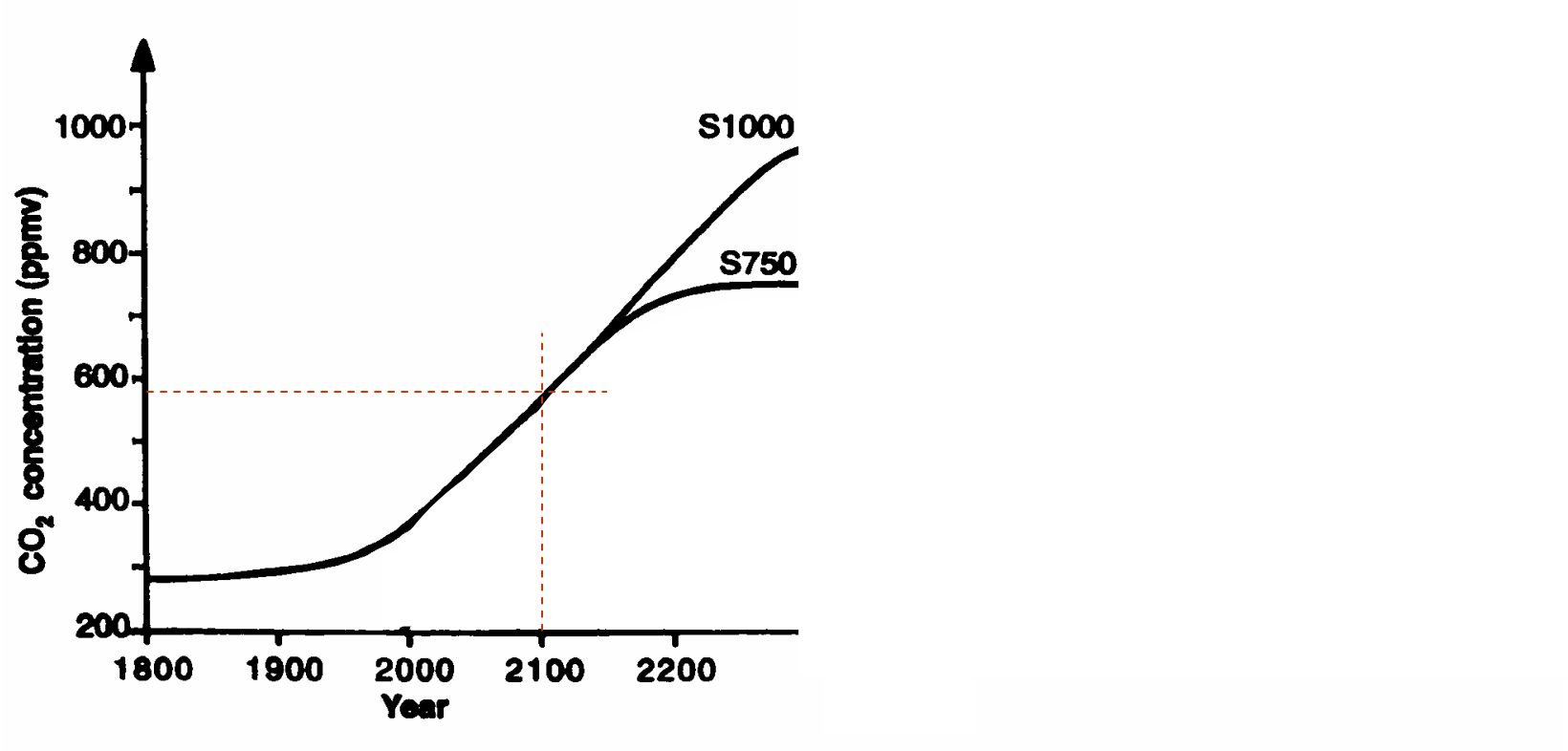
A cost-effective energy supply mix, to meet a climatic goal of 2 degrees

