How, and at what costs, can low-level stabilisation be achieved? An overview

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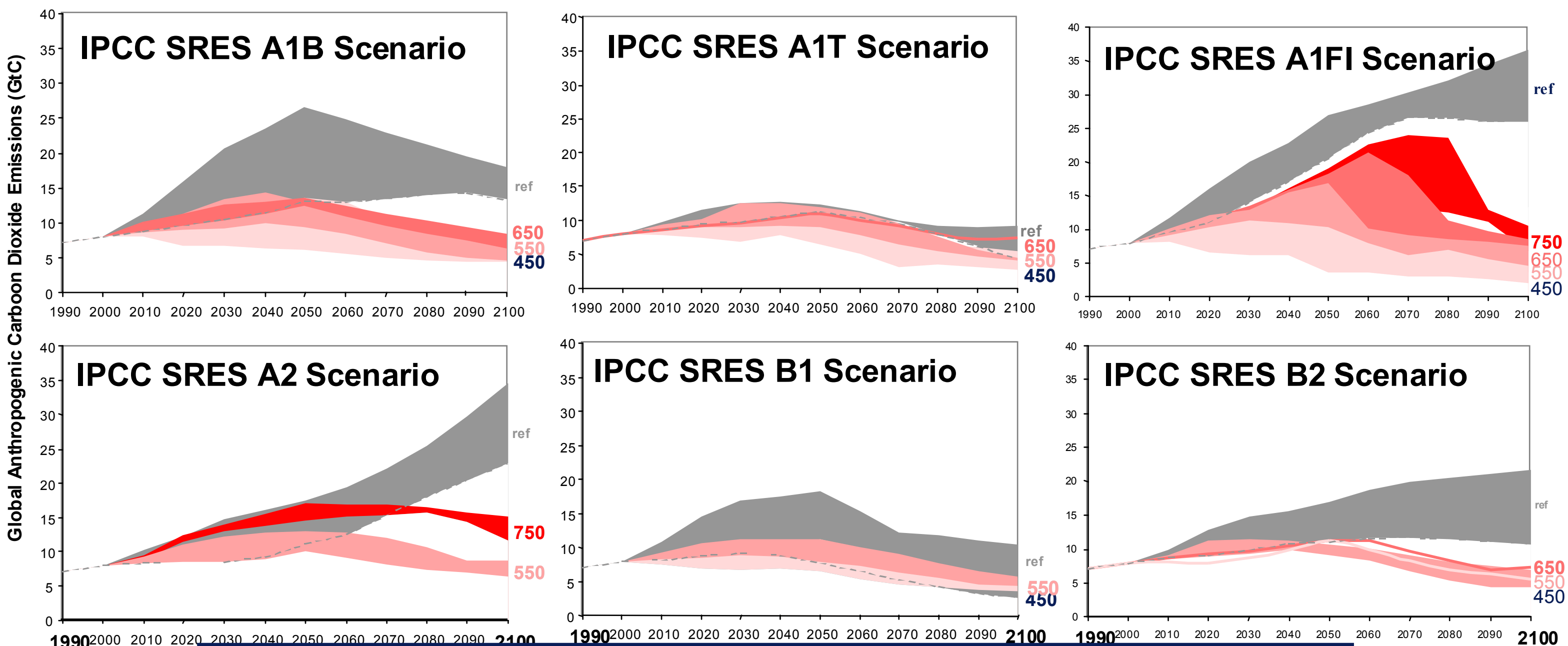
