Non-food Biofuel Supply Chains:
Vision, Challenges, Technologies

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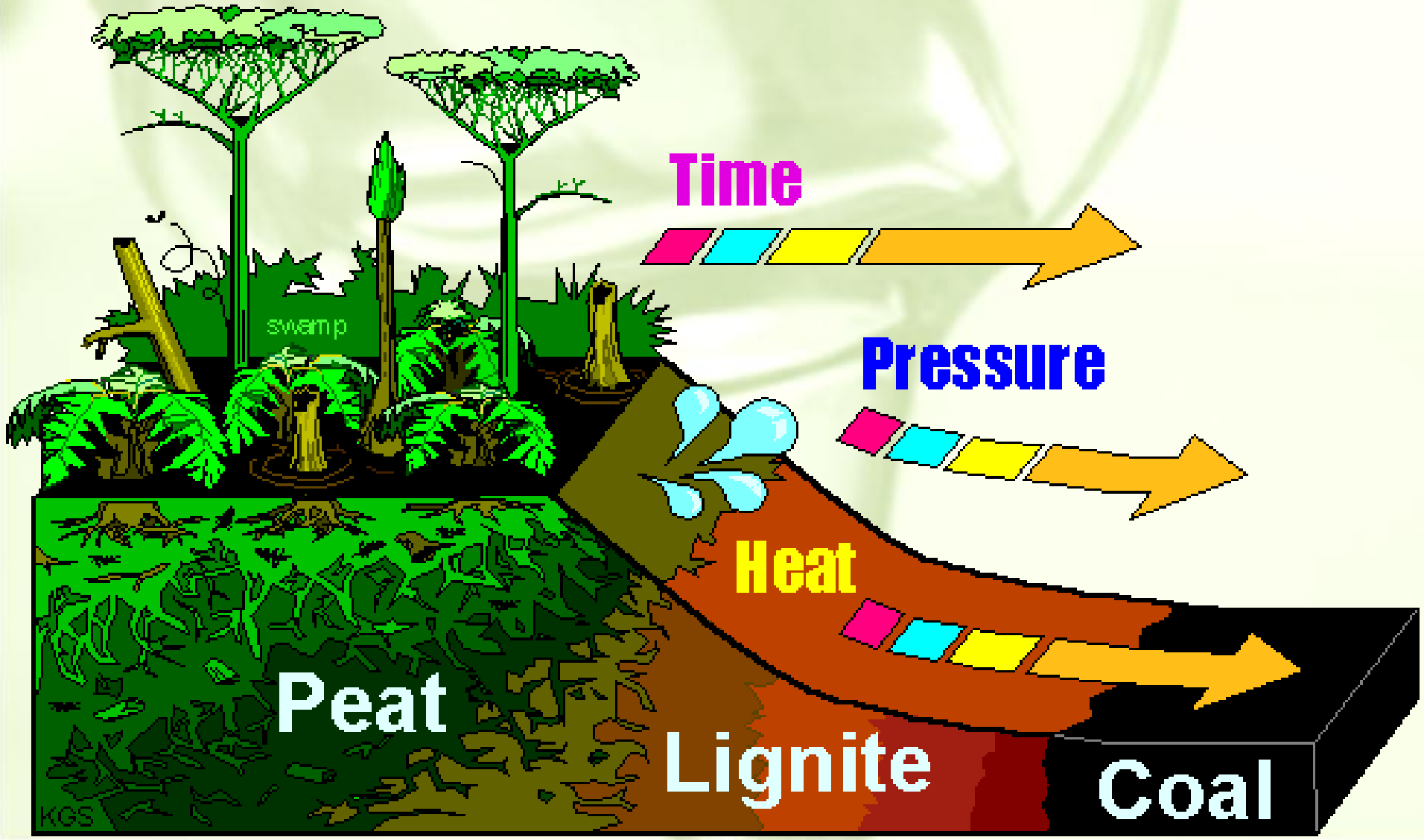
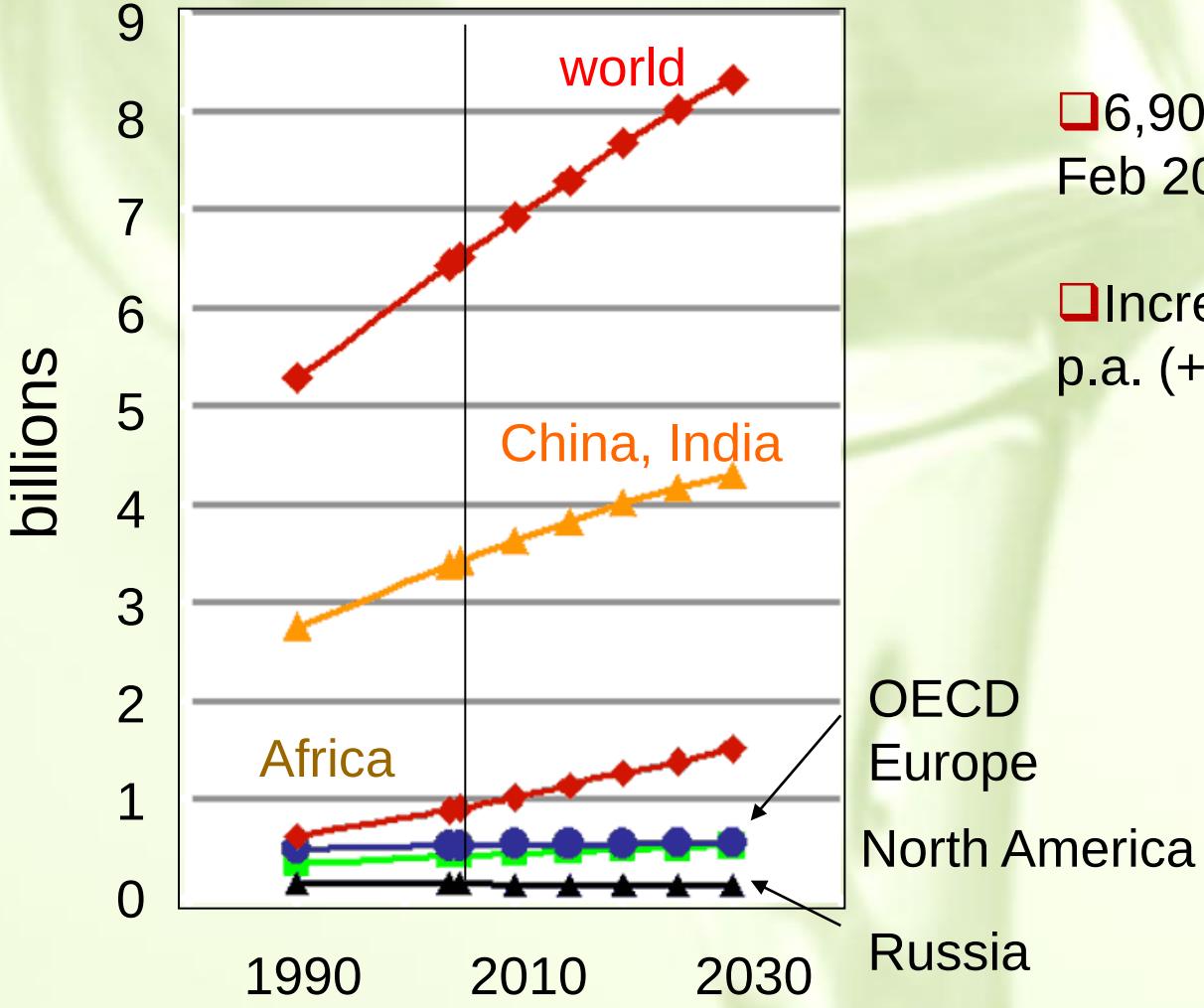
- 3,850,000 EJ solar energy absorbed by Earth per year
- More energy received in one hour than used in one year


