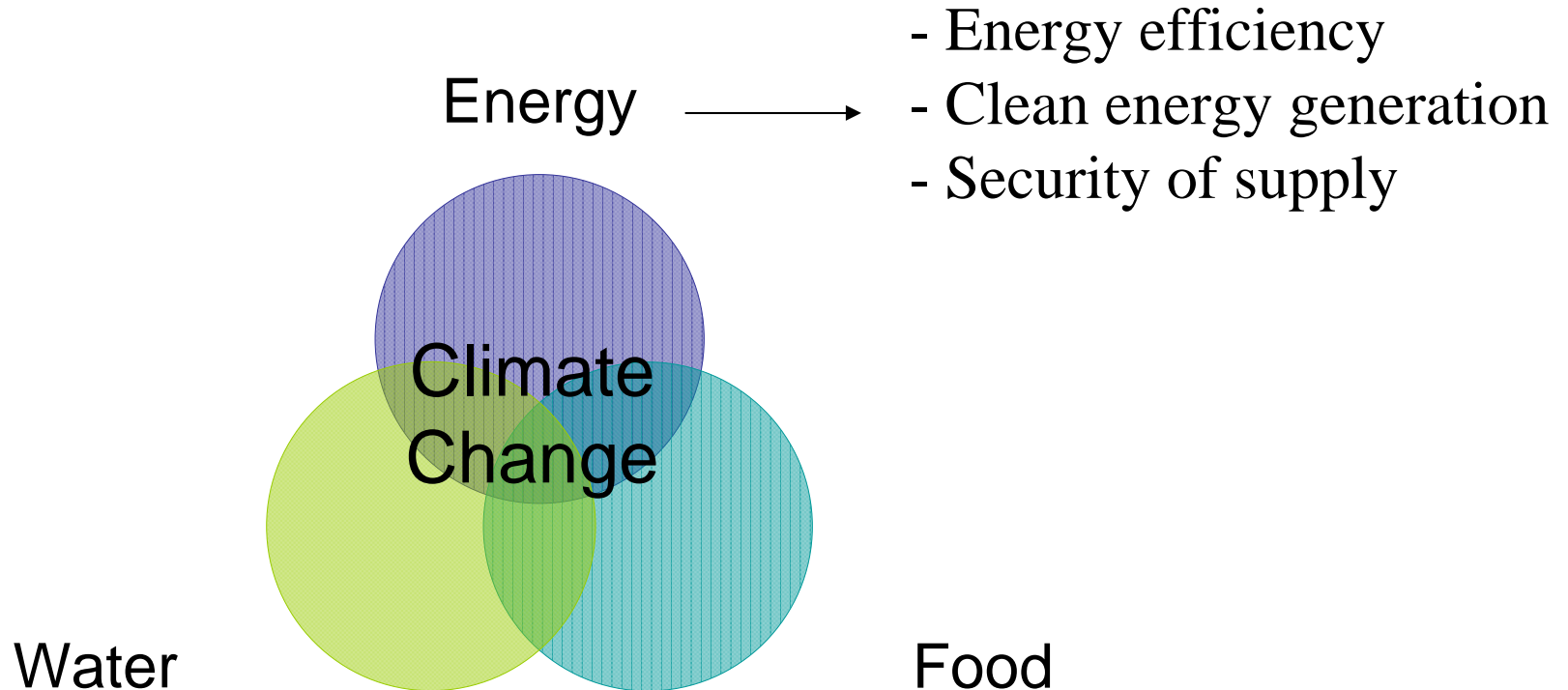


# UK government activity - promoting transition to a low carbon economy

Professor Brian Collins,  
Presentation to the Chinese Academy  
of Engineering,  
1 December 2008

# The Global Challenge



# UK Energy White Paper 2007

## UK government objectives:

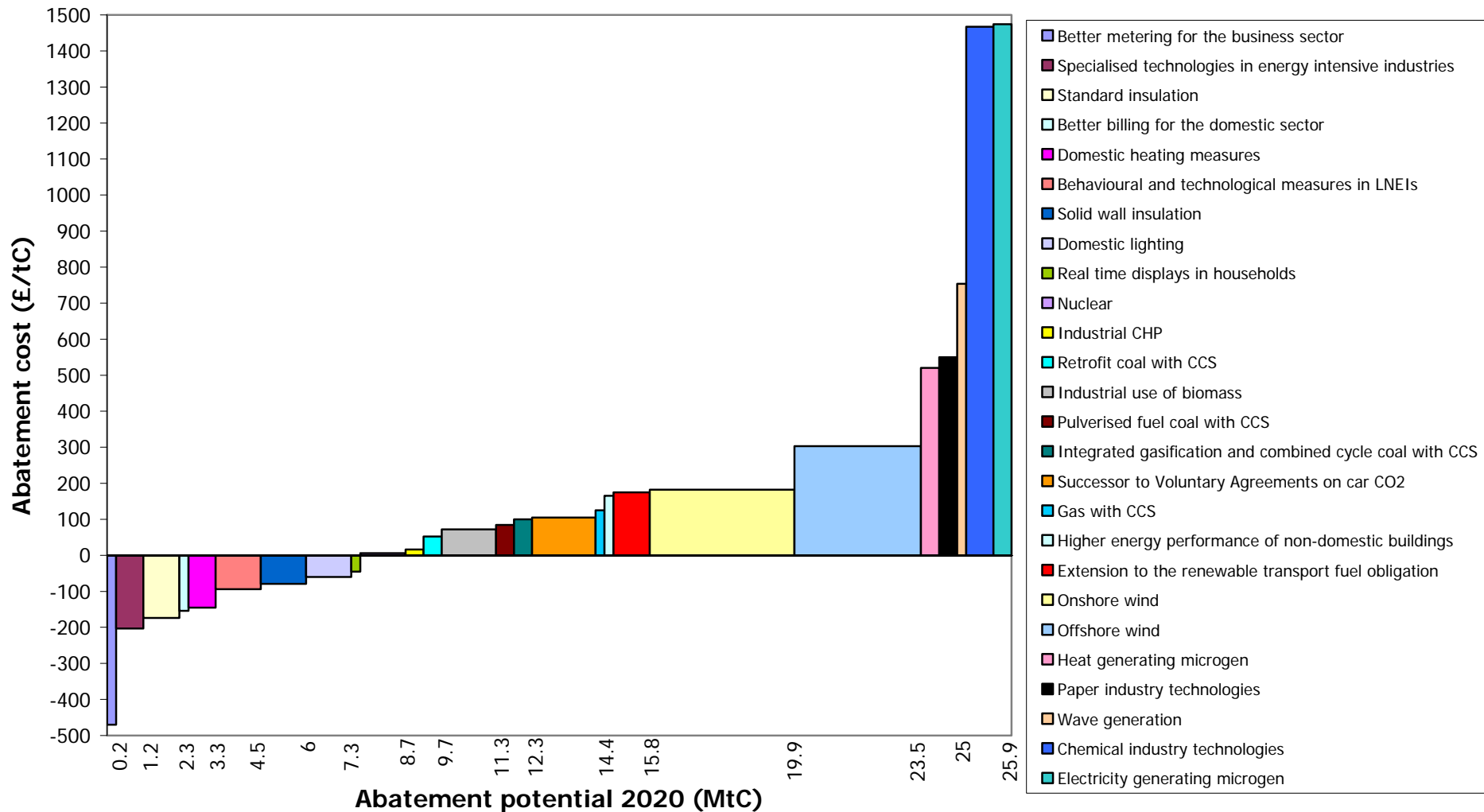
- mitigation of climate change by reduction of carbon dioxide emissions from energy generation
- secure supply of clean, affordable energy