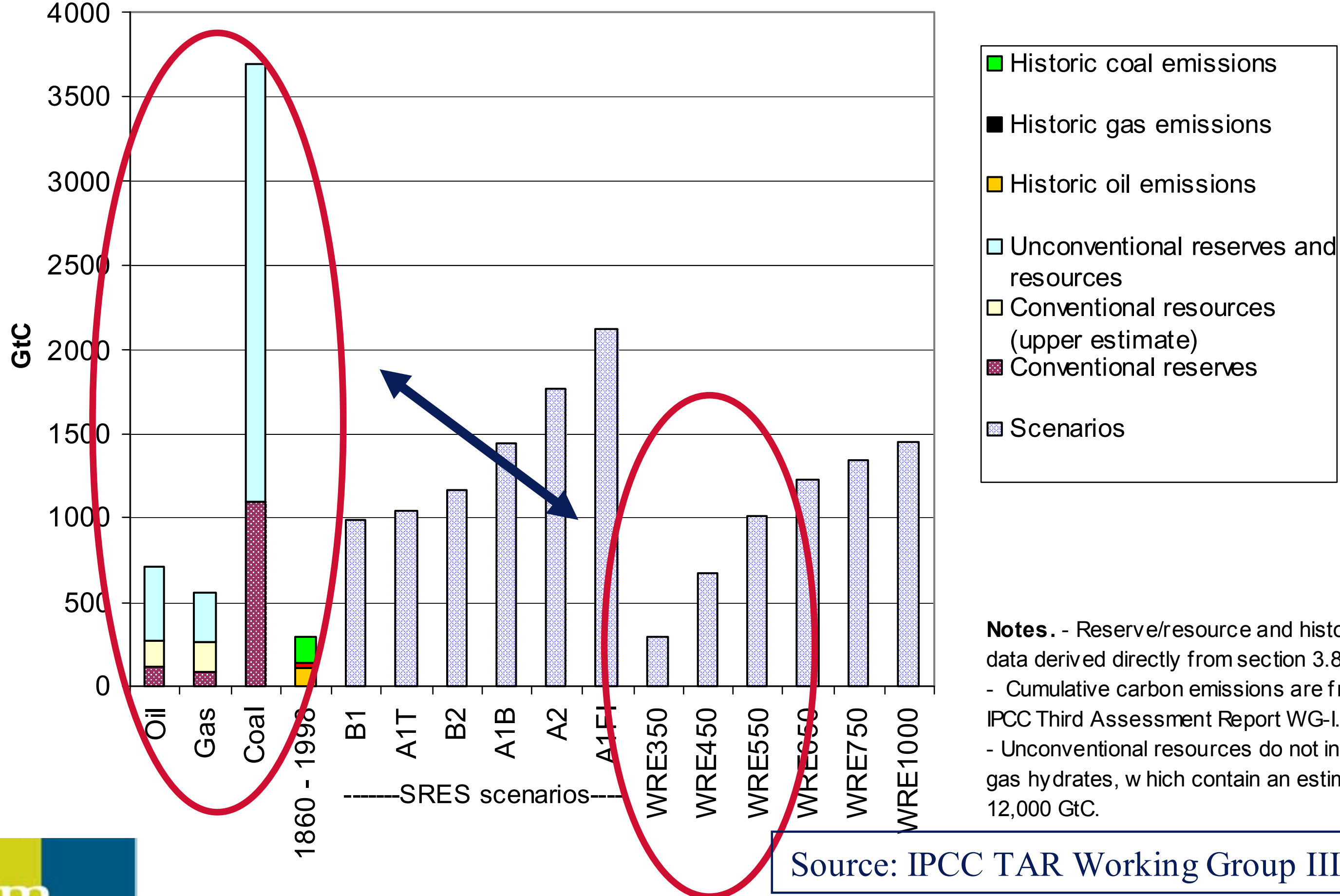
The stabilisation challenge depends on the reference scenario and the stabilisation level



