

POLICY REVIEW: ENERGY AND THE ENVIRONMENT

January 2007

This paper is based on documents prepared by the Prime Minister's Strategy Unit to facilitate discussion in the Policy Review. The paper is not a statement of policy.

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Progress and achievements

Climate Change

- UK greenhouse gas emissions fell 7% between 1997 and 2005 despite a 25% growth in the economy over the same period
- The world's leading carbon trading system has been established in Europe, covering 46% of UK CO₂ emissions

Energy & resources

- The efficiency of energy and resource use has been improved in many areas
- Household recycling rates have increased from 7% of all household waste in 1997 to 27% in 2006

Built environment

- Urban development densities are rising and more use is being made of previously developed land for new housing

Transport & environment

- There has been real progress in some areas of transport policy, with increased use of rail and a landmark demonstration of road pricing

Natural environment

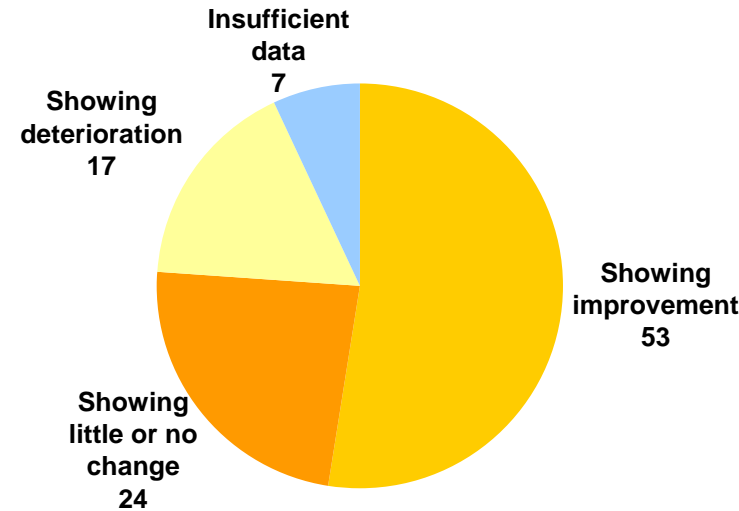
- Many aspects of the UK's natural environment have also improved - air and rivers are getting cleaner

Overall picture

- More than half of the Government's sustainability indicators show improvements on 1999, and a further quarter are unchanged

The Government's basket of sustainable development indicators suggests some progress, but further work to do

Aggregate movement in sustainable development indicators

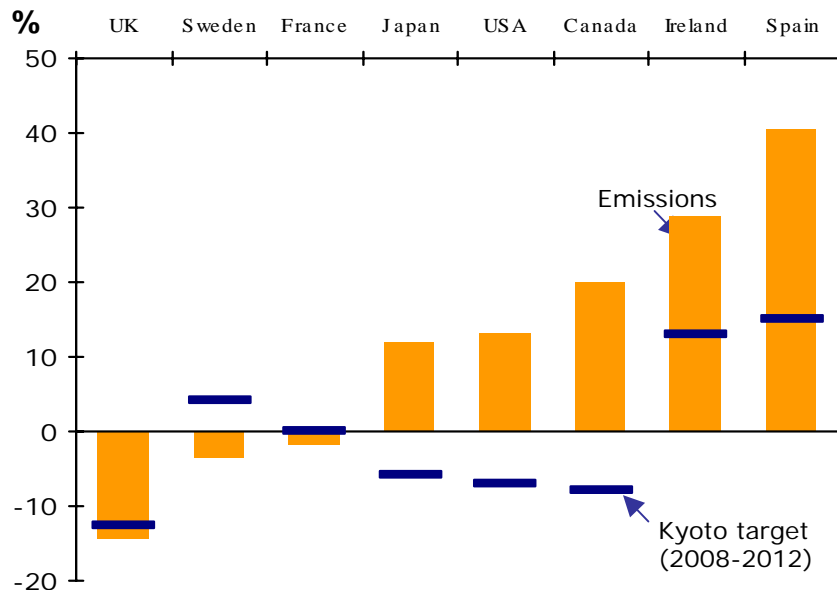


Source: DEFRA Sustainable Development Indicators

The UK is a recognised leader in European and global efforts to tackle climate change

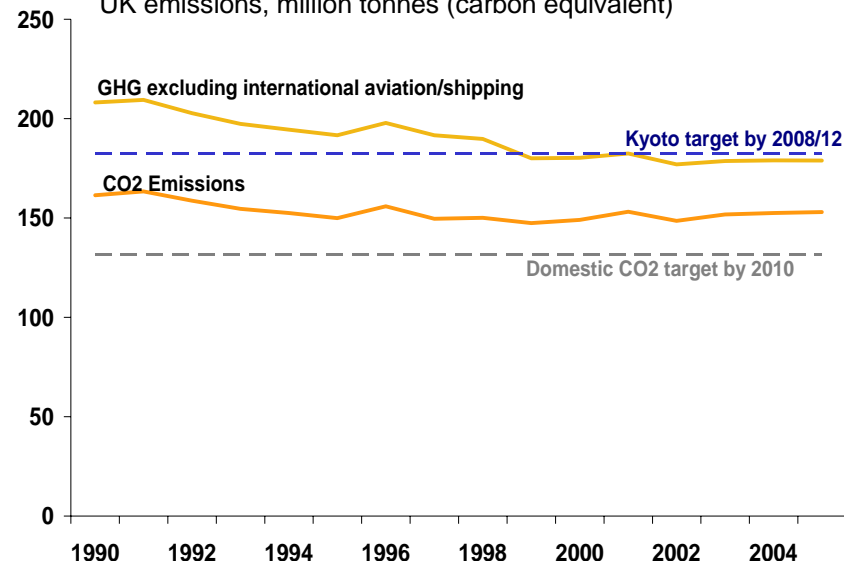
The UK is ahead of most countries in meeting its Kyoto commitments

Change in GHG emissions 1990-2003



UK greenhouse gas emissions fell 7% between 1997 and 2005 despite a 25% growth in the economy over the same period, but CO₂ emissions have started rising again

UK emissions, million tonnes (carbon equivalent)



