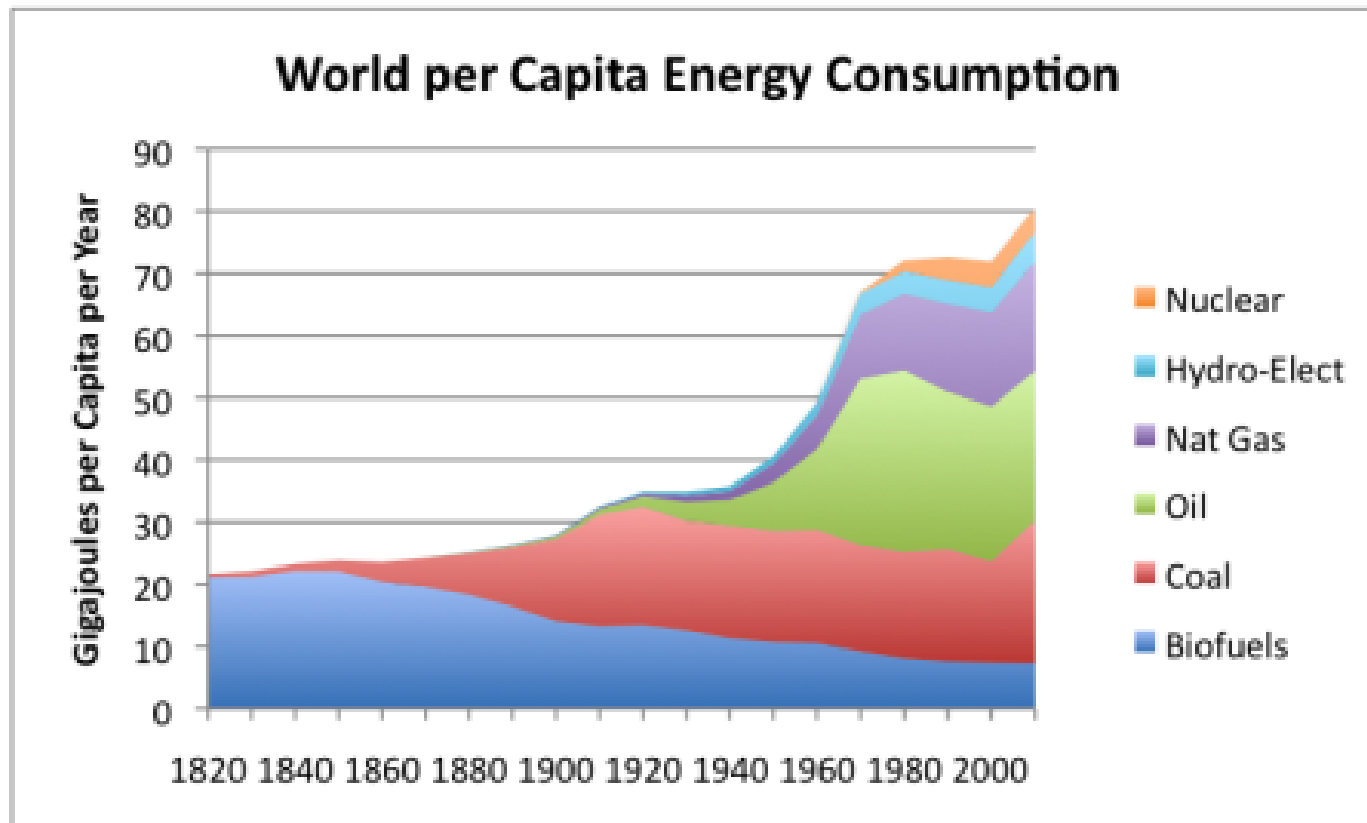


World population 1820-2000



From 1 billion to 7 billion people in two centuries.....

World per capita energy consumption

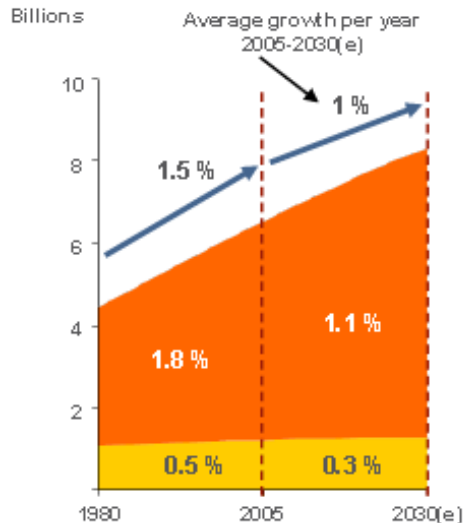


- Per capita world energy consumption, calculated by dividing world energy consumption

Global Population, GDP and Energy demand growth

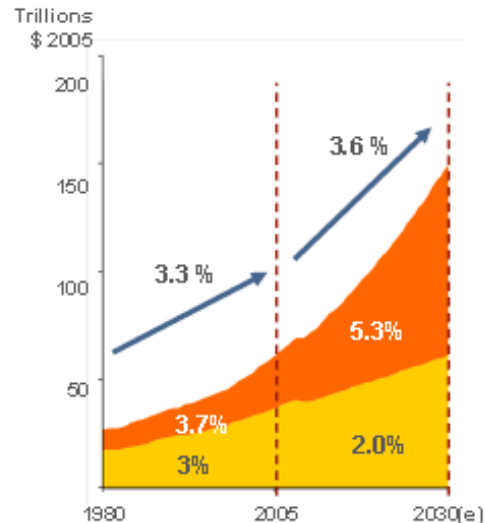
Global energy demand growth

Population

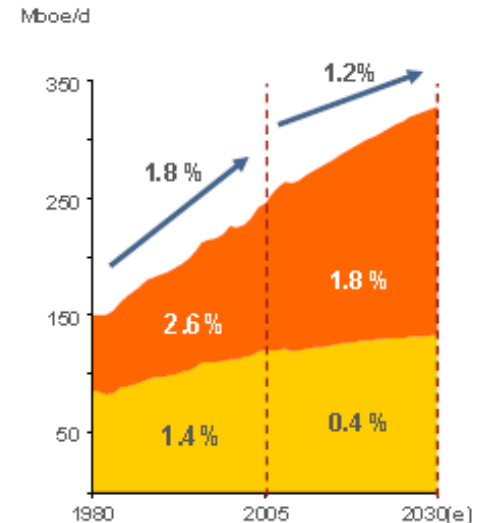


GDP

(purchasing power parity)



Energy demand



● OECD ● Non-OECD

Sustainable consumption ?