Time
Pressure
Heat
swamp
Peat
Lignite
Coal
KGS

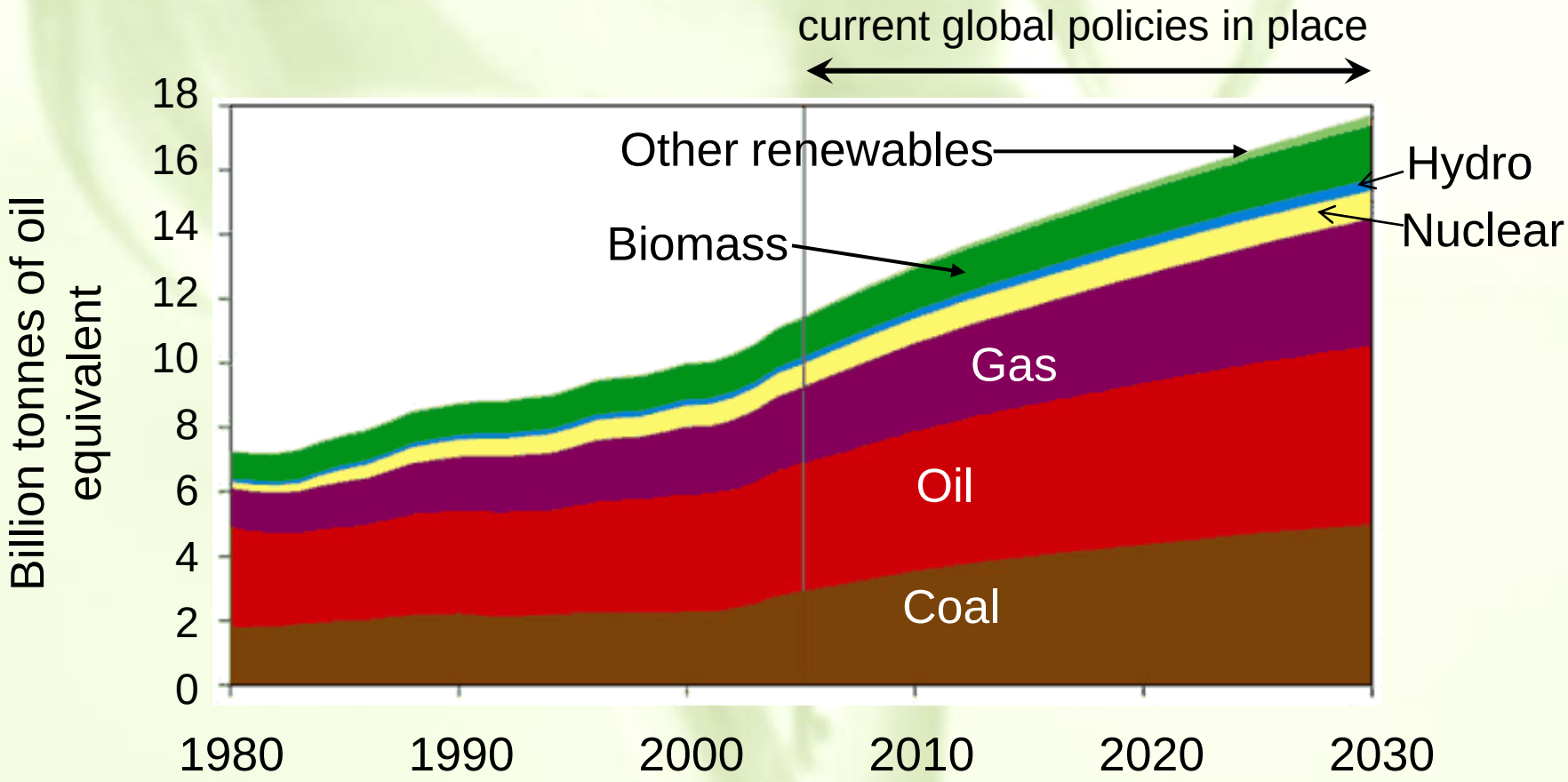
Population rising



- 6,900,078,562 on 15 Feb 2011
- Increasing 81367 million p.a. (+1.5%)

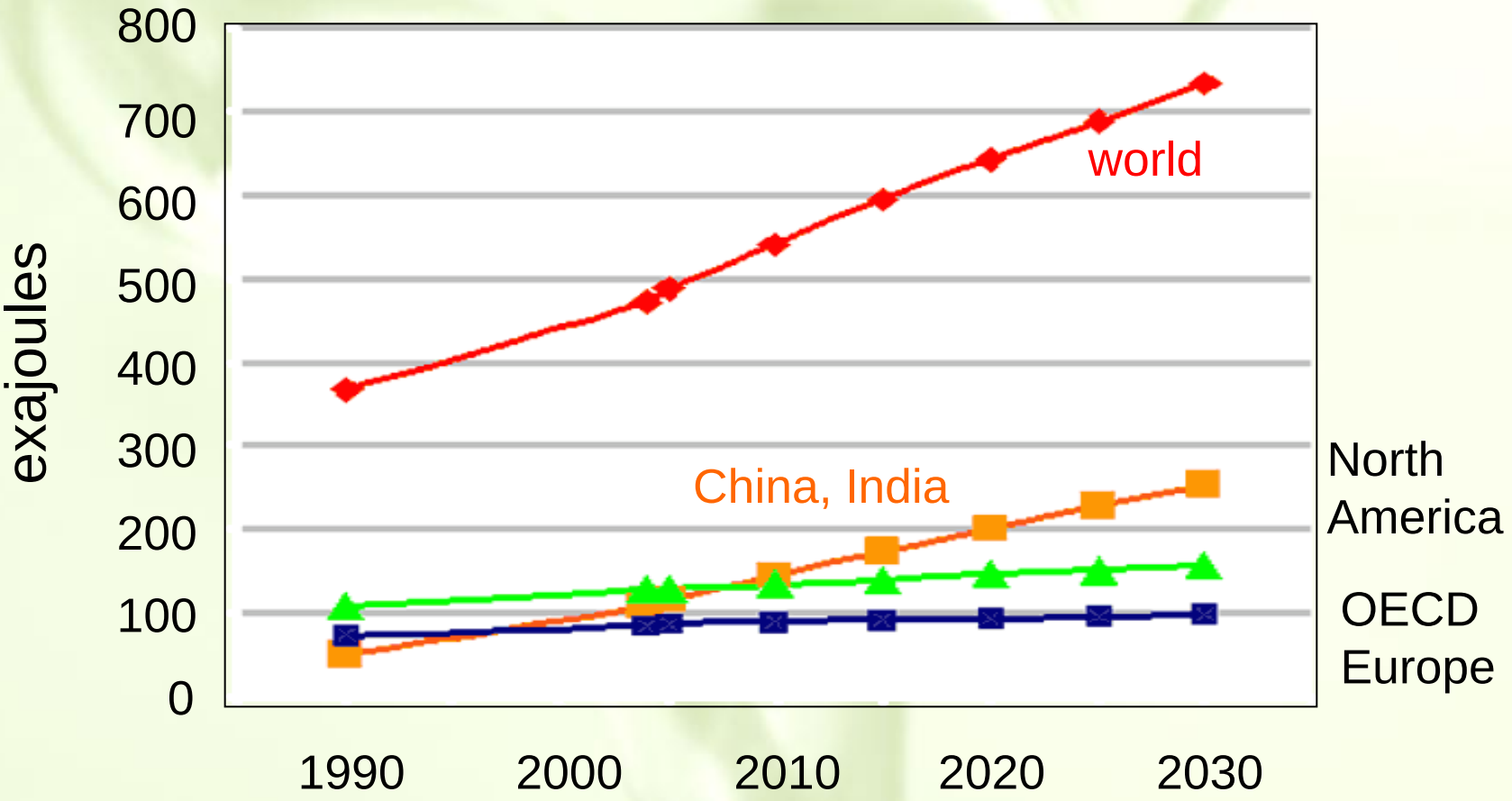
Sources: DOE/EIA Int Energy Outlook 2008
US Census bureau

Pressure on energy resources



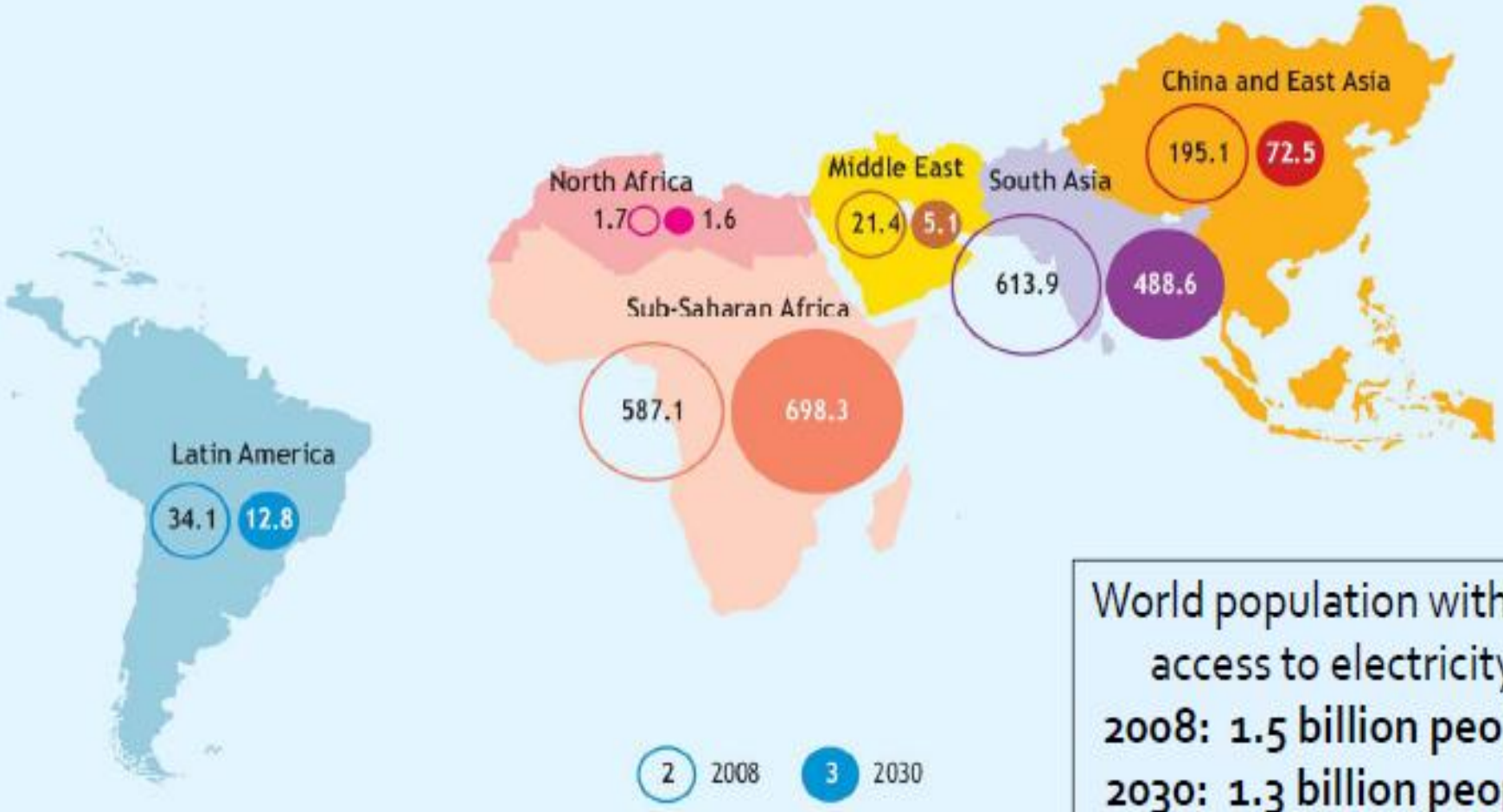
World Energy Outlook 2007

Demand for primary energy consumption



Source: DOE/EIA Int Energy Outlook 2008

Number of people without access to electricity in the Reference Scenario (millions)



