

The Impacts of Climate Change: what do we know, how do we know it, and what should we do?

Prepared for CUEN
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Plan of talk

- Reasons for concern
- Setting a price on CO₂ emissions

Climate change

Climate change is a far greater threat to the world than international terrorism.

Sir David King, BBC News, 9 January 2004

Climate change can be likened in its destructive scale to the effects of using weapons of mass destruction, according to Britain's leading scientist.

*Lord May, President of the Royal Society,
The Independent, 29 November 2005*



The role of carbon pricing

‘Technology has a clear connection with government policy. Incentives must come from taxes or a carbon price.’

Source: IPCC chair Rajendra Pachauri May 2007

‘If we want action, then clearly there has to be a price attached to carbon which will move us towards a low carbon economy.’

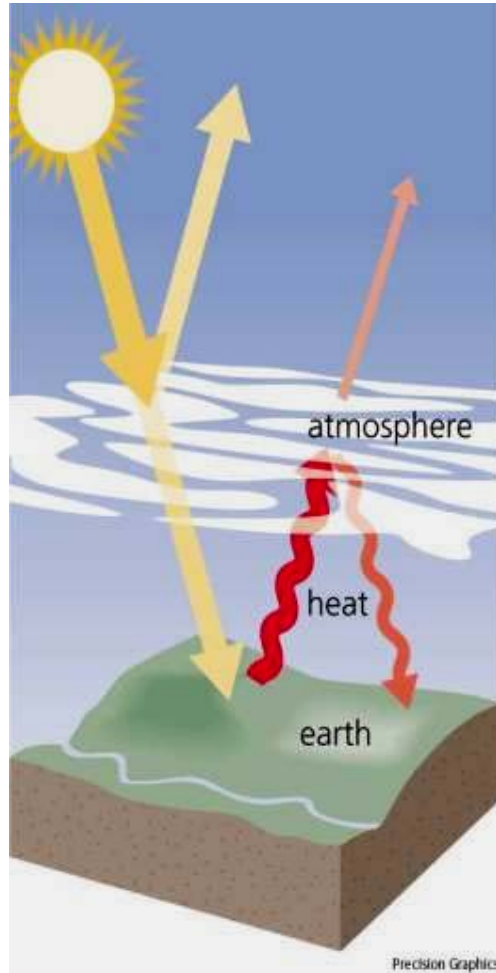
Source: IPCC chair Rajendra Pachauri 19 November 2007

‘The shadow price of carbon should be incorporated into policy and investment appraisals in the same way as any other cost or benefit.’

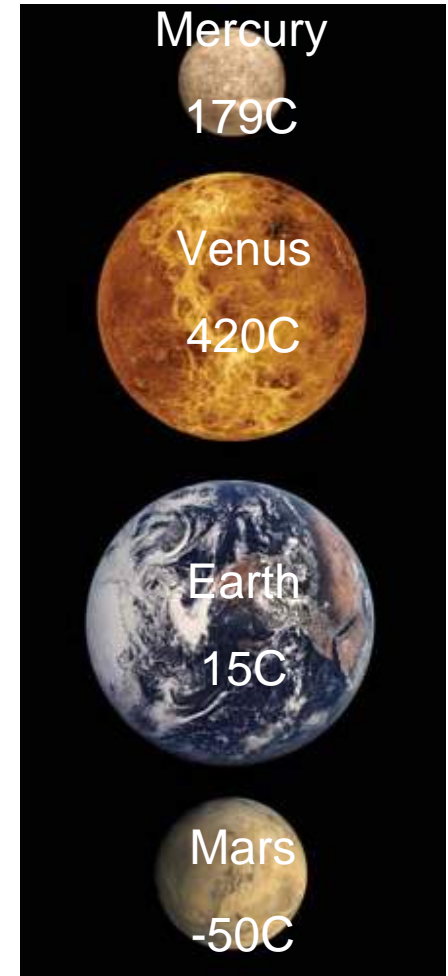
Source: Defra, December 2007



Greenhouse Effect



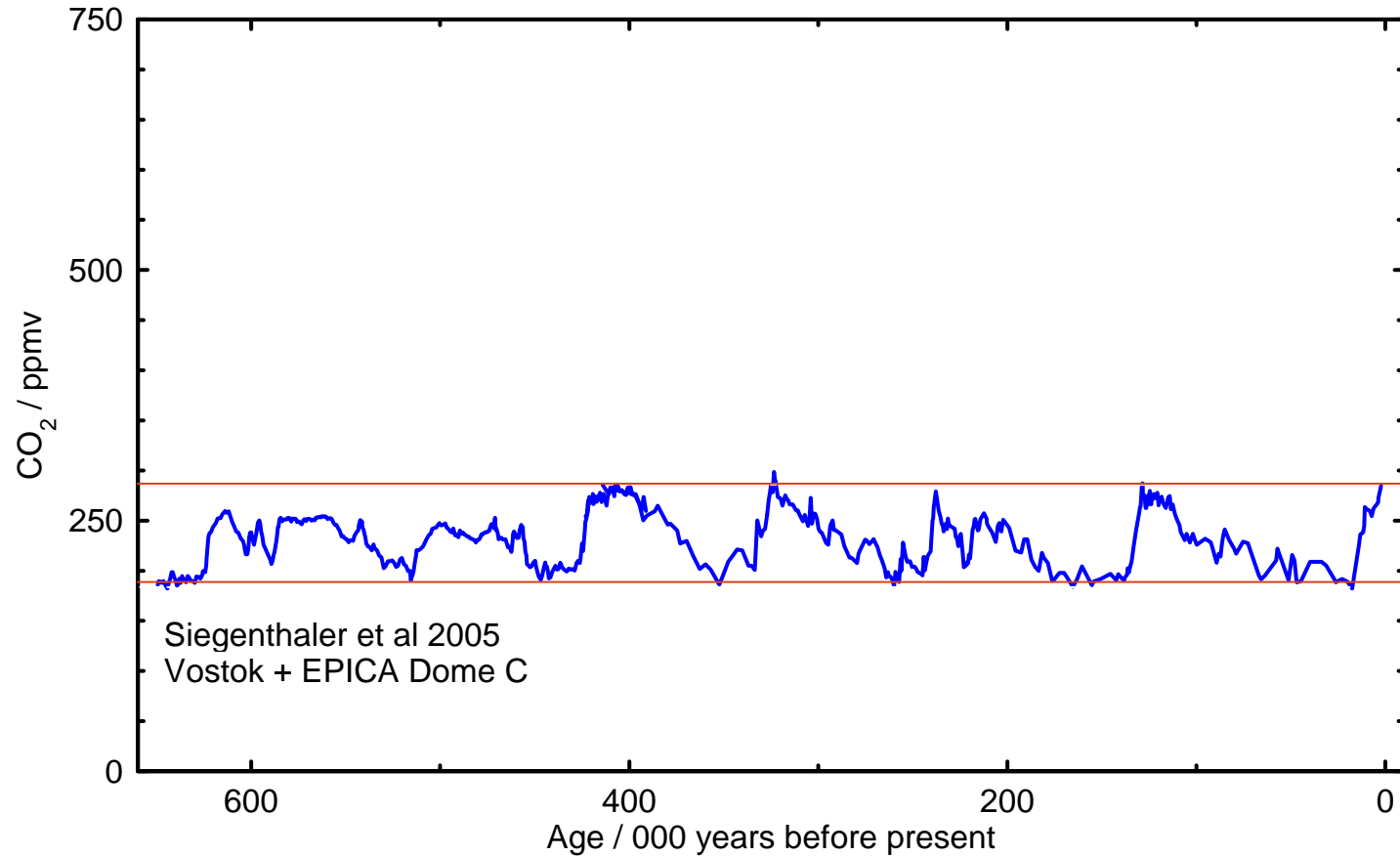
- 19th century physics
- Verified by data from Mars, Venus & Mercury
- Earth's surface would be 33C cooler and frozen over without it