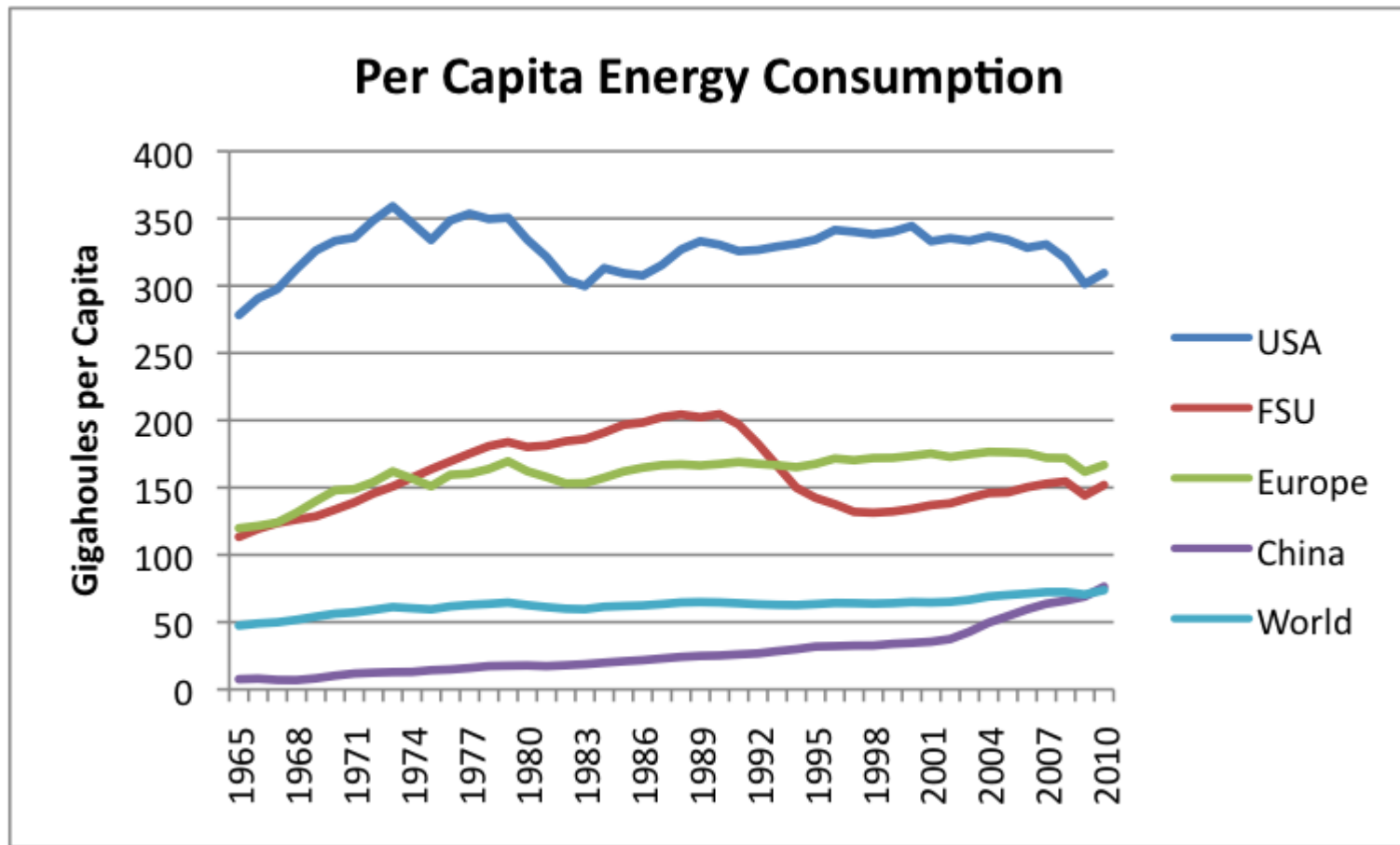
Inequalities in wealth and income, in the world population

- In today's world of 7 billions people, inequalities are stark.
- 2 billion people live under the poverty line of £2 a day.
- The remaining 5 billion people divide into three groups:
- Three billion live with less than £40 a day, which allows basic electricity consumption in their homes - a light bulb and maybe a stove
- One billion live with less than £80 a day, enough to run a washing machine
- One billion have comparable lives to the developed world and are able, for example, to afford fly on holiday

World energy consumption will grow by 56% between 2010 and 2040

- EIA's recently released [International Energy Outlook 2013](#) projects that world energy consumption will grow by 56% between 2010 and 2040, from 524 quadrillion British thermal units (Btu) to 820 quadrillion Btu.
- Most of this growth will come from non-OECD (non-Organization for Economic Cooperation and Development) countries, where demand is driven by strong economic growth.