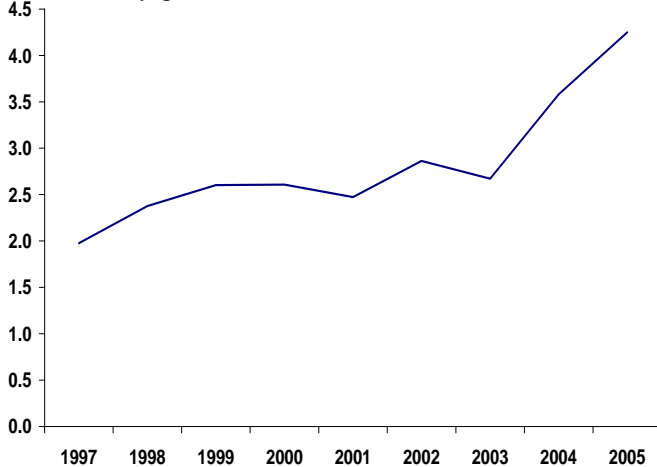
Source: DEFRA

- The UK has been at the forefront of international efforts to tackle climate change in the EU, G8 and UN, and is working towards agreement with the G8 and major developing countries on a framework for all countries to reduce emissions after 2012 and, in the EU, to strengthen and extend the EU Emissions Trading Scheme.
- The Stern Review is the UK's most recent contribution to the construction of an international consensus on the need for action
- The UK has committed itself to a 60% cut in carbon dioxide emissions by 2050: 65 million tonnes of carbon (MtC) compared to emissions of 152.5MtC in 2005
- The Energy Review Report and Climate Change Programme set out steps towards a cut of 30% in CO₂ emissions by 2020

The efficiency of energy and resource use has been improved in many areas

The proportion of electricity from renewable sources more than doubled, from 2% in 1997 to 4.2% in 2005

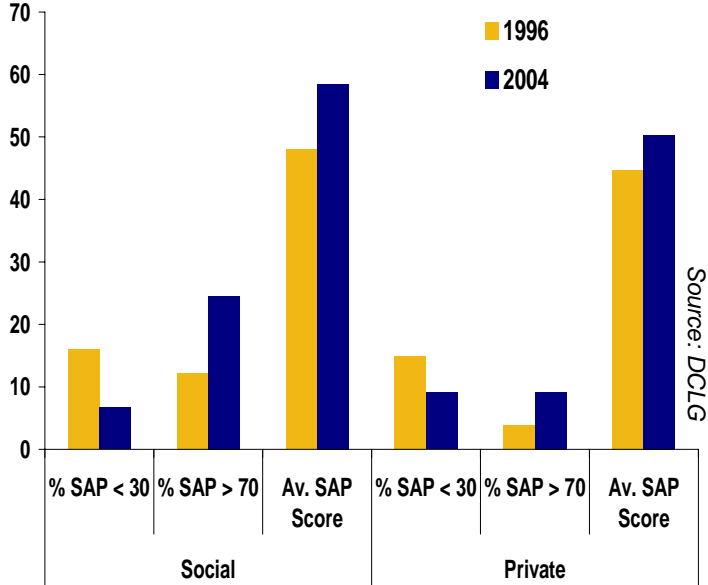
Electricity from renewable sources as % of total electricity generation



Source: DEFRA

There has been an improvement in the energy efficiency of new homes

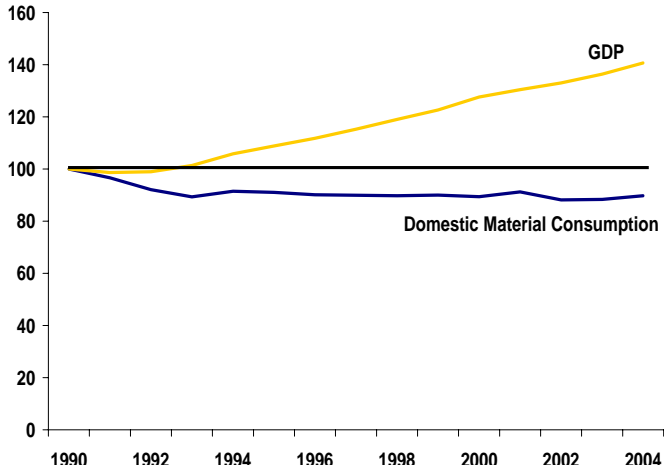
% SAP score*



Source: DCLG

Overall material consumption has remained stable even as the economy has grown

Index 1990=100



Source: DEFRA

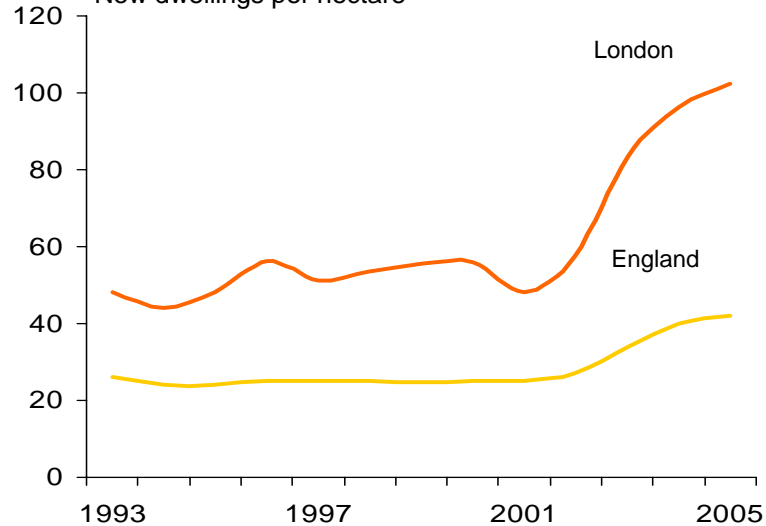
- In households, high efficiency condensing boilers took 95% of the 1.3m unit market for new boilers in 2005 compared to 16% in 2003, thanks largely to new regulations
- Even the least efficient fridge on the market today is twice as energy efficient as its counterpart of 1997, but increased demand for second fridges means consumption has fallen only 2%
- Electricity suppliers must use at least 10% renewable sources by 2010; the Energy Review aspires for this to reach 20%
- Household recycling rates have increased from 7% of all household waste in 1997 to 27% in 2005/6

* SAP is an index of energy efficiency. It is based on calculated annual space and water heating costs for a standard heating regime for a home and is expressed on a scale of 1 (highly energy inefficient) to 120 (highly energy efficient)

Urban development densities are rising and more use is being made of previously developed land for new housing - housing that is becoming increasingly energy efficient

