



# Failed Markets, Irrational Markets and Environmental Policy

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## The conventional wisdom - 2006



*“There is a growing recognition that the dispersion of credit risk by banks to a broader and more diverse group of investors, rather than warehousing such risk on their balance sheet, has helped make the banking and overall financial system more resilient.*

*The improve resilience may be seen in fewer bank failures and more consistent credit provision. Consequently the commercial banks may be less vulnerable today to credit or economic shocks”.*

IMF Global Financial Stability Report, April 2006

# After the crash: challenges to neoclassical economics



## Assumption

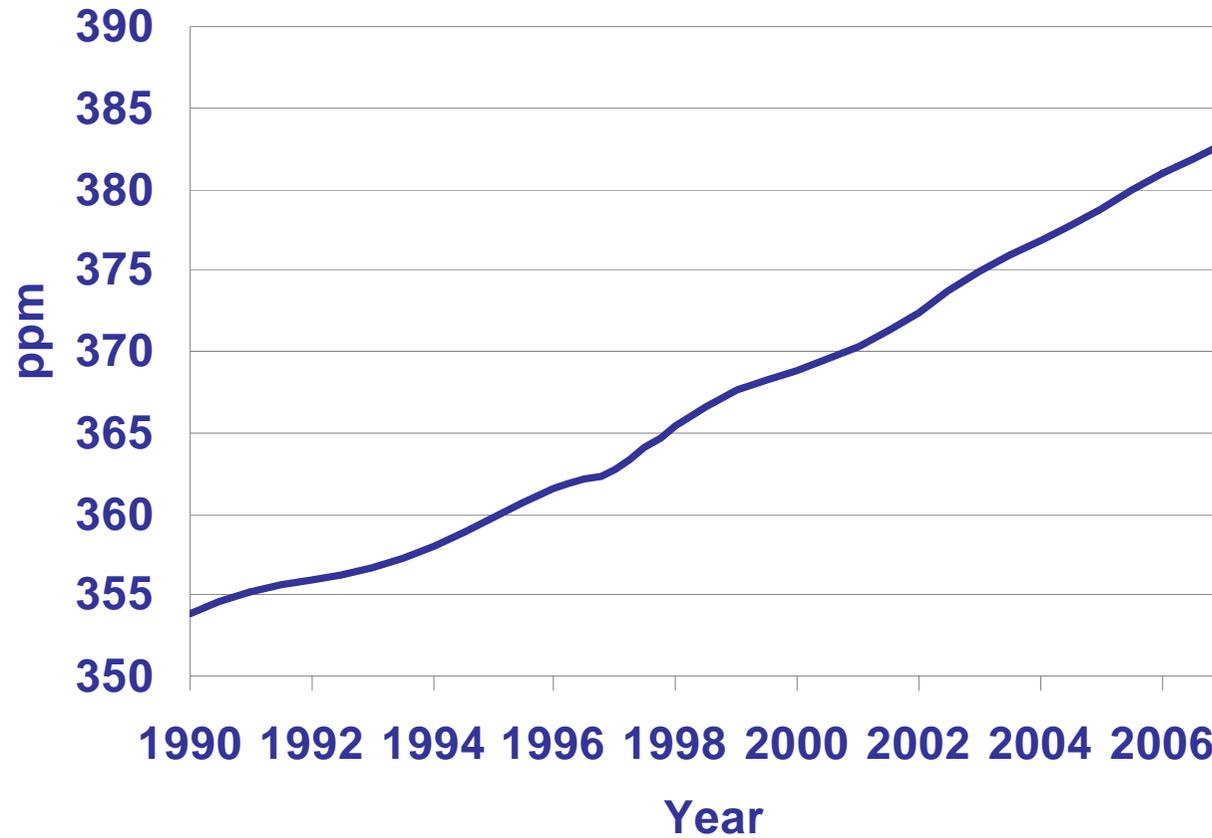
- Liquid financial markets efficient and rational
- Future market risk inferred from past observations
- Market discipline and competition deliver social optimality
  - Only valuable innovation survives

## Reality

- Periodic and inherent potential for irrational exuberance or despair
- Inherent uncertainty in social and economic relationships
- Not all innovation socially useful
- Potential for significant rent extraction

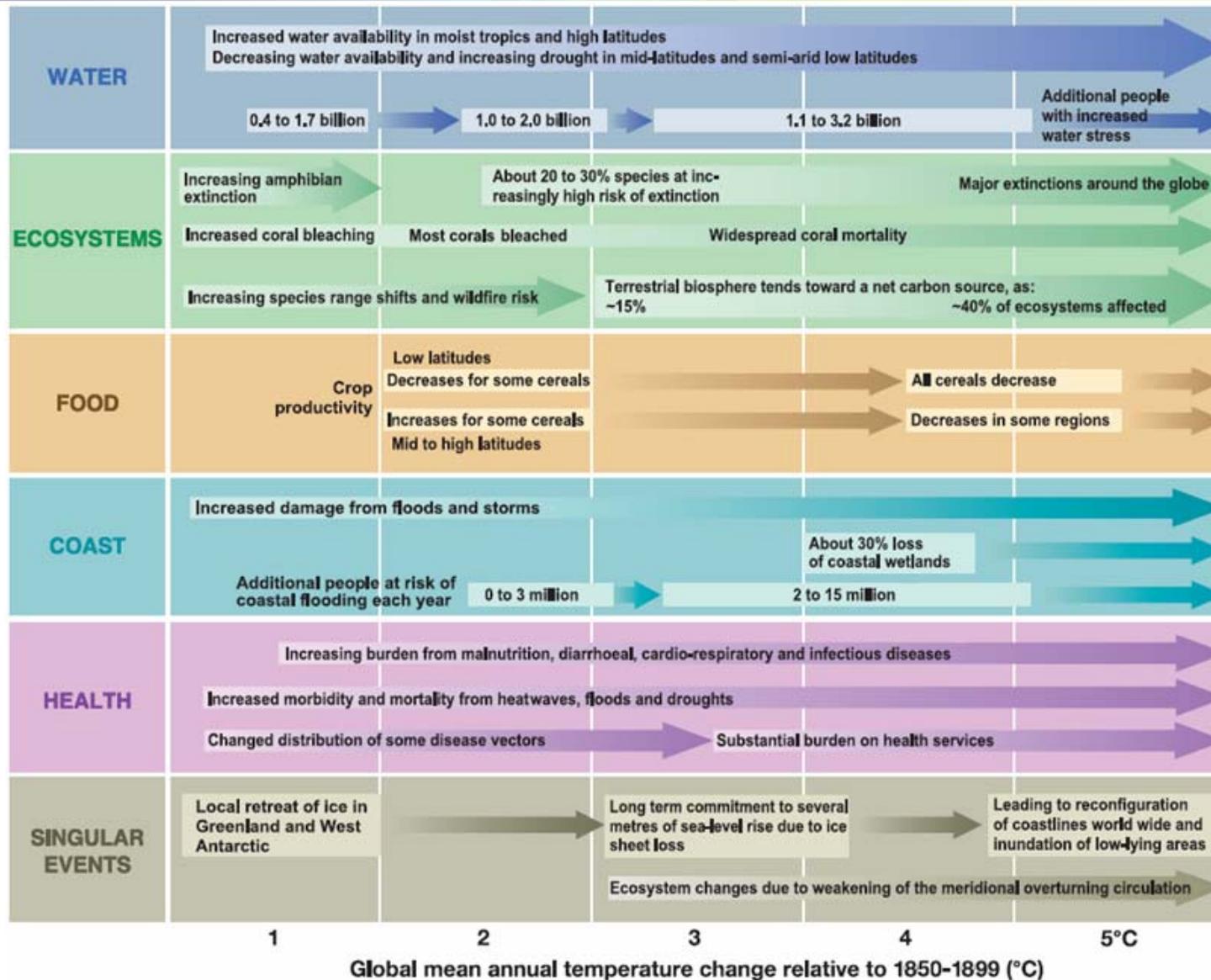
- Carbon markets and uncertainty
- Prices versus regulation: economies of scale in choice
- Malleable consumer preference: nudging consumer choice
- Economic growth and happiness
- Valuing the future: discount rates and social choice

# Global annual averages



Source: NOAA/ESRL

# Global impacts of changes in climate



# Proposed temperature objectives



- Keep very low (<1%) the estimated probability of exceeding +4°C temperature rise
- Minimise the likely increase above 2°C