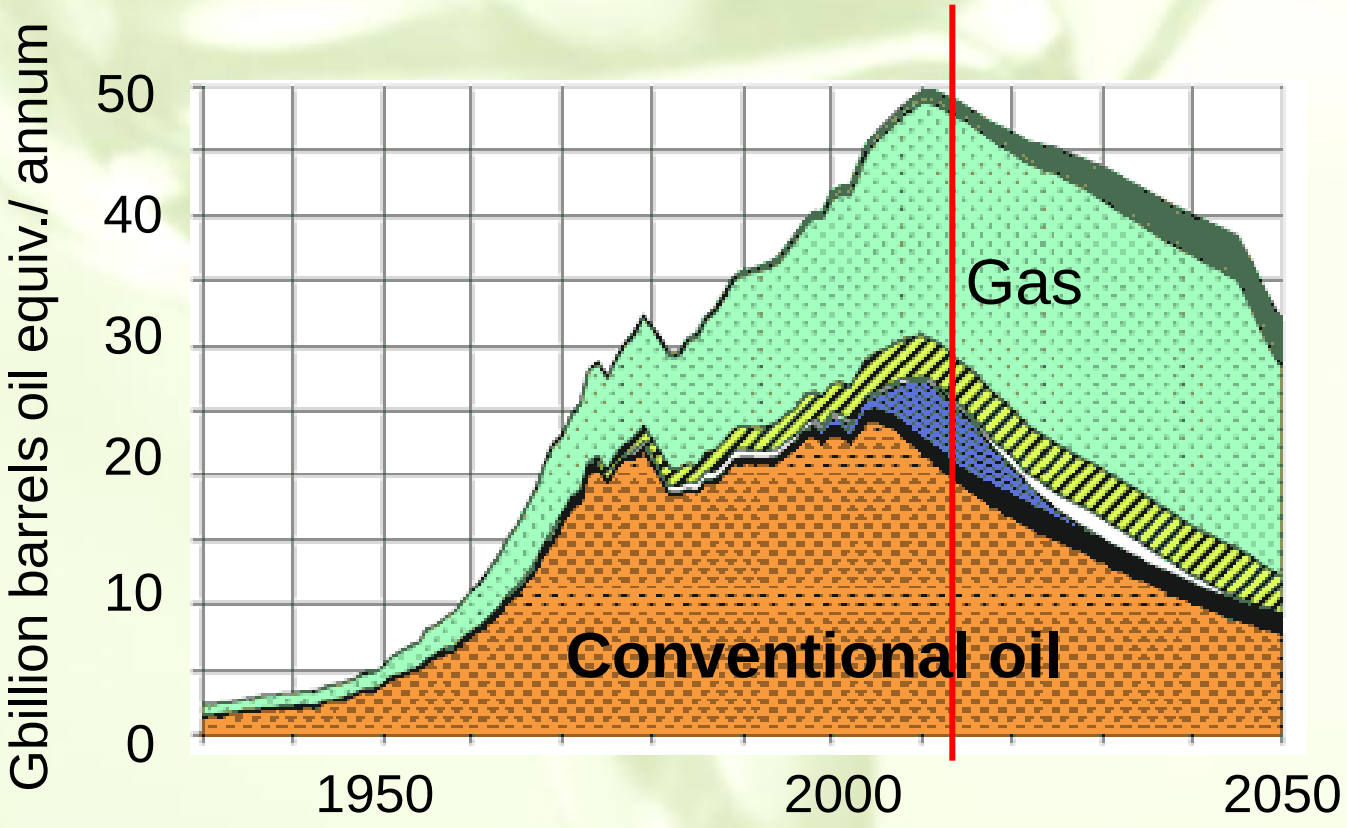
World population without access to electricity

2008: 1.5 billion people

2030: 1.3 billion people

World fossil fuel reserves & availability declining

production peak in all world hydrocarbons ~ 2012



Source: Association for the study of peak oil and gas 2006

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Environment › Peak oil

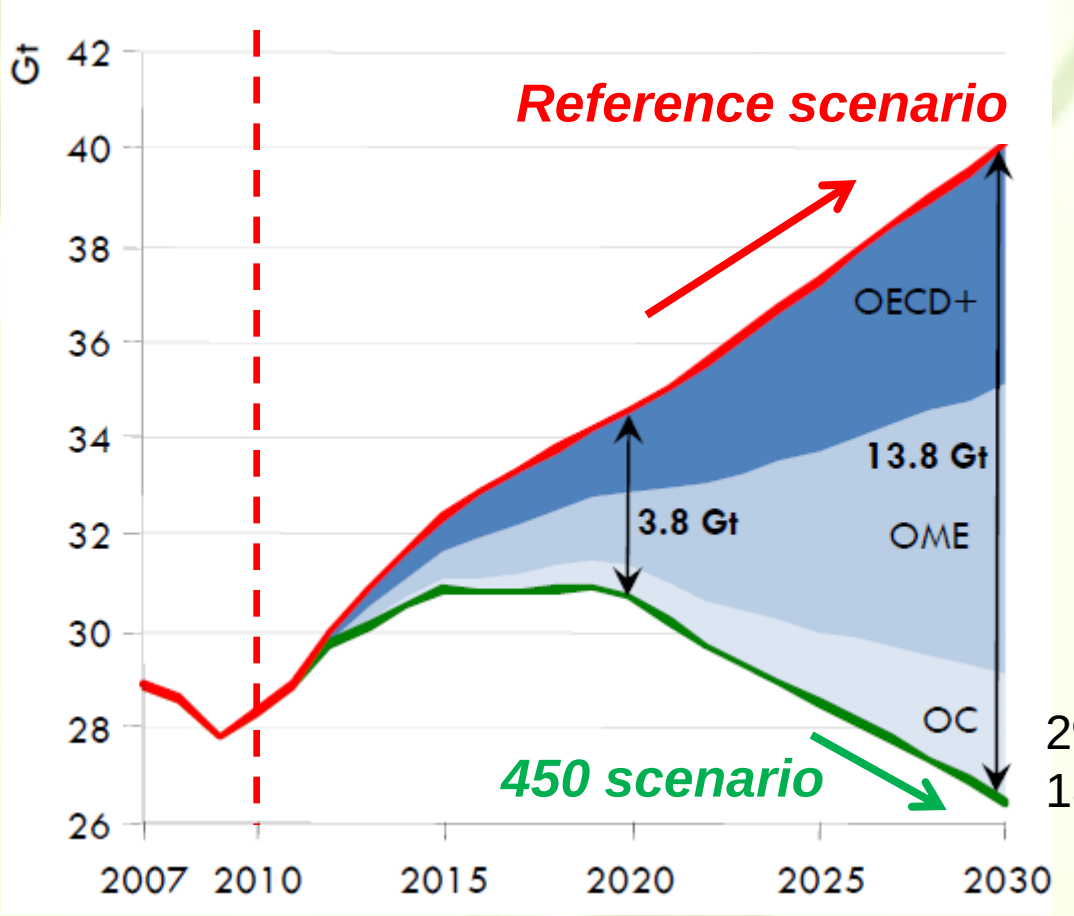
Peak oil: We are asleep at the wheel

Revelations that the Saudis have overstated their oil reserves are a timely reminder of the huge threat to the global economy

• WikiLeaks cables: Saudi Arabia cannot pump enough oil to keep a lid on prices

Jeremy Leggett
guardian.co.uk, Thursday 10 February 2011 15.20 GMT
Article history