The density of new housing has increased, particularly in London

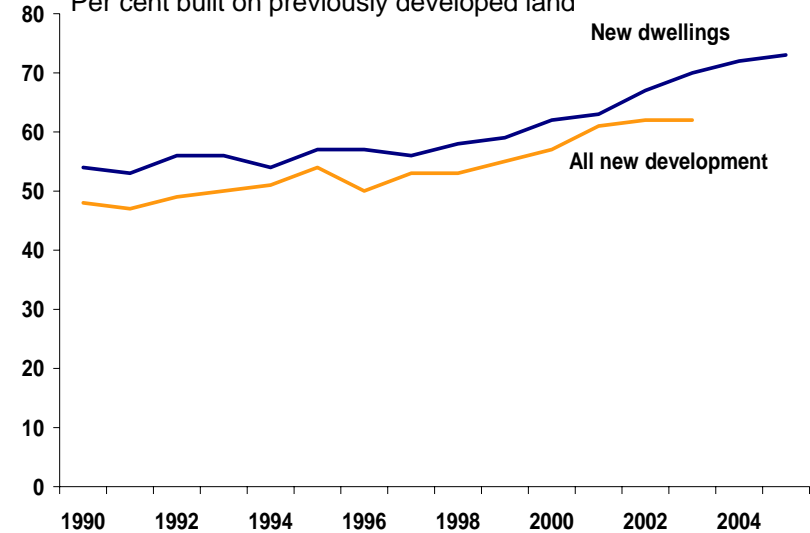
New dwellings per hectare



Source: DEFRA Sustainable Development Indicators

In 2005, 73% of new homes were built on brownfield sites, up from 54% in 1990

Per cent built on previously developed land



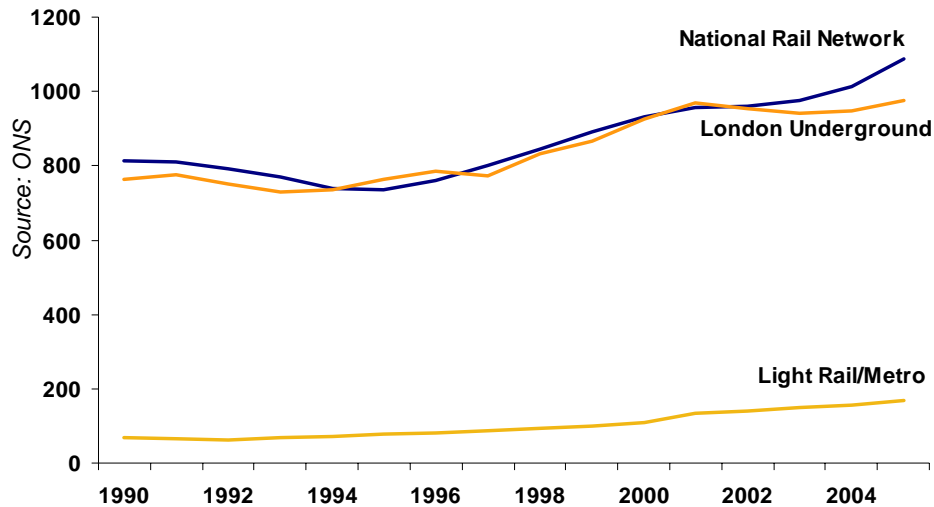
Source: DEFRA Sustainable Development Indicators

- New buildings erected in the UK should be 40% more energy efficient than those built before 2002*
- The introduction of energy efficiency certificates from 2007 will provide greater information for home-owners about the sustainability of their home
- All local authorities can now require on-site micro-renewable technology (e.g. wind turbines, heat pumps) for large developments

There has been progress in some areas of transport, with greater use of rail and a landmark demonstration of road pricing

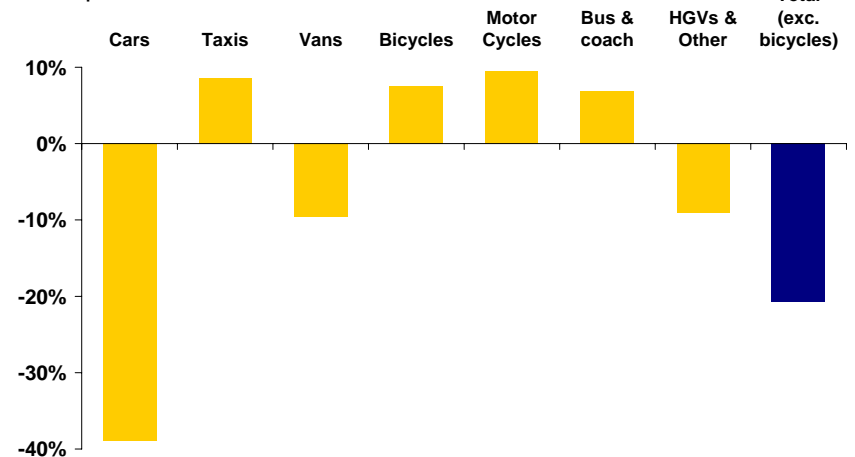
There has been a substantial increase in rail passenger miles

Millions of passenger journeys



In 2003 the UK's first road pricing scheme was successfully introduced in London in the form of the congestion charge

% change in vehicles entering the congestion charge zone between 7am-6.30pm after the introduction of the scheme



Source: GLA

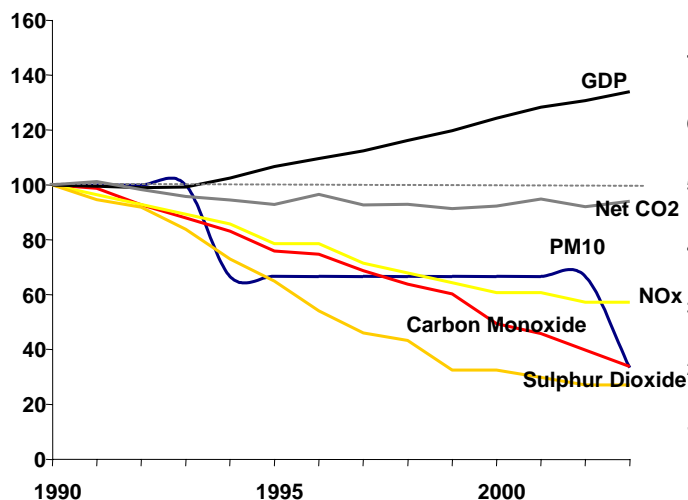
- As well as reducing congestion, London's congestion charge scheme is estimated to have cut traffic related CO₂ emissions within the charging zone by 19%, and road transport fuel consumption by 20%*
- The average carbon output of new cars sold in the UK has fallen from 189gC/km in 1997 to 169gC/km in 2005, and the EU voluntary agreements with car manufacturers together with company car tax and vehicle excise duty are expected to save 2.3MtC in 2010 – equivalent to taking 2.3m cars off the road
- By 2009 all of the petrol and diesel in the UK will be sulphur-free
- The Renewable Transport Fuel Obligation means 5% of transport fuel sold will come from renewable sources by 2010; the Energy Review proposed doubling this by 2015, subject to certain conditions