## Priorities:

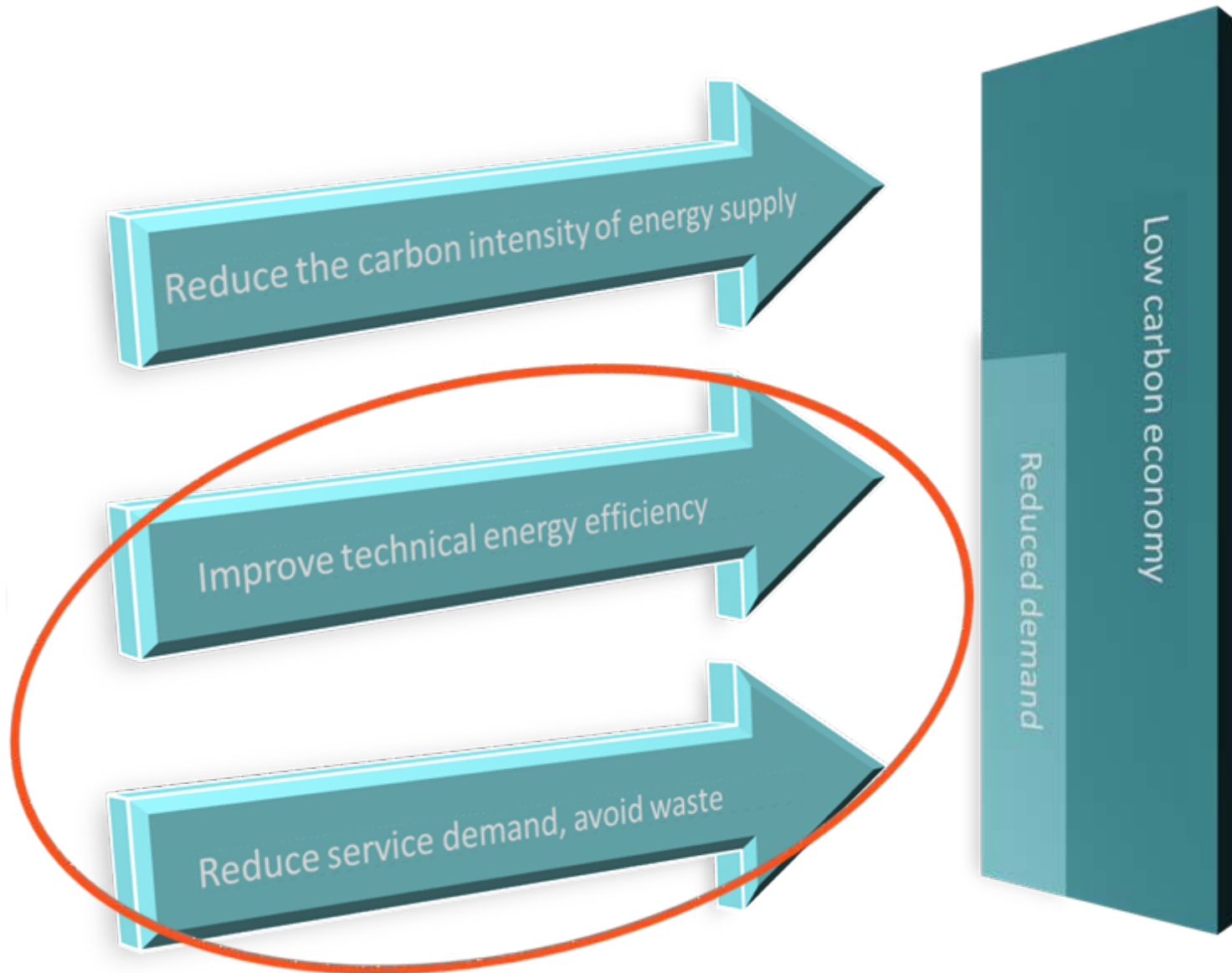
- Energy efficiency
- Cleaner, low carbon energy generation (including carbon capture and storage)
- Secure reliable energy supplies

# UK Energy Efficiency Strategy

## Marginal abatement cost curve 2020



# UK Energy Efficiency: Strategy



# UK Energy Efficiency

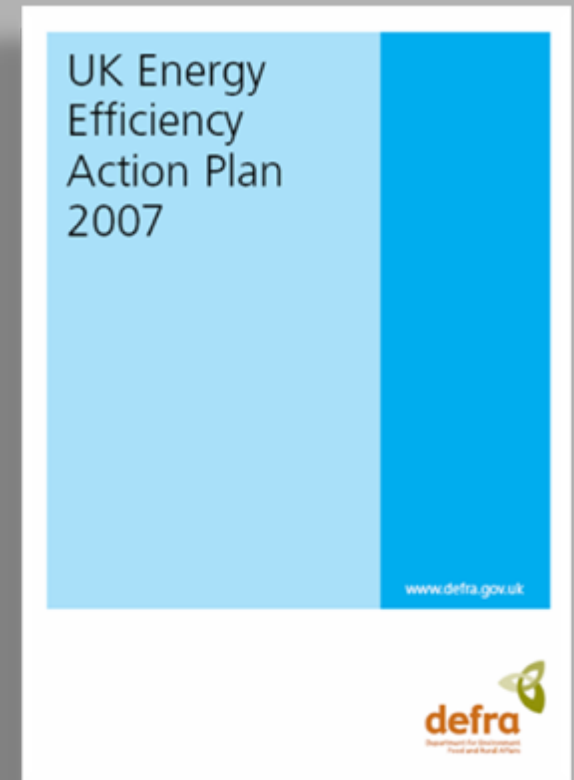
## Energy Efficiency Strategy Team

Co-ordination work and cross-cutting issues. Also cross-cutting stakeholders, UK focus, including DAs

June 07: National Energy Efficiency Action Plan sets out measures to meet target of 9% reduction in energy use as set out in EU Energy Services Directive