Source: IPCC WG1, 2001; Chris Rapley, British Antarctic Survey, 2007



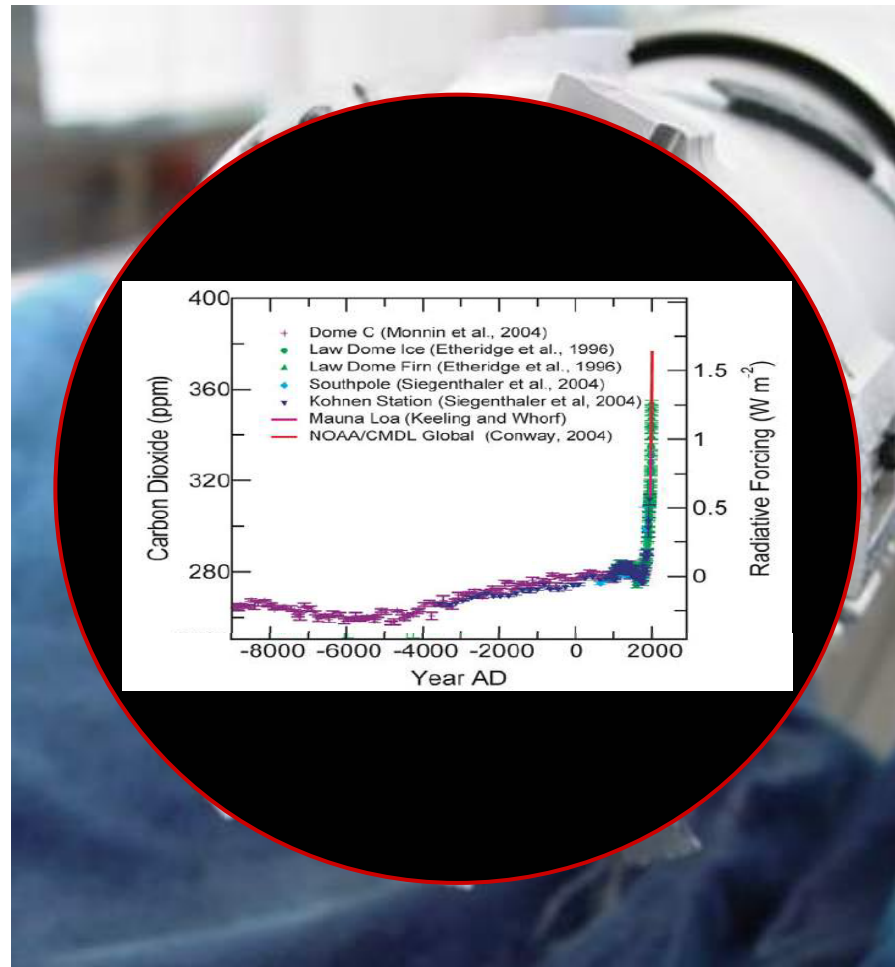
Past atmospheric CO₂ concentrations



Source: Chris Rapley, British Antarctic Survey, 2007



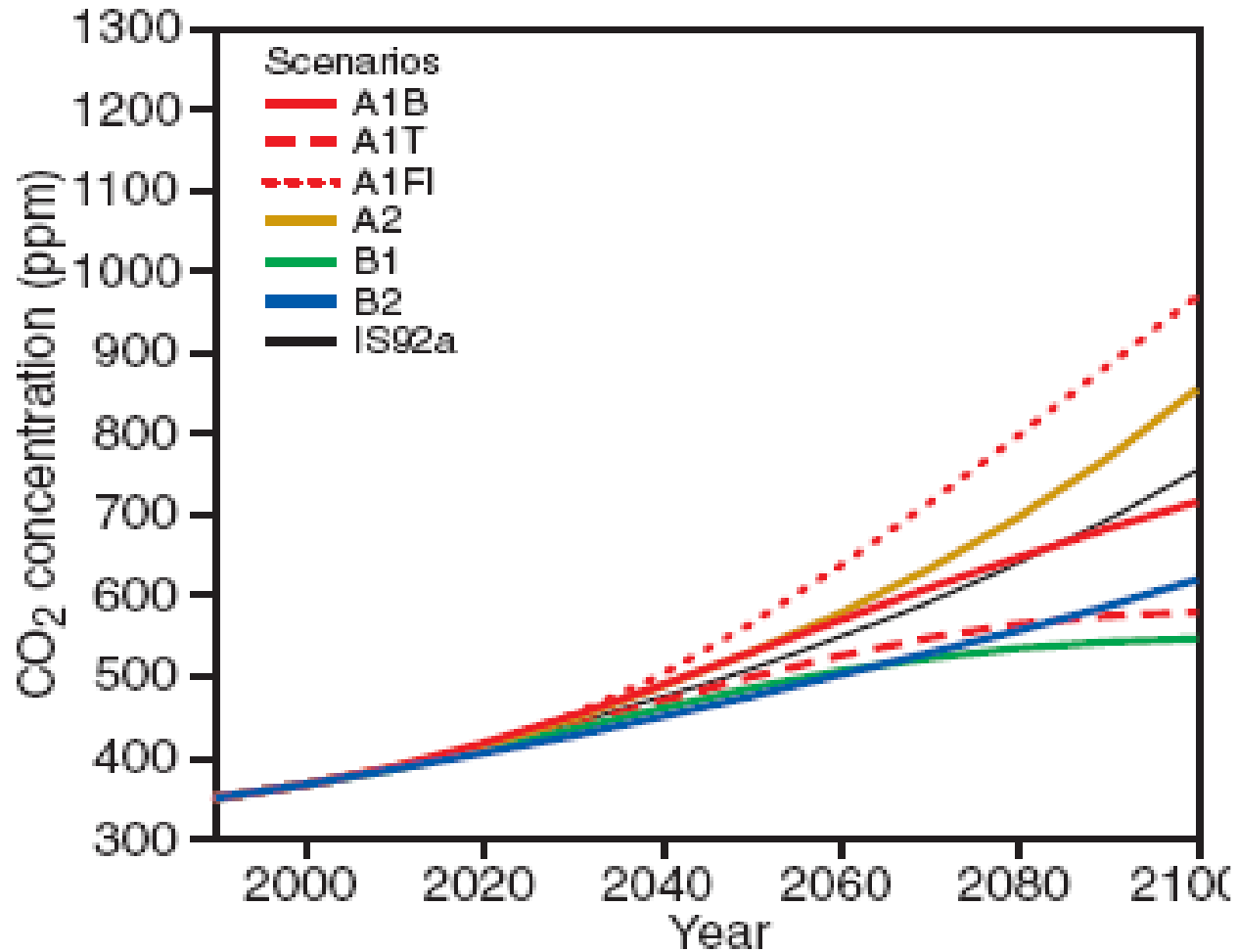
Present atmospheric CO₂ concentrations



Source: Chris Rapley, British Antarctic Survey, 2007



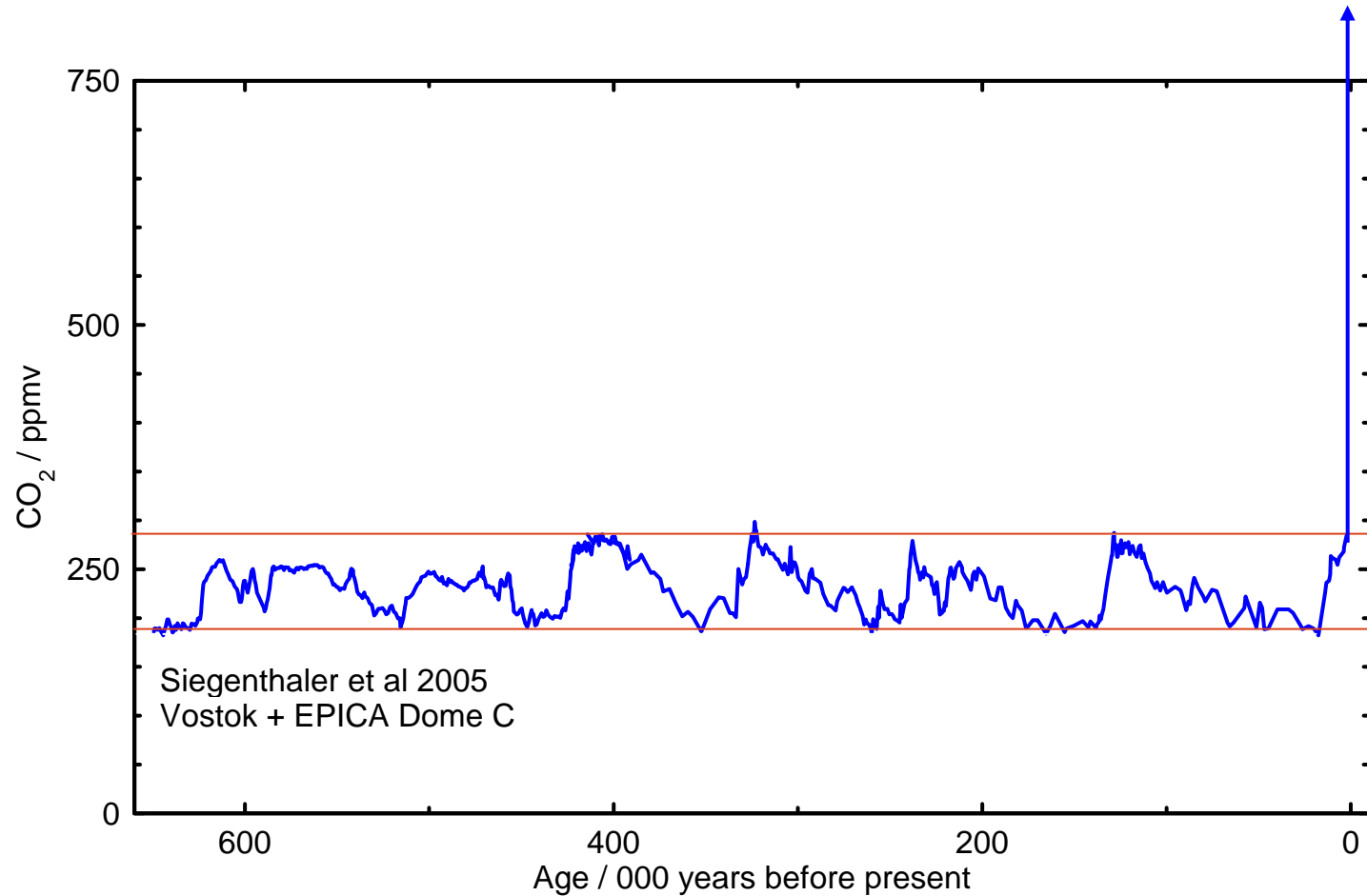