Carbon emissions to be avoided for 450 ppm CO2 stabilisation could go up to 1500 GtC till 2100

Source: IPCC TAR Working Group III

Shortage of fossil fuel is not going to help to stabilise CO2 concentrations



Notes. - Reserve/resource and historic use data derived directly from section 3.8.1.
- Cumulative carbon emissions are from the IPCC Third Assessment Report WG-I.
- Unconventional resources do not include gas hydrates, which contain an estimated 12,000 GtC.

Source: IPCC TAR Working Group III

Mitigation options

- Energy efficiency
- Decarbonisation
  - energy sources (gas, nuclear, biomass, wind, solar)
  - CO2 removal and storage
- Biological carbon sequestration
- Reducing other greenhouse gases from industry, agriculture, waste

Large long-term technical potential of renewable and nuclear energy supply

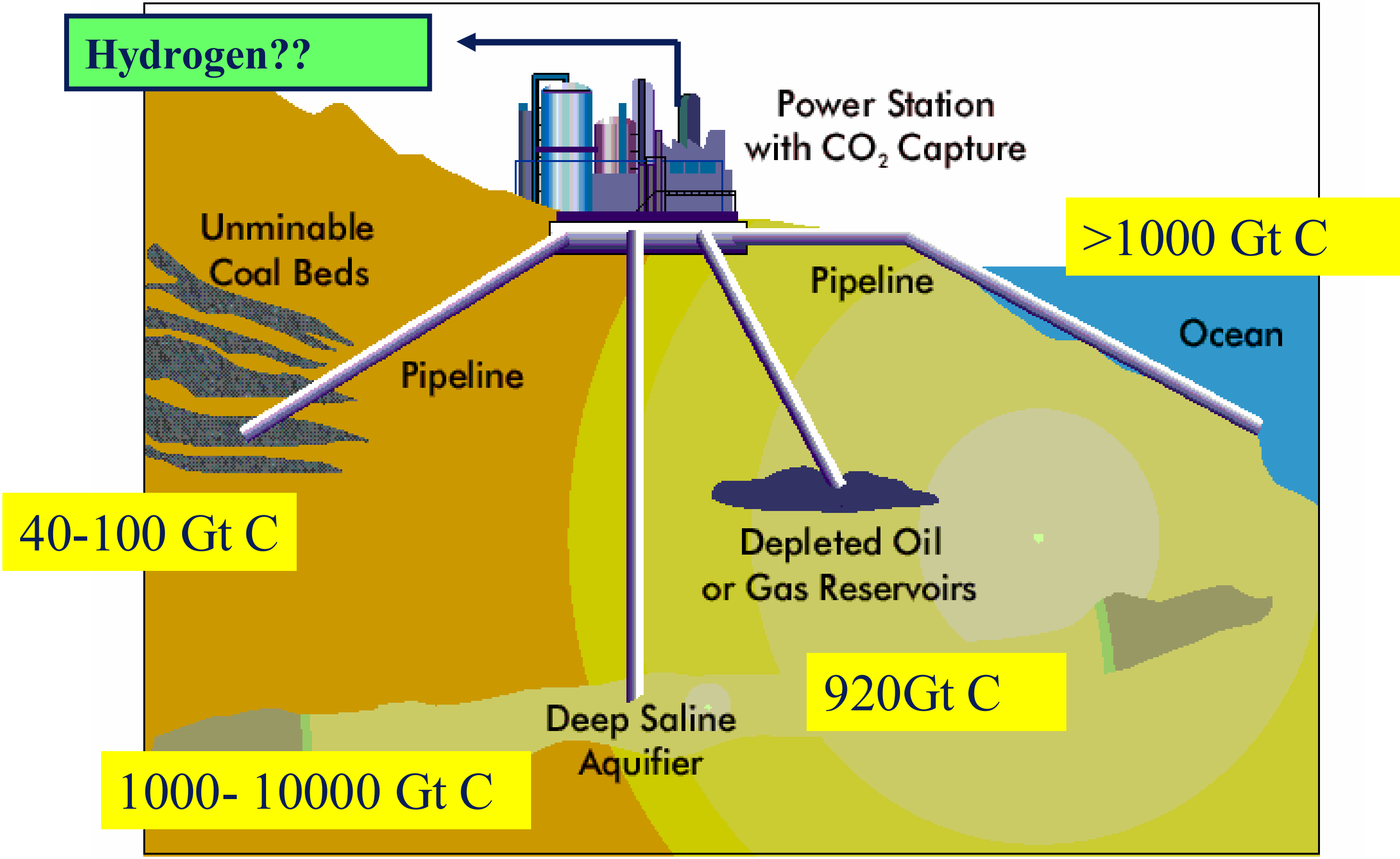
	Long-term Technical Potential (EJ/yr)
Hydro	>130
Geothermal	>20
Wind	>130
Ocean	>20
Solar	>2600
Biomass	>1300
Total Renewable	>4200