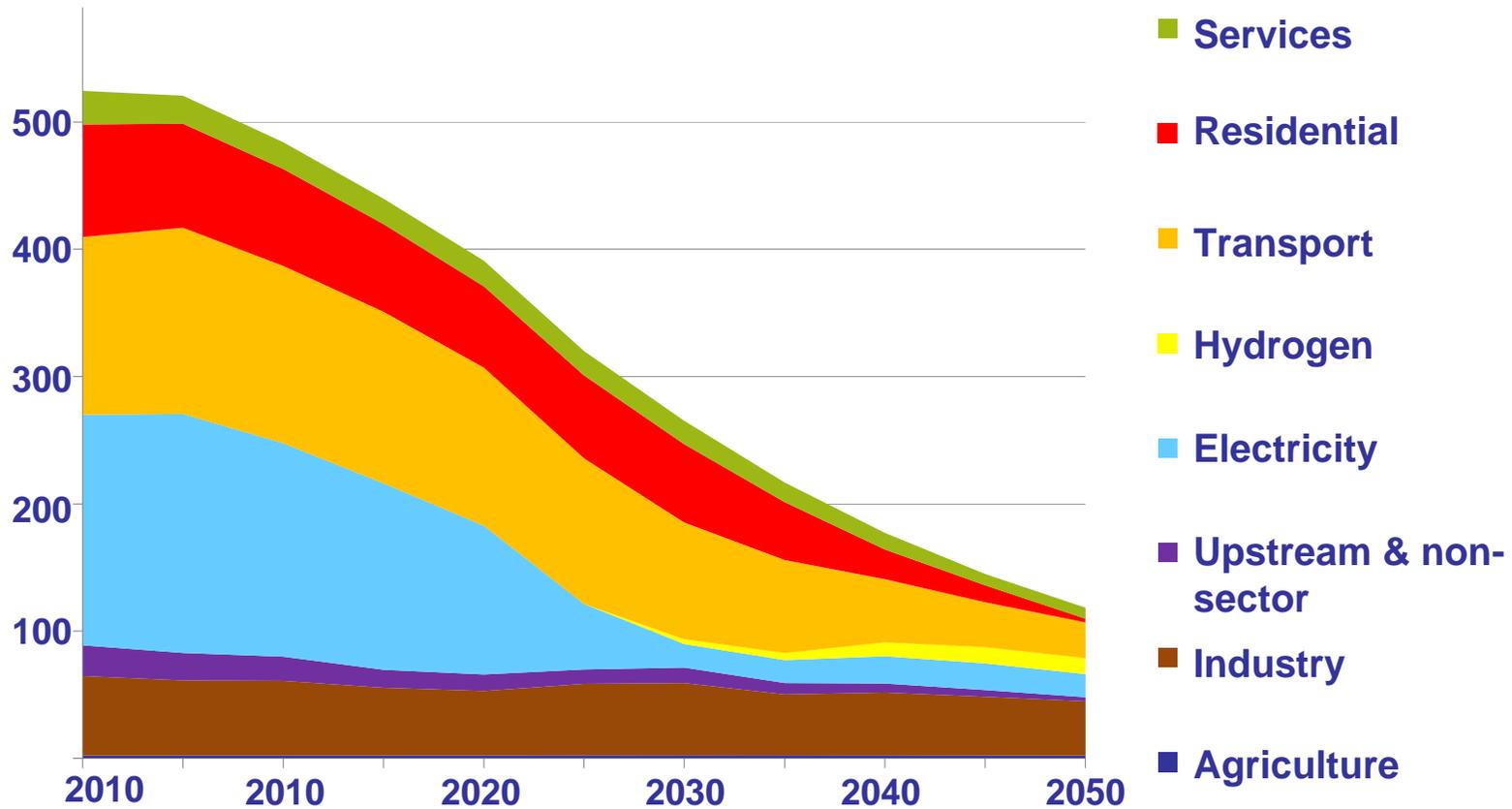
# Proposed approach to UK targets



- World needs to reduce emissions to 20-24 Gt CO<sub>2</sub> by 2050
- World population in 2050: 9-10 billion
- Implies average 2.1 – 2.6 tonnes CO<sub>2</sub> per capita
- Implies UK reductions 78-82% versus 1980 baseline

# Possible path to 80% cut

Domestic fossil fuel & industry process CO<sub>2</sub> emissions  
(MtCO<sub>2</sub> per year)