Maria Grahn

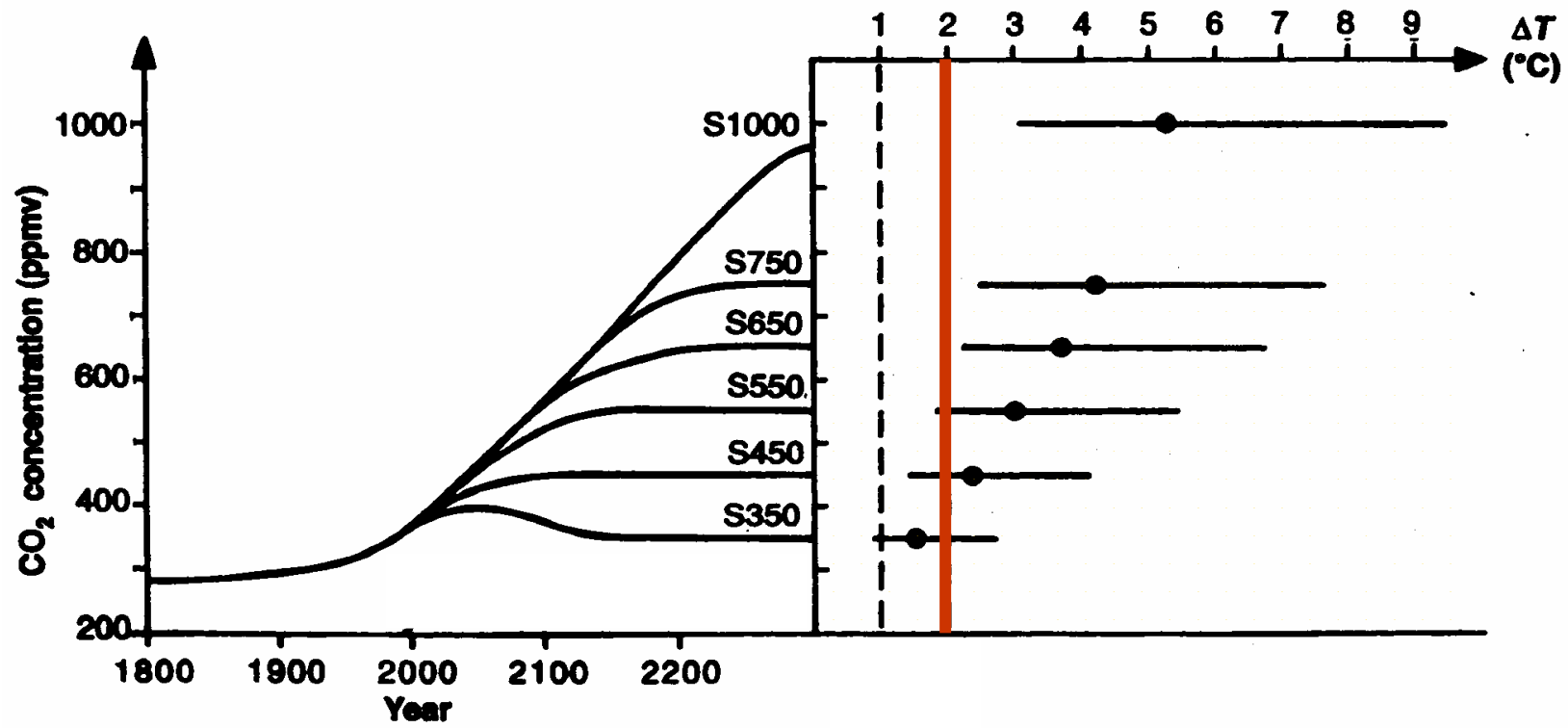
Physical Resource Theory, Energy and Environment,
Chalmers University of Technology, Sweden



The European Council confirms, in the presidency conclusions of 23 March 2005, that the global annual mean surface temperature increase should not exceed 2ºC above pre-industrial levels.

http://www.delbra.cec.eu.int/pt/whatsnew/SI_0300_EN_st07619.pdf (page 16)