2100 Total Energy Demand for SRES scenario range: 520-2740 EJ/yr

Source: Nakicenovics et al, IPCC,2000

Nuclear total:7700- 462000 EJ
>> average 77-4620 EJ/yr over next 100 years

Technical potential of CO2 capture and storage

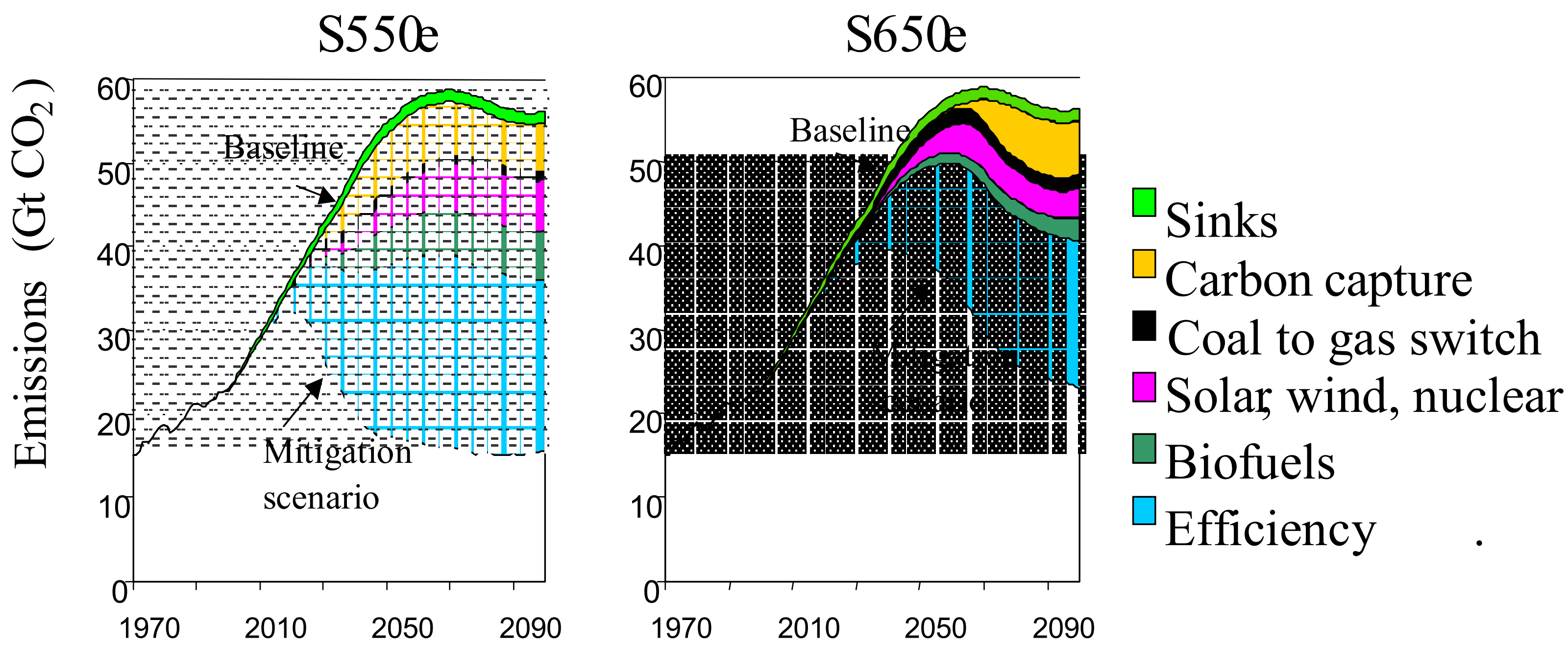


source: IEA, 2004; Moomaw et al, IPCC, 2001

Other options

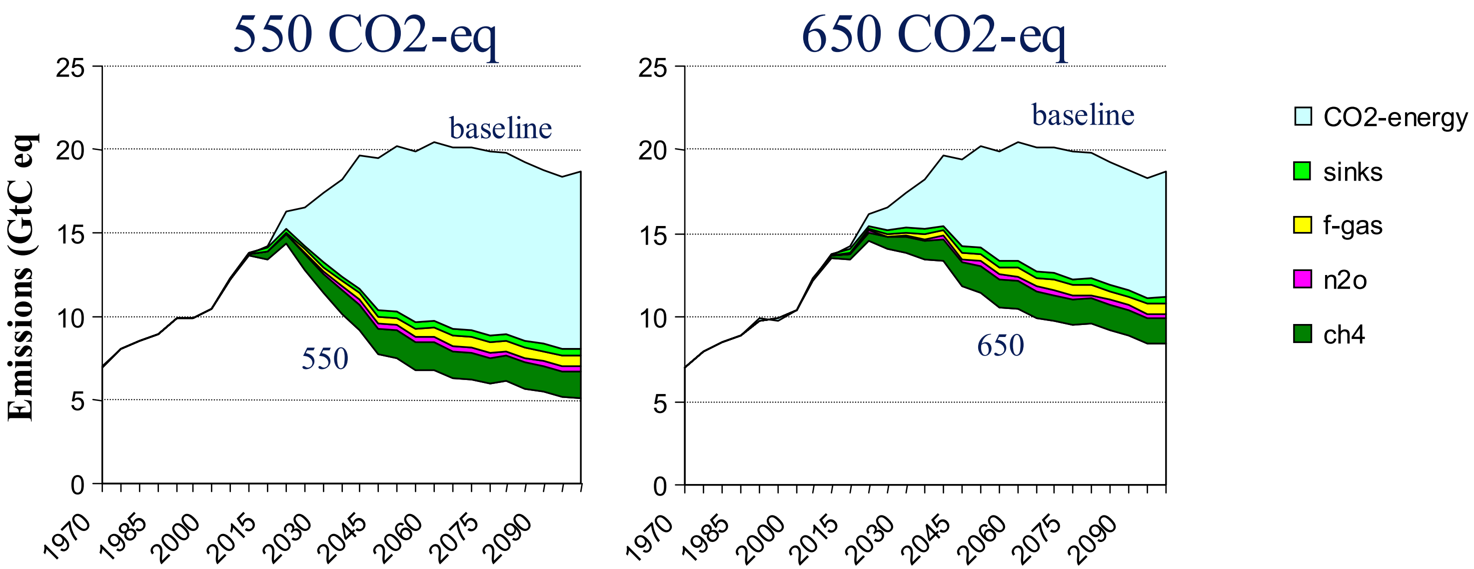
- Energy efficiency improvement: many hundreds of Gt C
- Biological sequestration/ avoiding deforestation: ~100 Gt C
- Non-CO2 greenhouse gases:~200-300 Gt C