Per capita energy consumption for selected countries



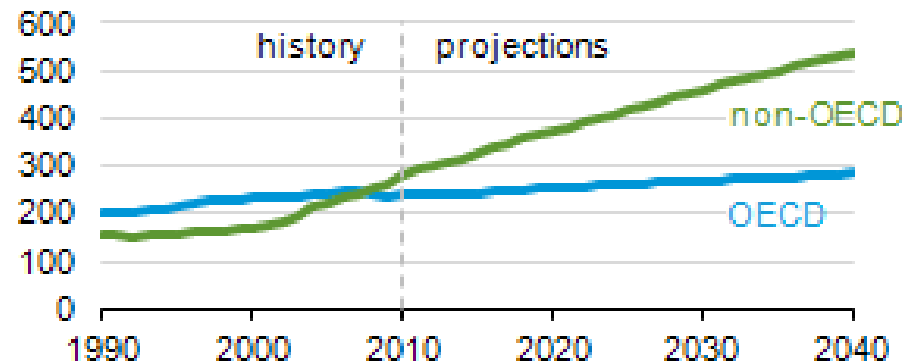
- Per capita energy consumption for selected countries, based on BP Statistical Data energy consumption
- FSU refers to the Former Soviet Union. Europe refers to a list of 12 large countries.

Forecasts for 2040-2050

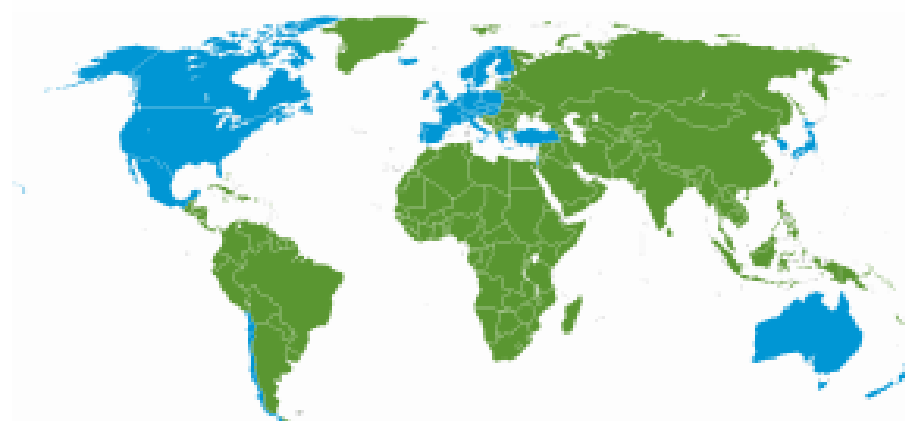
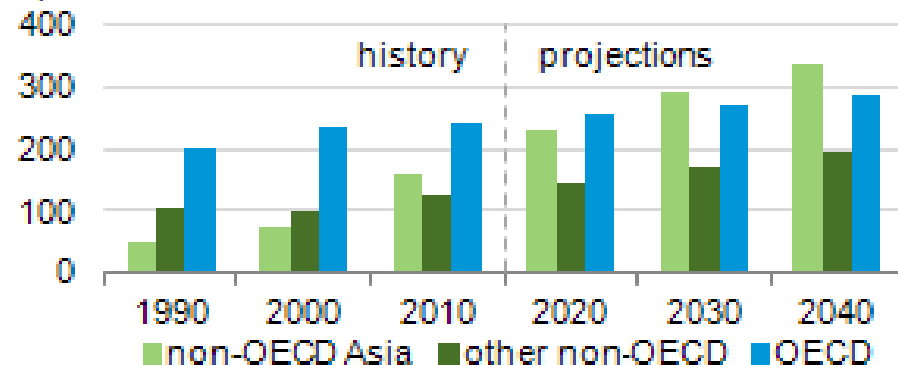
- EIA's International Energy Outlook 2013 _projects that *world energy consumption will grow by 56% between 2010 and 2040*, from 524 quadrillion British thermal units (Btu) to 820 quadrillion Btu.
- In the Shell “New Lens scenario 2013”, with the world population headed towards 9 billion at mid-century, and millions of people climbing out of poverty, *global energy demand could increase by as much as 80% at mid century*.
- Most of this growth will come from non-OECD (non-Organization for Economic Cooperation and Development) countries, where demand is driven by strong economic growth.

EIA projects world energy consumption will increase 56% by 2040 (IEA July 2013)

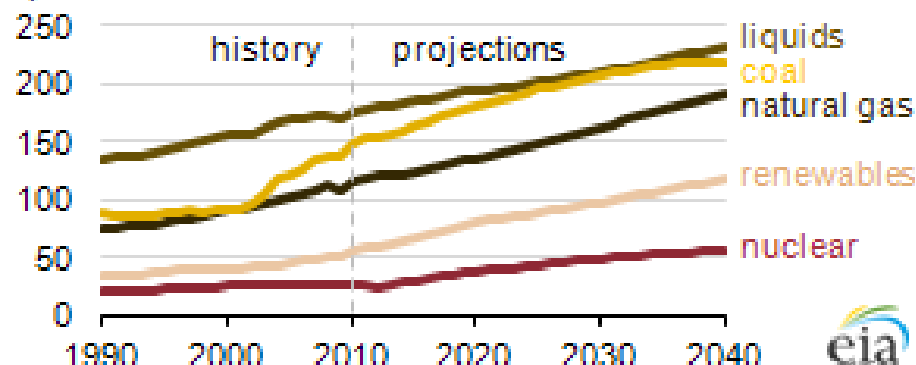
World energy consumption
quadrillion Btu