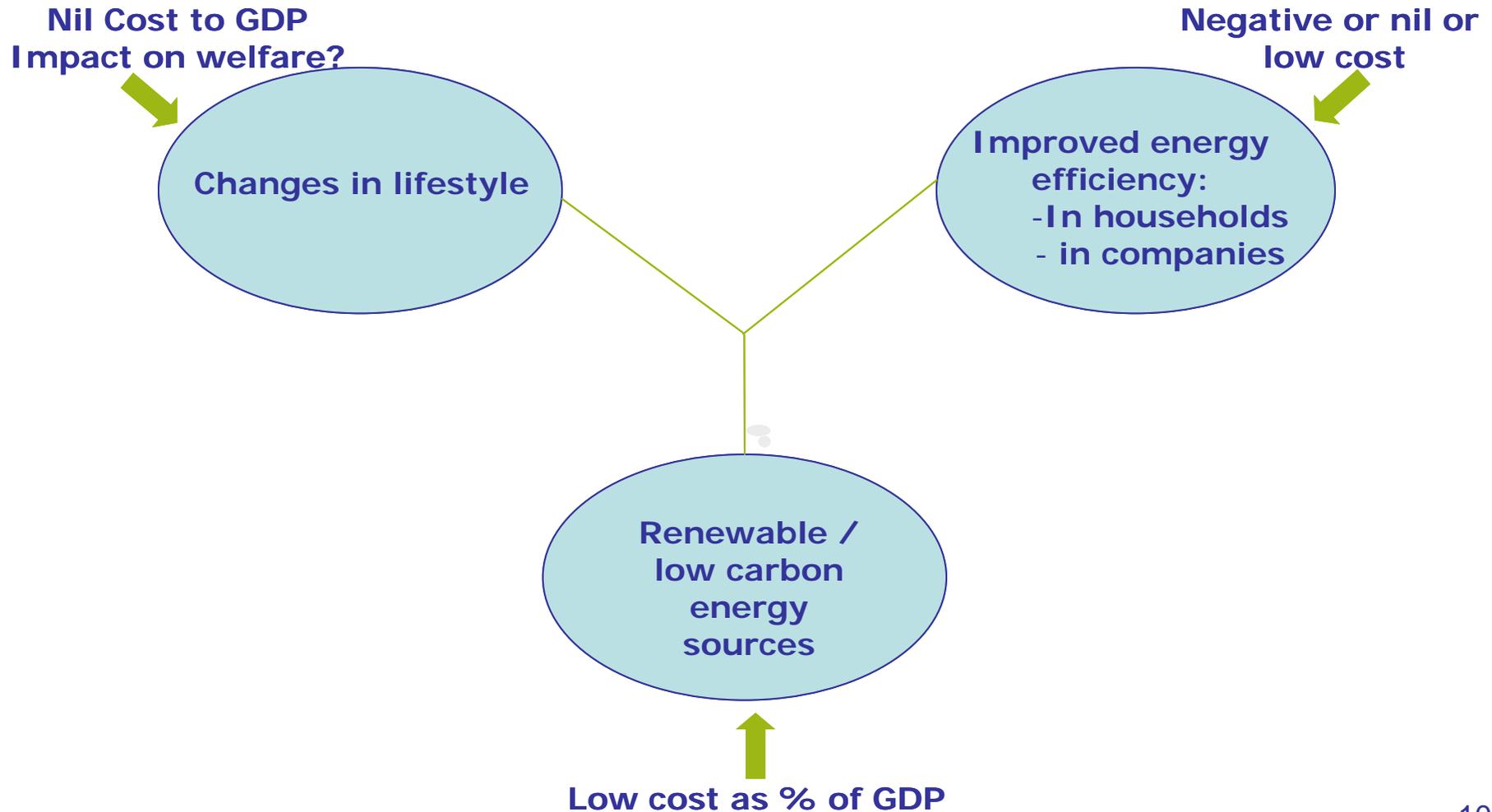


# Estimated costs of achieving 80% CO<sub>2</sub> cuts



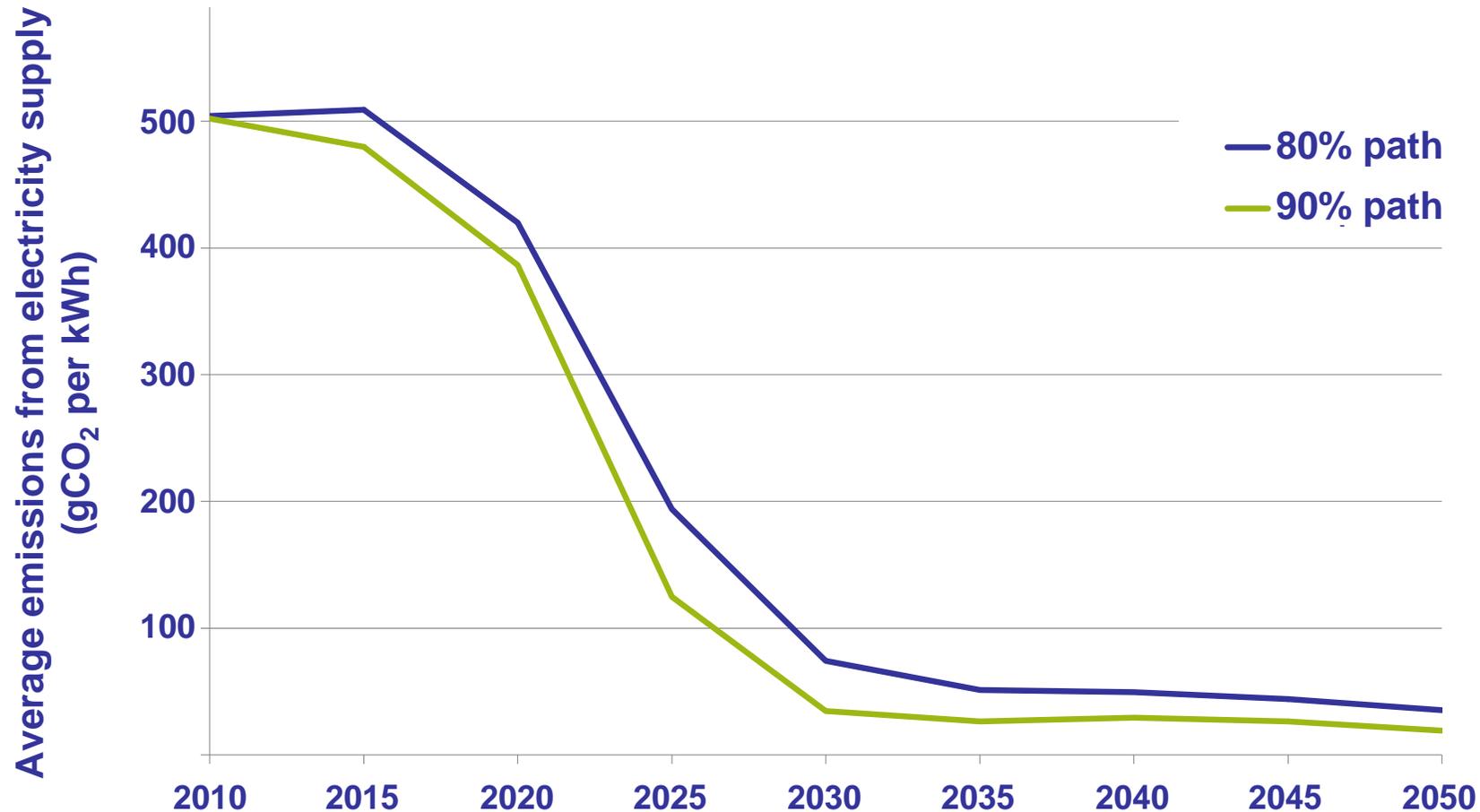
- 1.0 – 3.0% of 2050 GDP
- Depending on assumptions about technology availability
  - ... and on extent to which energy efficiency improvement potential achieved