The answer: a portfolio of least cost options



Source:van Vuuren et al, 2003

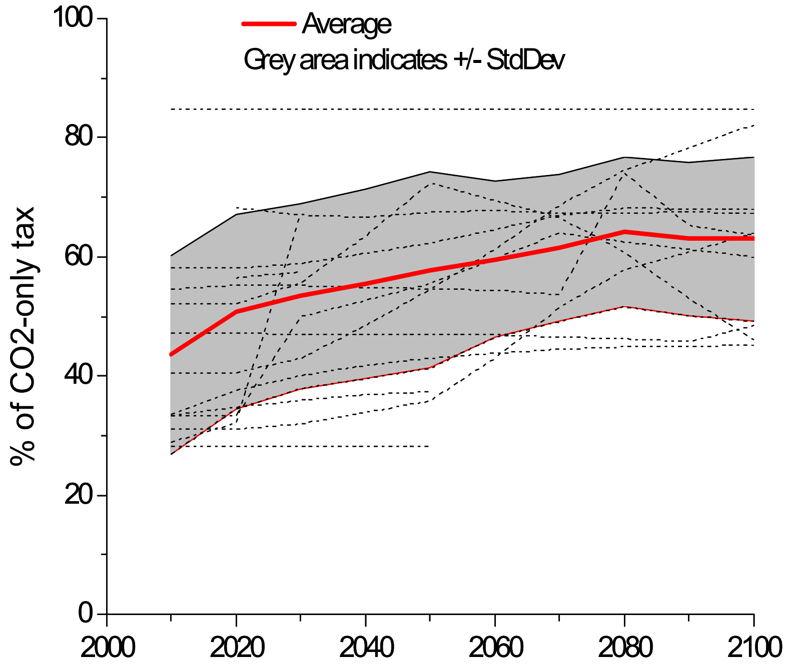
.. and using other GHGs

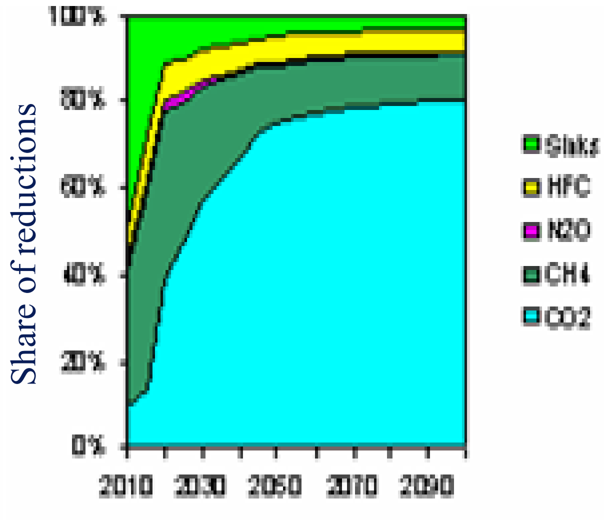


Source:van Vuuren et al, 2003

Costs are lower with multi-gas strategy, but focus shifts to CO2 over time

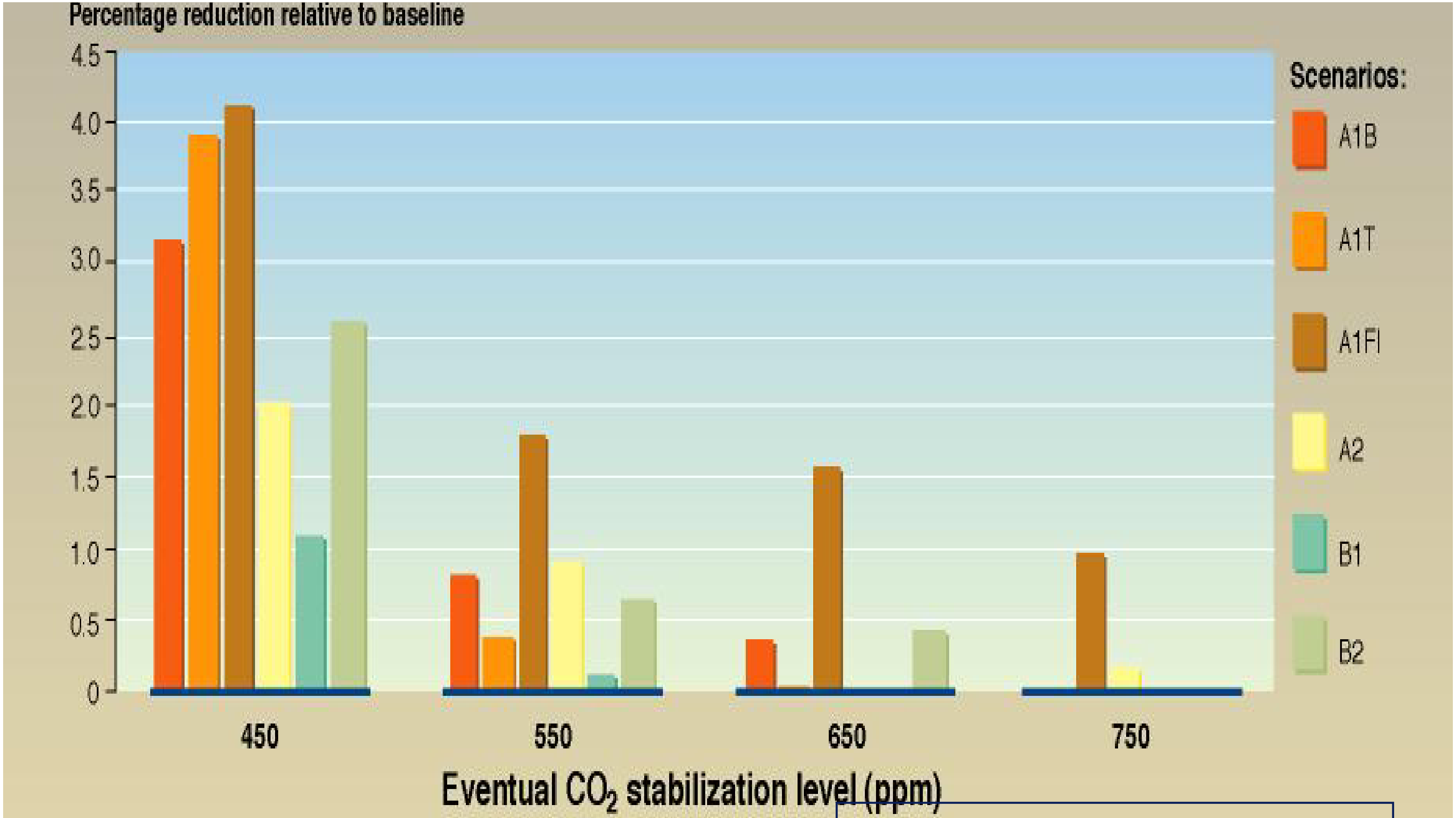
EMF-21 results for 650ppm CO2equivalent stabilisation