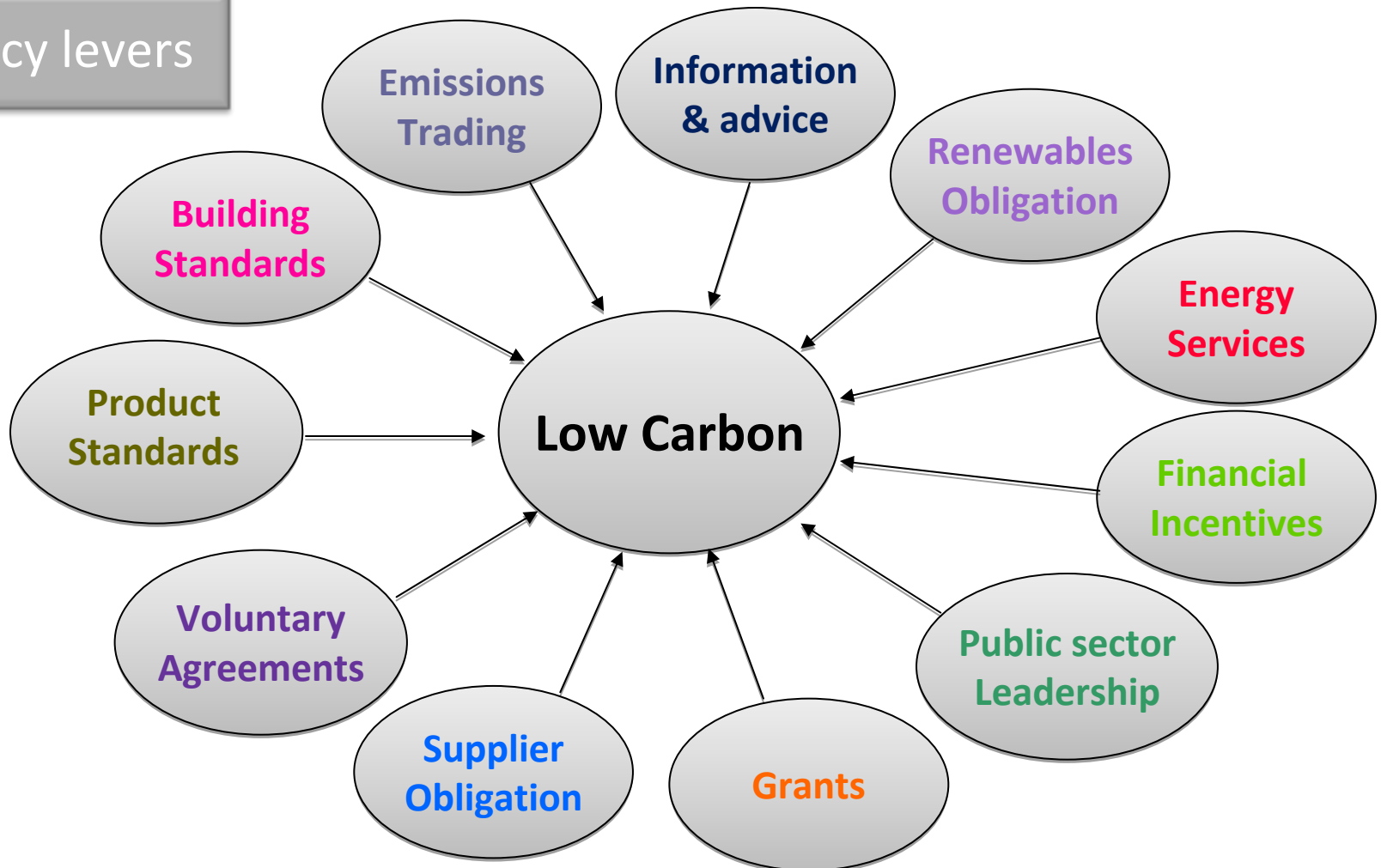
We expect to exceed that target, reaching an estimated 18% reduction in energy use by 2016

Our savings target by 2016 is 136.5TWh, and we expect to exceed this, saving 272.7TWh – equivalent to 69MtCO<sub>2</sub> by 2016



# UK Energy Efficiency: Levers

Policy levers



# UK Energy Efficiency: Households

## Energy efficiency policies in the household sector

### New homes

Building Regulations → 0 carbon by 2016

### Existing stock

Supplier Obligation, Community activity,  
Certification

Appliances in our homes, market transformation

Providing information and advice; Energy Saving Trust

Communicating and encouraging behaviour change;  
carbon calculator



# UK Energy Efficiency: Business and public sectors

## Energy efficiency in the business and public sectors

### Buildings

Building Regulations → 0 carbon by 2019  
targets for Public Sector, certification

### Emissions Trading

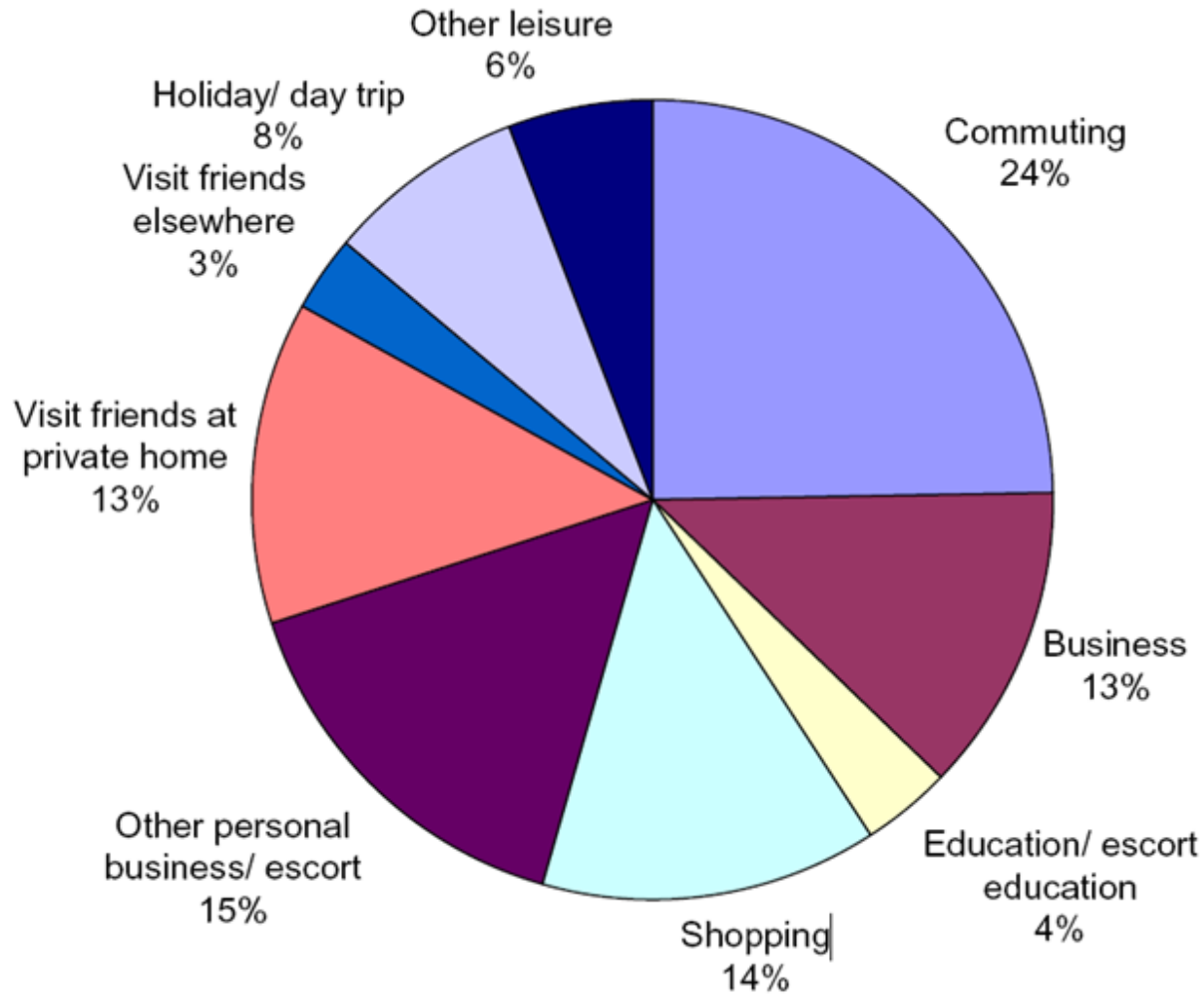
EU Emissions Trading Scheme  
Carbon Reduction Commitment