* GLA

Many aspects of the UK's natural environment have improved

Emissions of regional air pollutants have declined significantly

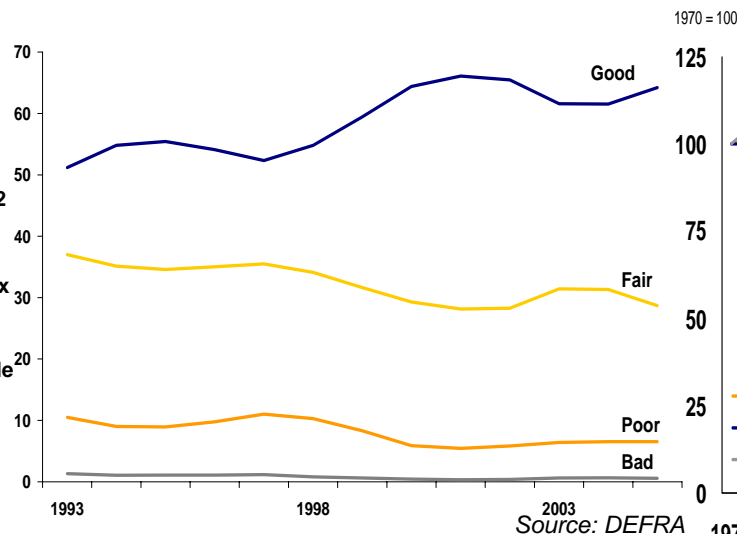
Emissions index: 1990 = 100



Source: ONS Social Trends (2006)

The proportion of English rivers rated good has increased

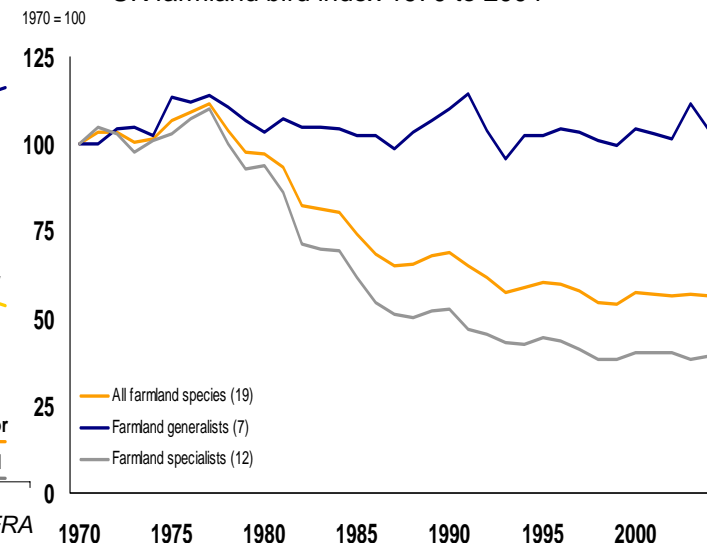
Chemical Water Quality, % of rivers in England



Source: DEFRA

After declining steadily since 1970, farmland bird populations have remained relatively steady since 1998

UK farmland bird index 1970 to 2004



Source: Defra/RSPB/BTO

- 22% of the habitats and 11% of the priority species monitored under the UK's Biodiversity Action Plan are increasing and, while 39% of habitats and 27% of species are still declining, the decline is slowing for 25% of all habitats and 10% of all species
- The amount of UK farmland certified for organic farming has increased 7-fold over the last decade, and now constitutes c.4% of total agricultural land. Environmental Stewardship schemes now cover c.1m more hectares than they did in 1997
- The UK accounts for about a third of the US\$5bn global market for Forest Stewardship Council-certified sustainable timber*
- Half of the UK's forest area received more acid deposition than it can support without damage in 2000, but under current legislation this will have fallen to less than a quarter by 2020

* "I will if you will", Sustainable Development Commission.

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Trends and challenges in the next decade

International action on climate change

- Climate change is perhaps the greatest long-term threat facing the world today
- The UK can influence climate change through European and global action but striking a meaningful global deal is a major challenge
- The EU's Emissions Trading Scheme provides the basis of an efficient abatement strategy for the UK and EU, but there are uncertainties about its future coverage and specification

The technology challenge

- The UK's latest strategies on energy and climate change aim for a partial 'decarbonisation' of the economy but the transformation required to meet a 60% reduction in carbon emissions through UK efforts on climate change should not be understated
- The UK faces major challenges in the next ten years in securing an energy supply portfolio that reconciles energy security, carbon reduction and competitiveness
- Meeting a 60% cut in carbon emission for 2050 would require profound technological change – especially in transport

Incentivising change and public engagement

- Incentives on individuals and households can encourage them to make more sustainable choices
- Demographic trends threaten to *increase* the pressures on the environment
- Engaging public opinion in the case for action on climate change will be a major issue in the years ahead

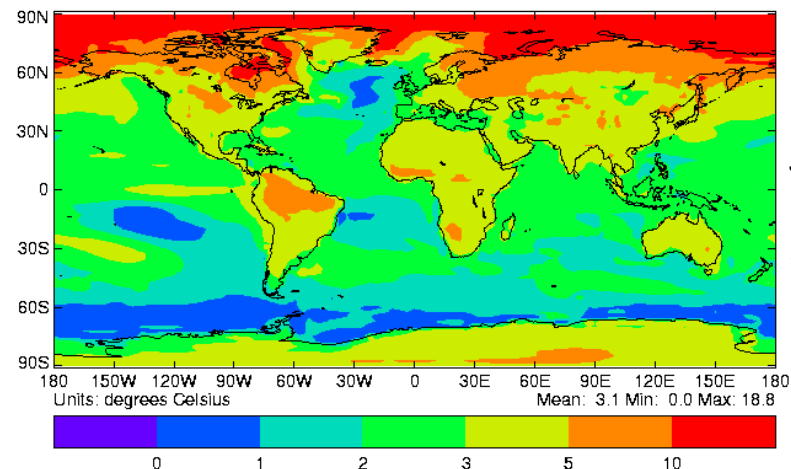
Beyond energy & climate change

- The UK faces challenges on a wide variety of other environmental issues, including the sustainability of fish stocks, waste management and water use

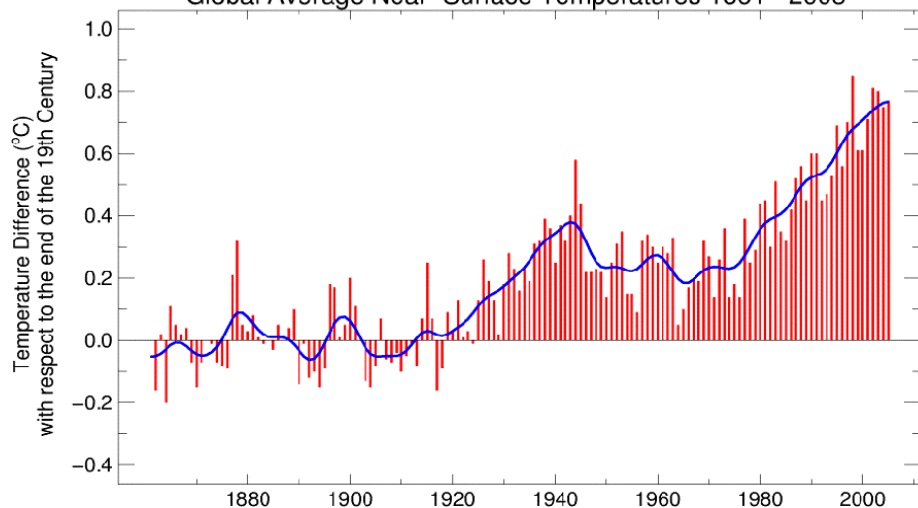
Climate change is the greatest long-term threat facing the world today