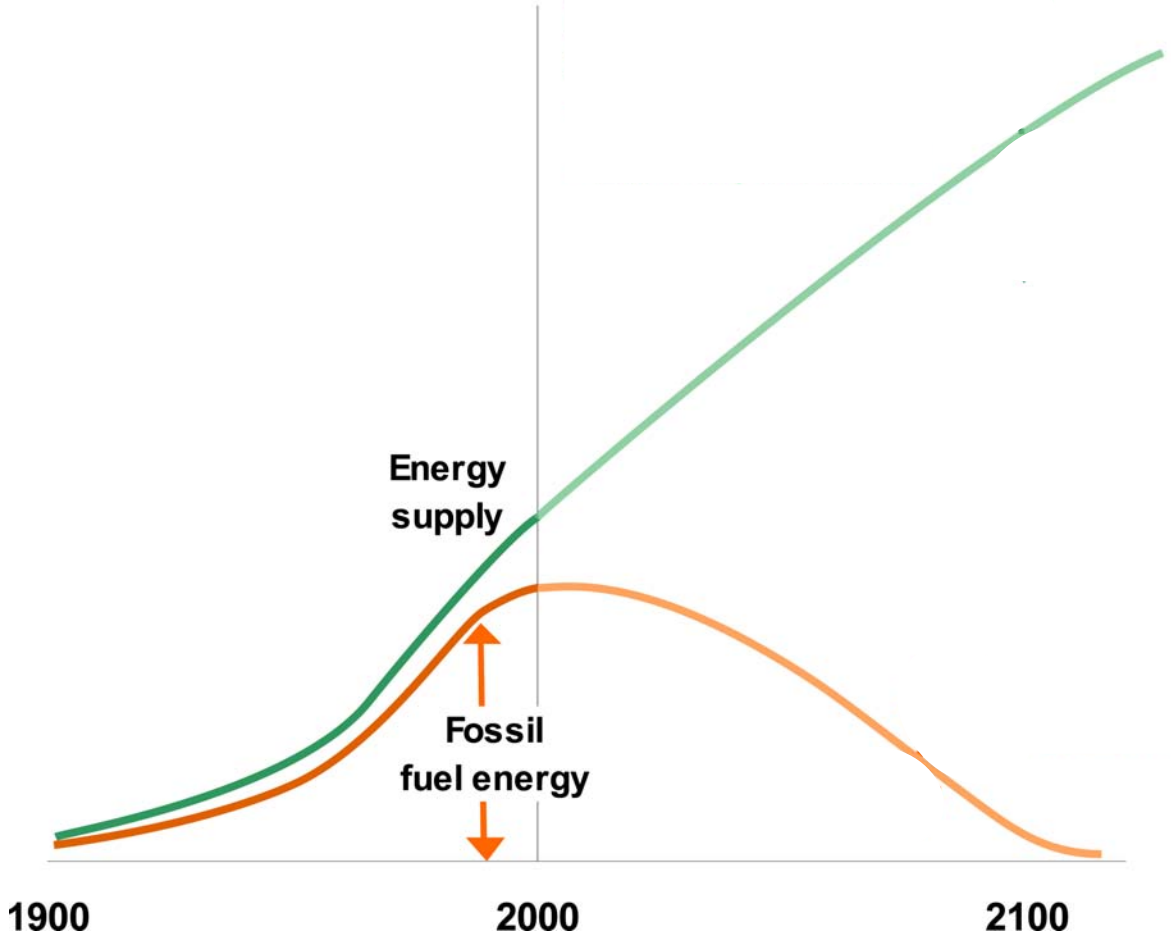
EU climate policy – 2 degree



SCIENCE • VOL. 276 • 20 JUNE 1997 • www.sciencemag.org Azar & Rodhe

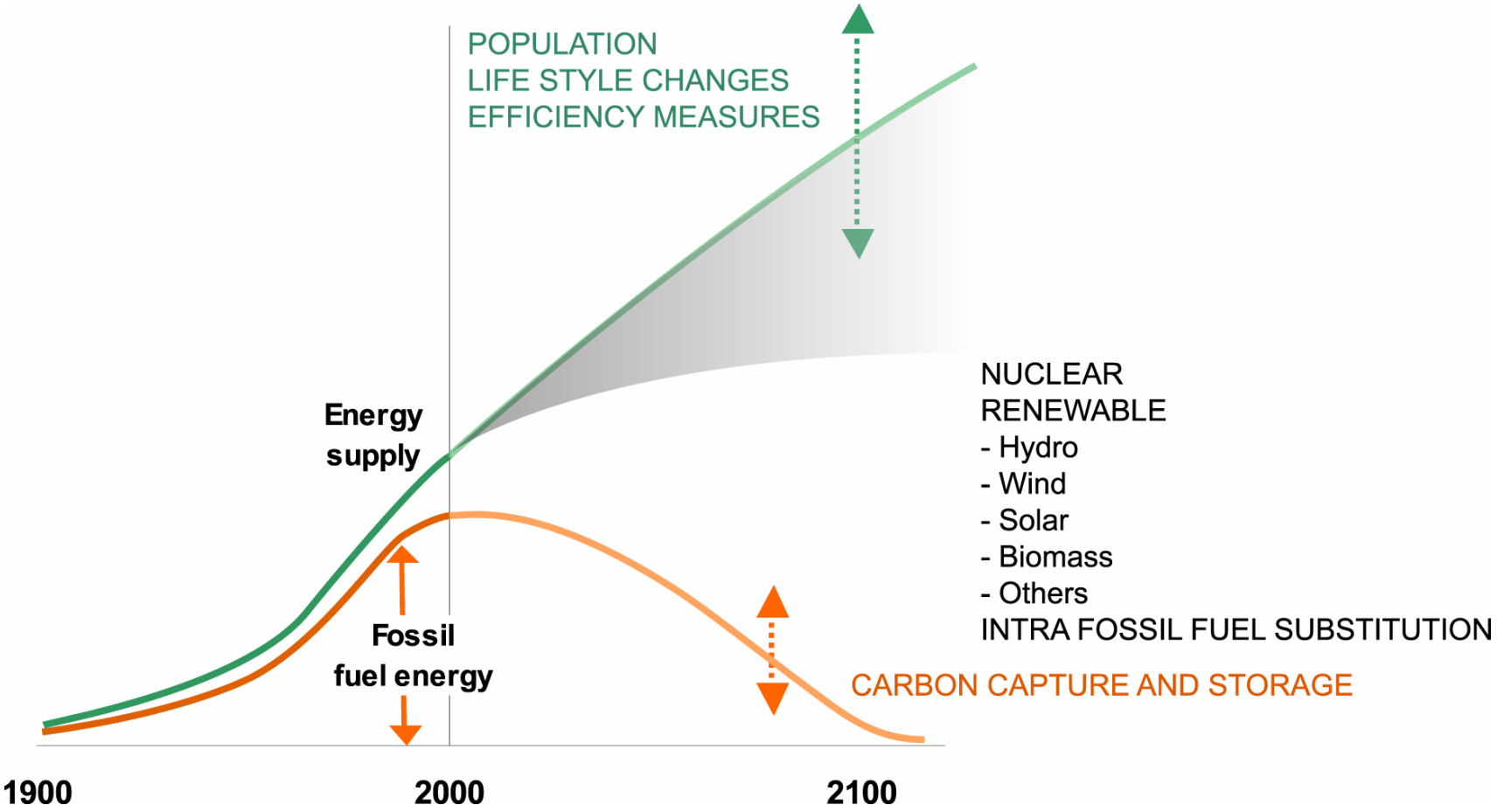
The European Council confirms, in the presidency conclusions of 23 March 2005, that the global annual mean surface temperature increase should not exceed 2ºC above pre-industrial levels.

http://www.delbra.cec.eu.int/pt/whatsnew/SI_0300_EN_st07619.pdf (page 16)


Energy
supply
Fossil
fuel energy
1900
2000
2100

CO_2 emissions from the energy system can be reduced by using

1) less energy 2) CO_2-neutral energy 3) carbon capture and storage (CCS).