Providing information and advice; Carbon Trust

Financial and fiscal tools; loans, tax reductions



# Carbon emissions from transport



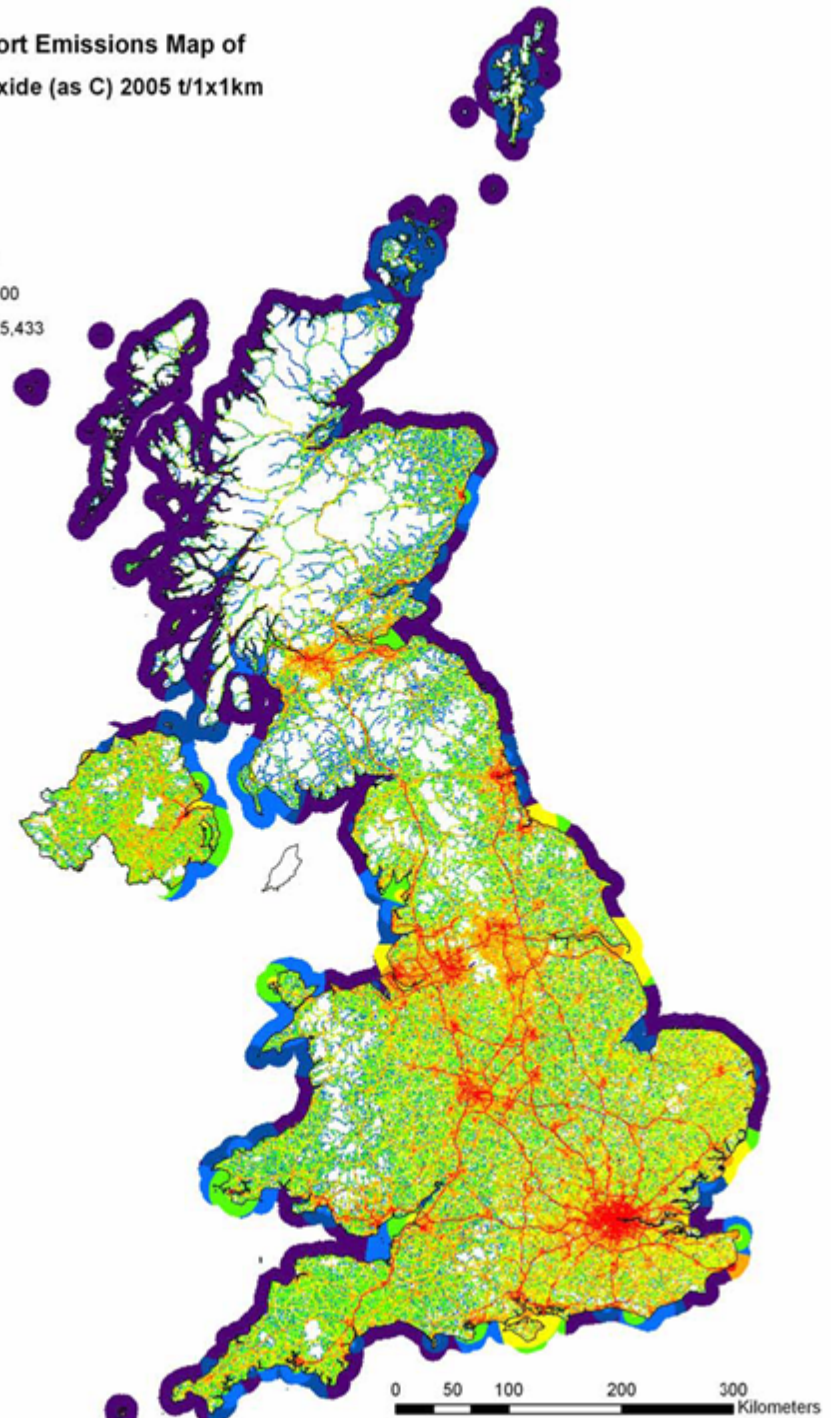
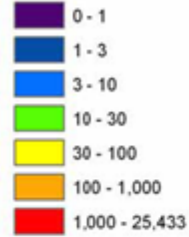
DfT analysis, 2002/2006 average for Great Britain