- Evidence is now very strong that, if unchecked, climate change will threaten production of food, health, land use, the environment and access to water
- It is estimated that if carbon dioxide concentration in the atmosphere were stabilised in the 500-550ppm range, temperatures could rise 2-5°C above what they are today

Change in average surface air temperature (Dec-Feb) from 1960-1990 to 2070-2100



Global Average Near-Surface Temperatures 1861– 2005



- But if current trends continue the IPCC predicts that greenhouse-gas concentrations will exceed 550ppm by 2050 and rise to between 650-1200ppm by the end of the century
- 1000ppm would result in the planet warming by 3 -10°C*

Source: Hadley Centre; Brohan et al. (2006)

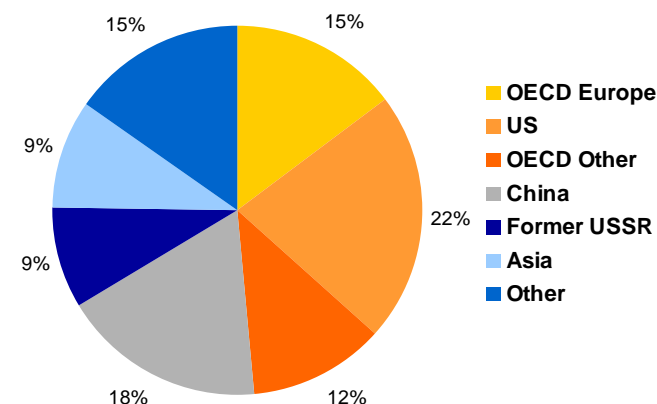
Source: Hadley Centre, HadCM3

The UK can influence climate change through European and global action but striking a meaningful global deal is a major challenge

Current & future challenges

International action

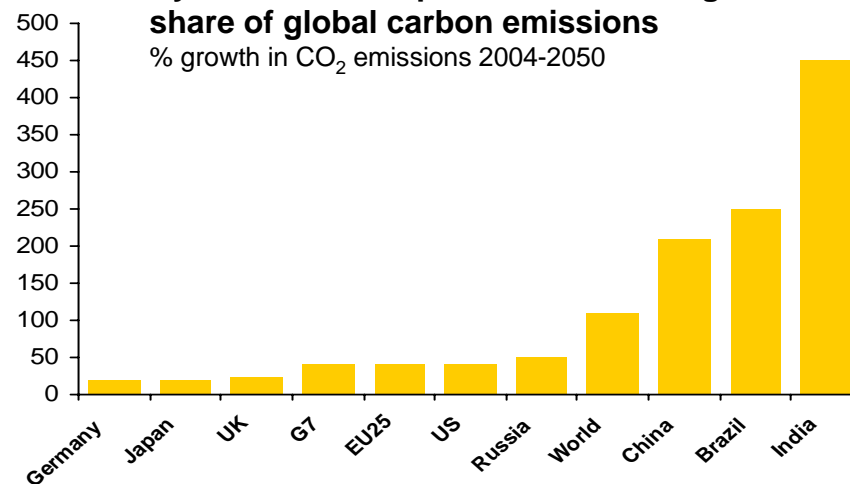
Today just twenty countries generate 79% of total CO₂ emissions; the US and China alone cause 40% between them



Source: IEA 2006

- The UK accounts for 2% of global CO₂ emissions and can influence climate change only as part of a global effort
- The Stern Review has made a compelling economic case for prompt international action:
 - **Costs of action are likely to be lower than costs of inaction**
 - **Costs of inaction will fall most heavily on developing countries**
 - **With the right incentives the private sector will deliver solutions**
 - **But an international framework that supports the achievement of shared goals is required**
- The UN Framework Convention on Climate Change, adopted by 189 countries, is the legal instrument of international action
- Attention is now focused on finding a new deal to succeed the current Kyoto Protocol commitments in 2012 and beyond

By 2017 Asia will provide a much larger share of global carbon emissions
% growth in CO₂ emissions 2004-2050



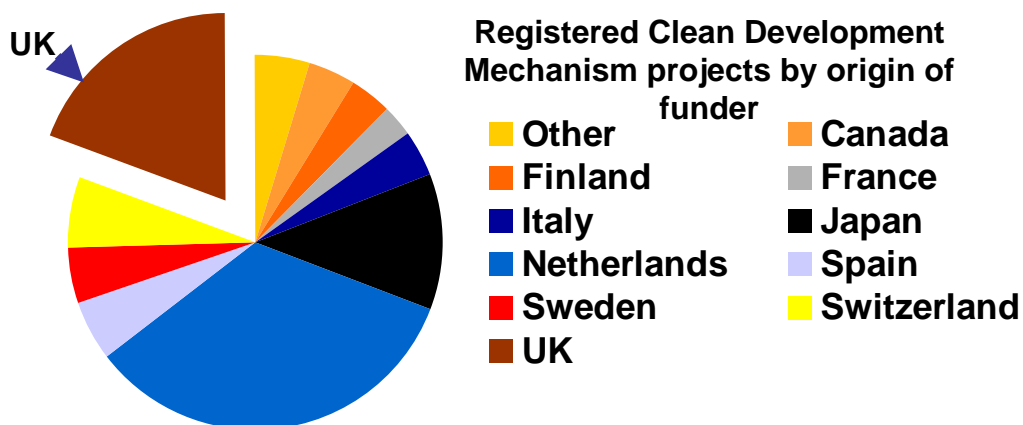
Source: PWC (2006) The World in 2050

Large scale global carbon trading would cut the cost of tackling climate change and mobilise the investment in developing countries that could help bring them into an agreement

Current & future challenges

International action

- International carbon trading has a key role in the UK's climate change strategy
- It gives carbon emitters the option of purchasing abatement from where it is cheaper
- Providing the abatement is verifiably 'real', the climate outcome is the same as cuts at home
- Carbon trading makes tackling climate change cheaper for the UK and could transfer money and technologies to developing countries
- For this to work as part of a global solution the world's rich countries must be prepared to see large transfers to poorer countries for purchase of carbon allowances



Financing carbon abatement in the developing world

The Stern Review notes that large transfers will be required for developing countries to accept constraints on carbon output, grow without large increases in emissions, and adjust to the effects of climate change

Existing mechanisms for such transfer include:

- The **Clean Development Mechanism (CDM)** established under the Kyoto Protocol allows developed countries to invest in abatement in developing countries
- The World Bank's **Energy Investment Framework** which provides a strategy for further finance and investment in clean energy and sustainable development in developing countries
- A 2% levy on CDM projects financing an **adaptation fund**

Stern suggests scaling up the CDM to finance abatement programmes rather than individual projects