# Three ways to achieve emissions reductions

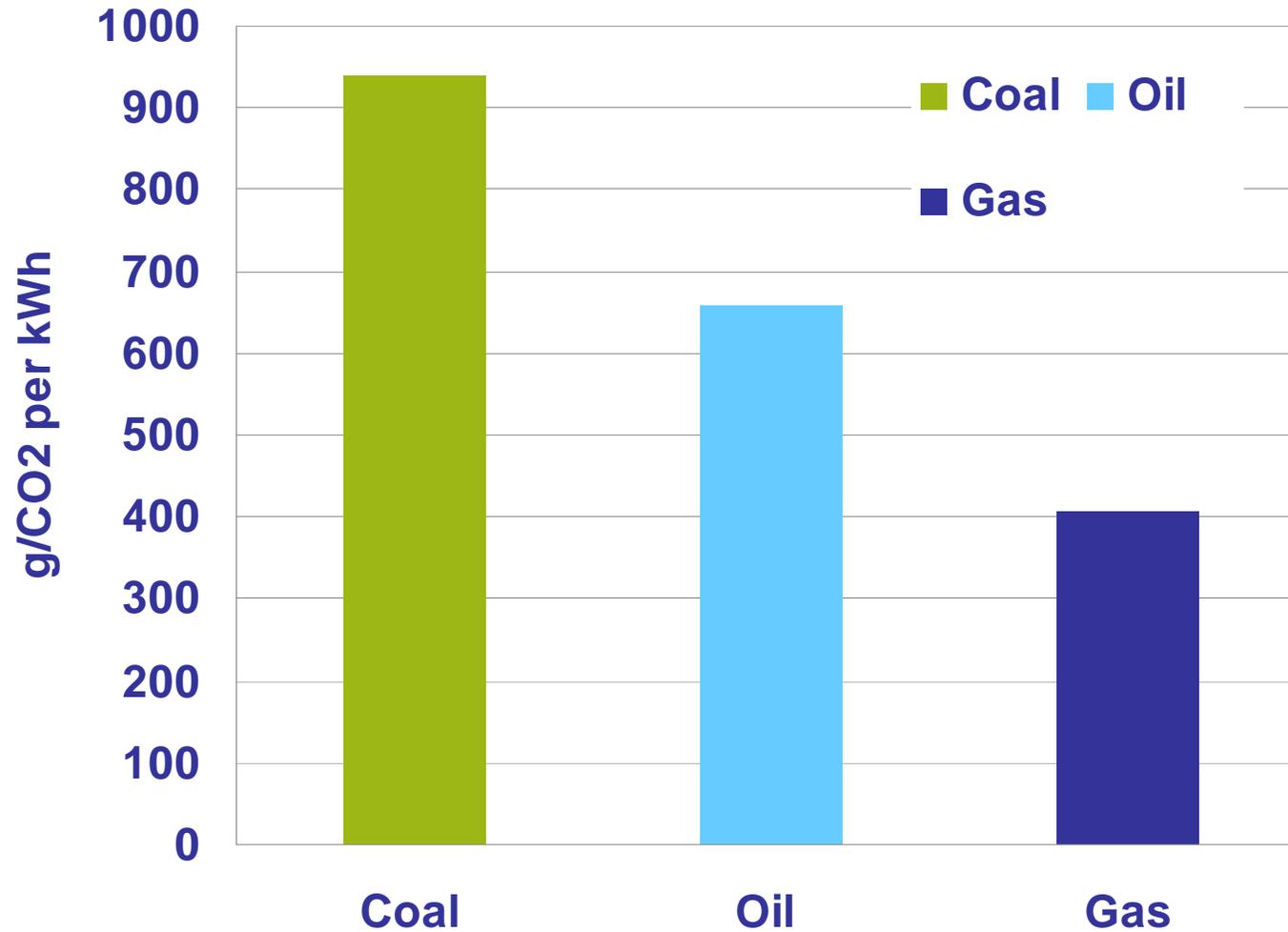


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# Decarbonising electricity

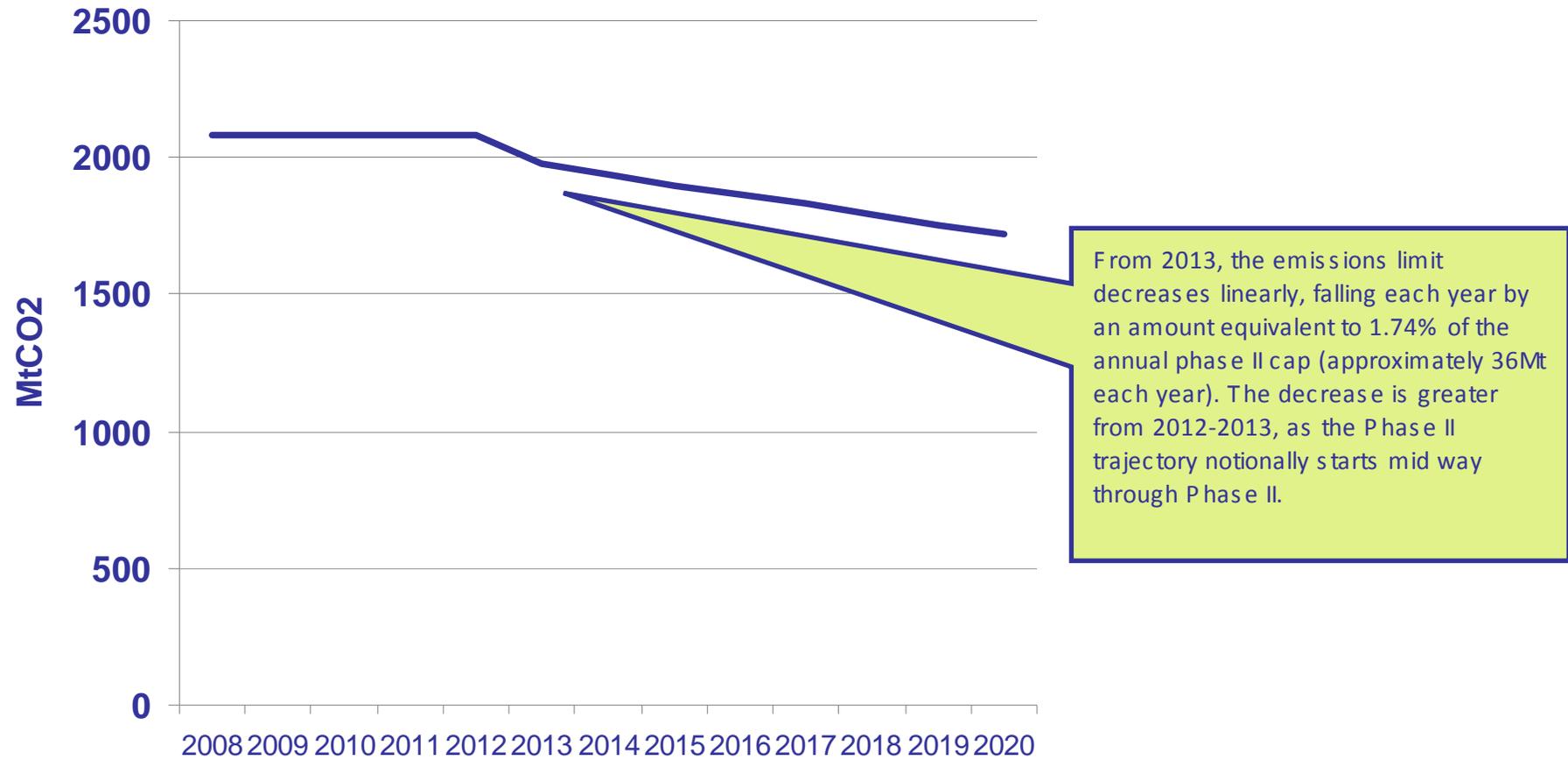


# Carbon intensity



Source: DUKES 2008, Table 5C

# Allowable total emissions under EU ETS



Source: European Commission

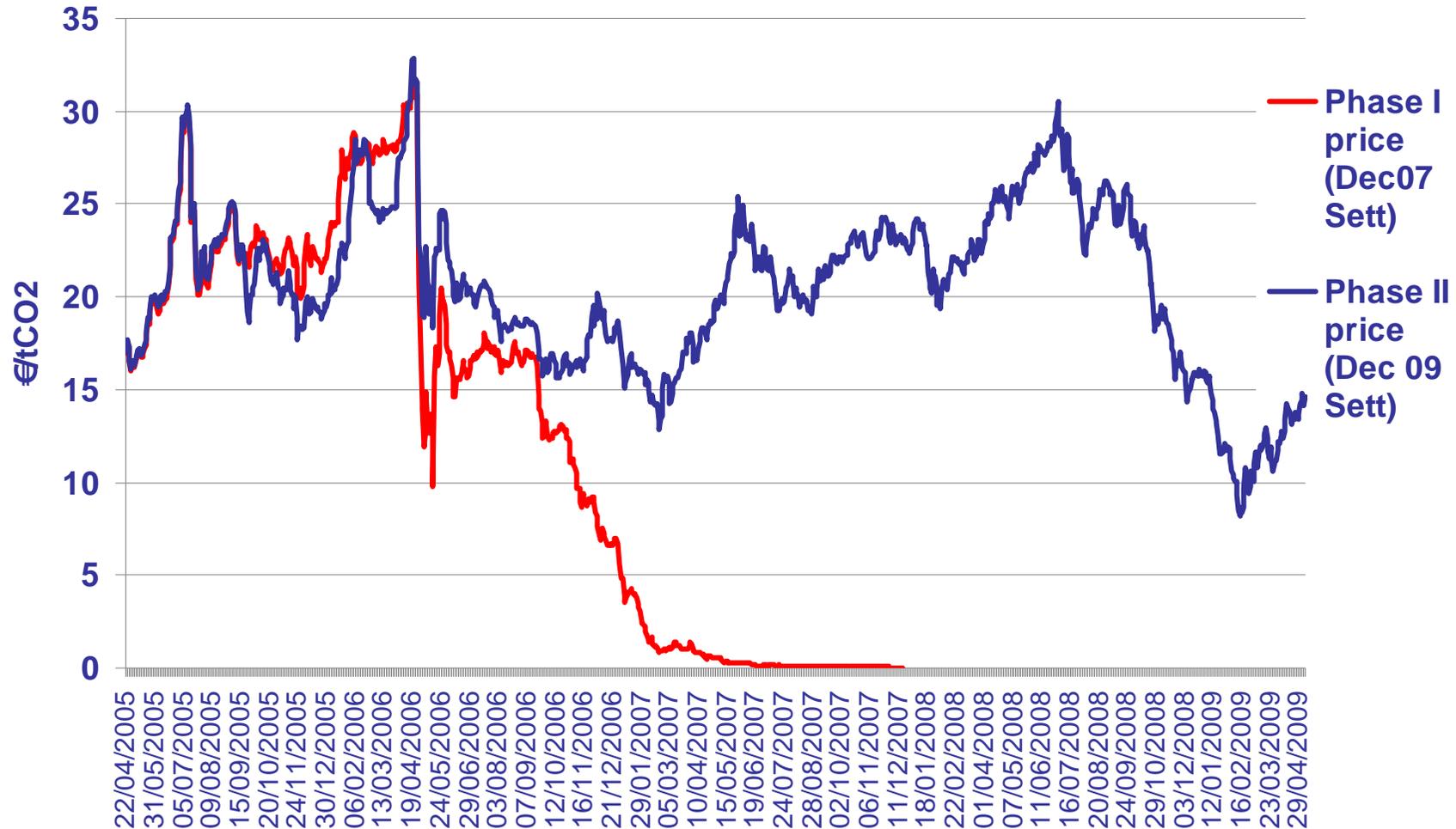
Note: Assumes 20% GHG target. Aviation not included. 14

