



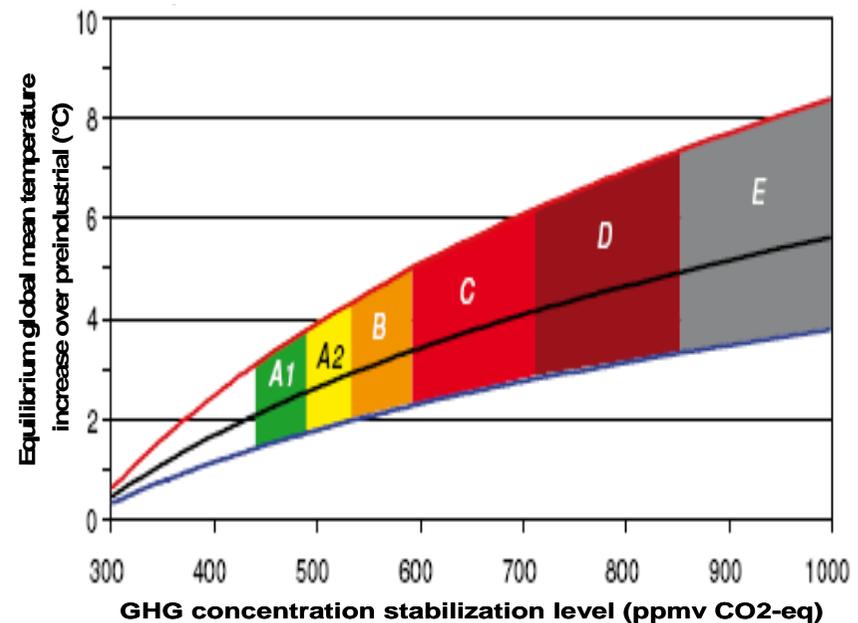
***Economic costs and benefits of climate  
change, adaptation and mitigation:  
Implications for business  
of recent scientific findings***  
***Terry Barker, Cambridge Econometrics and  
University of Cambridge***

A presentation to The First International Scientific and Business Congress on  
Protecting the Climate – A World Joint Strategy

23 April in Frankfurt-am-Main, Germany

# The key question: can “dangerous anthropogenic climate change” be avoided?

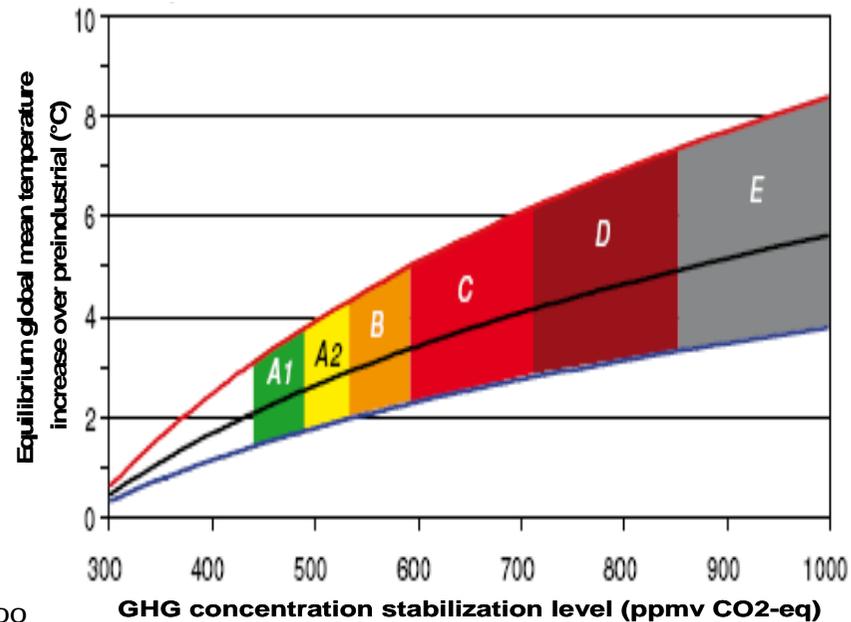
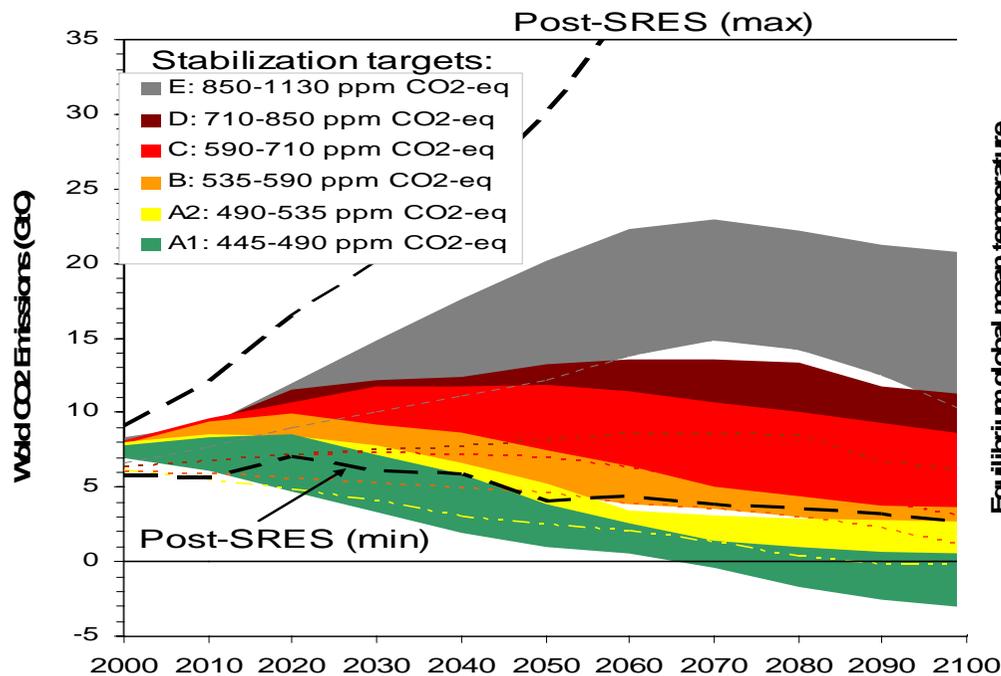
**EU interpretation:**  
global mean  
temperature increase  
at less than 2°C  
above pre-industrial  
level