Abatement measures needed for 450ppm $CO_{2\ eq}$ by 2030



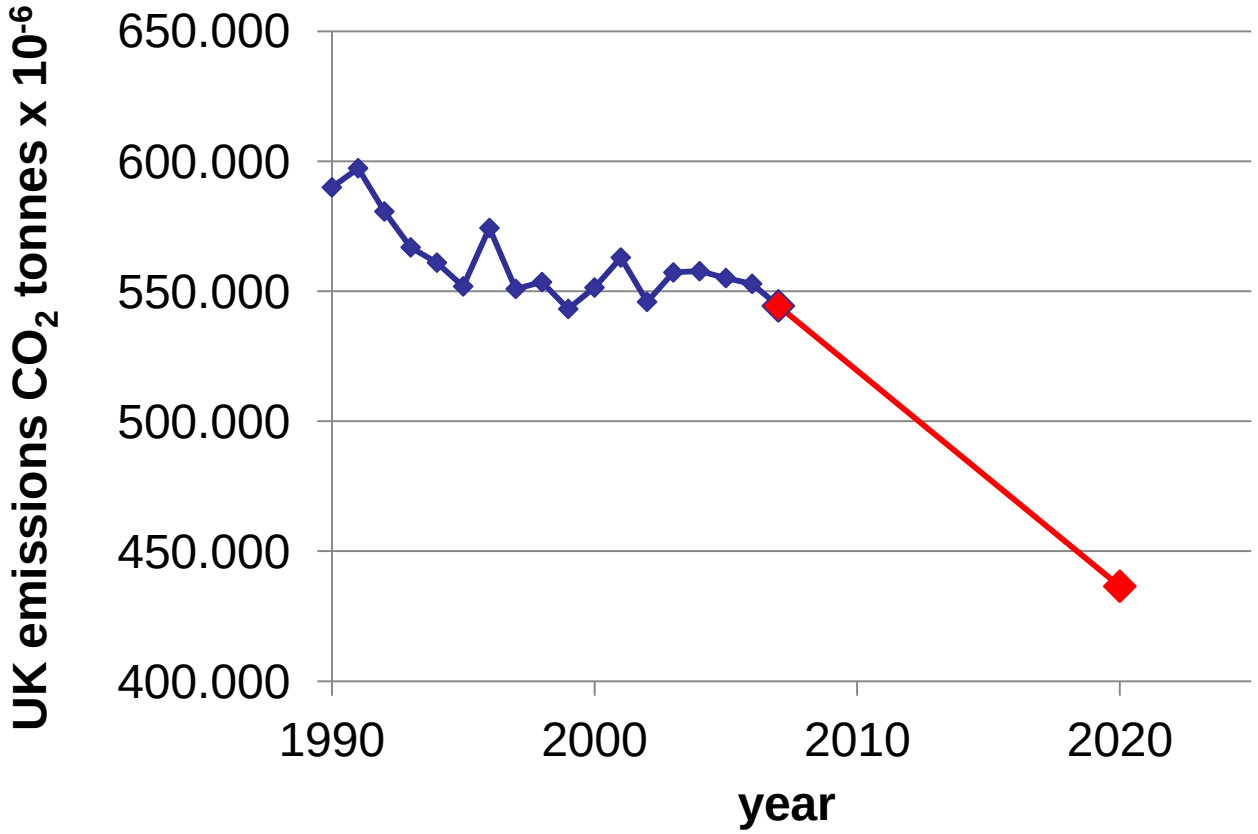
2º rise from 1850s

WEO 2009

- 2001: European Renewables Directive (ERD)
- 2003: EU Biofuels Directive
- 2009: Renewable Energy Directive (RED)/Fuel Quality Directive

- 2002: Renewables Obligation - *electricity suppliers; ROCs*
- 2008: Renewable Transport Fuels Obligation (RTFO) - t*ransport fuel suppliers; RTF certificates*
- 2010: Feed-in Tariffs (FITs) *etc*

UK : Legislation

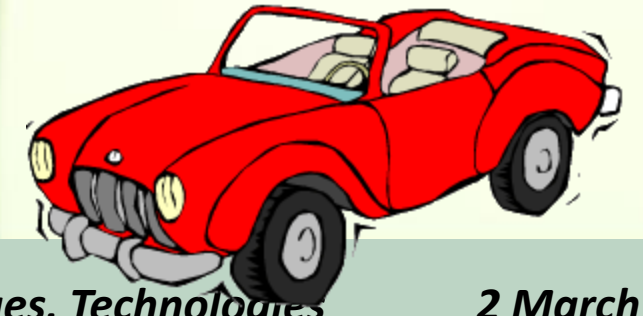


Climate Change Bill 27 November 2008


GOOD IDEA

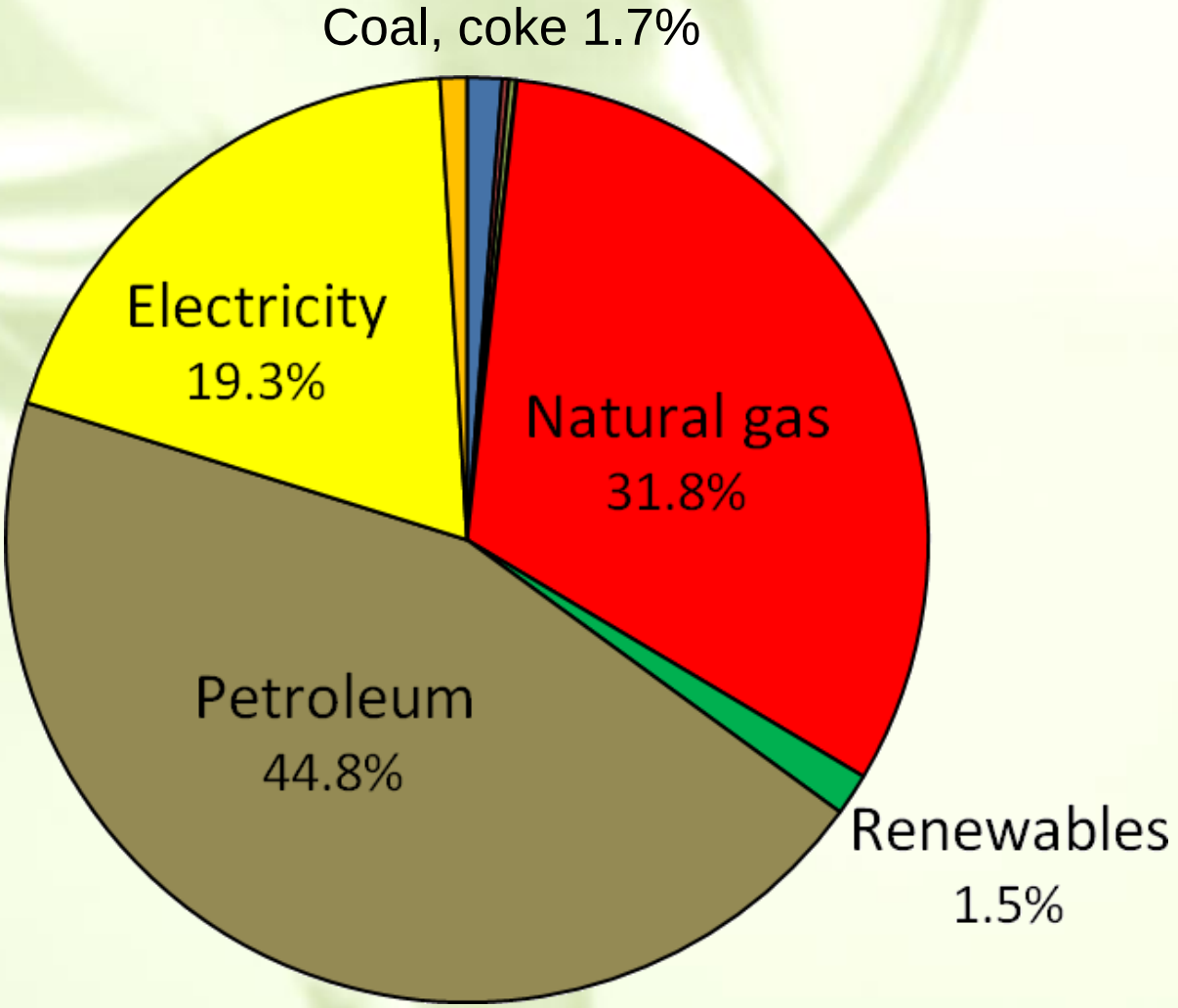
What do we (think) want?

Heating (gas)	45%
Hot water (gas)	16%
lighting (elec)	1%
TV (elec)	0.5%
Cooking (elec)	3%
Dishwasher (elec)	2%
Fridge/freezer (elec)	2%
Washer/drier (elec)	0.5%
Car (petrol)	30%



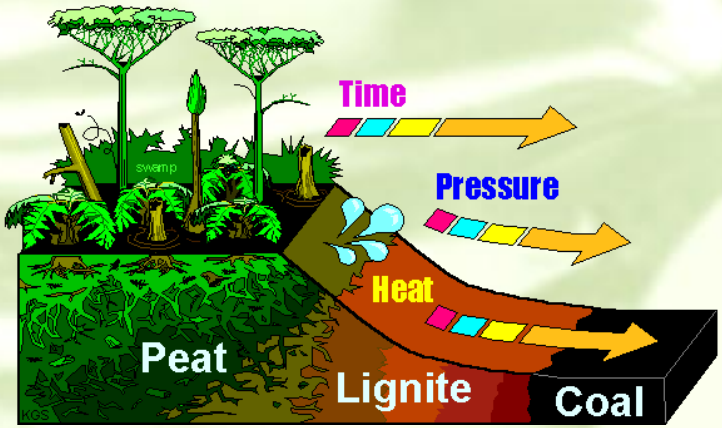
Source: New Scientist Sept 2006

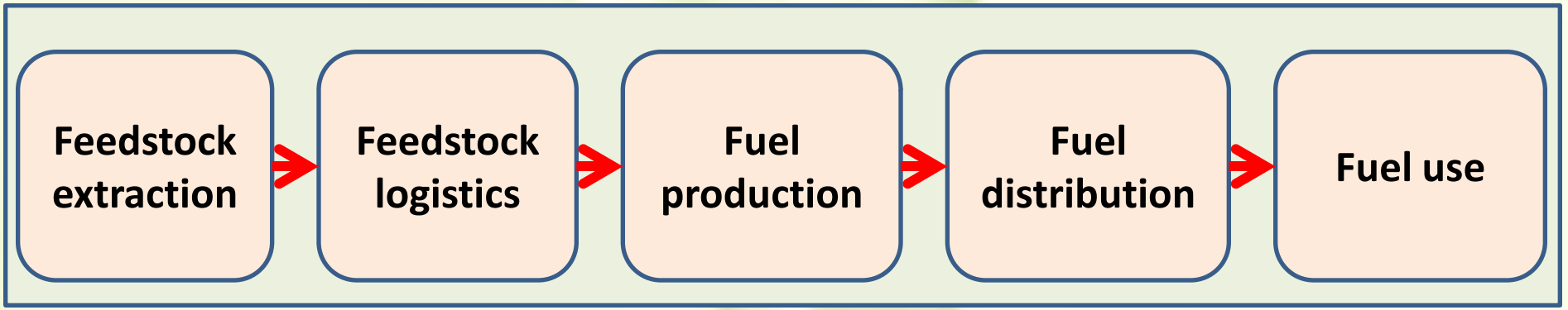
Where do we get it from now?