In the EU Emission Trading Scheme (ETS) limits were set on such trading to ensure that member states did not avoid domestic action by buying all abatement from overseas - the 'supplementarity principle'

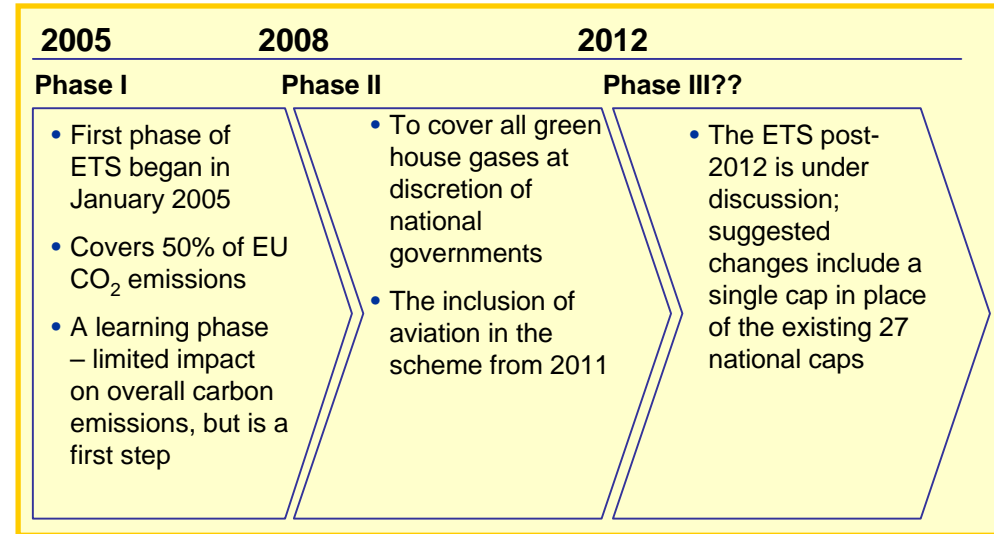
The EU's Emissions Trading Scheme provides the basis of an efficient abatement strategy for the UK and EU; its future coverage and specification are under discussion

Current & future challenges

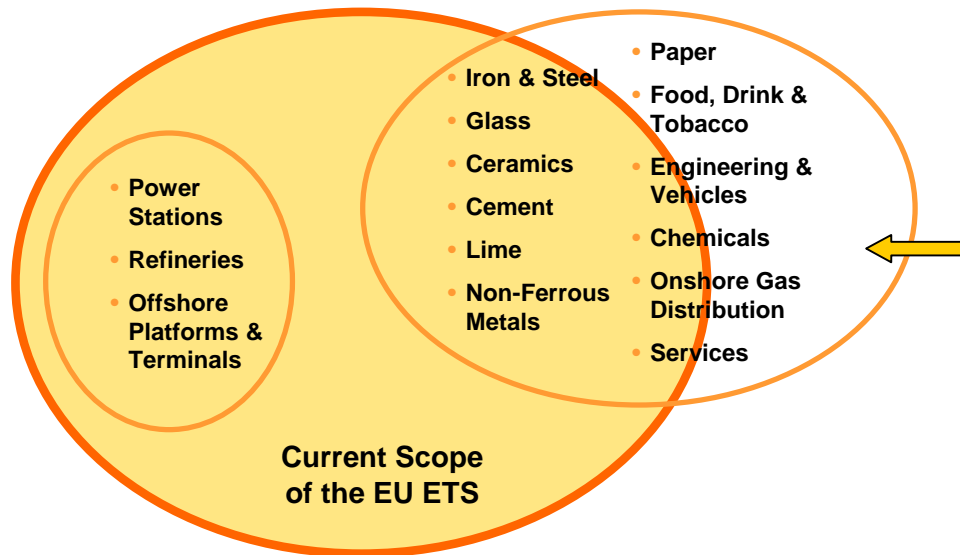
International action

- The EU's Emission Trading Scheme (ETS) could provide a cornerstone of a global carbon trading system
- The ETS covers 46% of UK CO₂ emissions today and is the UK's carbon pricing instrument of choice
- Extension of the ETS to road transport and aviation before 2012 is under consideration in Brussels

The development of the EU ETS



Coverage of the EU ETS in Phase I



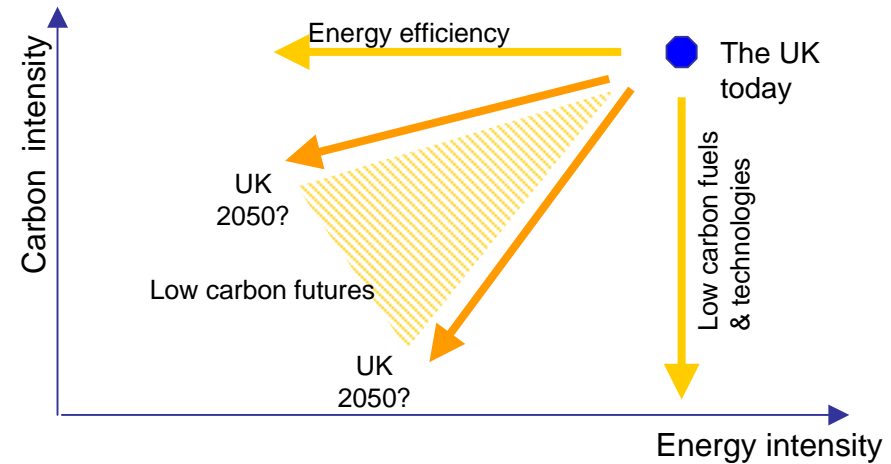
Installations with total combustion capacity > 20MW are included; smaller installations are not

- The ETS needs further development if it is to provide the most effective support to the EU's efforts to tackle carbon emissions

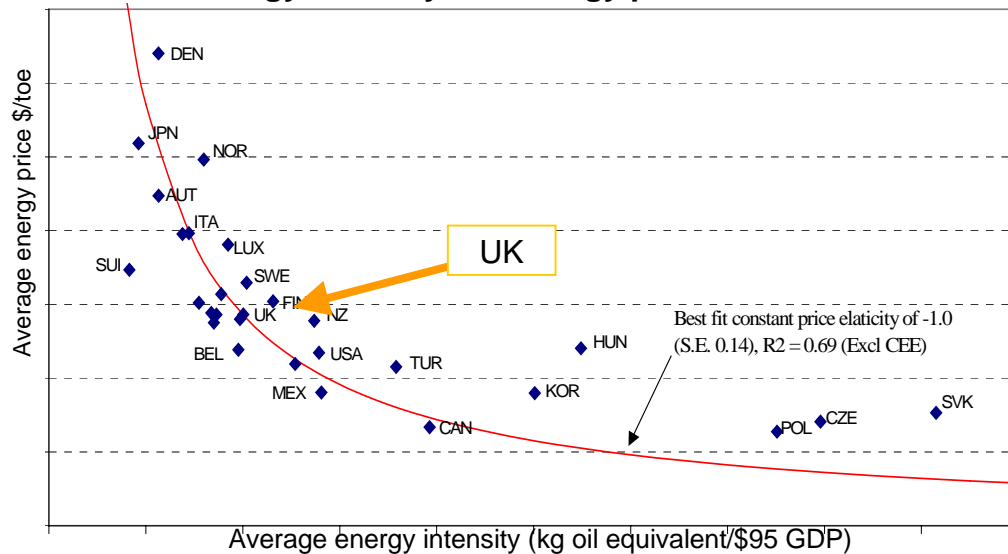
The UK's latest strategies on energy and climate change aim for a partial 'decarbonisation' of the economy