# The lower the stabilisation level, the earlier global emissions have to go down

Range comes from different models

Range comes from alternative estimates of climate sensitivity



Multigas and CO<sub>2</sub>-only studies combined

Note lack of studies below 450ppmv-CO<sub>2</sub>-eq

# Risk analysis of climate change

- **Risks are different for climate change, adaptation and mitigation**
  - for countries and time periods
  - outcomes are not smooth, but may be abrupt
  - systemic loss of natural assets (rainforest or coral reefs) is effectively irreversible
  - climate risks are asymmetrical: (unbounded?) risks of higher rather than lower temperatures and sea level rise
  - risks for economic damage from mitigation policies are well-known and bounded
- **There are possibilities of catastrophe (IPCC WG1 Box 10.2: approx. 3% probability of climate sensitivity leading to  $> 8^{\circ}\text{C}$ )**
  - conventional cost-benefit analysis is “*especially and unusually misleading*” (Wietzman, 2007)
  - and a sea level rise of several meters over this century cannot be ruled out (Hansen *et al*, 2008)
- **Economic assessment should cover both costs & benefits *and* such risks**

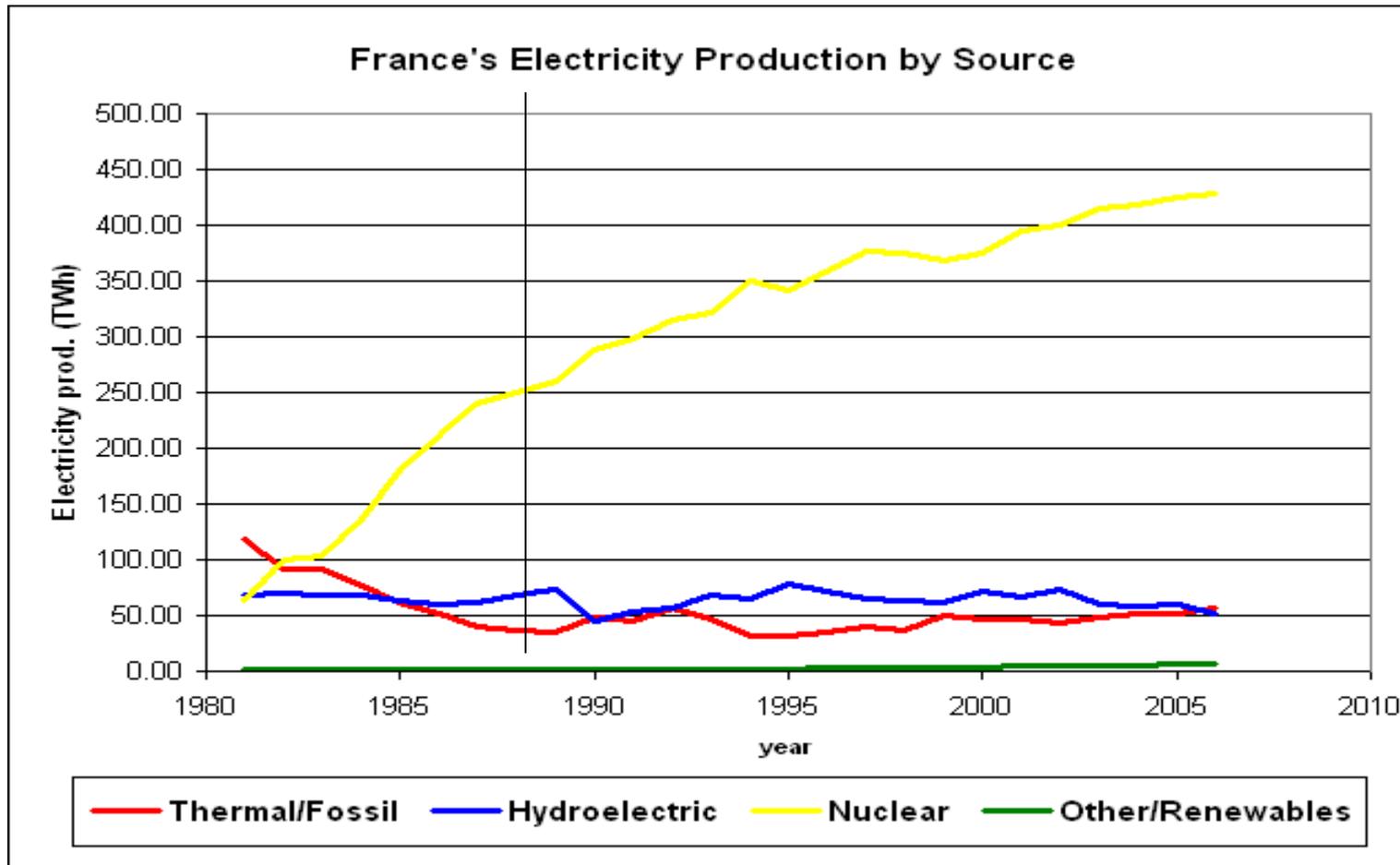
# Implications for avoiding dangerous climate change