World energy consumption
quadrillion Btu

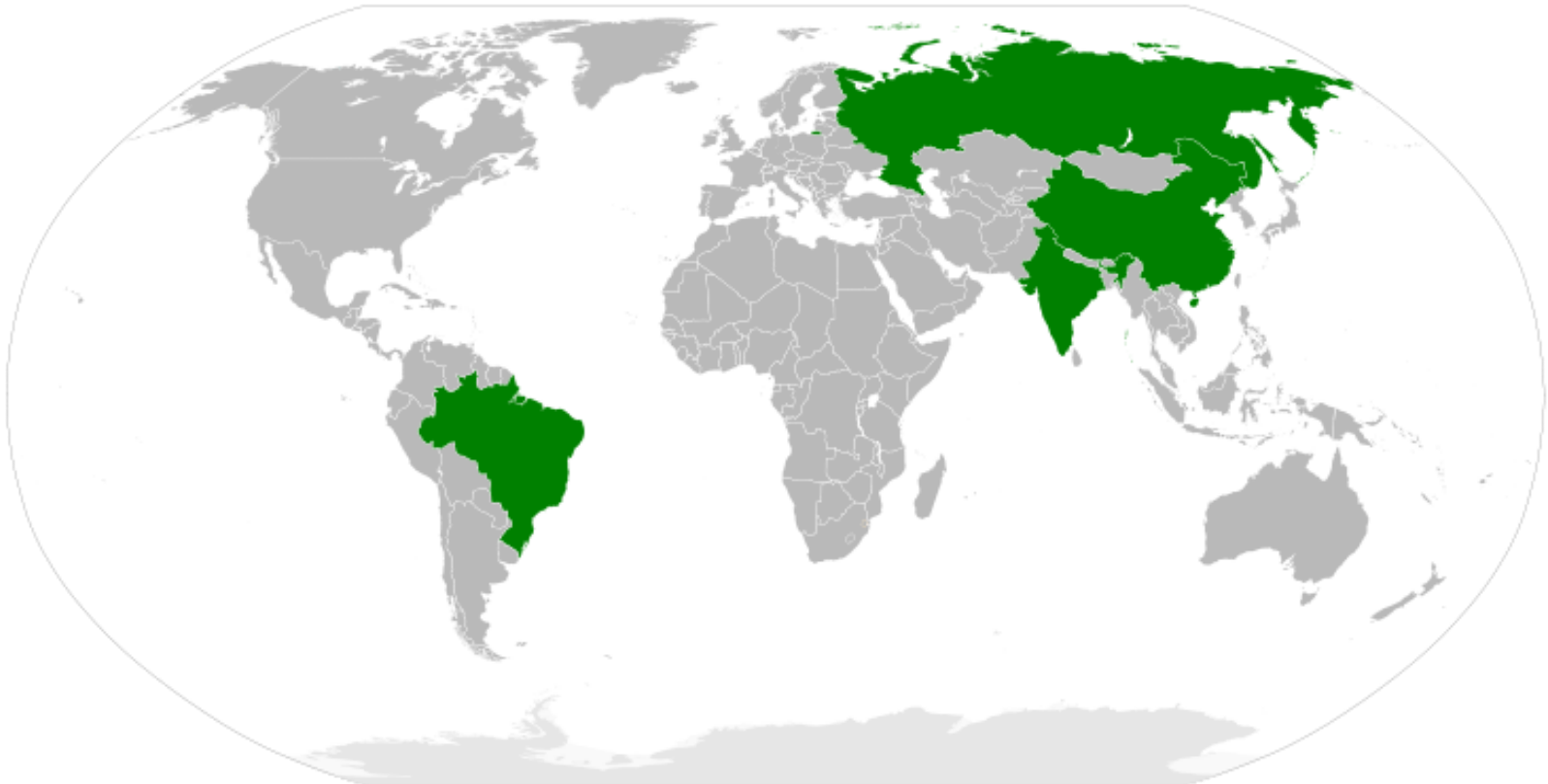


World energy consumption by fuel
quadrillion Btu



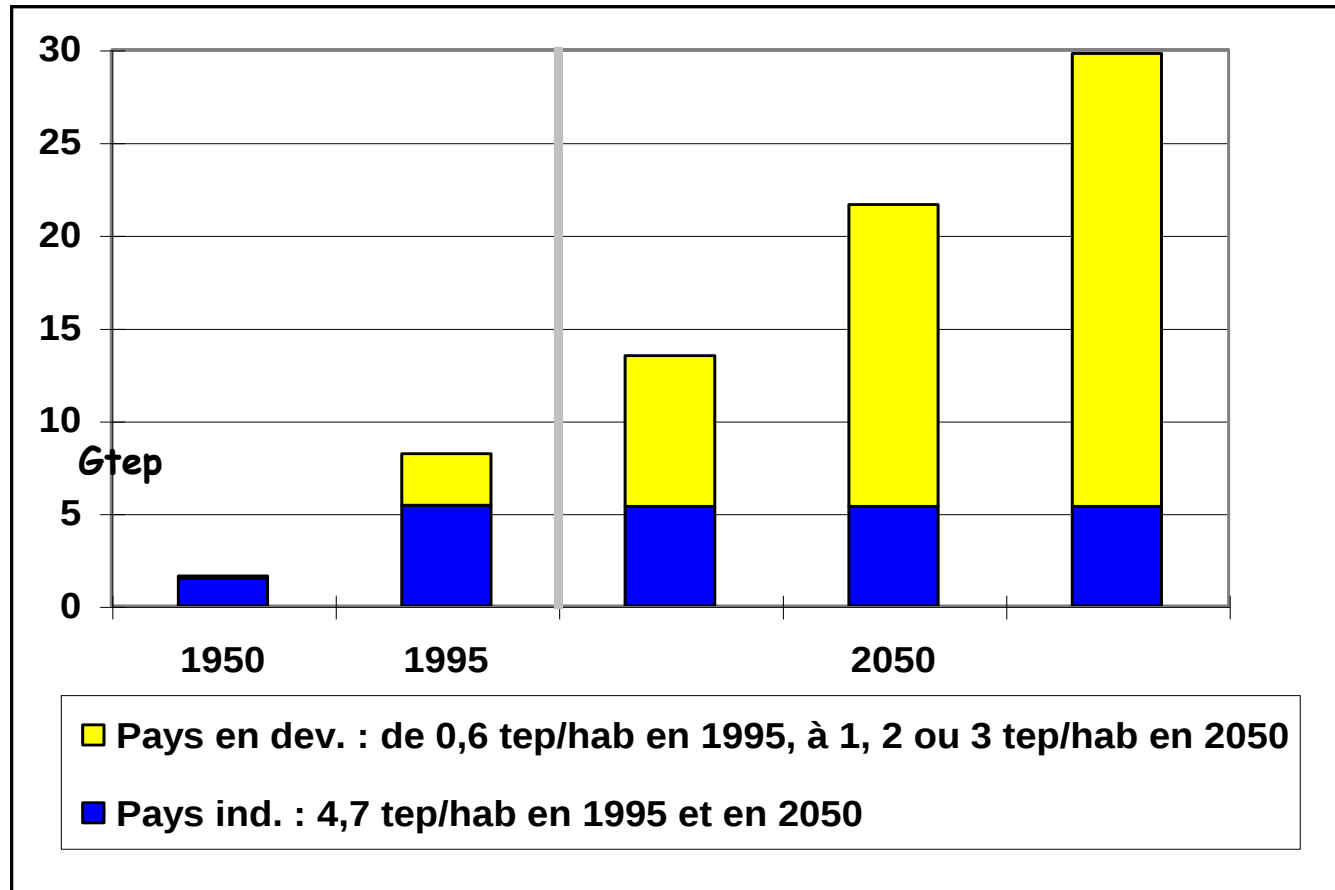
Bric Countries energy consumption growing