- The UK has had a higher energy intensity than many OECD countries, due in part to historically lower prices
- UK strategies for energy security and climate change aim for decarbonisation via improved energy efficiency and promotion of low carbon technologies and alternative fuels

There are many pathways to a low carbon economy

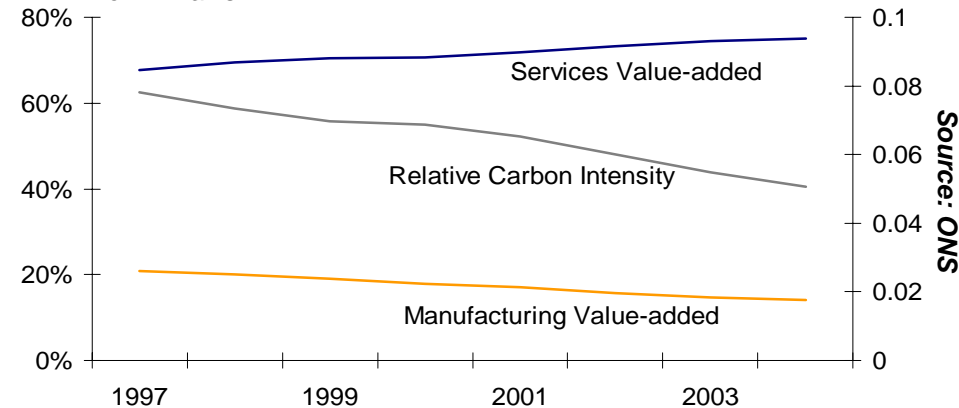


Energy intensity and energy prices are linked*



The UK's growing services industries are 12 times less carbon intensive than the manufacturing sector

Gross Value Added as % of total on LH axis, Relative Carbon Intensity on RH axis



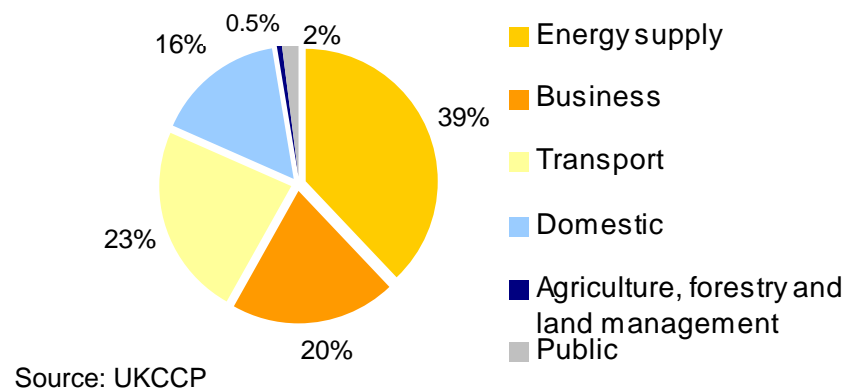
* Newbery, 2003. Analysis conducted for 1993-9.

Carbon intensity is defined as 000s tonnes of CO₂ per £m of GVA. Relative intensity is the ratio of services/manufacturing

But the transformation required to meet a 60% cut in carbon emissions should not be understated

- Demonstrating ongoing reductions in domestic emissions strengthens the UK's strategy of scientific and political leadership on climate change
- The UK has set a target of cutting its emissions by 60% by 2050 - implying a **80-90%** reduction in the carbon intensity of the economy if achieved domestically (rather than by trading) because of economic and population growth in the years ahead
- The UK needs to find the right balance between domestic abatement and support for abatement elsewhere, a balance that may change over time

UK CO₂ emissions in 2004 by source
Projections to 2020 show emissions from transport and business grow in relative importance



Uncertainty about future global policy affects firms' investment decisions while long product and infrastructure lead times and lifetimes slow the decarbonisation process

Current & future challenges

Making the transition

Policy uncertainty is not conducive to investment in more expensive low carbon technologies

- Improving certainty in the post 2012 Kyoto and EU ETS carbon trading framework can result in greater certainty for investors
- Incentives for investment in low carbon technologies and infrastructure – including nuclear power, renewables and carbon storage and sequestration, are strengthened by certainty in the carbon policy and price
- Carbon pricing can provide a more equitable way to encourage low carbon technologies than direct government subsidies, which can distort investment in energy supply

Long product and infrastructure lead times and life spans slow the decarbonisation process

- Around **70%** of the UK **houses** that will be occupied in 2050 are already built*
- The average **car** lasts 13 years - a vehicle sold this week could be running to 2020**
- **Shipping** will soon be the largest sulphur dioxide and nitrogen oxides source in Europe#; container ships last 30 years but the average liner at sea today is less than 10 years old - and will be afloat in 2020##
- **Civil aircraft** have operational lives of 20 years or more; most aircraft delivered this year will still be flying in 2020
- Planning and construction of a **nuclear power station** takes 8-15 years

To reach the target for a 60% cut in carbon emissions by 2050, more profound technological change would be needed – especially in transport

Current & future challenges

The technology challenge

Electricity

- 70% of UK power generation currently comes from coal and gas
- No single new technology will take the UK to the 2050 target
- A combination of nuclear, renewables and gas/coal, and carbon capture and storage (CCS) is likely to be required
- Micro-grids would be used to distribute some of the energy

Heat

- Heat for homes and businesses is currently dependent on electricity and gas
- Carbon capture and storage might make feasible continued use of fossil fuels
- Technologies such as micro-combined heat and power might provide energy for home heating