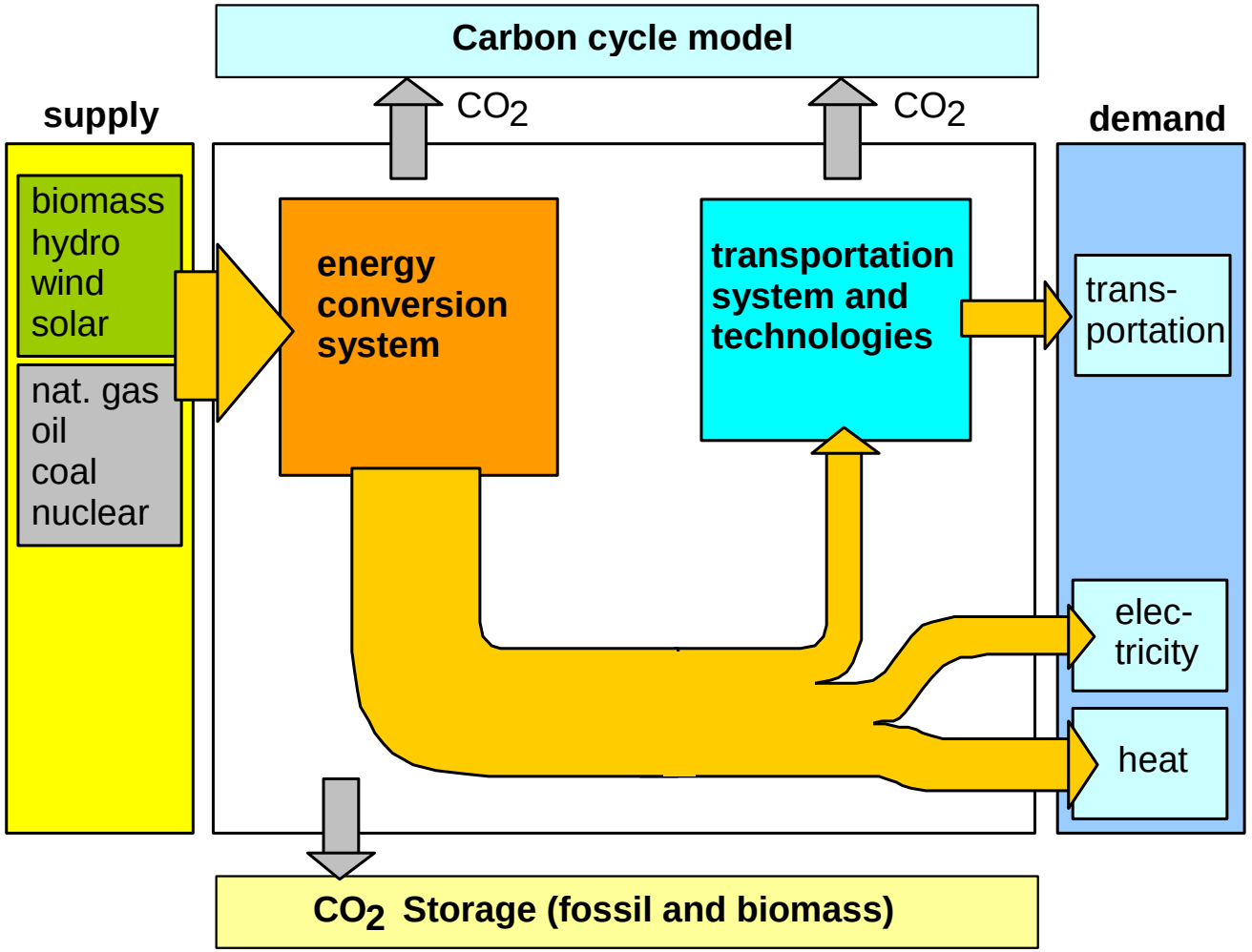


How can we reach the climate goal of 2 degrees at lowest cost?

A cost-effective energy mix.