- **Bric Countries :** Brazil, Russia, India, China
- Other countries : Chile, Argentina, Africa and Mediterranean ...



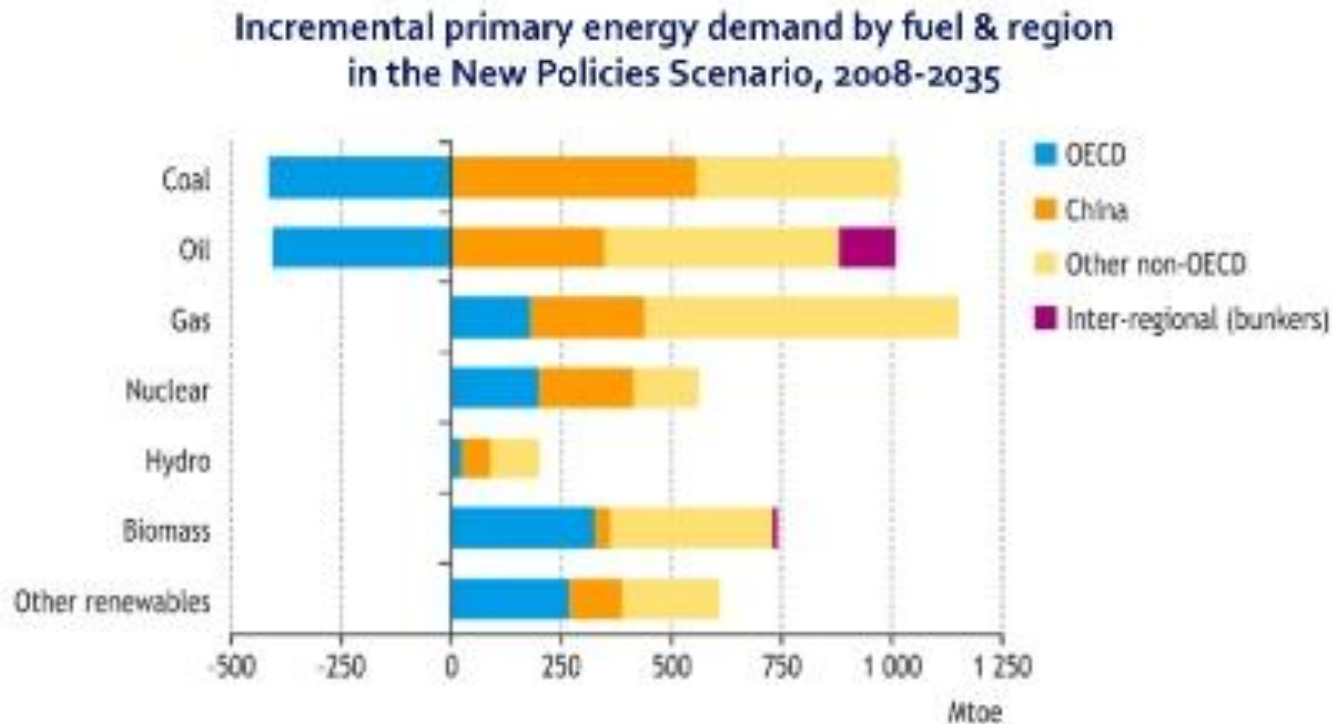
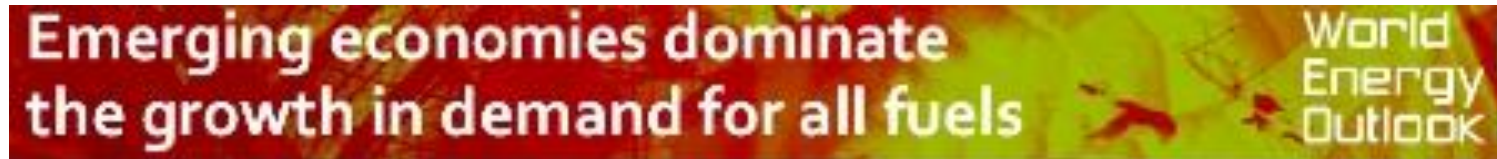
Three scenarios of World Energy consumption by 2050

Consumption per capita : Steady for industrialized countries,
for the developing countries : 1, 2 or 3 toe per capita ...
1 tep (toe) is equivalent to 41.86 GJ or 39.68 MMBtu



Population of developing countries: from 4.6 in 1995 to 8.1 Billion en 2050
Population of industrialised countries : from 1.15 to 1.14 Billion