- To have a good probability of achieving  $<2^{\circ}\text{C}$  rise
  - $\text{CO}_2$ -eq concentrations have to be  $<450\text{ppm CO}_2\text{ eq}$  (c/f c430 now)
  - global GHG emissions have to fall by  $>70\%$  below baseline by 2050
  - technologies have to be developed to capture  $\text{CO}_2$
- Global warming is a stock problem and industrialized countries are responsible for most of current stocks
  - hence reduction in OECD of c90% below BAU/1990 by 2050
- Risks are asymmetric
  - so precaution suggests a zero carbon economy as soon as possible (without excessive costs)
- Eventually all countries & sectors have to decarbonize
  - not “How much?” but “When?” for each business and government

# Examples of accelerated decarbonisation

- France's move to nuclear power in the 1980s
- Copenhagen's 25% reduction in CO<sub>2</sub> emissions below 1990 levels
- Studies of 30% reduction in US CO<sub>2</sub> emissions over 4 years to 2010 required for Kyoto ratification
  - US GDP costs estimated to be less than 1%GDP including emission trading and co-benefits from reduced air pollution

# France: decarbonising electricity production from 50% thermal in 1980 to 10% in 1987



Source: <http://www.eia.doe.gov/emeu/international/electricitygeneration.html>

# Copenhagen's 25% cut in per capita CO<sub>2</sub> emissions below 1990 levels

- *“Every citizen has reduced his input to global warming from 7 tons to 4.9 tons, by 2.1 tons in fact compared to the 1990 figures.” ... despite remarkable growth in the city ... due to connecting the district heating system and generating stations to cleaner fuels, especially ...natural gas.”*
- *“So, we dare to set an ambitious new goal of reducing CO<sub>2</sub> emissions by a further 20% by 2015 compared to today (2005 figures). This means that by 2015 we will have reduced emissions by 40% compared to 1990.”*

# US study of accelerated reductions in CO<sub>2</sub> emissions

US Administration EIA study (1998) for Congress on effects of ratifying the Kyoto Protocol on the US economy, assuming action from 2006

	2010		2020	
number of years to adjust	3 to 4		13	
trade in emission permits	none	Annex I	none	Annex I
CO <sub>2</sub> change (%)	-30.6	-18.4	-35.1	-23.9

note: \* ancillary benefits are estimated and are not in original study.

Source: US Energy Information Administration (EIA) (1998). *Impacts of the Kyoto Protocol on U.S.*

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# US GDP costs for accelerated reductions in CO<sub>2</sub> emissions

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Base GDP effect (%)	- 4.2	-2.0	-0.8	-0.6
Additional effects of:				
non-CO <sub>2</sub> +sinks	0.7	0.3	0.1	0.1
revenue recycling	1.9	0.7	0.4	0.2
ancillary benefits*	0.4	0.3	0.4	0.3
Total GDP effects (%) *	-1.2	-0.7	0.1	0.0

note: \* ancillary benefits are estimated and are not in original study.