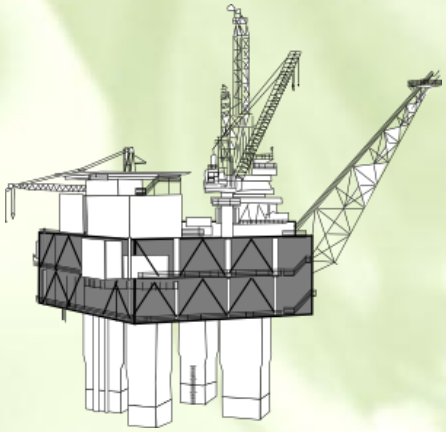
UK 2009

What does the fossil fuel supply chain comprise?

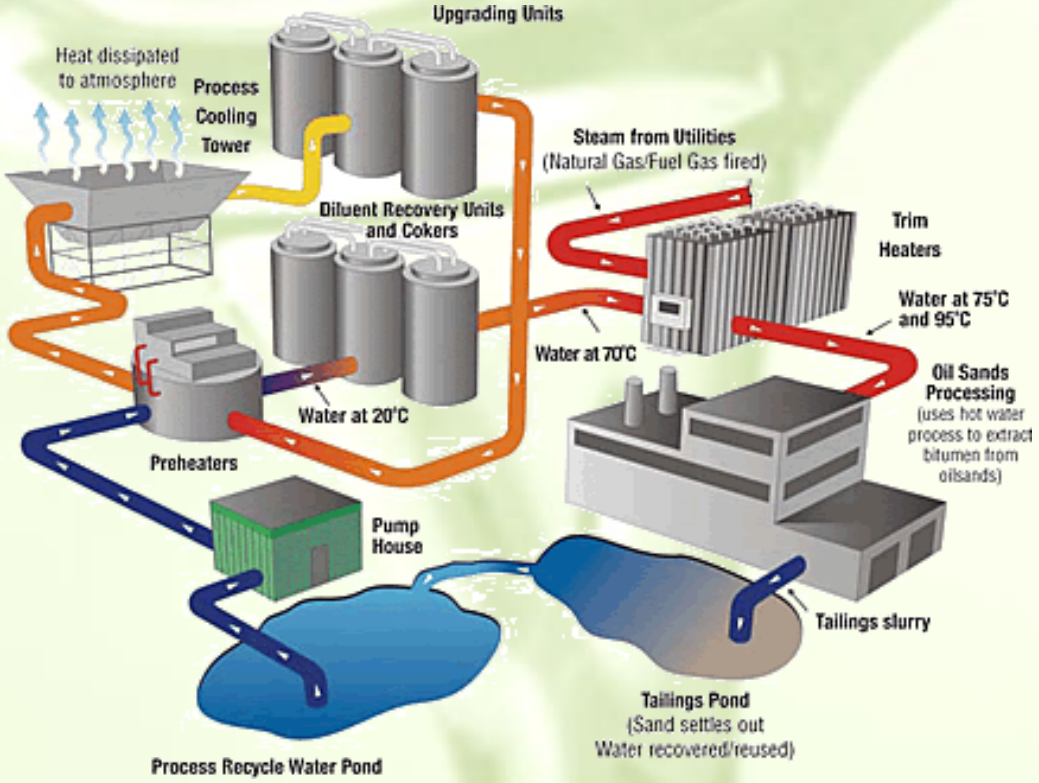




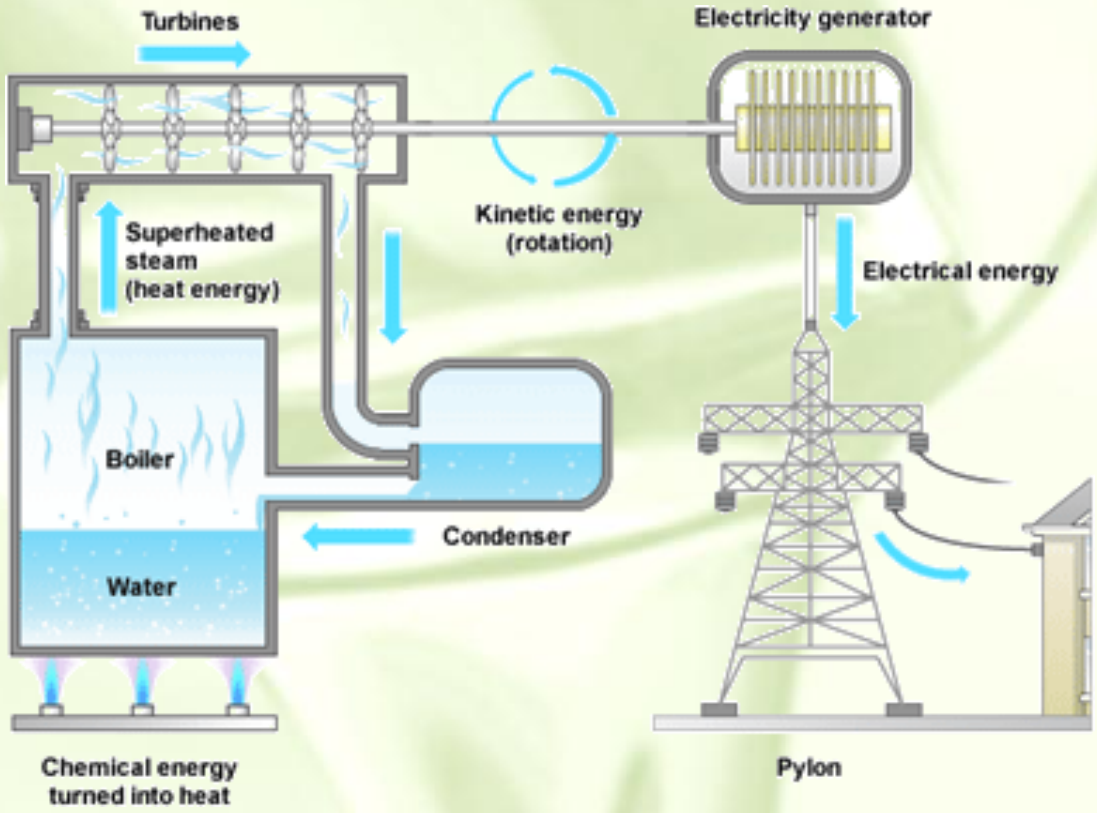
..pumped



...piped / shipped

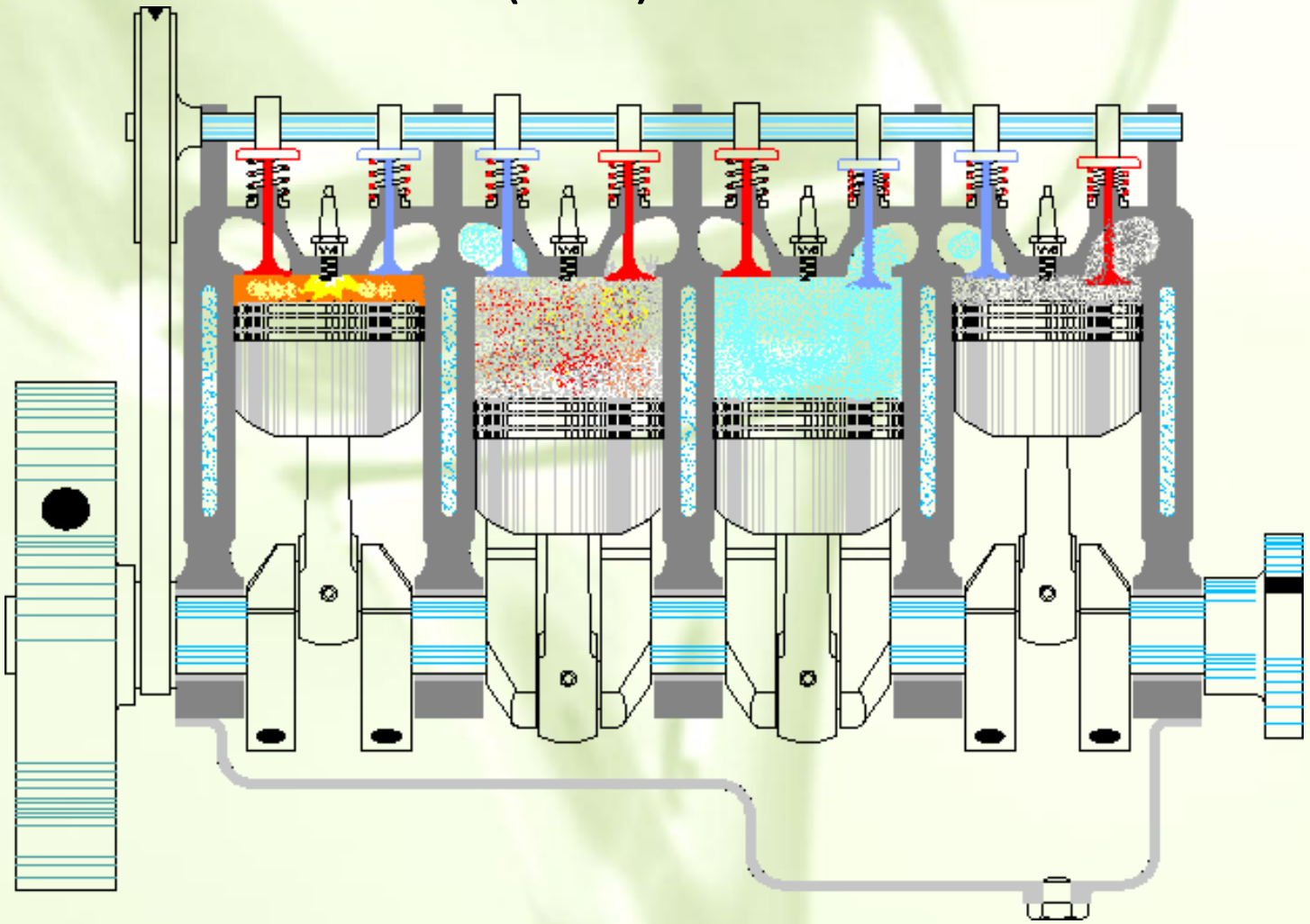


....refined

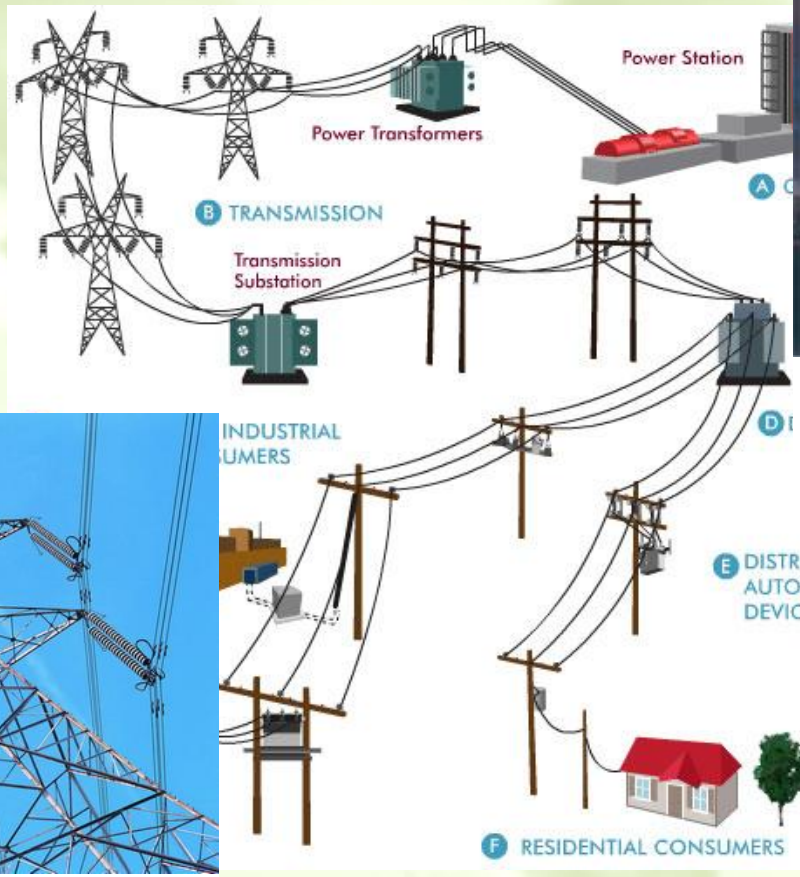