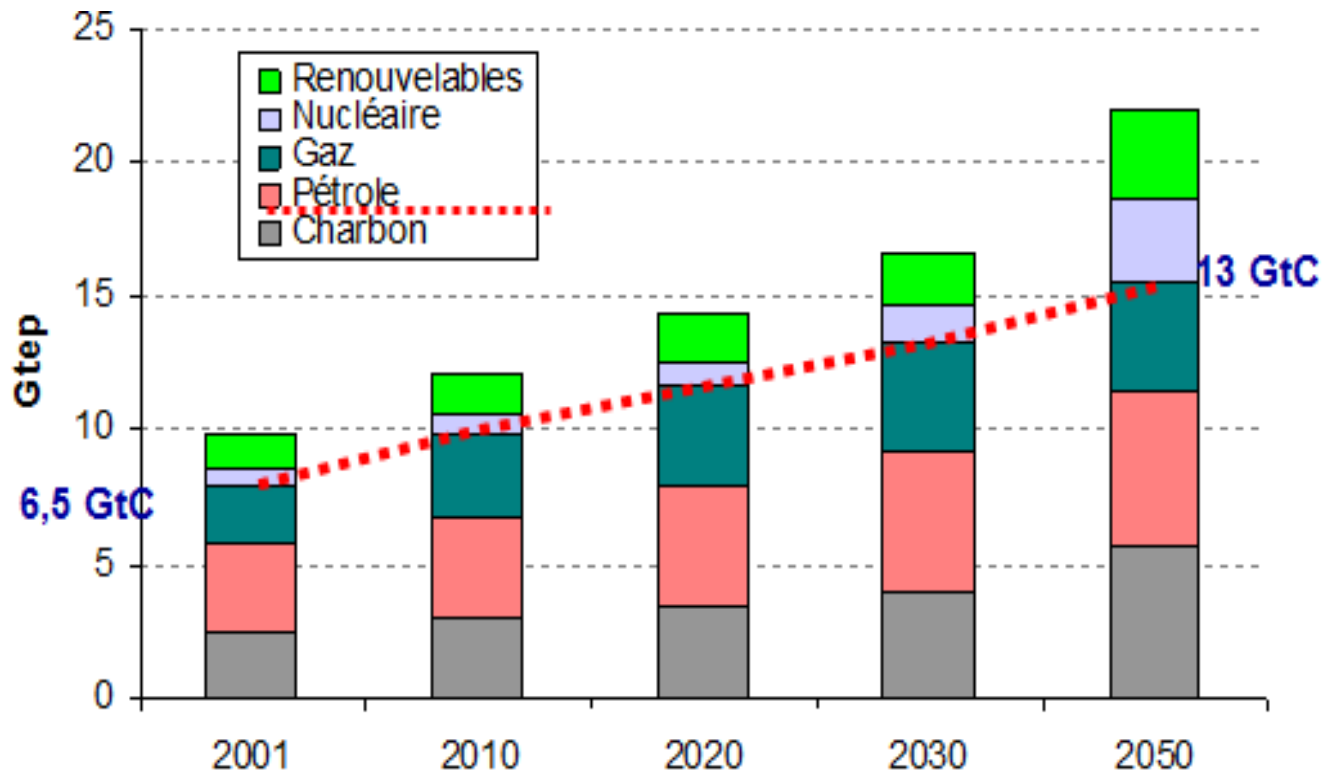
Emerging economies dominate the growth in demand for all fuels



*Demand for all types of energy increases in non-OECD countries,
while demand for coal & oil declines in the OECD*

A point on our consumption Energy consumption...