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# What are the macro-economic costs by 2030 for different stabilization levels?

Stabilization levels (ppm CO <sub>2</sub> -eq)	Median GDP reduction <sup>[1]</sup> (%)	Range of GDP reduction <sup>[2]</sup> (%)	Reduction of average annual GDP growth rates <sup>[3]</sup> (percentage points)
590-710	0.2	-0.6 – 1.2	< 0.06
535-590	0.6	0.2 – 2.5	<0.1
<b>445-535<sup>[4]</sup></b>	<b>Not available</b>	<b>&lt; 3</b>	<b>&lt; 0.12</b>

[1] This is global GDP based market exchange rates.

[2] The median and the 10<sup>th</sup> and 90<sup>th</sup> percentile range of the analyzed data are given.

[3] The calculation of the reduction of the annual growth rate is based on the average reduction during the period till that would result in the indicated GDP decrease in 2030.

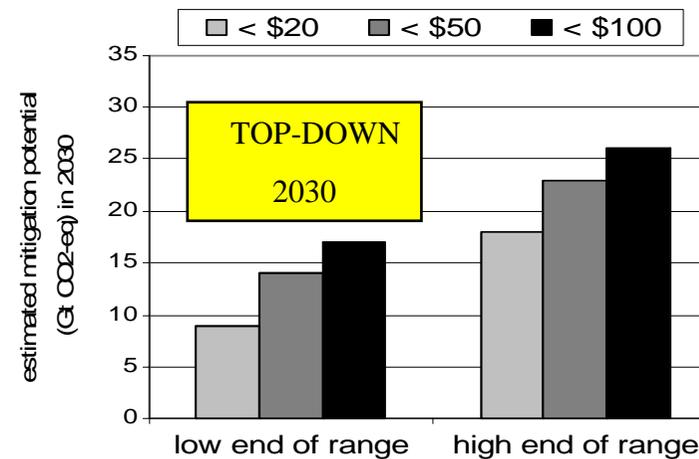
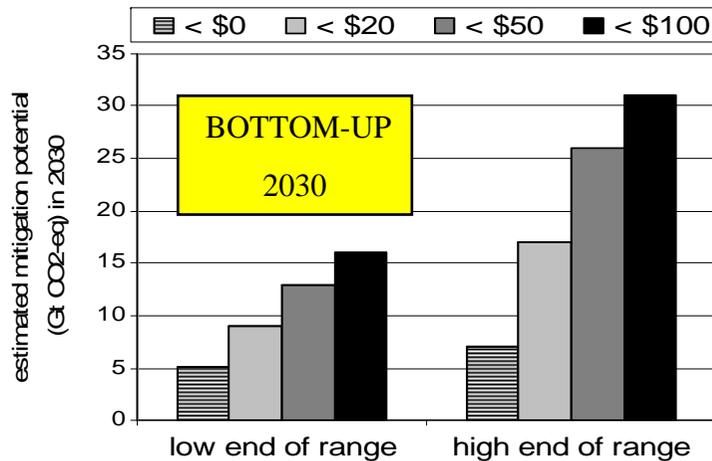
[4] The number of studies that report GDP results is relatively small and they generally use low baselines.

# Implications for business

- Adaptation to climate change is necessary: the damages from extreme events will go on rising
- Opportunities in mitigation
  - No-regrets options especially in buildings
  - New markets in low-carbon products and processes
  - Global niche markets will develop, supported by government policies, supported by technological agreements and CDM and JI mechanisms
  - Governments have recognised that the market failure in innovation should be recognised