# Carbon market advantages



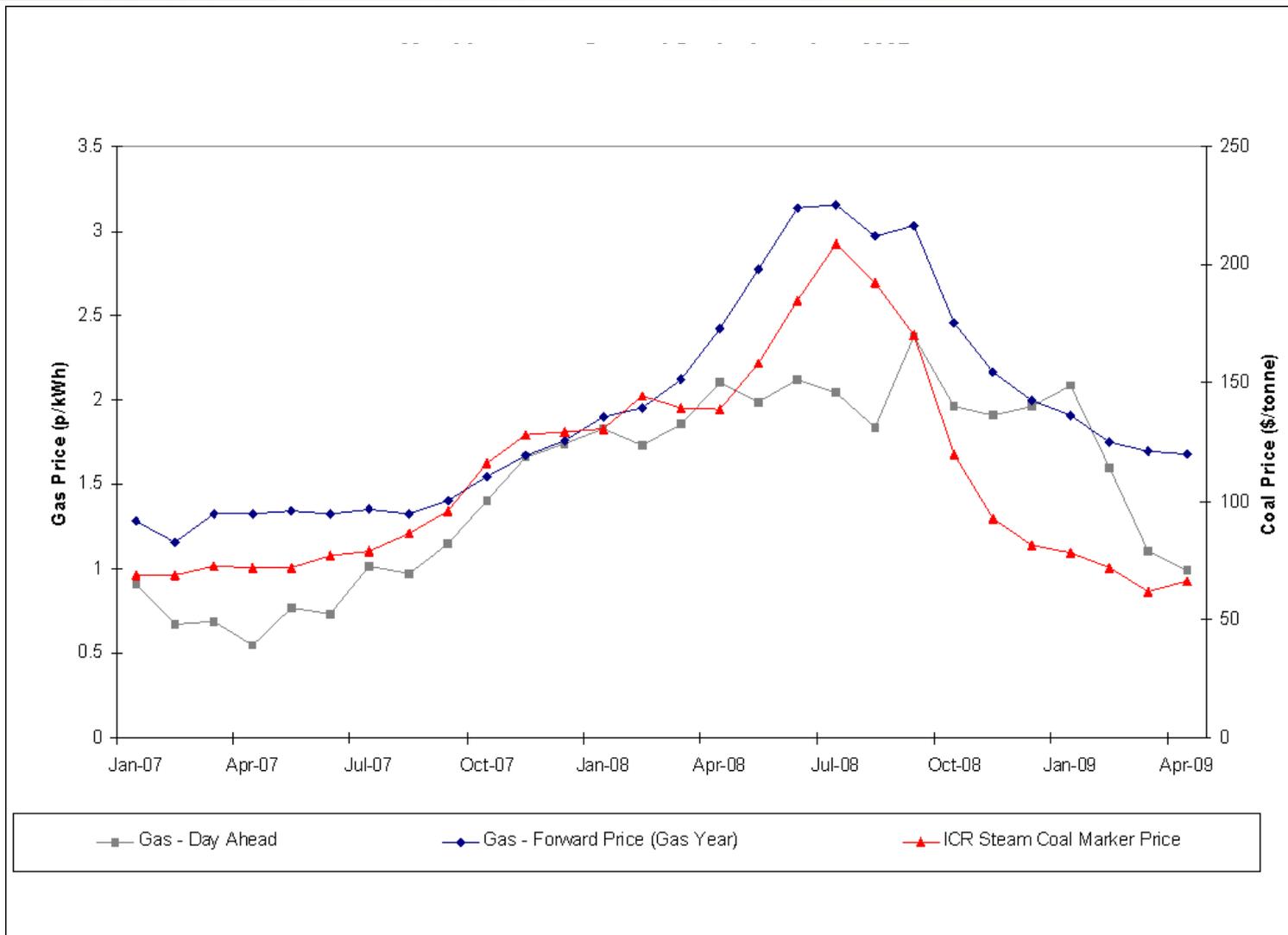
- Cap can be set to achieve required climate objective
- Price – present and anticipated – will produce search for least cost way of meeting objectives

# Prices and values in EU ETS in April 2009

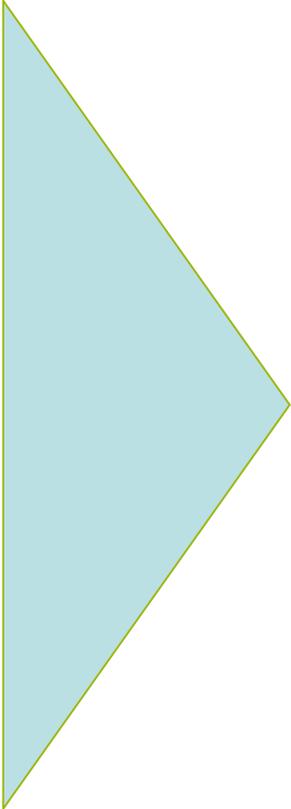


Source: European Carbon Exchange

# Monthly average gas and coal prices since 2007



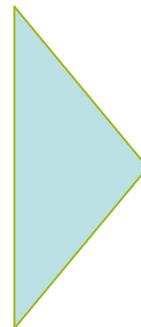
# Limitations to reliance on carbon markets

- 
- Policy uncertainty – and dependency?
  - Inherent cumulative uncertainty – and short-termism?
  - Higher cost of capital / discount rate
    - Disadvantaging high capital cost options
  - Diversification to reduce impact of uncertainty

## Diversification: social and private considerations

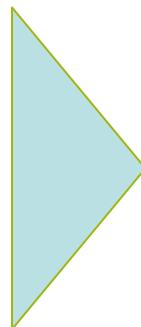


- Diversity to ensure security of supply and hedge against uncertainties in the availability/cost of different technologies



Need to be reflected in socially optimal strategy

- Diversity to hedge uncertainty over future policy, or inherent uncertainty in price movements