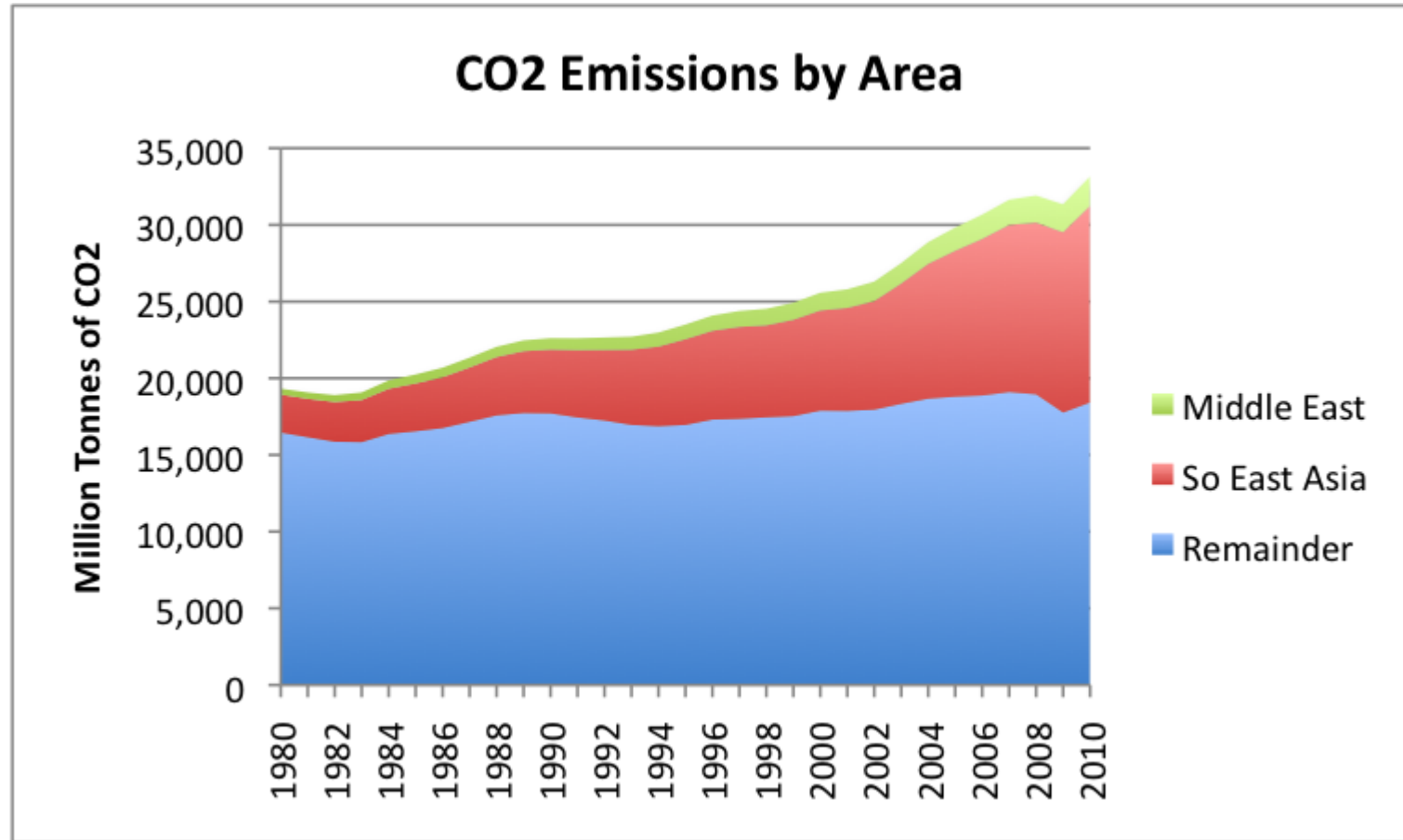
Not enough oil... but too much coal



Without energy and climate policies, global energy consumption and emissions would double by 2050

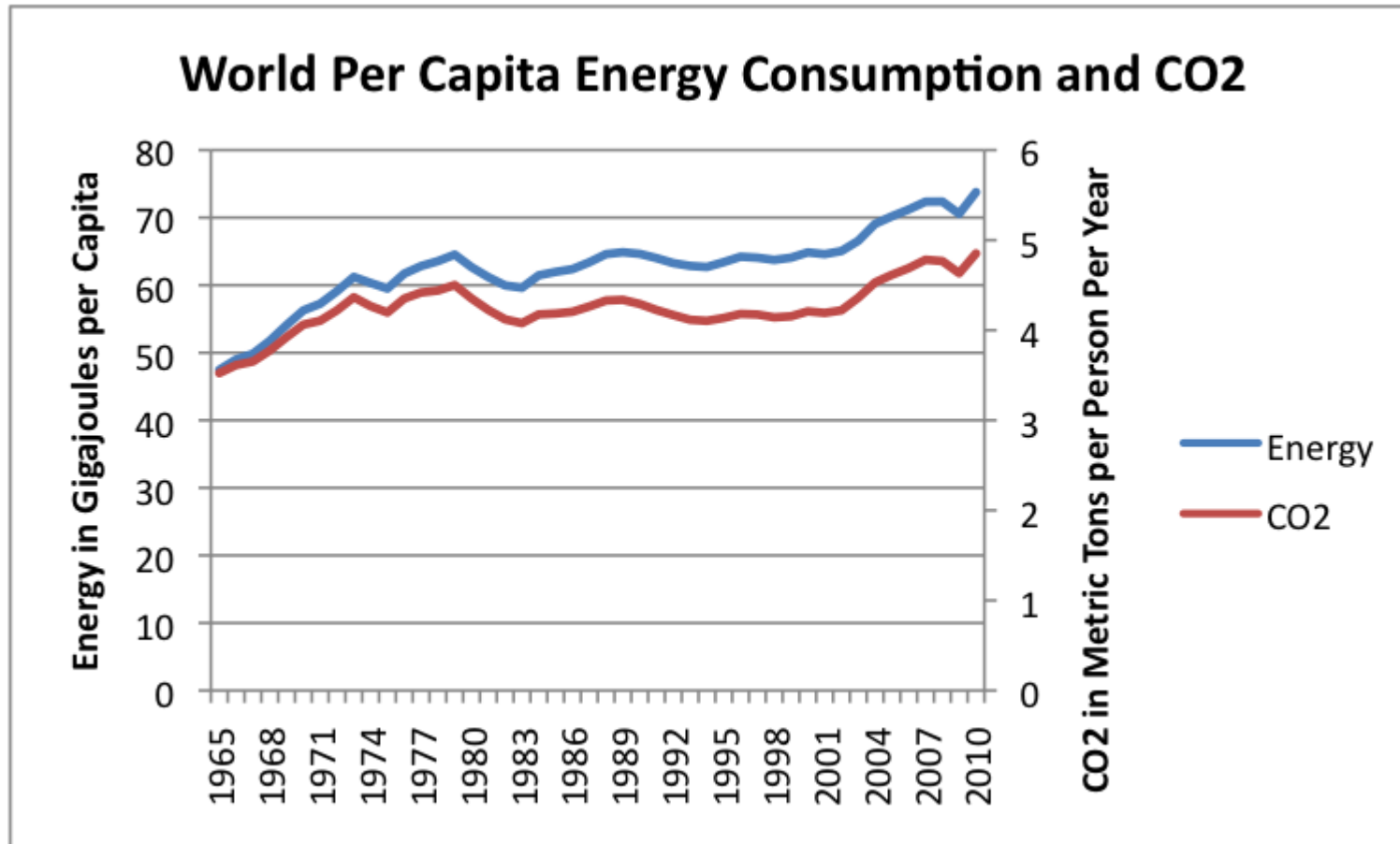
CO2 emissions by Area

(Middle East South East Asia)



Carbon dioxide emissions by the three major areas described (Southeast Asia, Middle East, Remainder), based on BP Statistical Data

World per Capita energy consumption and CO2



If we compare the growth of CO2 emissions and the growth of energy use, both on a per capita basis, we see that the CO2 emissions grew more slowly than energy consumption in the 1970 to 1990 period, so the lines increasingly diverged. This divergence appears to result from the changing fuel mix (more nuclear and more natural gas, relative to coal) during the period. Since 2000, the two lines are approximately parallel, indicating no further CO2 savings **given the greater use of coal** again. Wind and solar contributions are not large enough to make an appreciable difference in CO2 levels