# Economic potential is substantial for the mitigation of global GHG emissions over the coming decades

- Estimates are from both bottom-up and top-down studies



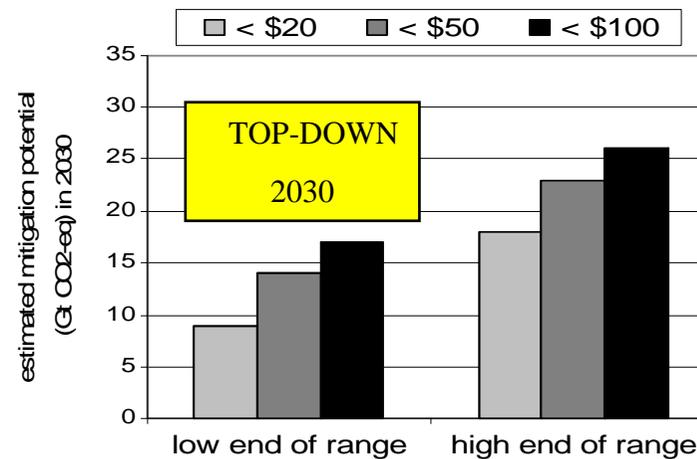
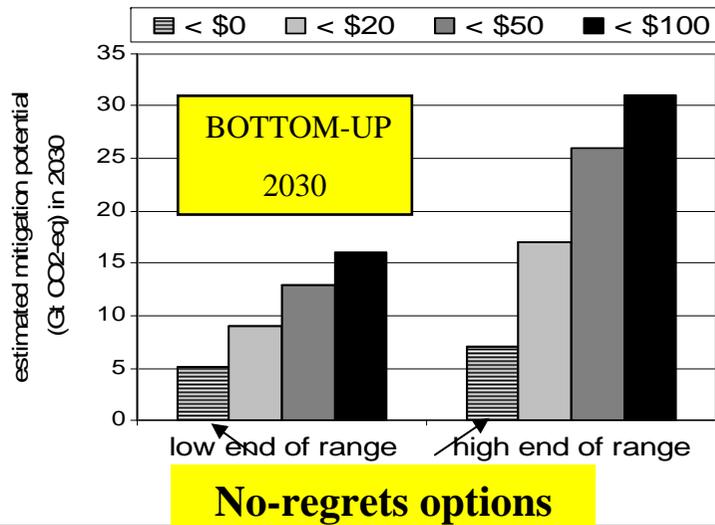
*Figure SPM 5A: Global economic potential in 2030 estimated. Cost categories in US\$/tCO<sub>2</sub>eq.*

*Figure SPM 5B: Global economic potential in 2030 Cost categories in US\$/tCO<sub>2</sub>eq..*

Note: estimates do not include non-technical options such as lifestyle changes

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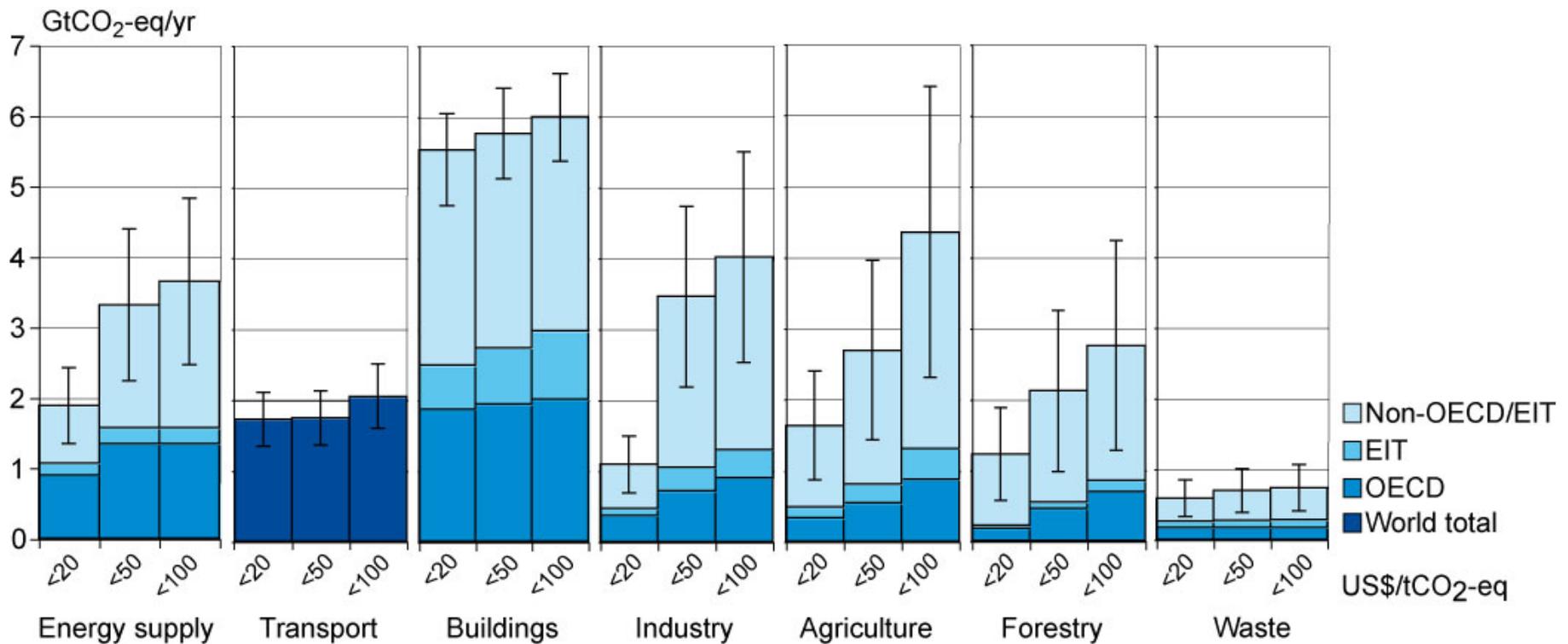