Future atmospheric CO₂ concentrations



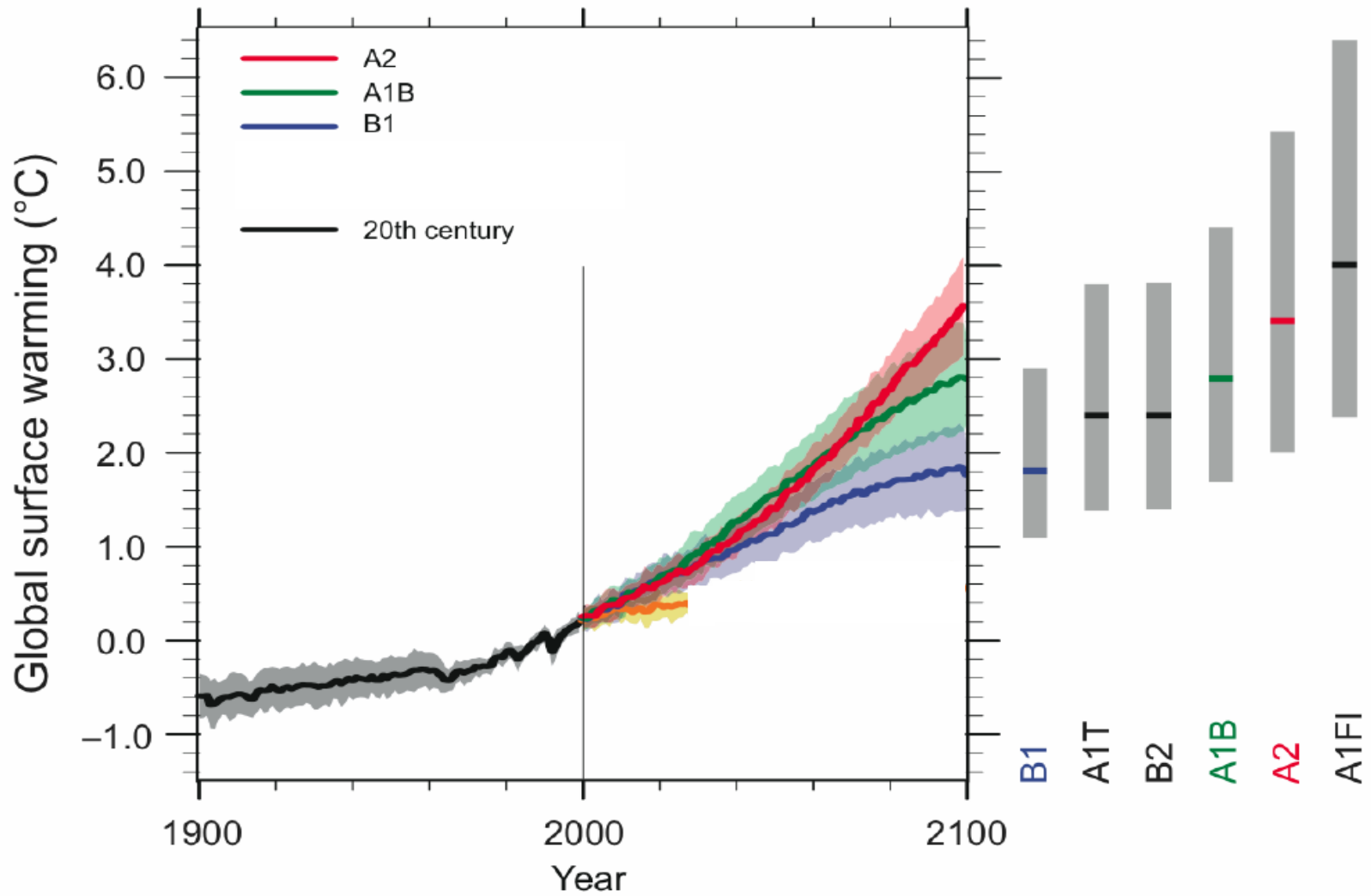
Source: IPCC WG1, 2001



Past and future CO₂ concentrations



Multi-model Averages and Assessed Ranges for Surface Warming



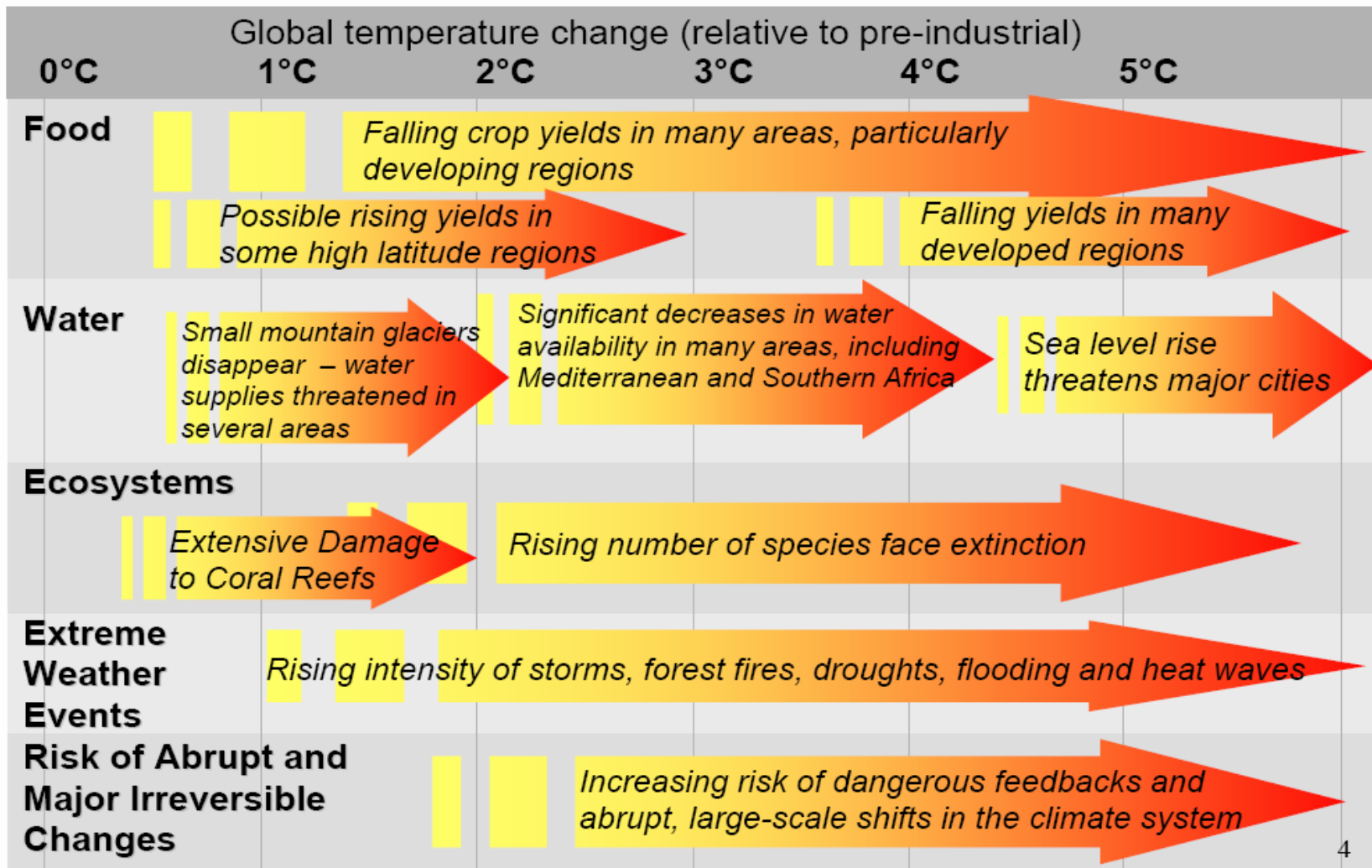
Source: IPCC WG1 SPM, 2007

<http://www.ipcc.ch/SPM2feb07.pdf>





Projected Impacts of Climate Change