Will be reflected in private decisions

... but do not change socially optimal strategies

# Climate Change Committee

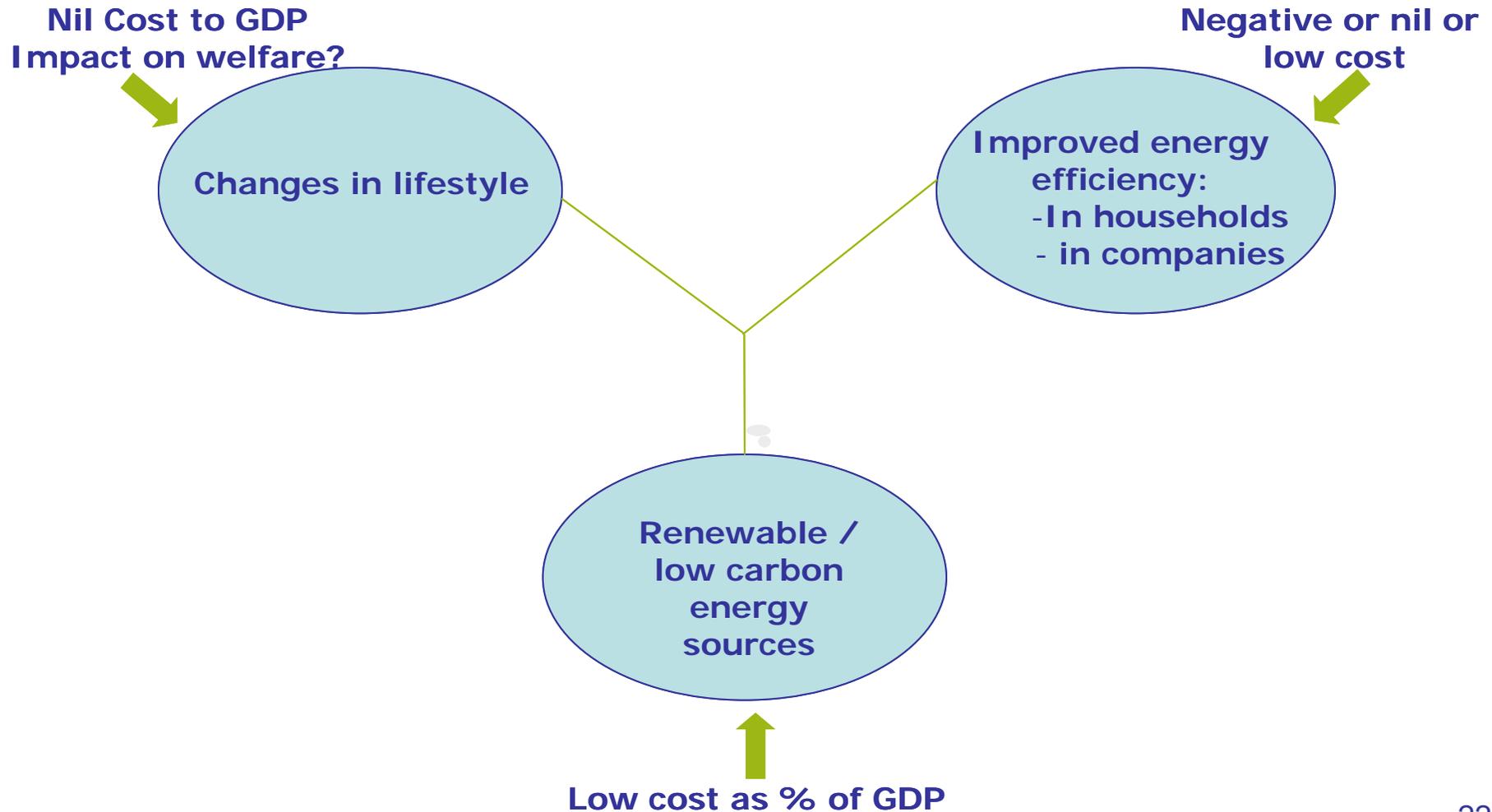
## Recommendations on unabated coal



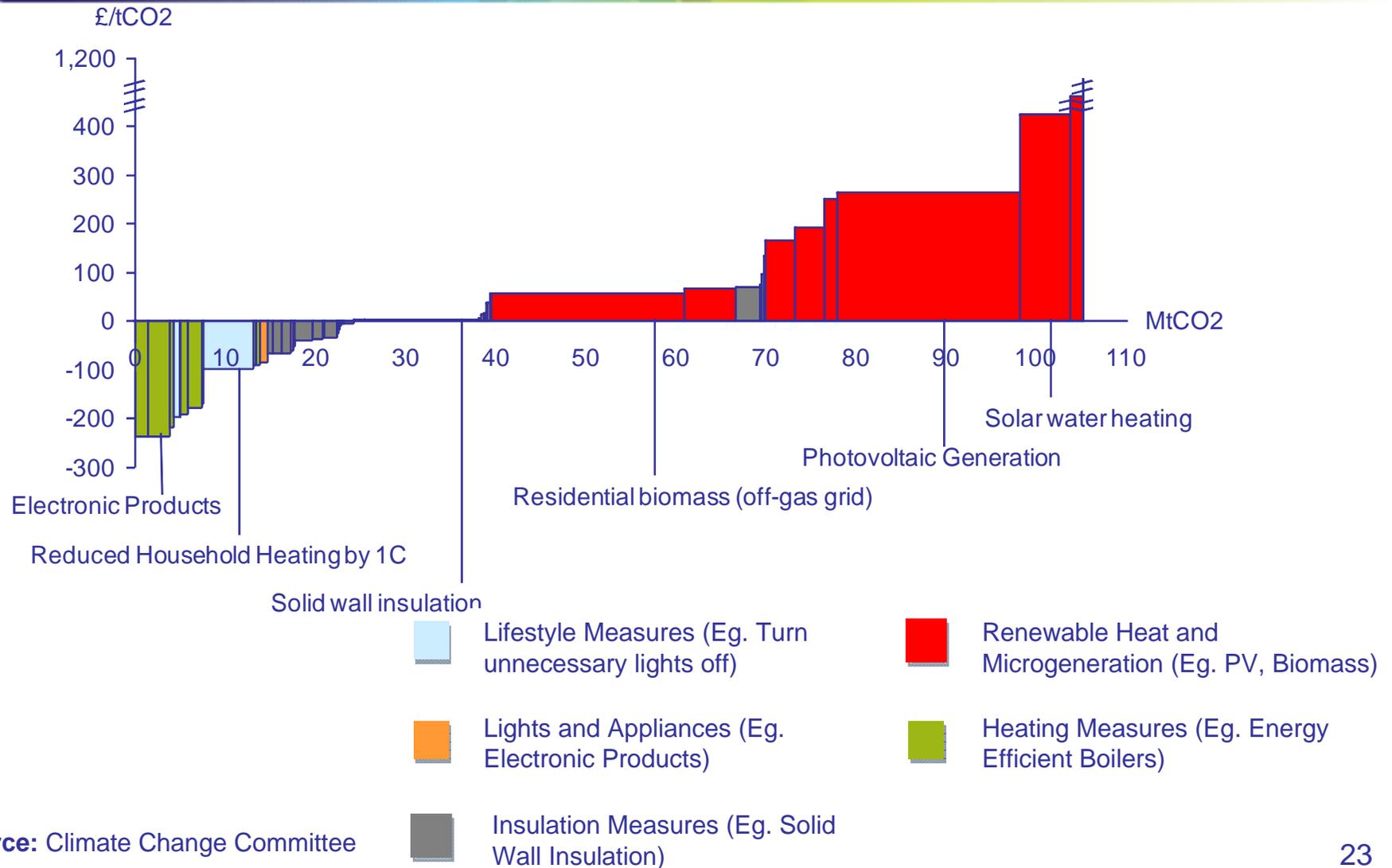
- Investment in coal fired generation without carbon capture and storage should only be allowed with the clear and publicly stated expectation that it will be retrofitted with CCS in the early 2020s.
  
- Policy to be achieved via:
  - Floor price to carbon within EUETS?
  - Clear license conditions?

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# Three ways to achieve emissions reductions



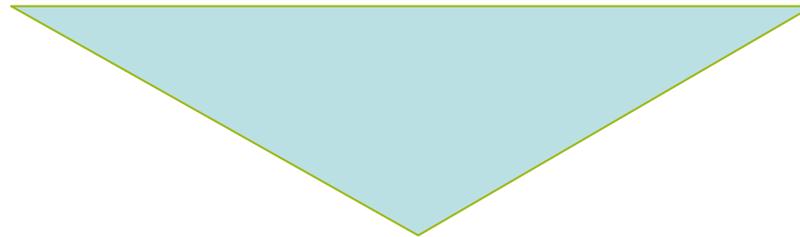
# Negative cost efficiency improvements



Source: Climate Change Committee

# Why do we leave money on the table?

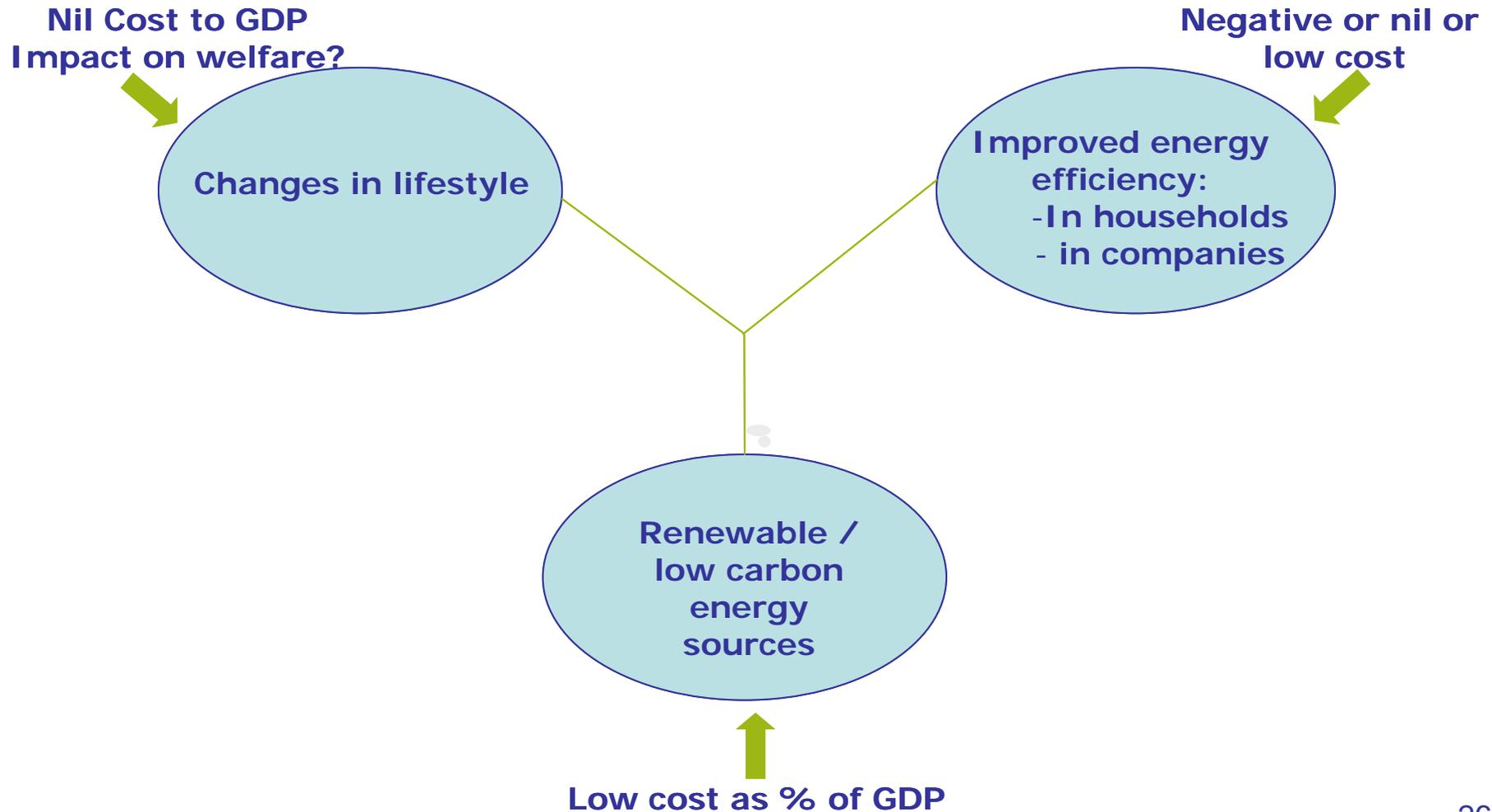
- Small relative to total household budgets
- Costs of decision-making



- Regulation achieves economies of scale in decision-making
- Early adoption more likely to be driven by climate responsibility than by rational economics