The GET model

a global energy optimization model – minimizing the total cost

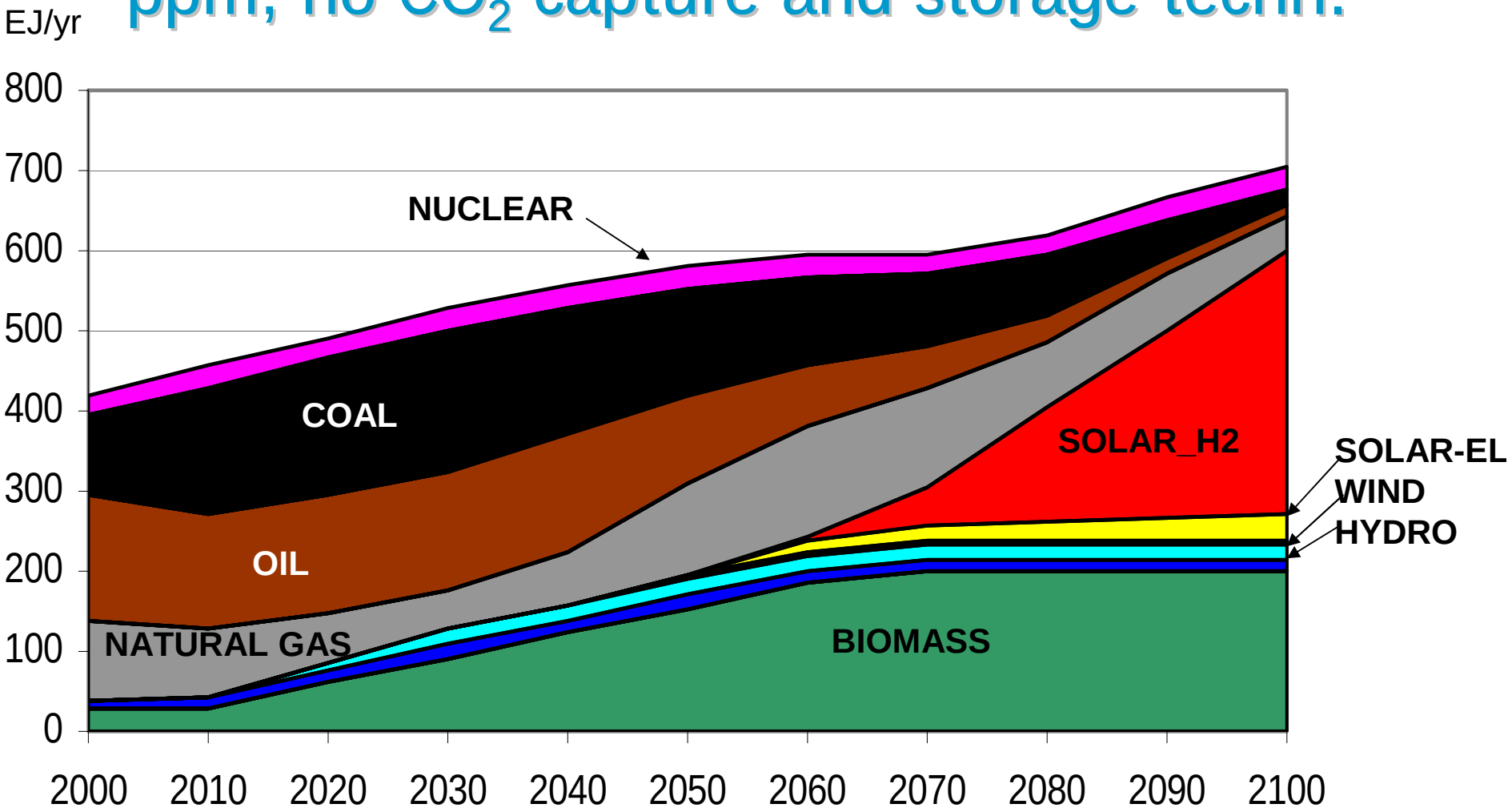


Constraints in these runs

- The amount of biomass that can be used for energy is maximised to 200 EJ/yr*.
- The contribution of nuclear is fixed to current level, to simulate current nuclear policy.
- Energy security and agriculture policies are not taken into account in the model.
- CO_2-emissions corresponding to 450 ppm
- 100 years to reach a stabilised CO_2-conc.