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Source: Stern Review on the Economics of Climate Change, 2006



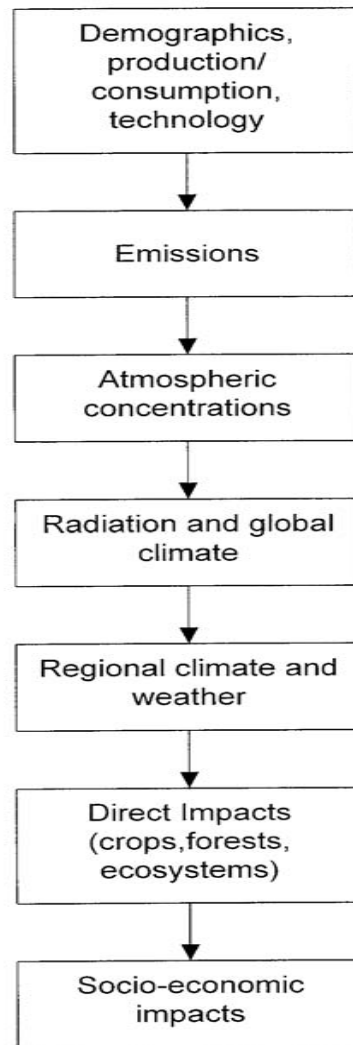
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What do we know?

- Climate change is very likely to be a serious problem
- No certainty about exactly what the impacts will be and when they will occur
- We need to take account of this uncertainty when deciding what we should do