....burned in thermal power plants to produce steam and drive turbines to generate electricity

....or in Internal Combustion Engines to generate electricity and heat (CHP) – or motion



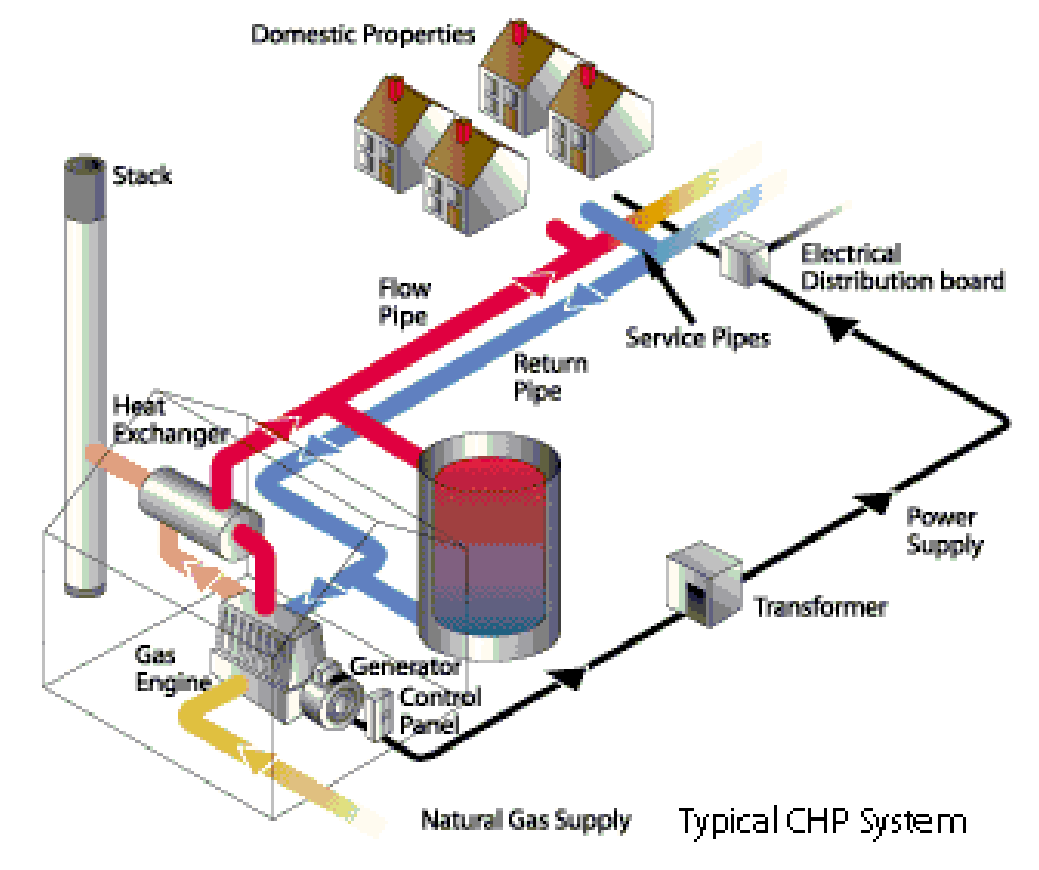
Distribution – centralised, with grid operators



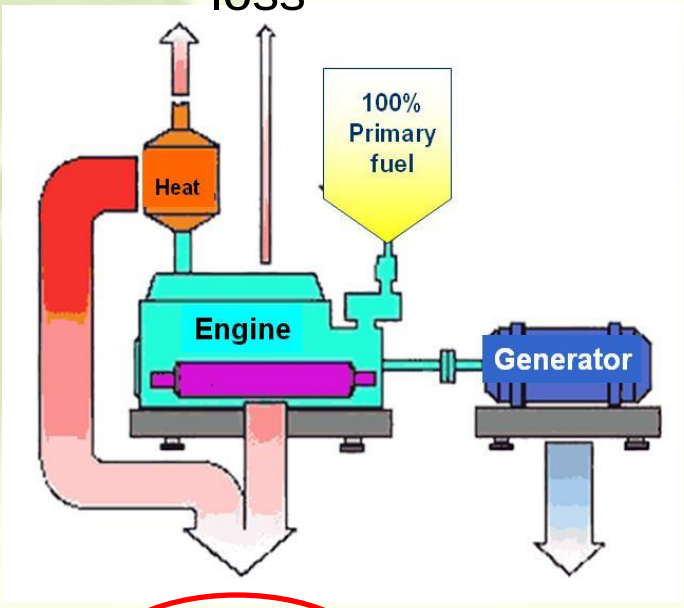
Coal-fired power station
~ 30-35% efficiency