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# Three ways to achieve emissions reductions



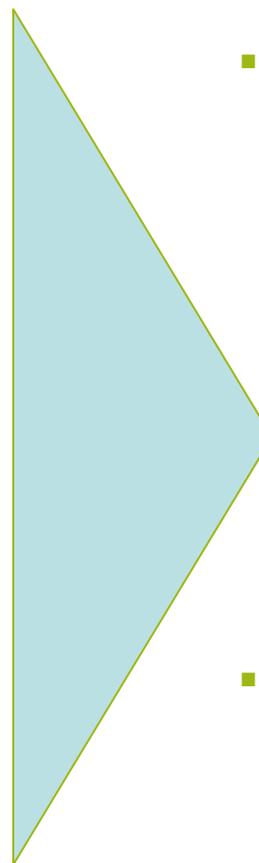
# Lifestyle choices



- Car size and performance → >25% reductions in grams per km for modest changes
- Driving style and speed → 10% – 15% reductions from minimal/positive impact measures
- Car versus cycling → 100% reduction
- Diet → Beef = 16kg CO<sub>2</sub> per Kg  
Chicken = 4.5kg  
Potatoes = 0.2kg

## Classical Consumer Preference Theory

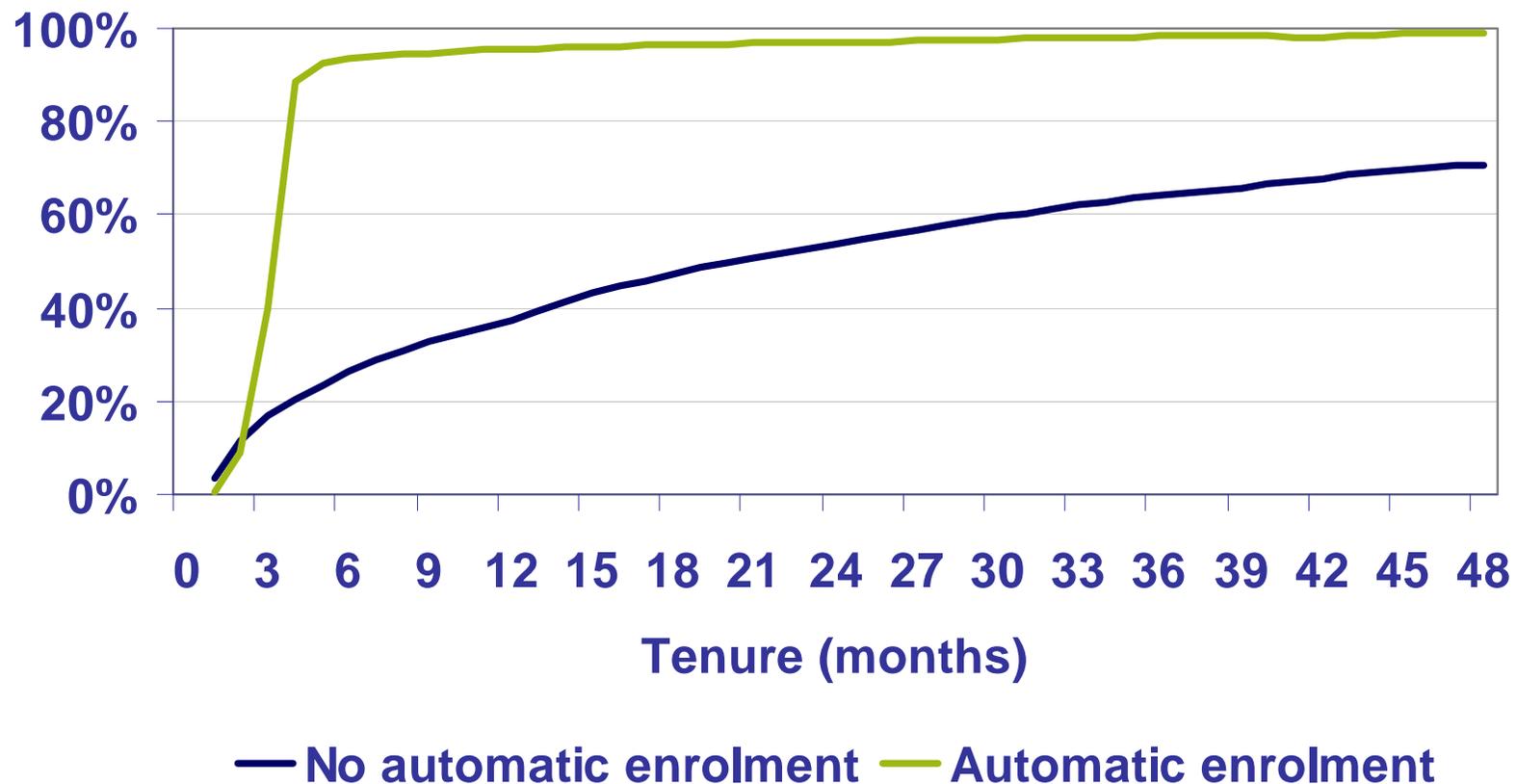
- Individuals have a defined set of preferences, and defined utility trade-offs between different combinations of consumption
- Within income constraints they allocate consumption over time and at any point of time – so as to maximise utility
- Taxation or regulation which changes their pattern of consumption must reduce utility



## Social Reality

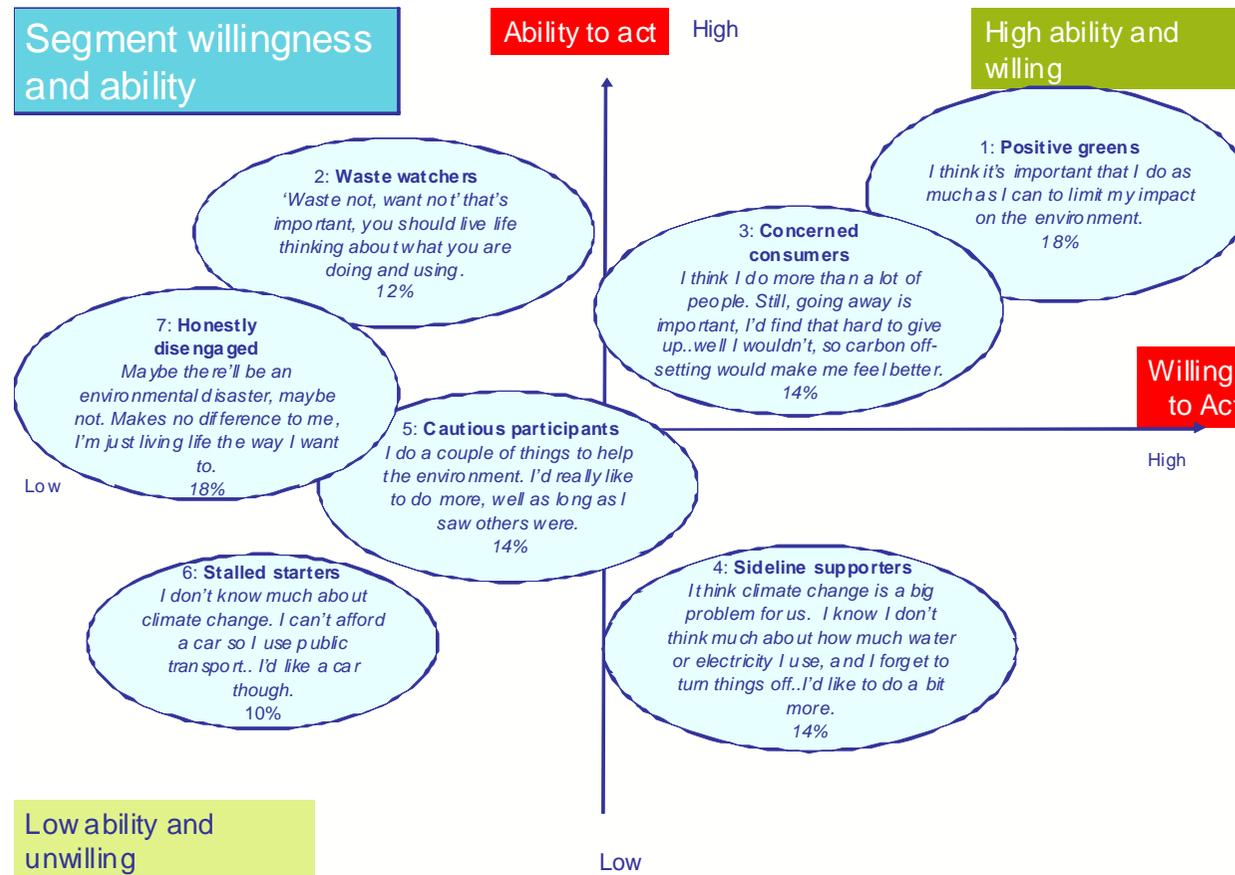
- Once basic needs are met consumer preferences are increasingly changeable, socially determined and influenced
  - Fashion
  - Car size
  - Speeding
  - Diet
- Social responsibility can be a consumer preference

# Employee pension scheme participation



Source: Madrian and Shea, 2001

# Behavioural segments



## Definitions

'Ability to act' depends on mainly external constraints which enable or limit ability to act such as income level and access to finance.