Source: van Vuuren, 2005

Costs: 2050 Global GDP reduction for various CO2 stabilisation levels and baselines



Source: IPCC TAR Working Group III

Scope of emissions trading and allocation of emission allowances has a big effect on costs

- EU: 30% below 1990 by 2020 (CO2 only, per capita convergence 2030, w/wo Afr/Asia) (RIVM/CPB 2004)

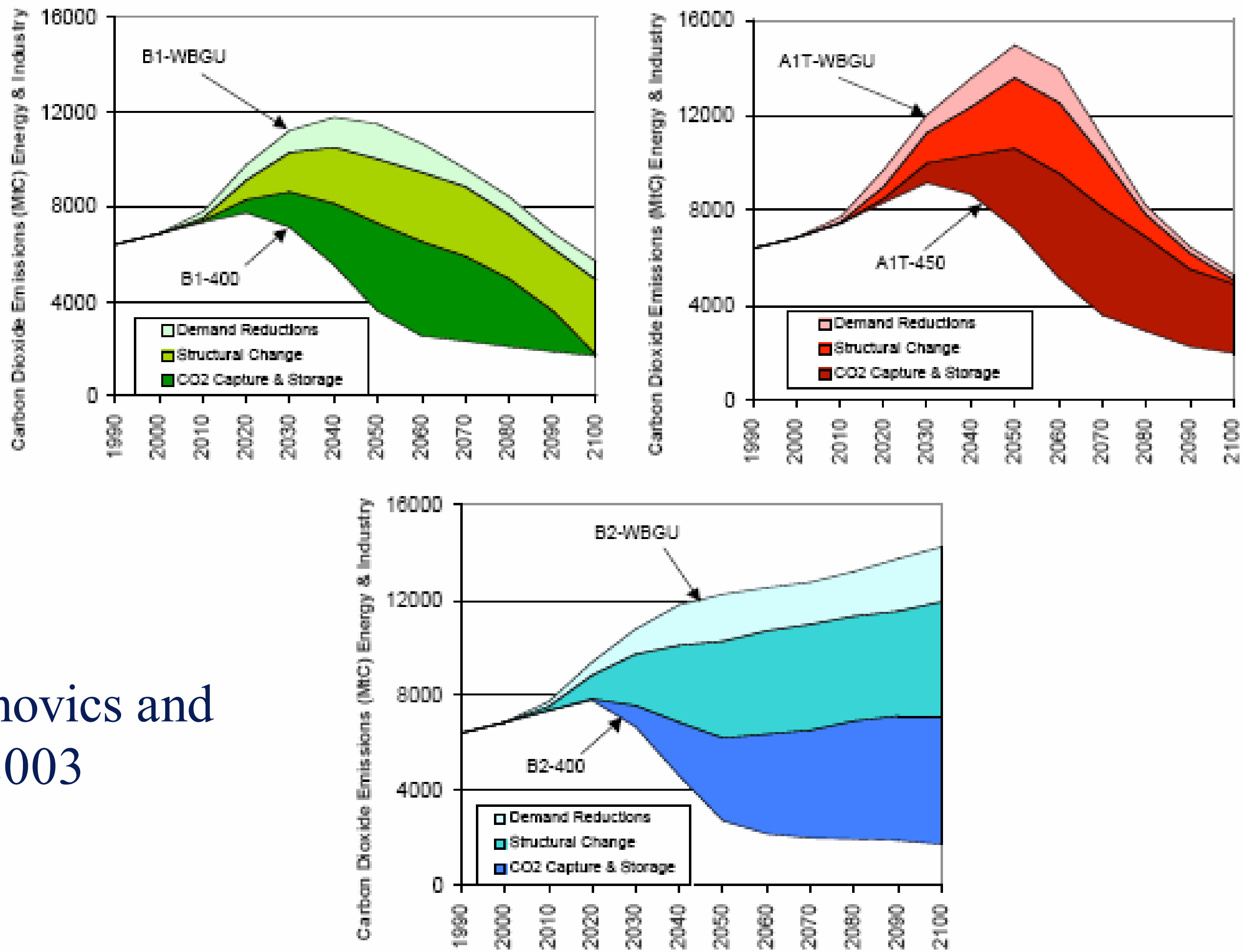
Country/Region	GNI change (% by 2020)
EU-25	-0.6 to -1.8
Russia	-1.4 to -1.8
Middle-East	-1.3 to +5.7
Africa/Asia Developing	+0.8 to +0.2

But what about real world implementation?

- Political reluctance (domestic, international)
- Lack of incentives
- Lack of awareness
- Vested interests
- ....