10% losses in transmission

Distribution - decentralised



15% flue 5% radiation loss

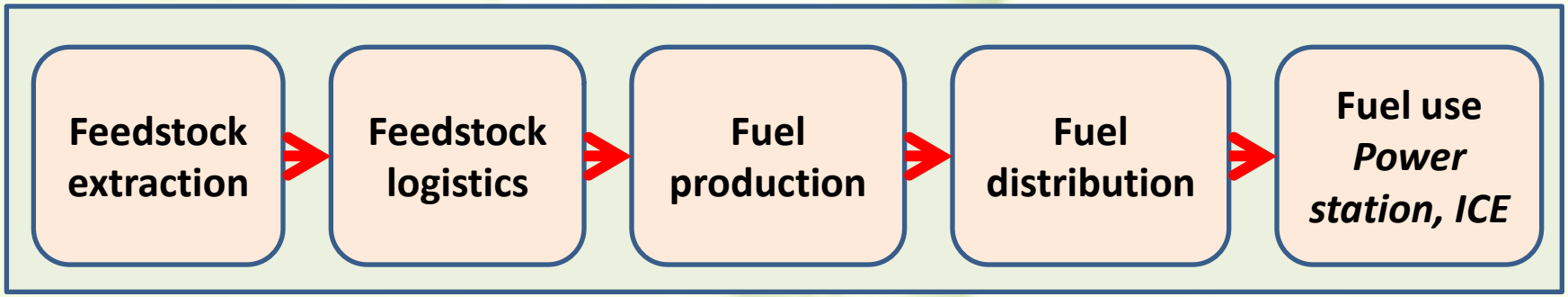


50% heat

37- 48% electricity

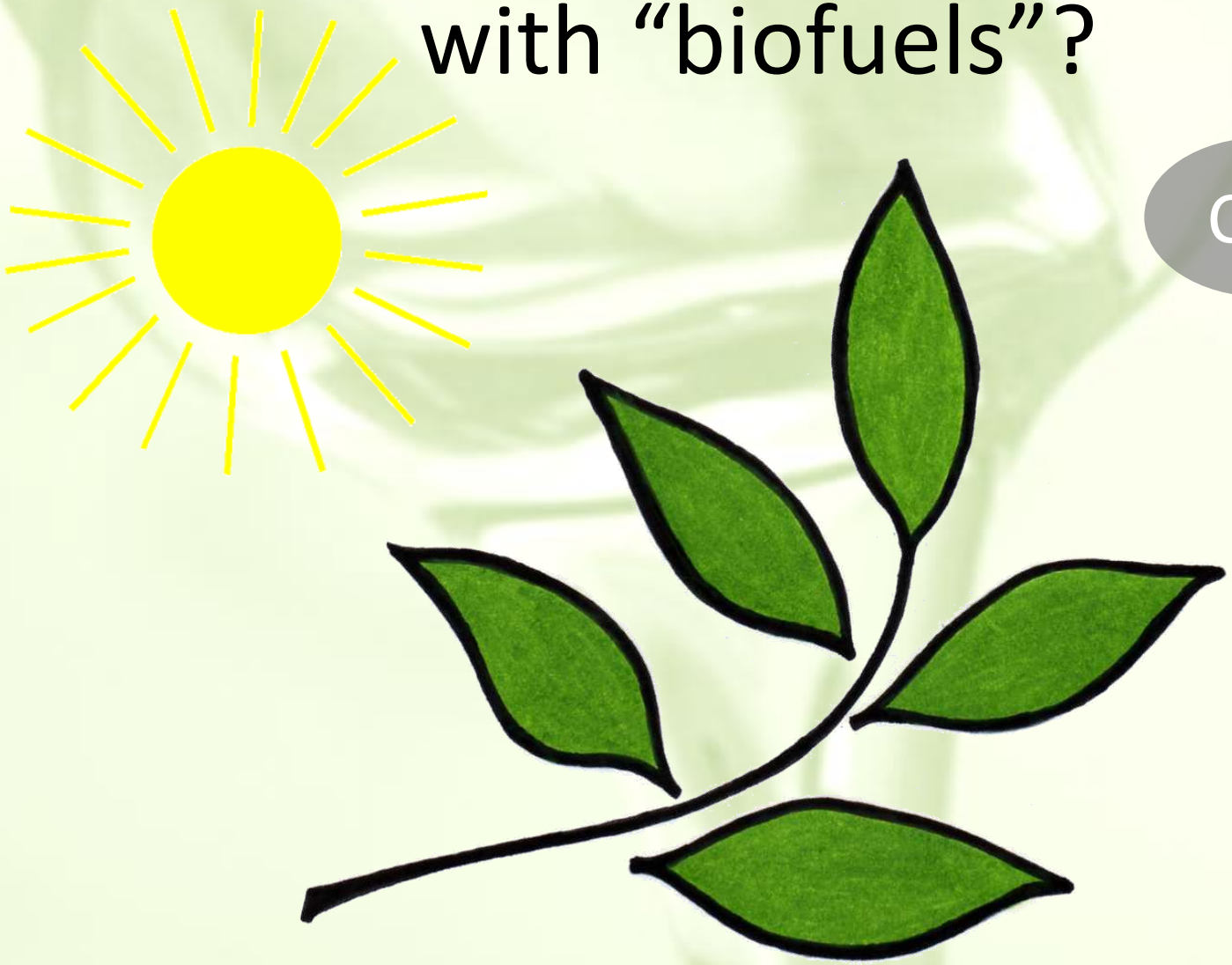
Fossil fuel supply chain

- 360 -286 million years ago: coal, oil (petroleum), natural gas
- ICE's, power stations built to suit materials
- Well-established supply chain

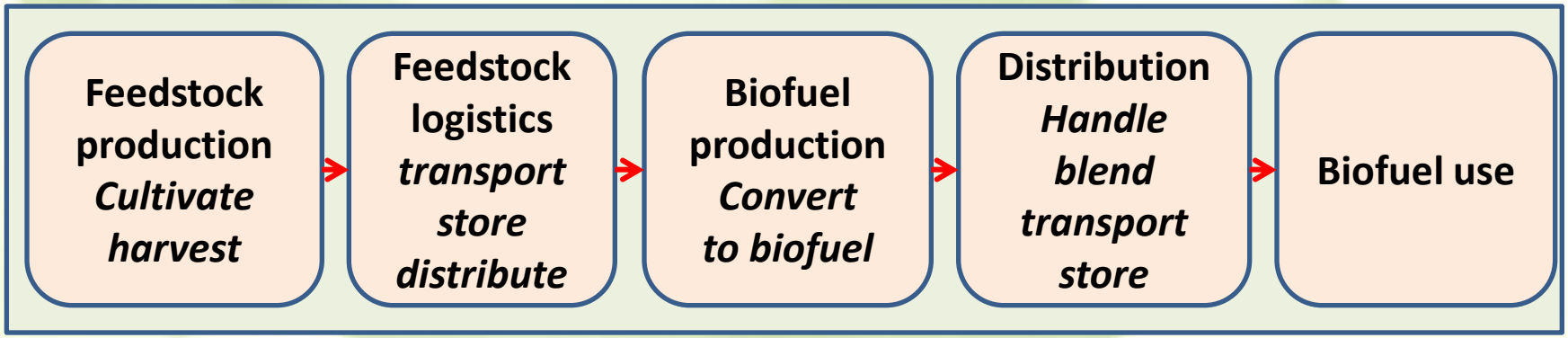


- Centralised grid - economies of scale

Can (should)we substitute “fossil” fuels with “biofuels”?