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# Economic growth and happiness



## Drivers of happiness

Measurable average income per capita important up to threshold level

Beyond that level:

- Relative income and status
- Stable consumption: no negative set-backs
- Low involuntary unemployment
- Social cohesion and trust

## Implications

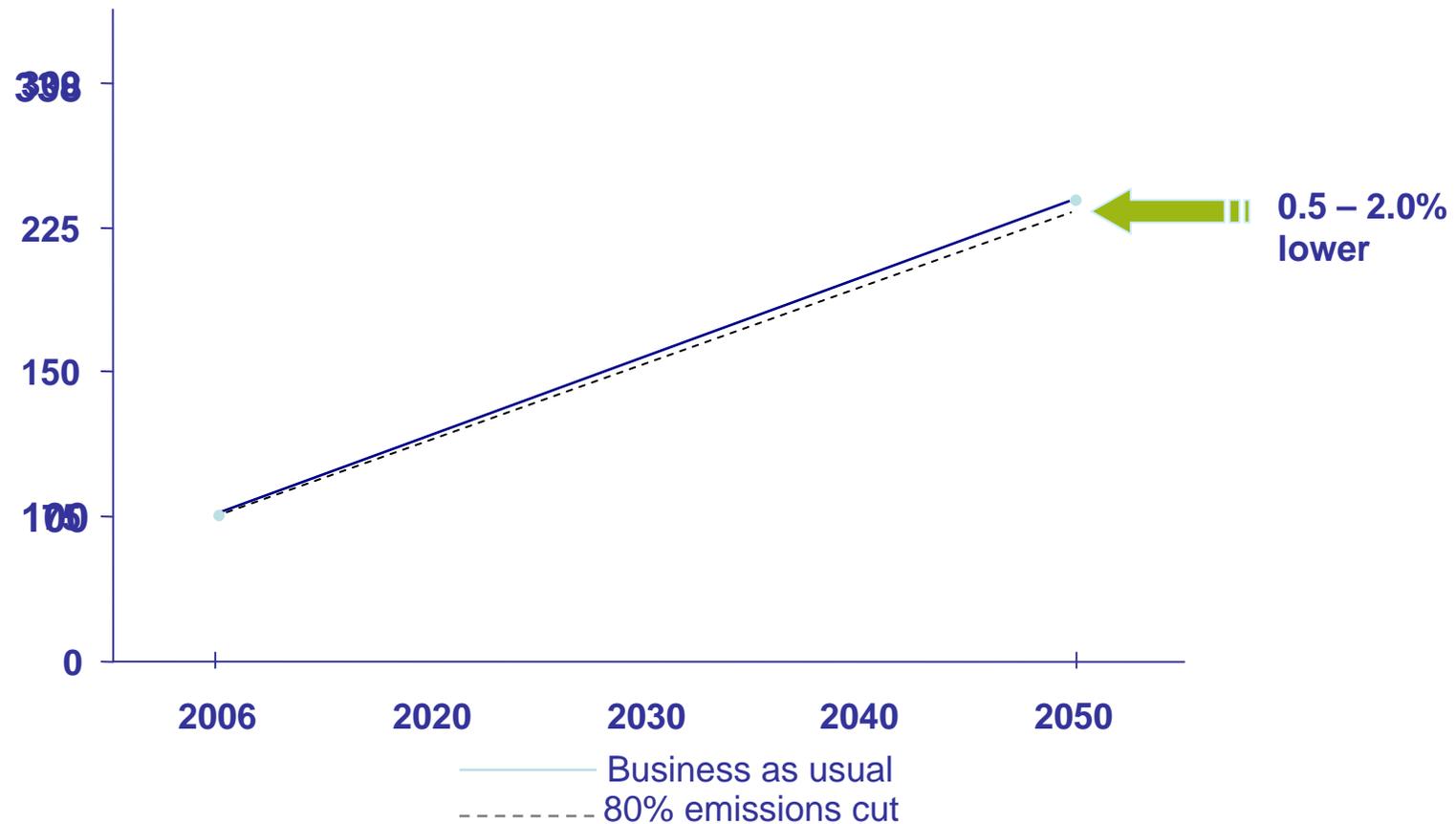
Measured GDP per capita growth an important objective in low income countries

Maximising growth of GDP not a required objective in high income countries, but:

- Growth stability important
- High employment important
- Measured growth may be welfare-neutral by product of other desirable social features

# Growth in UK living standards: with 80% emissions cut

GDP per capita 2006=100



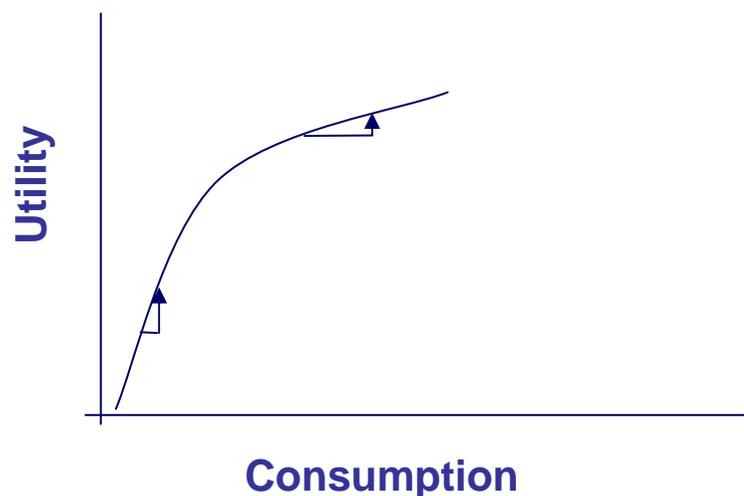
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# The impact of discount rates

	<b>£1000 in 2150 is worth</b>	<b>Assuming 2% per annum growth: 1% of GDP today is worth</b>
<b>Discounted</b>		
➤ at 4% real	£3.67 today	16.1% of GDP in 2150
➤ at 2% real	£59 today	1% of 2150 GDP

# Discount rates and the present cost of future climate change

## Declining marginal utility of consumption



## Future climate change impacts matter little?

- Marginal consumption of future richer people worth less than consumption today
- The greater the curvature, the higher the discount rate, and the less important is future consumption
- Climate change impacts expressed as reduction in future consumption
- If consumption growth delivers little additional welfare, don't sacrifice present consumption to benefit future richer people

# Discount rate complexities



**Winners and losers  
between generations and  
across the world**

If average Briton makes sacrifice today for a poorer African in 2100 → discount rate should be negative

**Aggregating market and  
non-market impacts**

If “quality of environment” falling over time, but material consumption rising, perceived total utility may be falling not rising; depends on relative weights

**Uncertainty and  
catastrophe effects**

Small probability of catastrophic event could justify negative discount rate

# Assessing climate change trade-offs



## Integrated assessment models

- Quantitative estimates of the costs of mitigation
- Quantitative estimates of adverse consequences of climate change
- Calculation of Net Present Value of different mitigation patterns, using defined discount rate

## Climate Change Committee approach

- Develop reasonable estimates of the cost of mitigation and characterise as a (small) reduction in the rate of growth
- Describe potential harmful impacts of temperature increase, and degrees of uncertainty about potential impact
- Reach a judgement about whether the sacrifice of growth is justified to avoid the described harm

# Economics as a social science



- **Rational financial markets and self-equilibrating macro-economics** →
  - Risk versus uncertainty
  - Systemic and behavioural drivers of instability – “Animal Spirits”, confidence multipliers
  - Strategic choices markets may not make
- **Rational consumer preference and inherent costs of interference** →
  - Social determinants of consumer preference
  - Behavioural drivers of consumer choice
- **Increasing consumption, increasing utility** →
  - Complex drivers of human welfare
  - Growth not an absolute objective
- **Quantified not present value decisions** →
  - Some decisions inherent judgemental, though informed by quantification