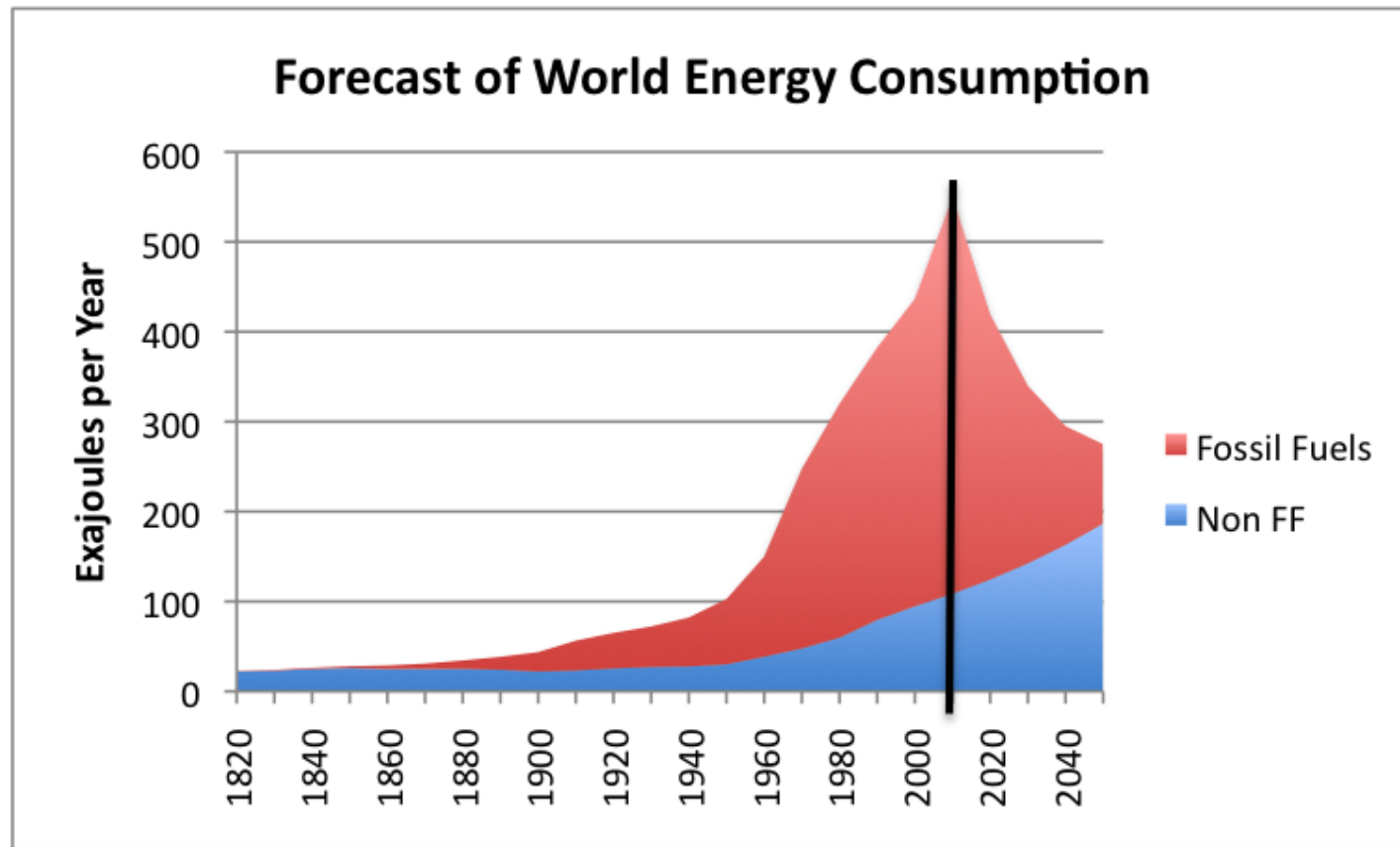
Growing Needs in Energy for Water

The needs in Energy for Water will increase, with population, urbanization and Climate change

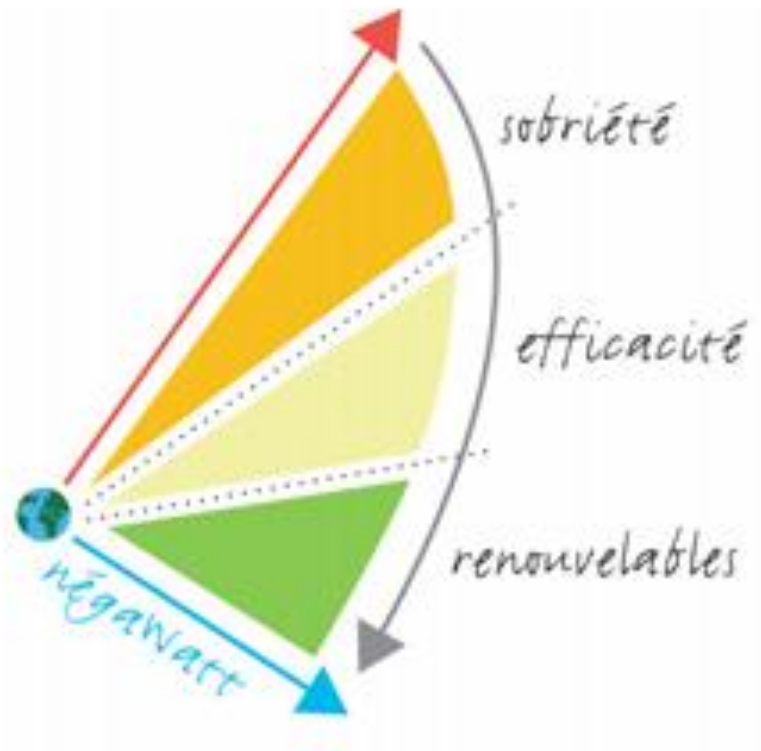
Examples:

- Desalination of seawater for water supply
- Large scale pumping for irrigation
- Large scale pumping for inter-basin transfers...
- Energy for water represents between 5 and 10% of electricity, in many countries, and this part will increase with the effects of climate change

Peak Oil ? The end of fossil fuels ?



The negawatt scheme



Sobriety

Efficiency

Renewables

(In this order, sobriety first)