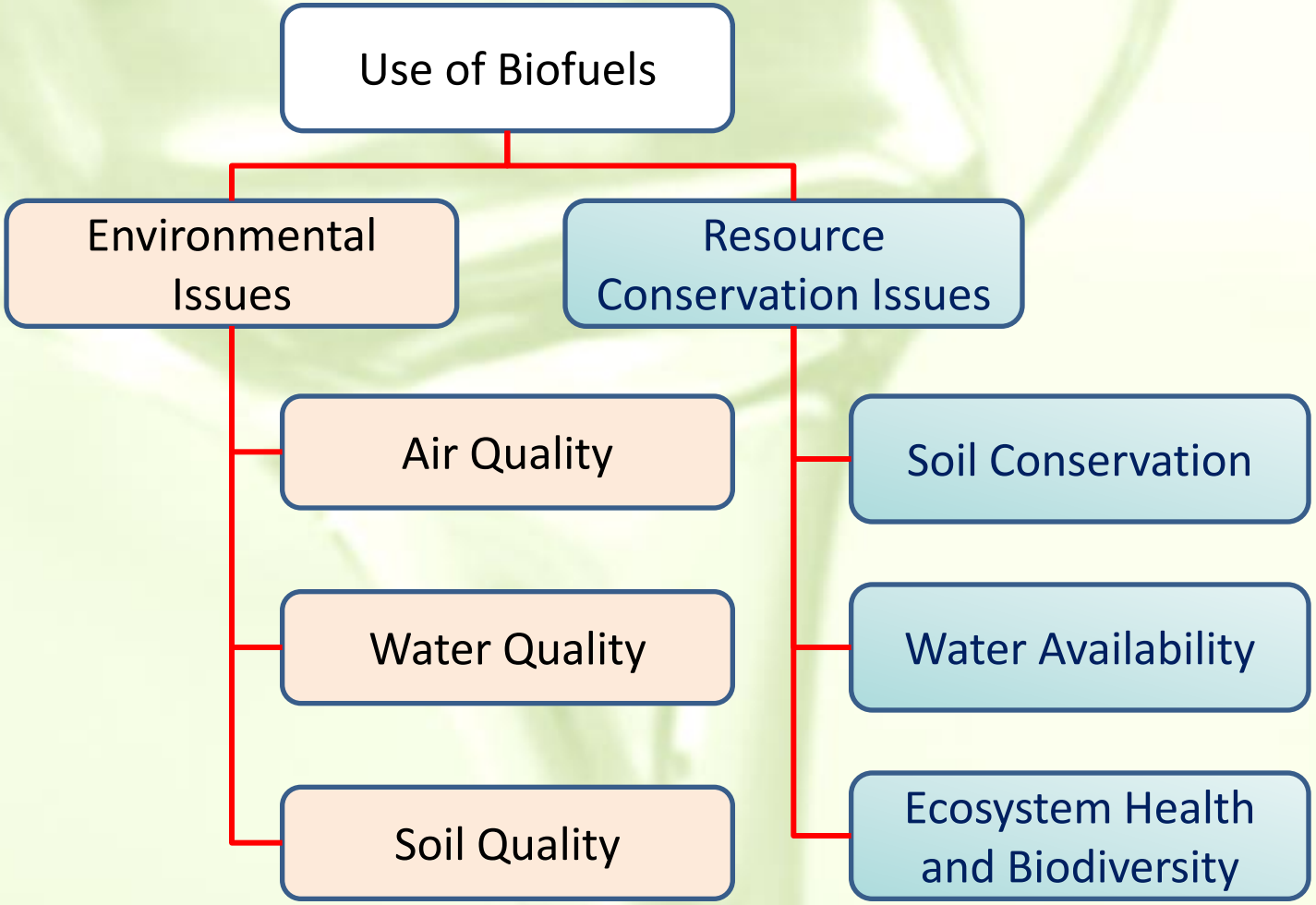


Considerations

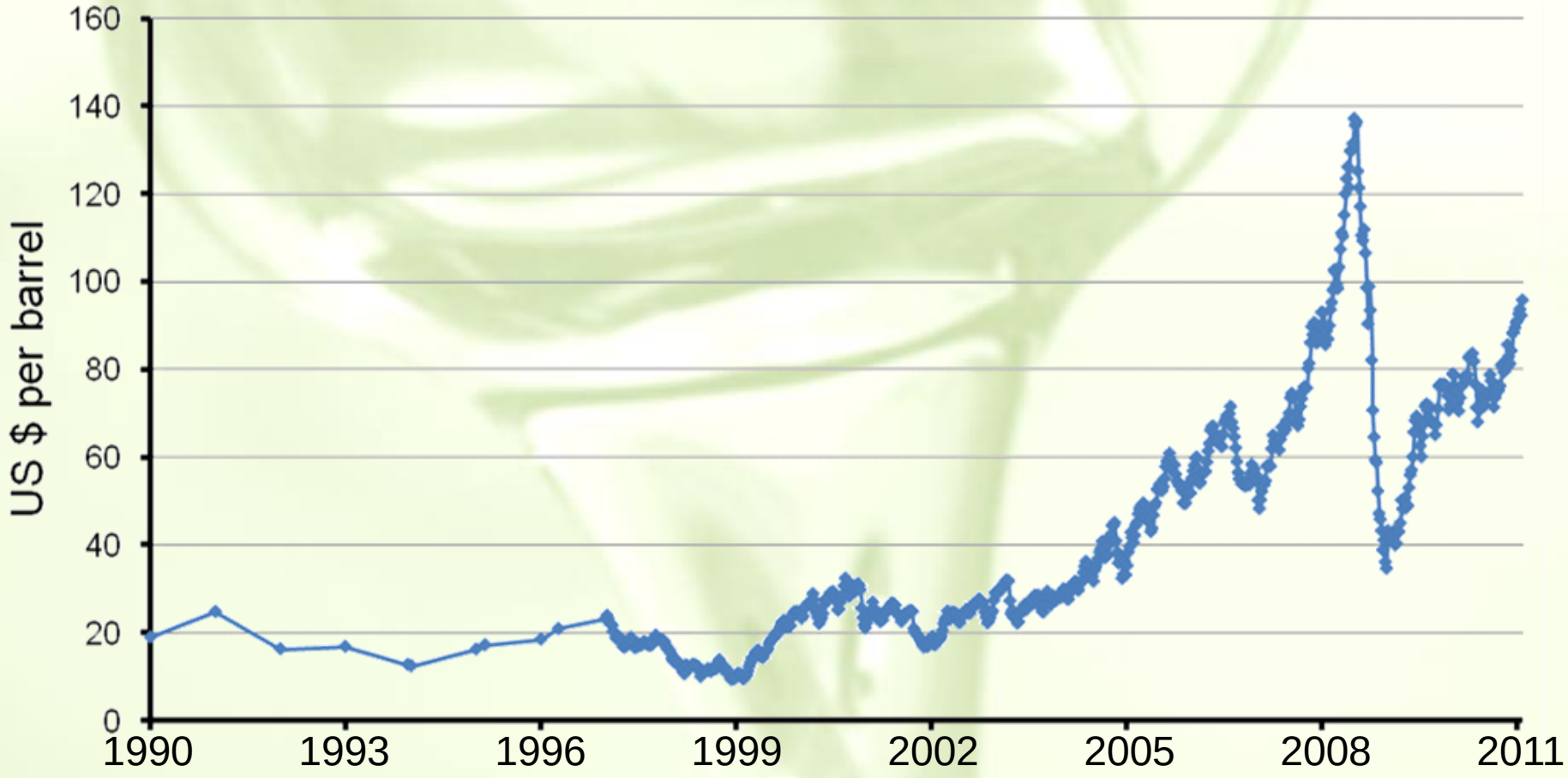


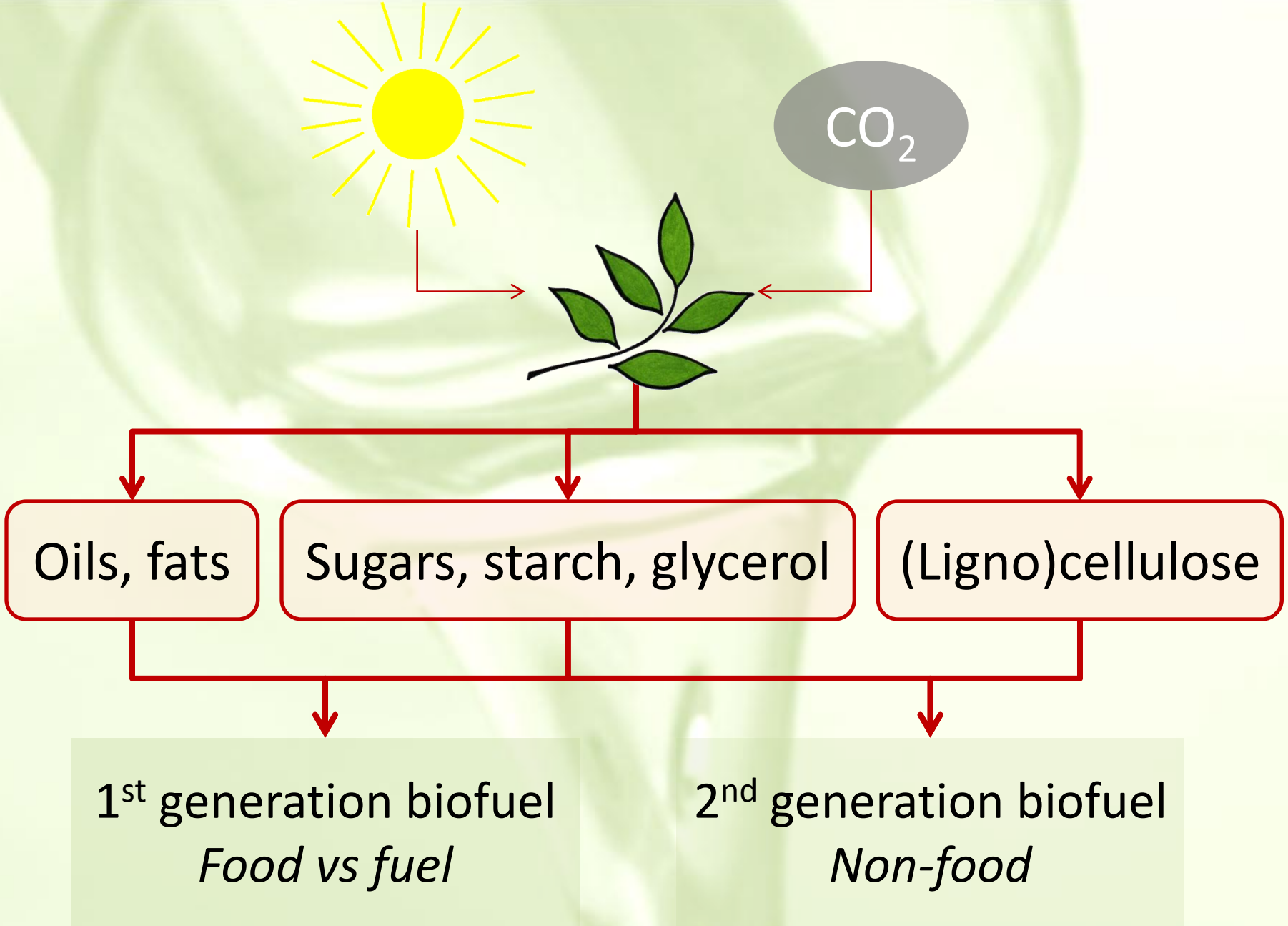
- Production: agriculture/aquaculture
- Transport: 70% water - bulky
- Biofuel production: mixtures of molecules
  - proteins, lipids (oils, fats), polysaccharides, lignin, cellulose
- Burners
- Decentralised or centralised?

Sustainability/impact considerations



Considerations: crude oil price




CO_2
Oils, fats
Sugars, starch, glycerol
(Ligno)cellulose
1st generation biofuel
Food vs fuel
2nd generation biofuel
Non-food

ACP

- *'EC's Strategy for Sustainable Development'*
- Build, enhance scientific & technological capacity for R&D & innovation
- Enable activities /policies critical to sustainable development

This ACP Project

- 36 months
- South Africa, Namibia, Ghana, UK, Italy
- Regional, local authorities, municipalities
  - sewage, water,
  - energy procurement

This workshop

- Understand contexts
- Develop connections
- Attract investment
- Build capacity
- Create sustainable non-food supply chains
- Africa