<http://www.dft.gov.uk/pgr/sustainable/analysis.pdf>

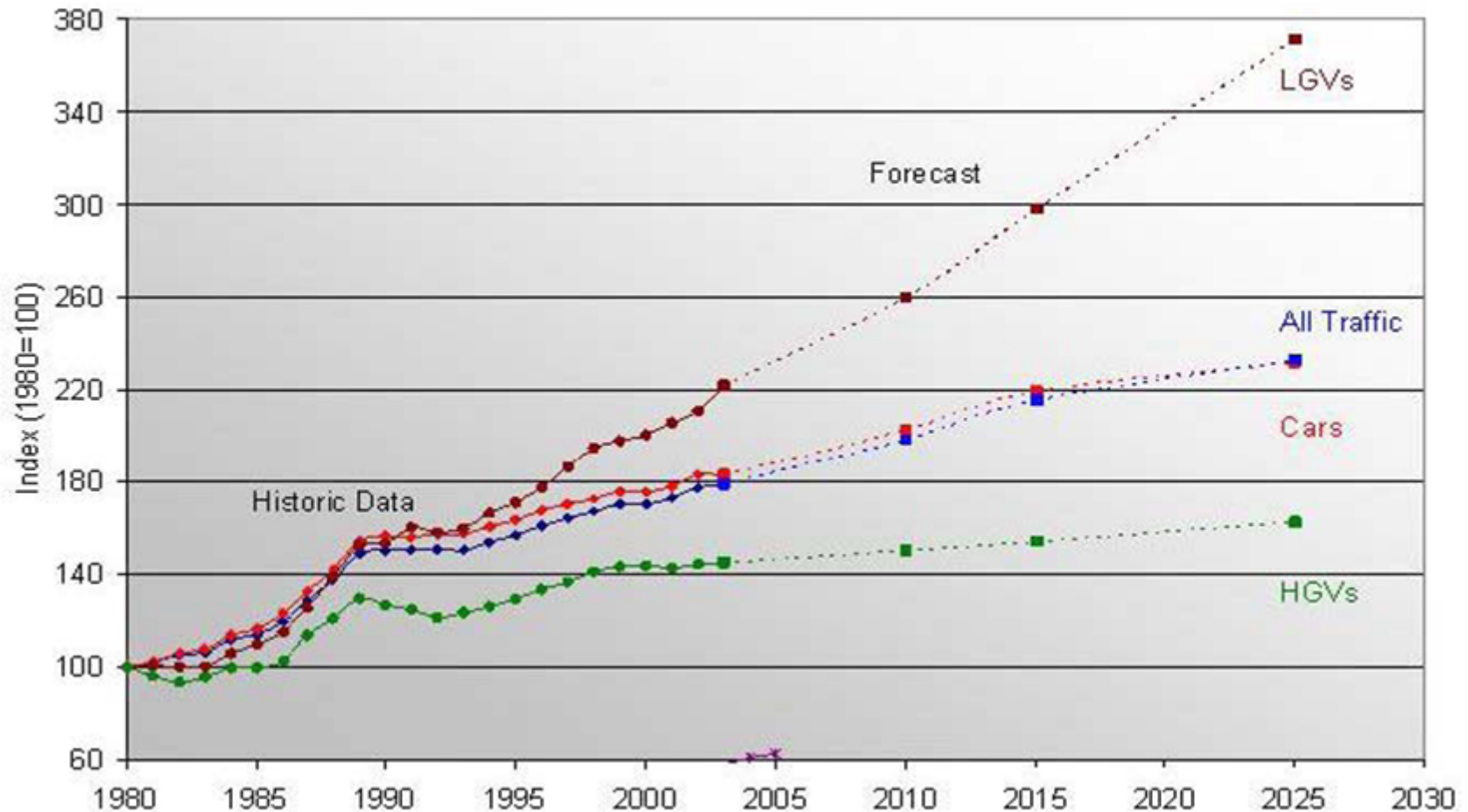
# Carbon emissions from transport

UK Transport Emissions Map of

Carbon Dioxide (as C) 2005 t/1x1km



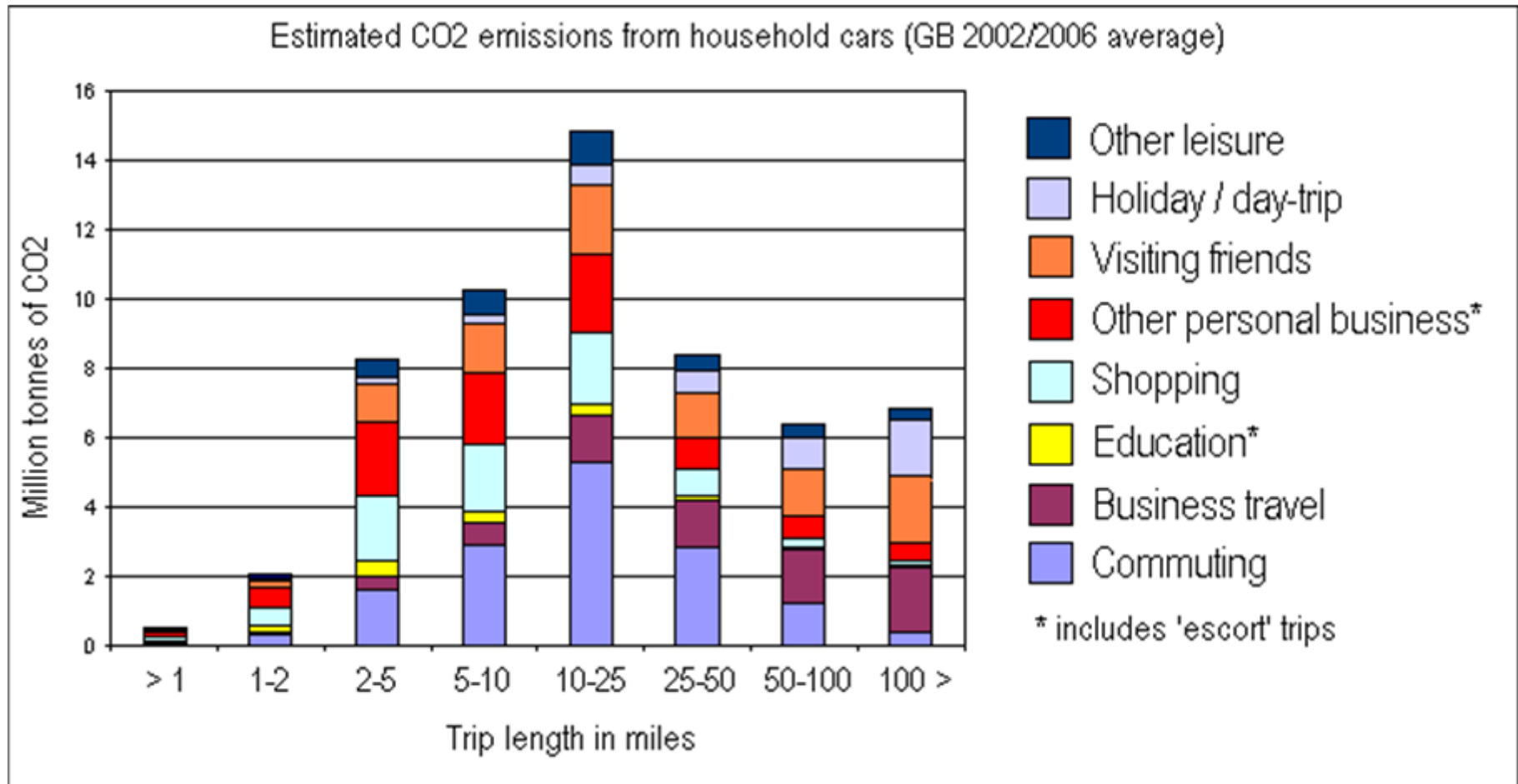
# Historic and forecast traffic growth (England)



Source: National Atmospheric Emissions Inventory 2006; forecasts from the NTM.