The scope of Integrated Assessment Models



Source: Parson and Fisher-Vanden, 1997

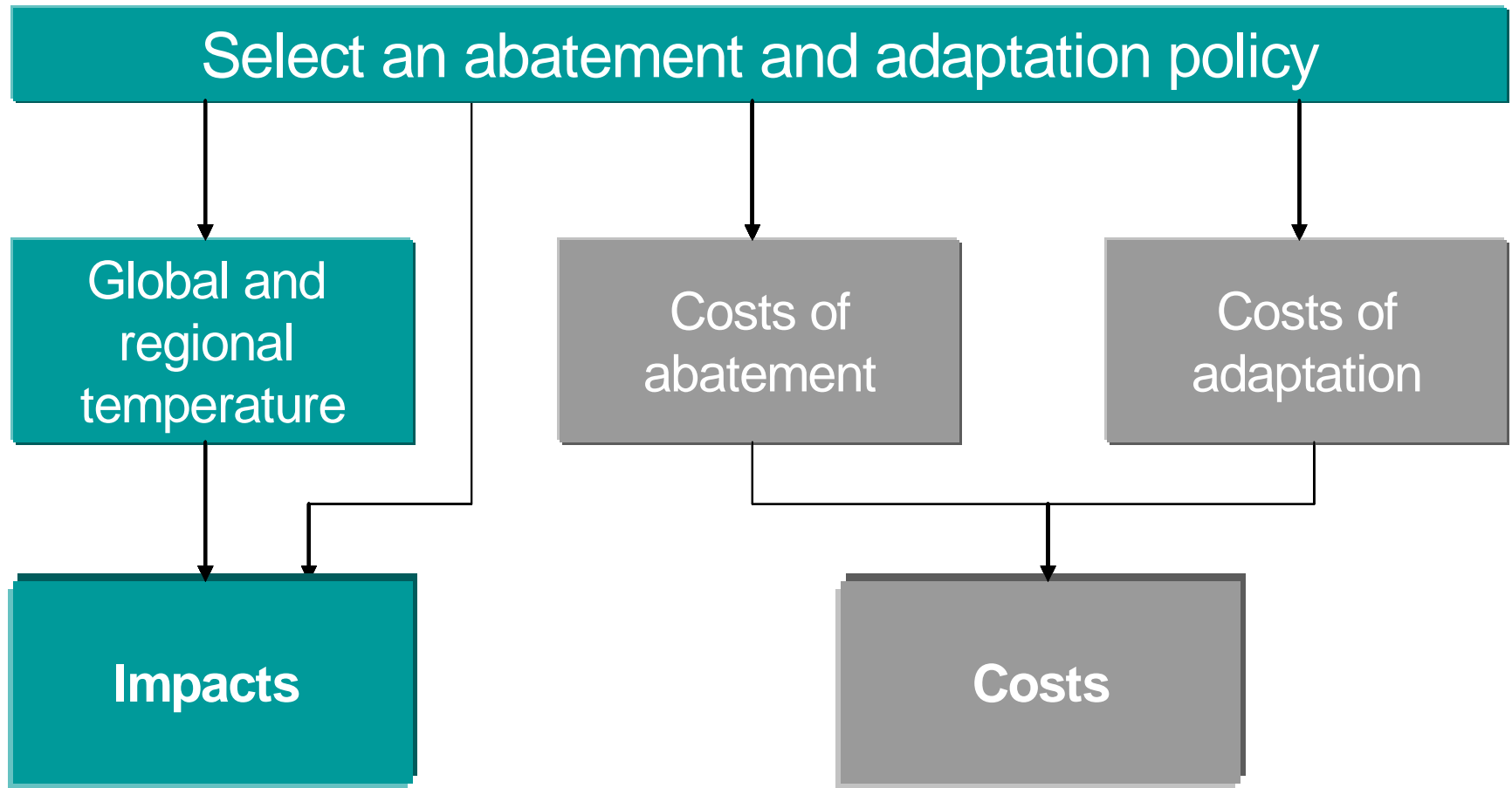


Scope of the PAGE2002 model

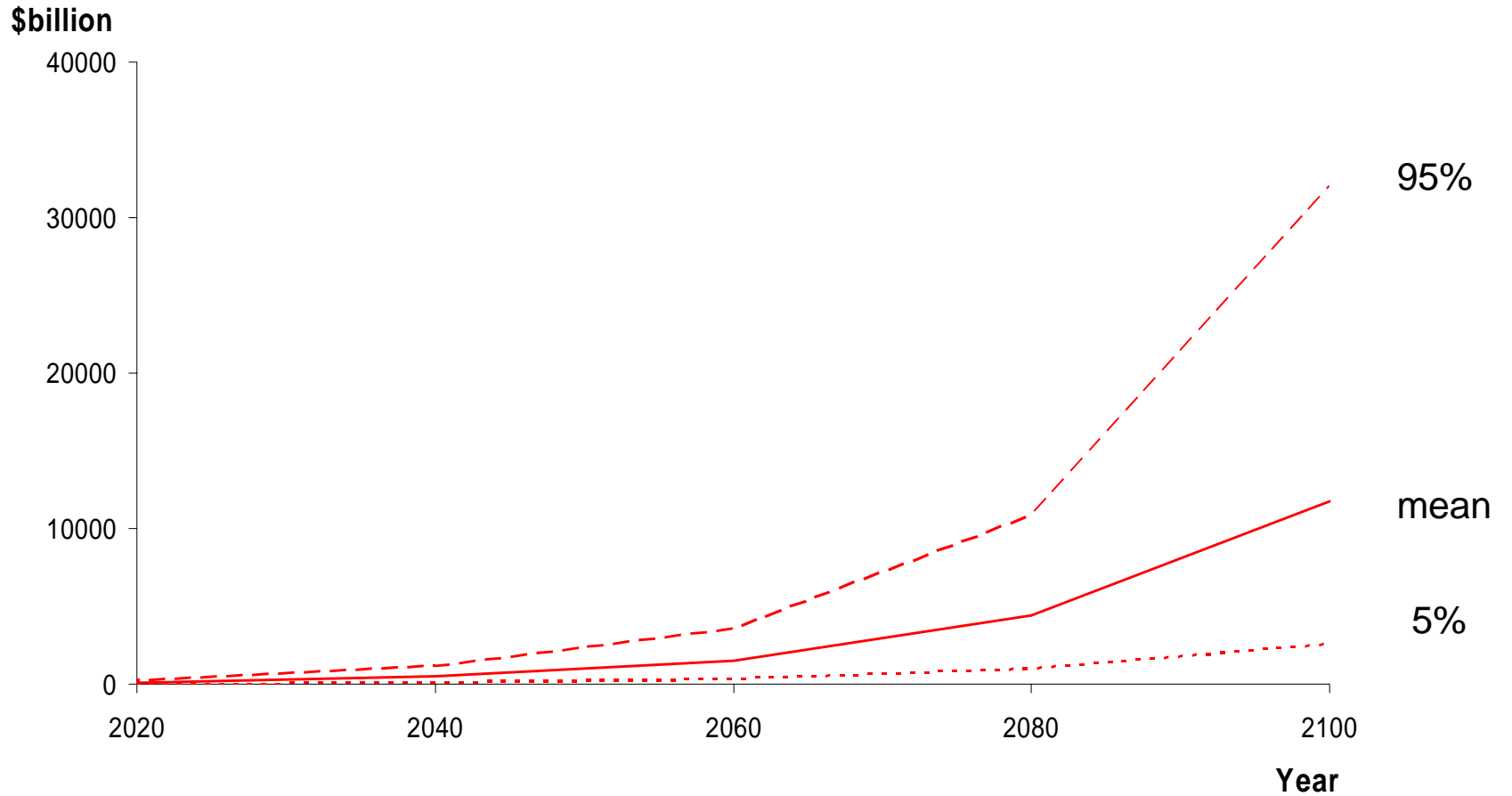
- Eight world regions.
- The major greenhouse gases.
- Economic, non-economic and catastrophic impacts.
- Time horizon of 2200.
- Probabilistic calculations.



Structure of the PAGE2002 model



Global impacts by year



	5%	mean	95%	
Total global impacts	10	70	200	\$ trillion

IPCC Scenario A2

Why bother?

Allows the calculation of social costs

- of different greenhouse gases
- at different times
- with different parameter values

To set a price on one tonne of CO₂ and other emissions for comparison with marginal abatement costs.