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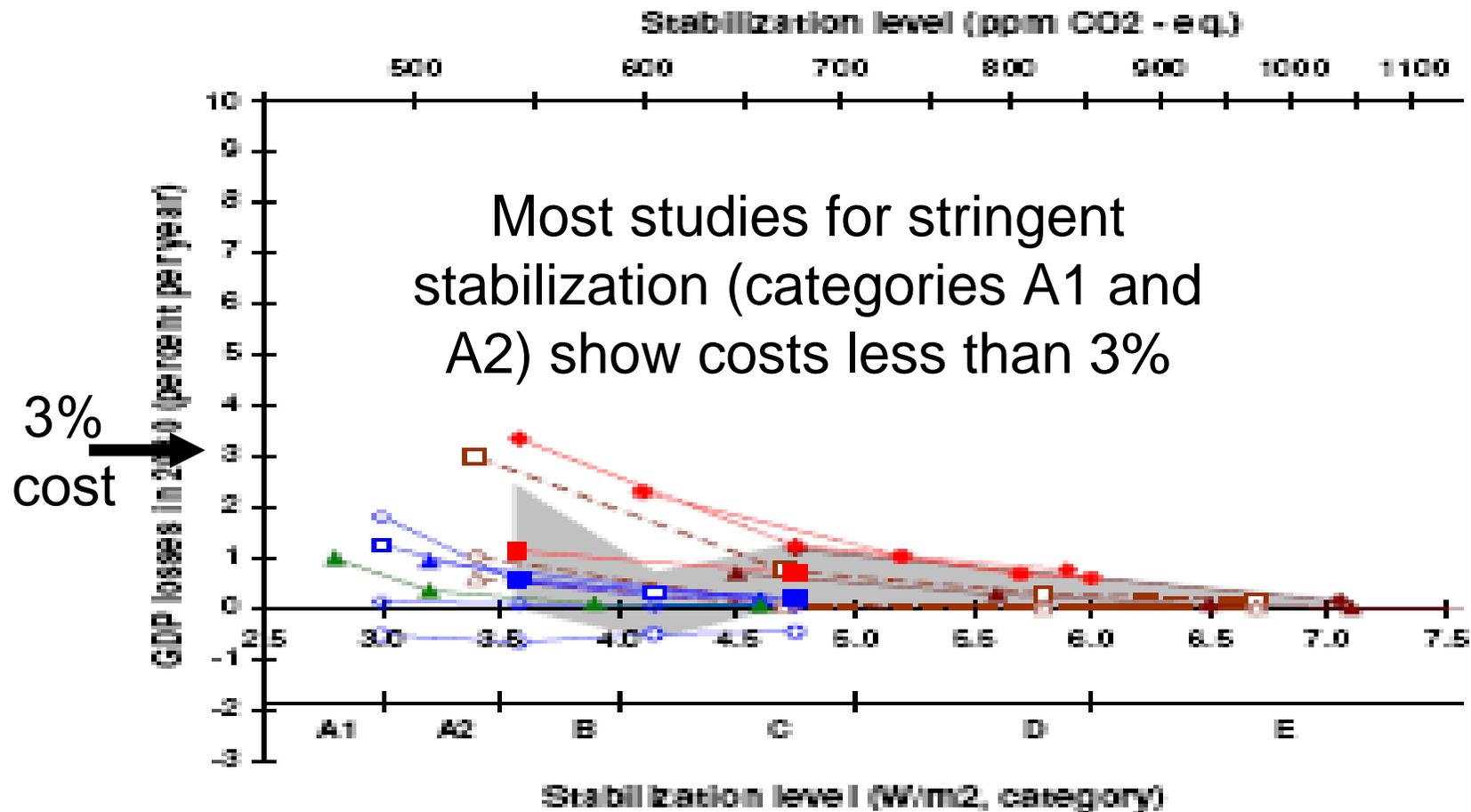
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# All sectors and regions have the potential to contribute (end-use based)