# Energy efficiency: transport

## Carbon reduction pathways



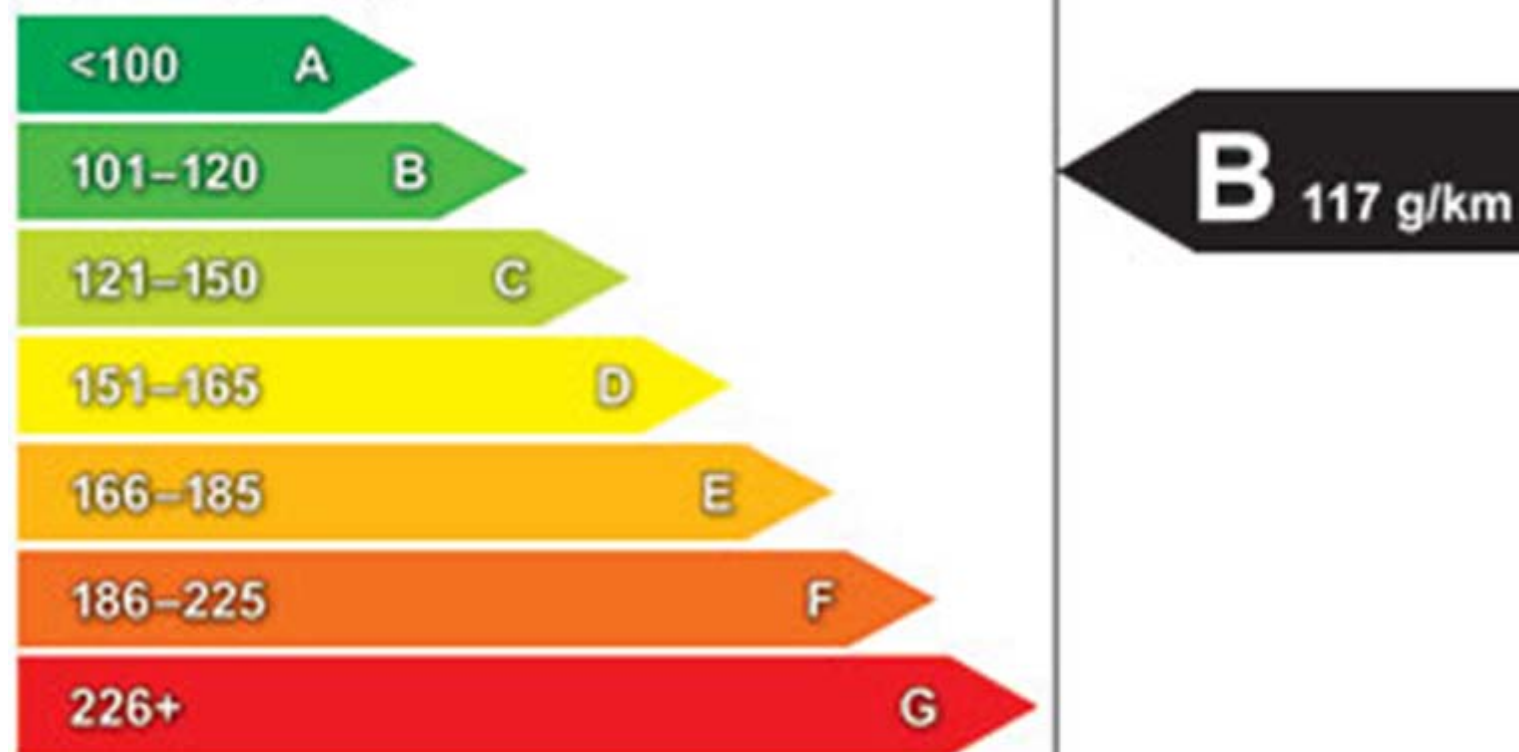
# Efficiency in the transport sector

- **Carbon Reduction Strategy for the Transport Sector (June 2008)**
- Carbon Pricing; including transport in EU ETS
- Promoting more efficient vehicles (EU regulation, fuel duty and vehicle excise duty)
- Promoting more low carbon transport (public transport, smarter travel choices, fuel-efficient driving techniques)
- Encouraging innovation and technology development in lower carbon transport technologies

# Fuel Economy

Low Carbon Car

CO<sub>2</sub> emission figure (g/km)



# EU Energy Efficiency

- The EU has adopted a 20% by 2020 energy efficiency target and has already adopted a suite of legislation
- 2<sup>nd</sup> Strategic European Energy Review
  - a forward-looking political agenda to achieve EU's core energy objectives of **sustainability**, **competitiveness** and **security of supply**
- Proposed Energy Efficiency Package
  - The Labelling Directive
  - The Cogeneration Directive
  - The Energy Performance of Buildings Directive
  - The Energy End-Use Efficiency and Energy Services Directive
  - A proposed Tyre Labelling Directive
  - Sustainable Energy Financing Initiative
  - The Eco-Design of Energy Using Products Directive

# International Energy Efficiency

- Acting with the G8 and Chinese counterparts
  - Energy efficiency has been strong focus of discussions within the G8 since the Gleneagles Summit in 2005
  - 25 recommendations for improving global energy efficiency endorsed in Japan
  - International Partnership on Energy Efficiency Co-operation
  - New high-level forum for international co-operation and collaboration launched by G8+3
  - Hope to formally establish in 2009
- Engaging Internationally
  - Working with the International Energy Agency, the Energy Charter Organisation, UN programmes and the Renewable Energy And Energy Efficiency Partnership

# UK Energy White Paper 2007

## UK government objectives:

- mitigation of climate change by reduction of carbon dioxide emissions from energy generation
- secure supply of clean, affordable energy

## Priorities:

- Energy efficiency
- Cleaner, low carbon energy generation (including carbon capture and storage)
- Secure reliable energy supplies

# Carbon Capture and Storage

A vital new technology of global importance

# What is Carbon Capture and Storage?

- a chain of technologies for CO<sub>2</sub> capture (from fossil fuel power plants or industrial point sources), transportation and storage
- the technologies have been proven individually