Valuing the impacts of climate change

Each tonne of CO₂ emitted in 2001 caused \$85 worth of damage.

This is rising at 2-3% per year in real terms.

The damage caused by a tonne of CO₂ emitted in 2008 is \$100. By 2020 this rises to \$135.

Source: Stern Review on the Economics of Climate Change, 2006



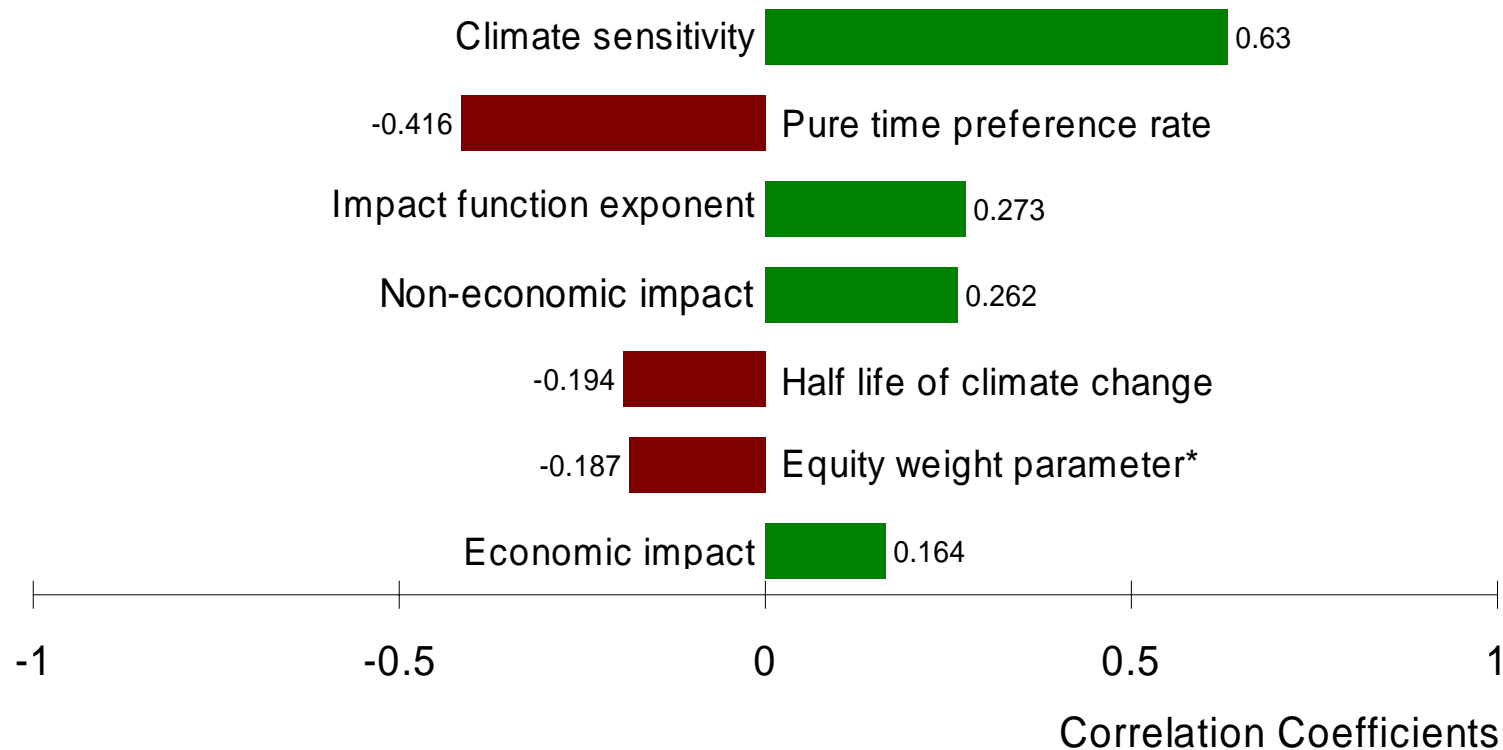
Social cost of carbon in 2008 with 'Stern review' assumptions

<i>2000 - 2200</i>	<i>\$US (2000) per tonne</i>		
	5%	mean	95%
CO₂	25	100	300

Source: 10000 PAGE2002 model runs using 'Stern review' assumptions



Major influences on the social cost of CO₂



* Negative of the elasticity of the marginal utility of consumption

Source: PAGE2002 model runs for scenario A2



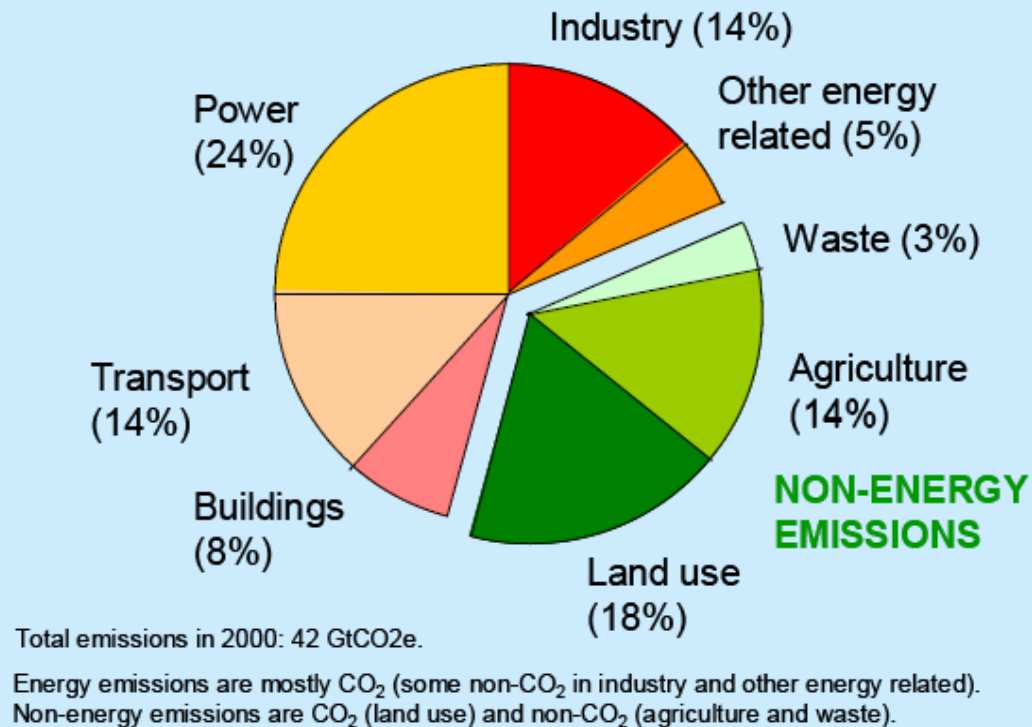
What does a price of \$100 per tonne of CO₂ imply?