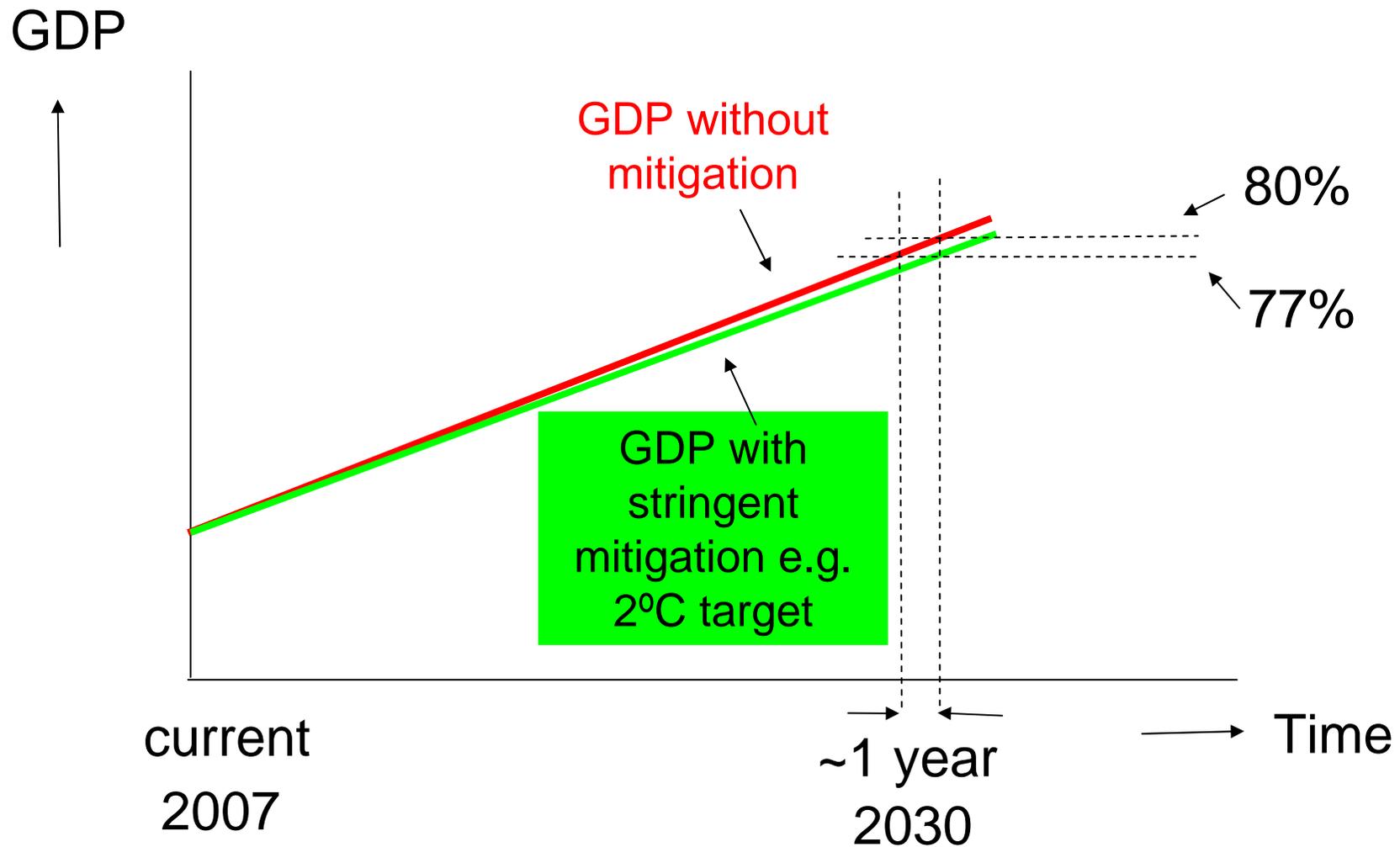
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# 3% maximum global cost by 2030 in context