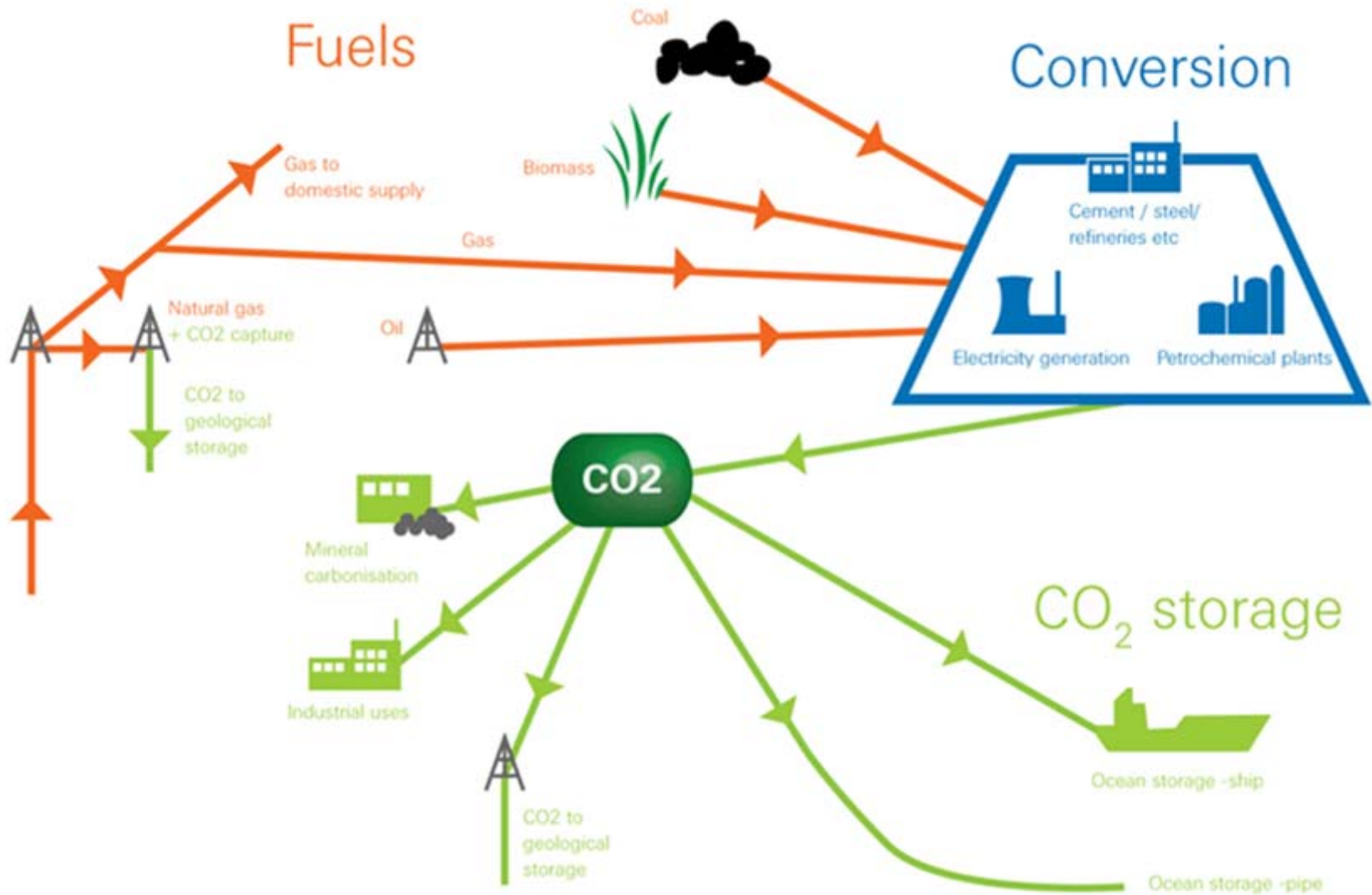
But

- urgent need to demonstrate the operation of the whole CCS technology chain, particularly in association with fossil fuel power plants

# The Importance of Carbon Capture and Storage?

- Under business as usual, global emissions from the energy sector will rise by 57% by 2030.
- Global primary energy needs are predicted to grow by 55% between 2005 and 2030. Coal demand is predicted to increase by over 70% in real terms in response.
- CCS technology has the potential to reduce CO<sub>2</sub> emissions from fossil fuel power stations by as much as 90%.
- Could contribute up to 20% of global CO<sub>2</sub> mitigation by 2050.
- Stern Review – without CCS marginal abatement costs rise from \$25 to \$43 per tonne.
- Fossil fuels remain important for secure energy supplies and meeting electricity needs of rapidly growing economies. CCS is only technology that will enable their continued use in a carbon constrained future

# How does CCS work?



# How does it work?

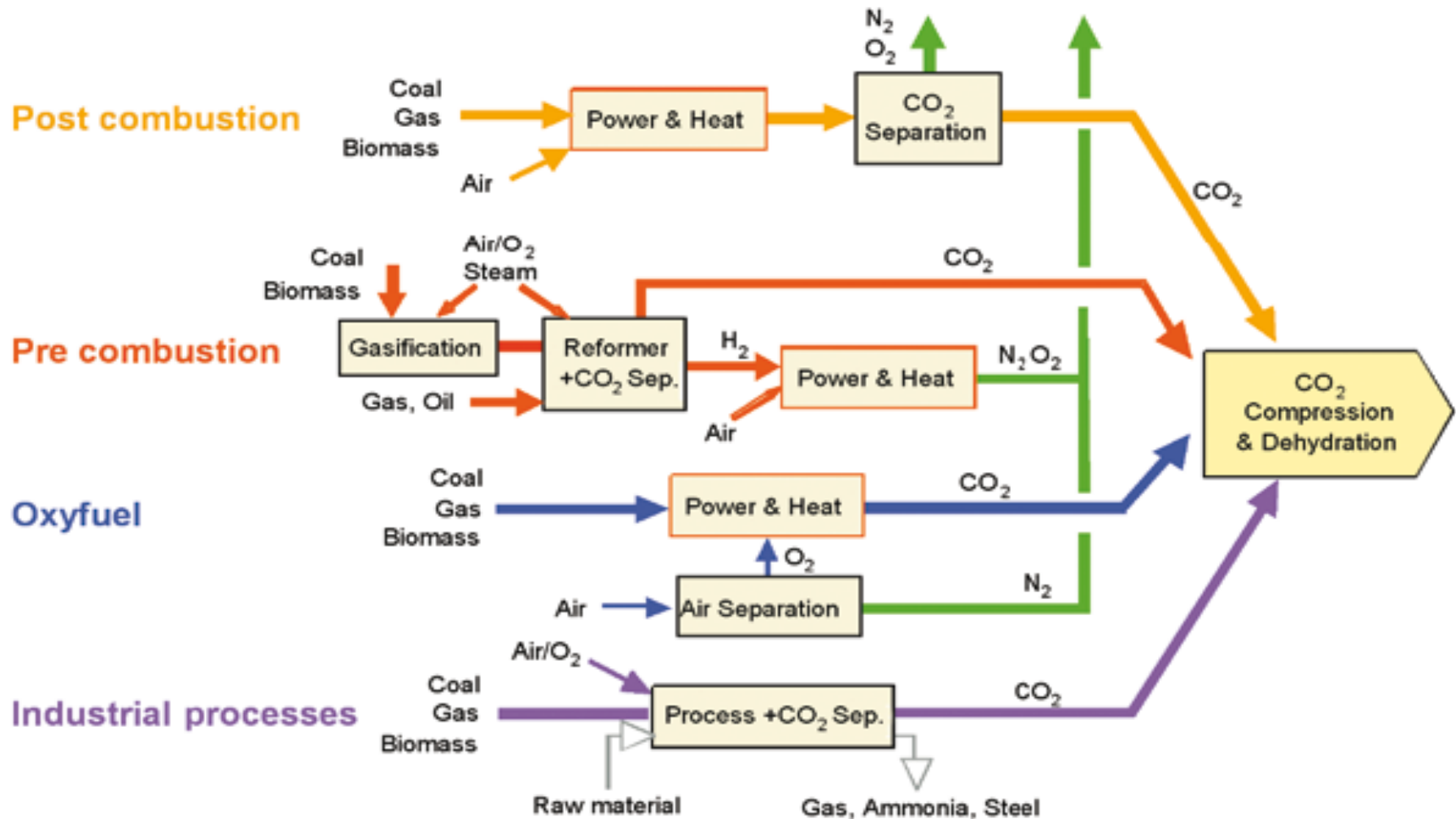
Three routes for capturing CO<sub>2</sub> from fossil fuel combustion plants:

- Post-combustion capture
- Pre-combustion capture.
- Oxy-fuel combustion.

Five main technologies, depending on the state of the CO<sub>2</sub> to be captured:

- Chemical solvent scrubbing.
- Physical solvent scrubbing.
- Adsorption/desorption.
- Membrane separation
- Cryogenic separation.