- 12 pence on a litre of petrol
Typical retail price 100 p/litre
- 1 p/kwh on gas
Typical retail price 3 p/kwh
- 4 p/kwh on electricity from coal
- 1.8 p/kwh on electricity from gas
Typical retail price 10 p/kwh
- £60 on a return air ticket from London to Barcelona
Typical retail price ???



What is causing climate change?

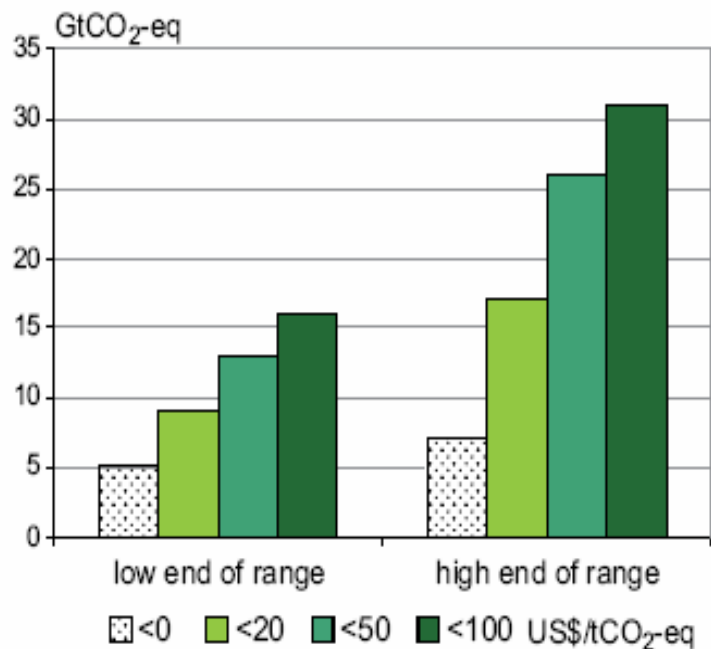
Figure 7.1 GHG emissions in 2000, by source⁸



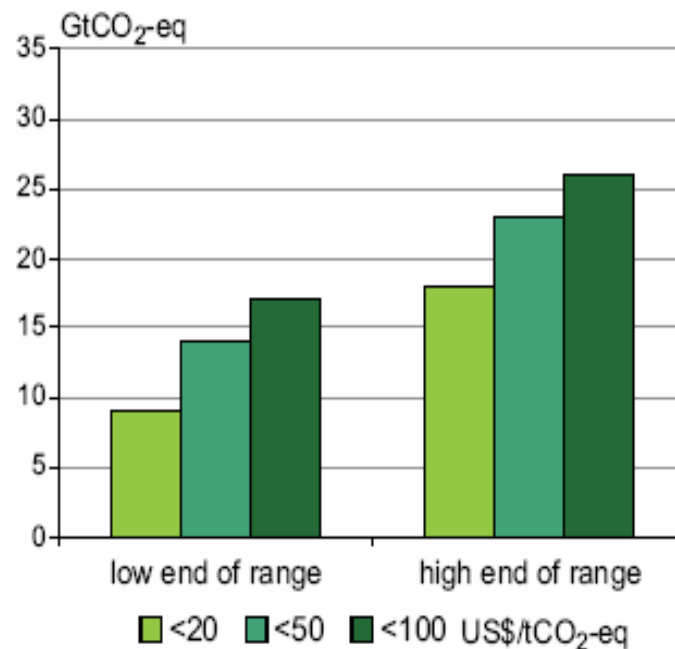
Source: WRI (2006)



Global abatement potential in 2030



Bottom-up studies



Top-down studies

Source: IPCC WG III, SPM, 2007

The economy would benefit from a price on CO2 emissions

The economic instrument which is most suitable for addressing the problem is a **carbon tax**, with appropriate consideration of equity and competitiveness effects, or **emission allowances** which are **auctioned** rather than given free to the emitters.

If the revenues from the taxes or auctions are spent on reducing burdensome taxes, then the costs of tackling climate change are reduced by about 2% of GDP, and may even be converted to benefits.

Sources: Terry Barker, Evidence to the House of Lords Select Committee on the economics of climate change, 2005, and Stern Review on the Economics of Climate Change, 2006, chapter 10.



Revenue in the UK from a climate change tax or auctioned permits

- Revenue from CO₂ in first year: £ 35 billion
(560 x 100 / 1.6) million
- International Air Travel: £ 4 billion
(20 x 3 x 100 / 1.6) million
- Other greenhouse gases: £ 6 billion
(27/153 x 35) billion
- Revenue in 2020: £ 43 billion
(Tax rate increases by 35%, emissions reduce by 30%)
- Total UK tax revenues in 2006 £500 billion

Source: Author's calculations



Possible Taxes to be Reduced

On businesses

Employers' National Insurance contributions

Corporation tax

On households

Employees' National Insurance contributions

Income tax

VAT



The UK shadow price of carbon

Initial proposals

- a shadow price of carbon ‘consistent with the damage experienced under an emissions scenario which leads to stabilisation at 550ppm CO₂e.’
- £25/tCO₂ in 2007
- rising in real terms by 2% per year
- reviewed in full every five years.

Source: Defra, The Social Cost Of Carbon And The Shadow Price Of Carbon: What They Are, And How To Use Them In Economic Appraisal In The UK, December 2007