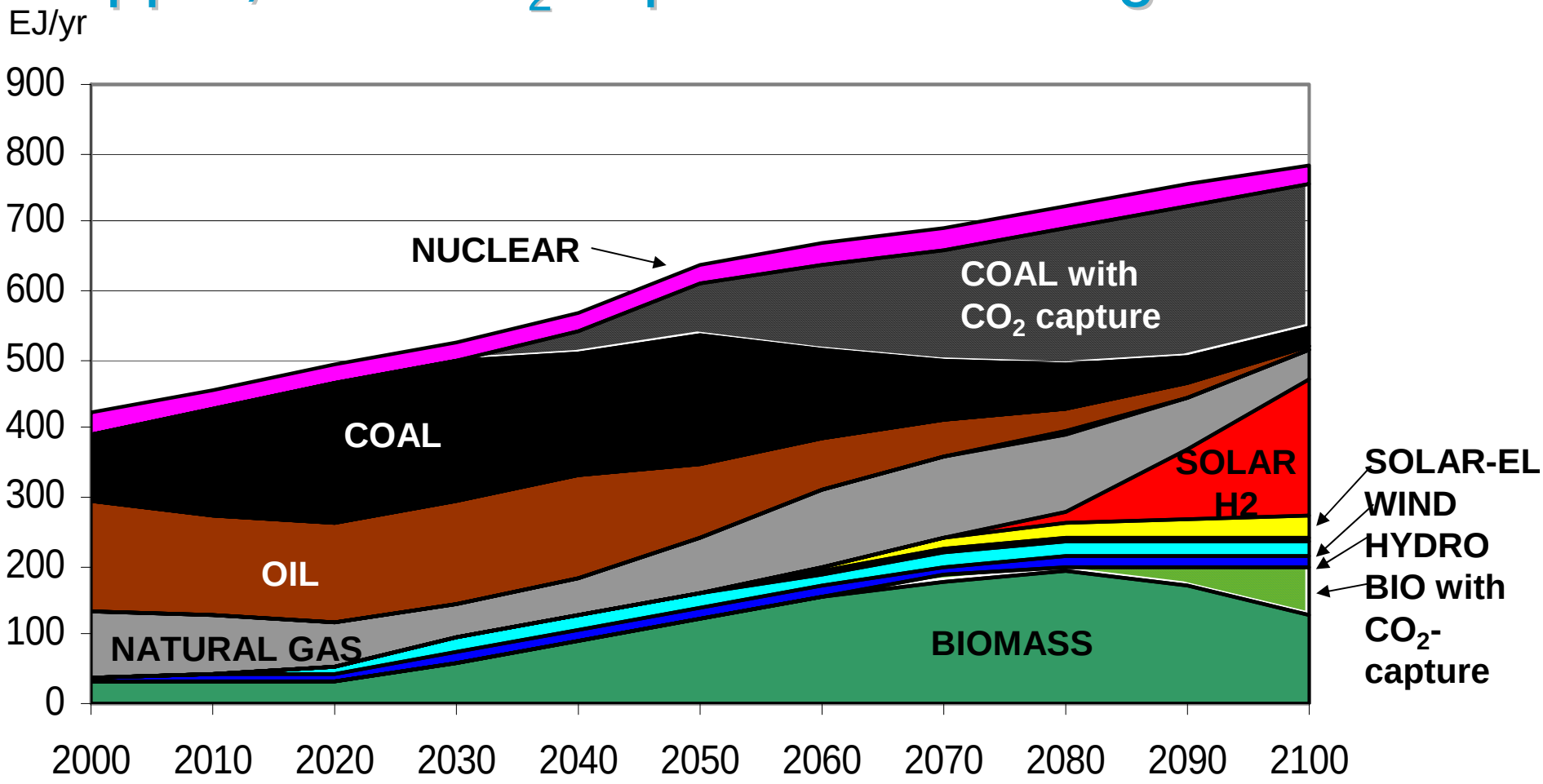
*) 200 EJ/yr equals 4.8 GTOE/yr (billion tons of oil equivalent per year)

Global energy supply mix – CO_2-target 450 ppm, no CO_2 capture and storage techn.



Source: Azar *et al* (2006) Carbon Capture and Storage From Fossil Fuels and Biomass – Costs and Potential Role in Stabilizing the Atmosphere, *Climatic Change*, published online 2006-03-01

Global energy supply mix – CO_2-target 450 ppm, with CO_2 capture and storage techn.



Source: Azar *et al* (2006) Carbon Capture and Storage From Fossil Fuels and Biomass – Costs and Potential Role in Stabilizing the Atmosphere, *Climatic Change*, published online 2006-03-01

Conclusions

A cost-effective energy mix to meet the European climatic goal of 2 degrees, includes

- Improved energy efficiency
- A phase out of coal or a large scale introduction of carbon capture and storage technology (CCS)
- Increased use of
  - Biomass
  - Wind
  - Solar energy

Changes in the energy systems will not occur by itself

A wise use of policy instruments are needed and should cover three main areas

- increasing costs for emitting fossil carbon
- steering towards energy efficiency
- supporting research, development and diffusion of new advanced energy technologies