# CO<sub>2</sub> capture systems



# Barriers to CCS deployment

**Lack of large-scale demonstrations of the full chain of CCS (zero currently operating), BUT:**

- UK government is committed to supporting one of the world's first commercial-scale demo projects (to be operational by 2014) in order to facilitate the widespread deployment of **CCS**.
- The EU Commission has an ambition for up to 12 commercial-scale **CCS** demonstration projects to be operational by 2015.
- G8 committed to the aim of launching 20 commercial-scale CCS projects by 2010.

**Funding** - substantial public subsidies required for the first demonstration projects

**Sharing knowledge and experience -**

- Knowledge transfer to be a significant part of the UK's demonstration project
- EU Commission proposal to create a Flagship Network to share information between EU projects
- Australian proposal for Global CCS Institute to share information and learning in order to facilitate demonstration projects

# UK actions on CCS

- If CCS is to be commercially deployable by 2020, a number of issues need to be addressed
- Developing strategic approach that aims to include the following elements
  - Infrastructure development
    - For transport and storage
  - Supply chain development
    - Skills
    - Industry capacity
  - Technology development
    - Continued R&D
  - Incentives
    - EU financing mechanism – UK pushing hard for agreement
    - CCS to be included in CDM and post-2012 architecture

# UK demonstration project

- One project – post-combustion capture on commercial-scale (at least 300MW) coal power plant
- Post combustion – tackle global emissions, retrofitting can reduce emissions already locked-in
- Carbon dioxide stored offshore
- Operational by 2014
- Project selected through competition being run under EU Procurement rules

# Joint activity with China – R&D

- China-UK MoU on Scientific and Technological Collaboration on Energy R&D signed in 2005
- 2 projects will be completed this year, covering underground coal gasification, the assessment of trace elements from gasification plants and drilling technologies
- 2 new collaborative projects agreed earlier this year
  - Advanced power plant carbon capture options
  - Co-firing with biomass
- Will add to already significant knowledge base developed through this MoU

# Near Zero Emissions from Coal (NZEC)

- EU-China summit declaration on climate change and energy:

**“We will aim to achieve the following co-operation goals by 2020: to develop and demonstrate in China and the EU advanced, near-zero emissions coal technology through CCS”**

- Agreement followed by two MOUs with associated projects:
  - China-UK MoU (Dec 2005) – UK NZEC Initiative (£3.5m)
  - China-EC MoU (Feb 2006) – COACH (€1.6m)

[www.nzec.info](http://www.nzec.info)

# NZEC

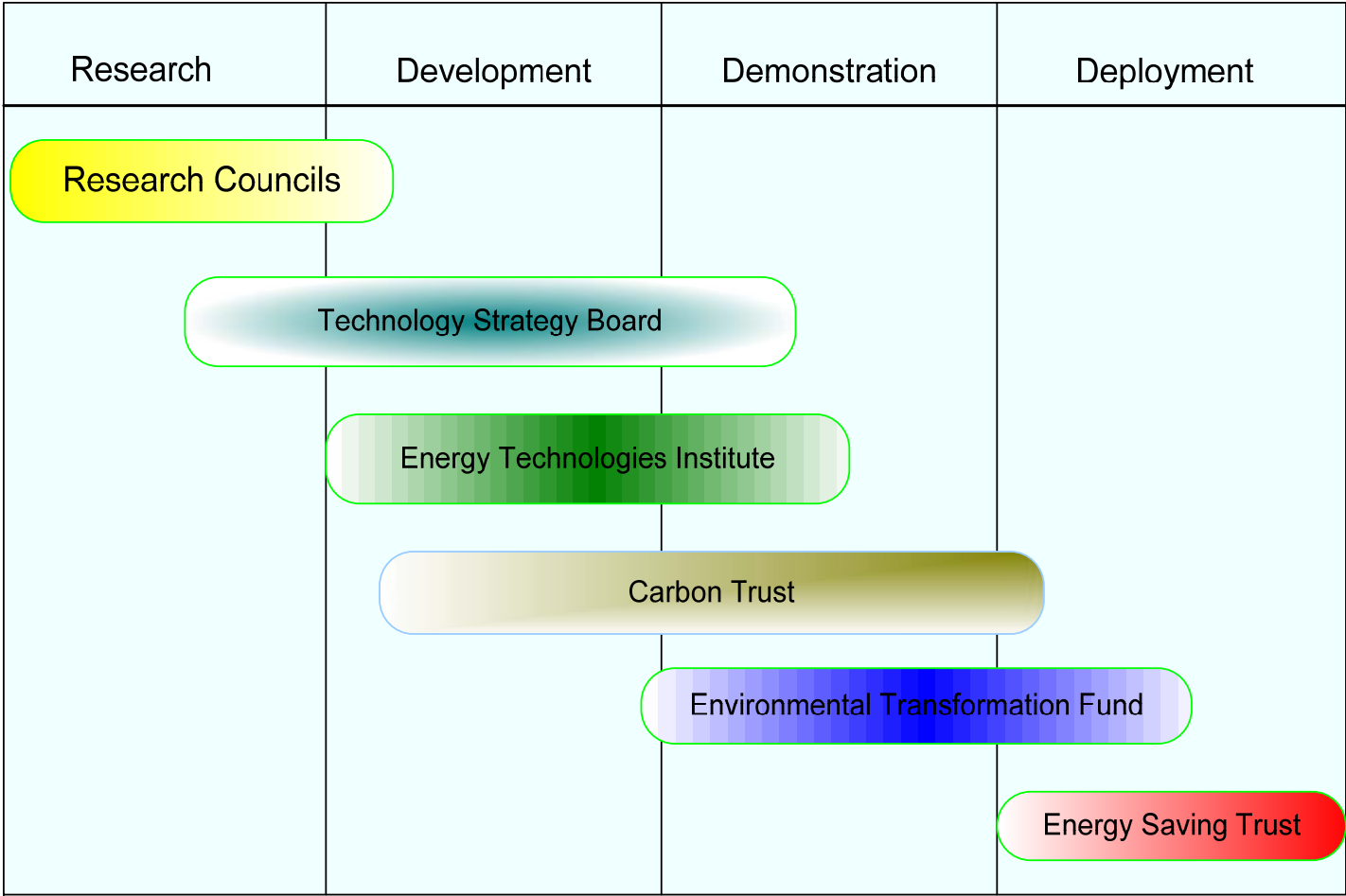
Phase I	Explore options for CCS with coal fired power in China	Assess options by early 2009
Phase II	Detailed design of identified projects	Definition stage, c.a. 1-2 yrs, complete by 2011-12
Phase III	Construct and operate demonstration project	Execute stage 3-4 yrs by 2014

# Energy Innovation

## The role of UK government:

- Providing a clear and stable regulatory environment for investors
- Facilitating technology demonstration and reduce risk of investment in technology and supply chain
- Leadership and influence in the development of new technologies
  - Promoting innovation, catalyse and accelerate commercialisation of technologies
- Removing supply chain barriers
- Streamline the planning system, improve grid access

# The National Energy Innovation Landscape



# Summary

- We need to explore all mechanisms for reducing carbon emissions in all sectors
- A range of engineering disciplines is needed
- International collaboration is essential
- Government intervention is vital