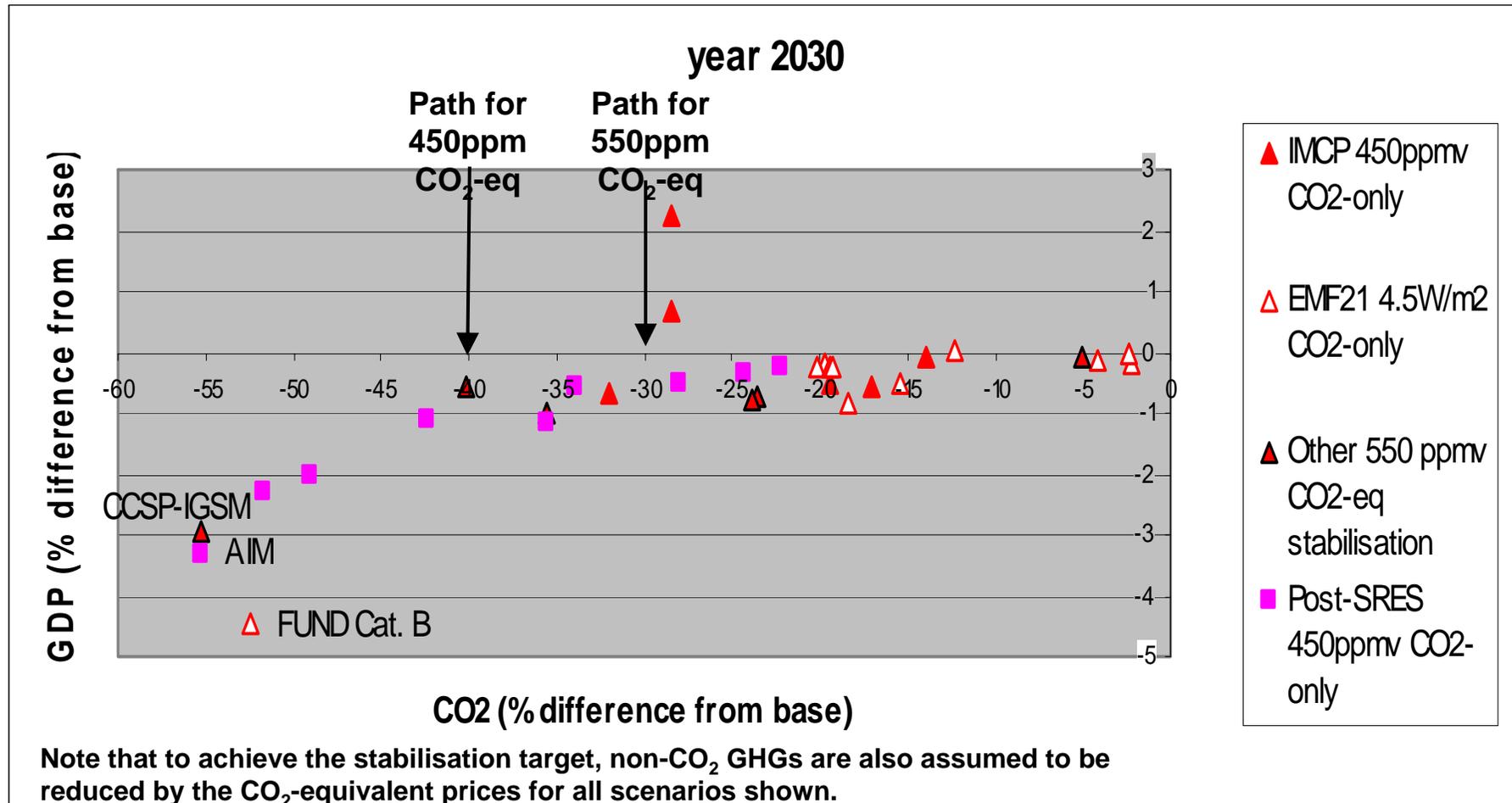


Source: IPCC AR4, WG III Report 2007, Chapter 3, Figure 3.25 (a)

# Illustration of the 3% cost number



# GDP and CO<sub>2</sub> effects for 450-550ppm CO<sub>2</sub>-eq stabilisation from modelling studies



# Summary: the costs of achieving the 2° C target

Key conclusion from IPCC AR4: not enough studies on stringent mitigation have been done!

Extrapolating from current studies:

***The macro-economic costs of the 2°C target appear to be negligible (even beneficial) for global GDP and welfare, provided policies are “well-designed”***

- Equilibrium models (providing nearly all the cost estimates) *assume* that mitigation will be costly, despite evidence from econometric models and business
- Low-cost, low-GHG technologies are likely to be developed both directly and through rising carbon prices
- But this requires international co-operation on allocation of burdens and benefits

# Conclusions for policy

- A rising real carbon price is required of about \$100/tCO<sub>2</sub> by 2020 (rising thereafter) to be on the safe side, e.g. by a trading scheme
  - the price should be guaranteed by government so as to reduce the risks of investing in low-GHG technologies, e.g. by reserving a % of traded permits
  - a portfolio of supporting policies (regulation, ecotax reform, information) will reduce costs and accelerate change
- A zero-carbon economy appears feasible at negligible (but uncertain) macroeconomic costs, with high carbon prices and strong regulation
  - the carbon price should be “long, loud and legal”
  - lower costs critically depend on international co-ordination

# Conclusions for business

- EU-based business has a “first mover” advantage in low-carbon global niche markets
- Climate change, energy security and high prospective oil prices are all now driving corporate policies at top levels
- Strategic business responses:
  - immediate: deep review and reform of existing practices, with retrofitting and replacement, assuming \$100/tCO<sub>2</sub> shadow price
  - novel low-carbon solutions for technologies, business models, value-chains
  - lobby for EU and global standards, good regulation, incentives for innovation and to reduce market barriers

# UK climate policies

- UK has an ambition to provide leadership in addressing climate change
  - Mrs Thatcher and the Hadley Centre
  - Tony Blair and G8
- One of the leaders in reducing CO<sub>2</sub> emissions
  - but due to “dash for gas”
  - 20% CO<sub>2</sub> target for 2010 looks unlikely to be reached and 60% by 2050 not enough
- Climate Change Bill: a constitutional experiment
  - CC Committee
  - 3 4-year budget periods (2008-12, 2013-17, 2018-22)