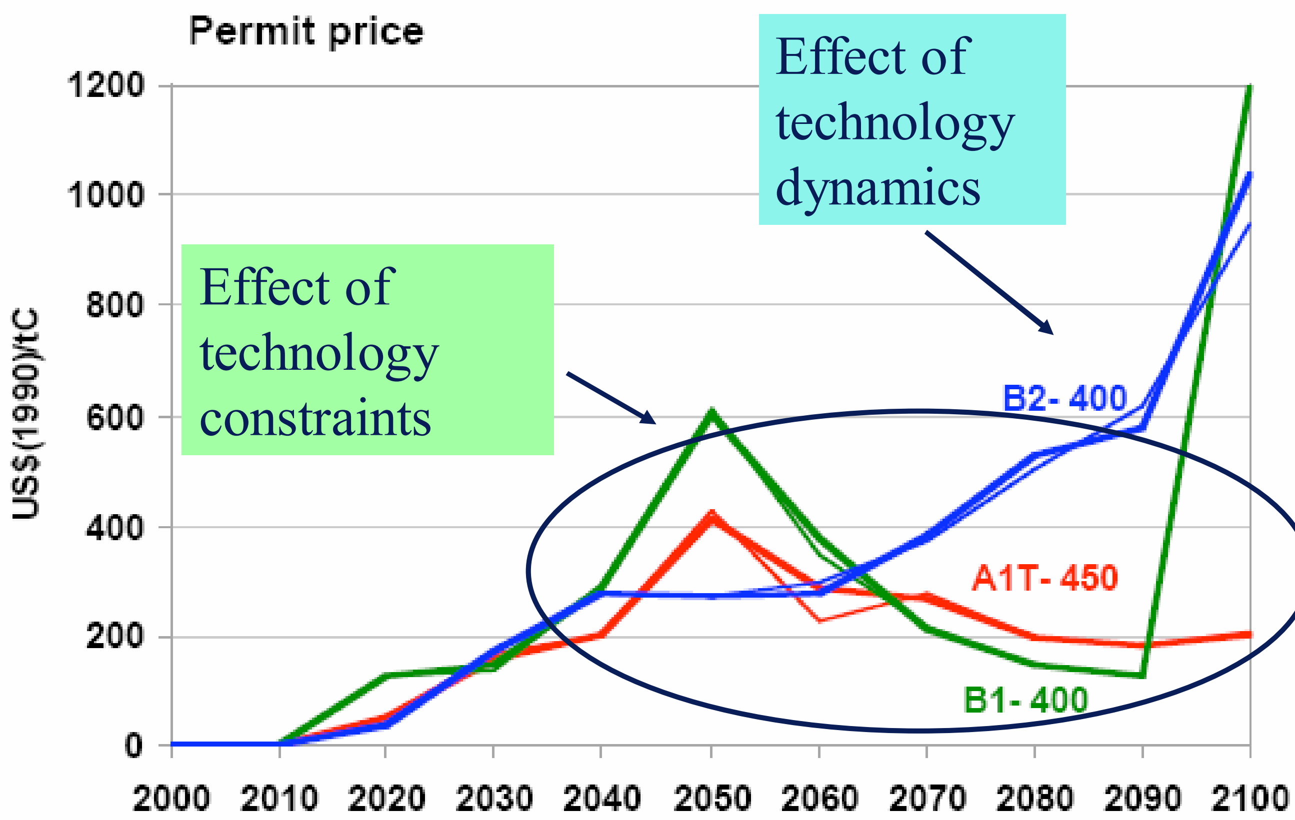
>> big obstacle

How to get to stabilisation below 550 ppm eq?



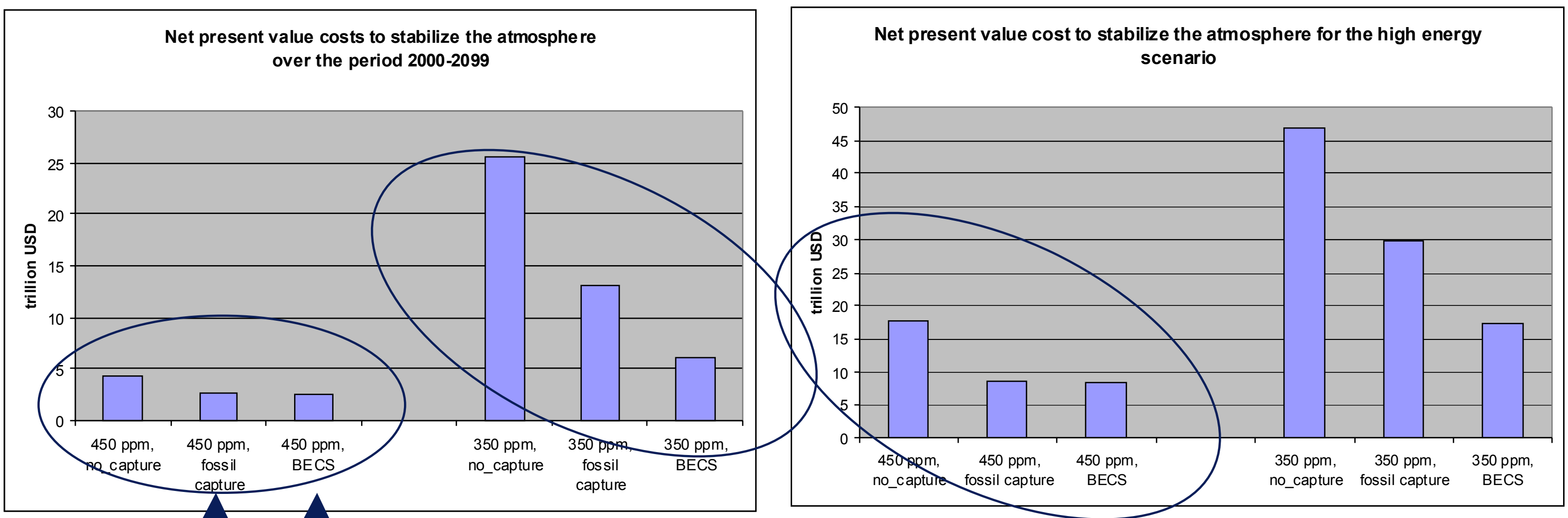
Source: Nakicenovics and Riahi, 2003

Marginal costs will increase



Source: Nakicenovics and Riahi, 2003

Excluding options can be costly



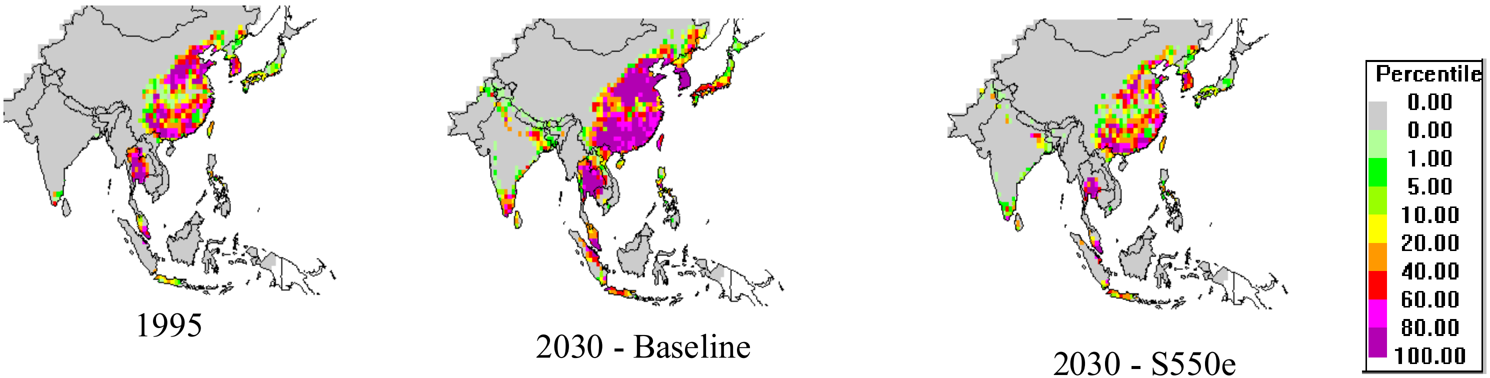
With CO2 capture

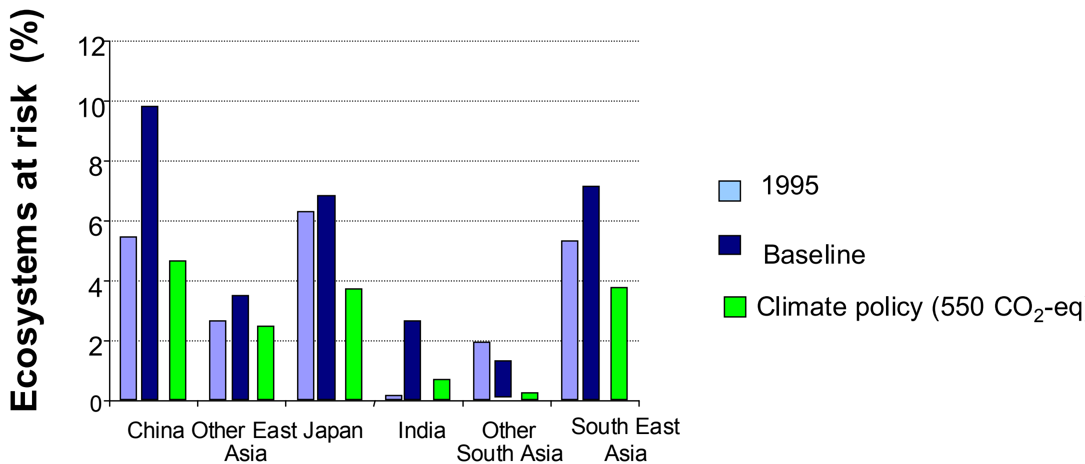
With CO2 capture from biomass

Source: Azar et al, 2005

Co-benefits can reduce costs of stabilisation

Acidification risk





Source:Van Vuuren et al. (2003)

Summary

1. Sustainable development strategies and corresponding behavioural attitudes make low-level stabilisation easier
2. Low-level stabilisation does not require totally new technologies (e.g. nuclear fusion)
3. There are no magic bullets: a portfolio of technology options is needed; excluding options will increase costs
4. Multi-gas strategies, emission trading, optimal timing and strong technology development, diffusion and transfer are essential to keep costs of low-level stabilisation relatively low (see also #1)
5. A big problem for low-level stabilisation is overcoming the many political (e.g. equitable allocation!), social and behavioural barriers to implementing mitigation options
6. Co-benefits (development, security, environment) are important for costs and acceptability