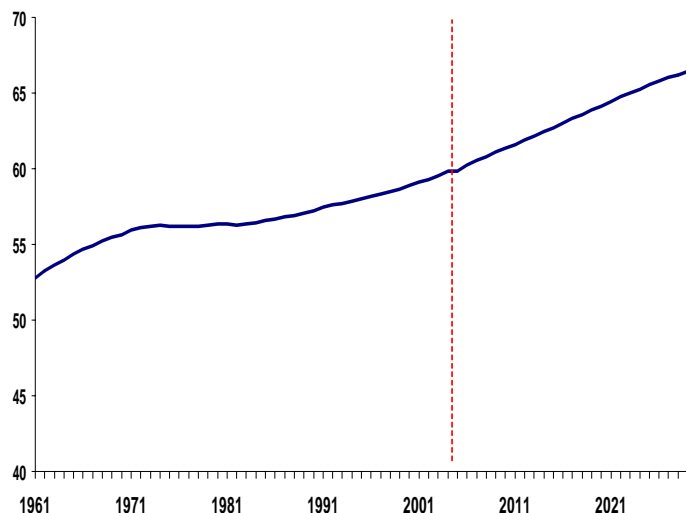
Transport

- Transport today is 100% dependent on fossil fuels
- Hydrogen fuel cells could radically reduce road emissions, although no consensus exists as to when these might be commercially viable
- Bio-fuels or diesel/petroleum hybrids will also partially reduce road emissions
- However, no substitute for aviation kerosene is in prospect (hydrogen is unlikely to provide in the foreseeable future)

Demographic trends threaten to *increase* the pressures on natural resources and the environment

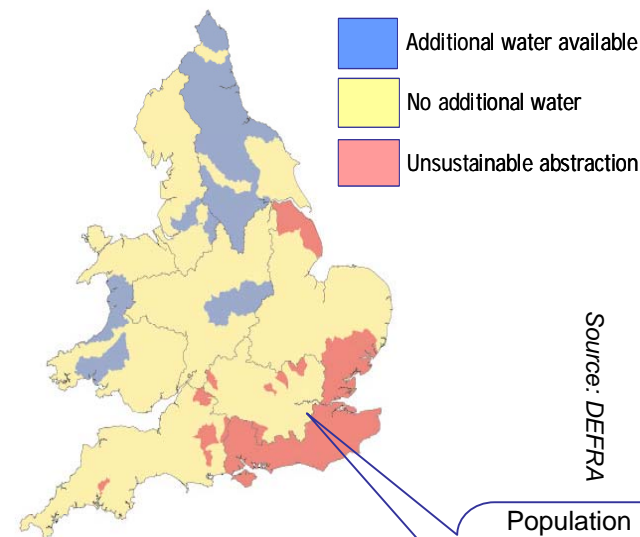
The UK population is projected to be 4.2m million higher by 2021; single households will have grown by 1.7m

UK population, millions



Source: Past data from ONS. Projections from Government Actuary Department

Across many parts of the country, but particularly in the South East, abstractions from surface water are at their limit during summer



Source: DEFRA

Current indicative availability: summer surface water

Population and housing growth is concentrated in London, the SE and E

- Population growth and demographic trends impact on resource and energy demand
- In 1991 lone households made up 27% of all households; by 2021 this figure is projected to be 35%
- Lower occupancy rates combined with population growth will increase the pressure on the supply of housing
- Occupancy is one of the key drivers of per capita water consumption - households with lower occupancy typically have higher per capita water consumption rates than those with higher occupancies. The same applies to municipal waste generation and energy use

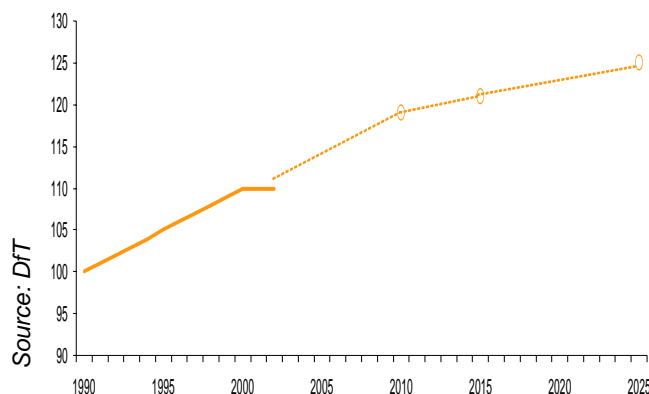
In transport the energy and pollution benefits of improved fuel efficiency and cleaner engines have been outweighed by ever increasing usage

Current & future challenges

Incentivising change

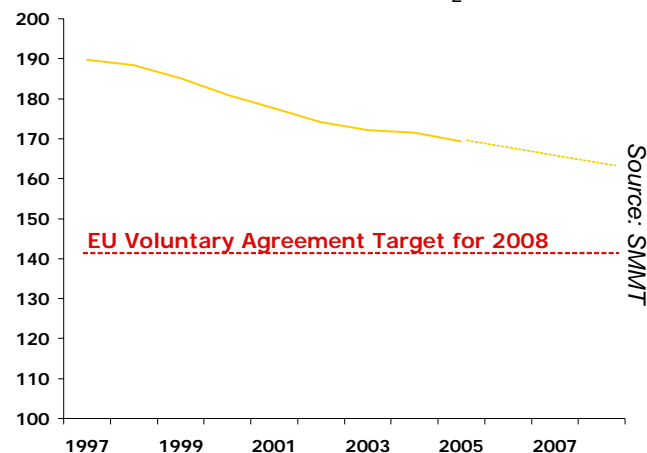
Car use increased 10% between 1990 and 2003, and is projected to increase another 14% by 2050

Growth in passenger miles
Index 1990=100



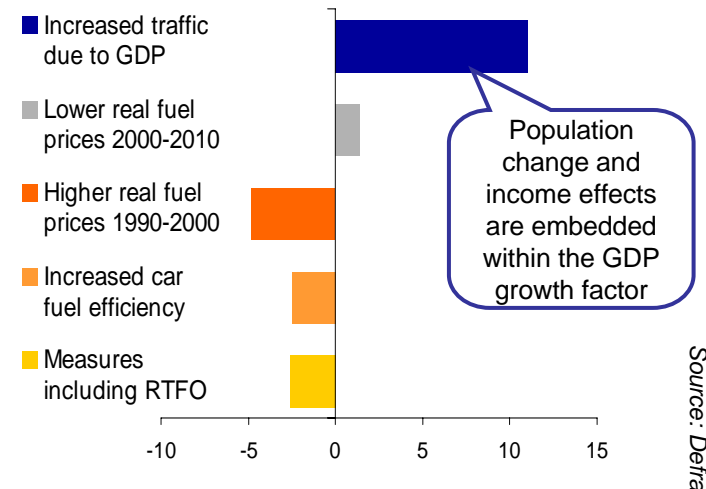
Despite progress on average emissions from new cars, the UK is a long way from the 2008 EU target

Average new car emissions, g CO₂/Km



Growth in transport emissions reflects the interplay of prices, technology and GDP

Impact of transport on carbon emissions from 1990-2010, MtC



- On average, cars have become more energy-efficient but there were about 4.5 million more licensed cars on the roads in 2005 than in 1997 and total car passenger miles is increasing; CO₂ emissions from road transport in 2004 were nine per cent higher than in 1990*
- Premature deaths attributable to ground-level ozone, generated in large part by road transport, are projected to rise from around 1400/yr in 2000 in the UK to 1700/yr in 2020**
- On present trends the car industry will miss the target in its voluntary agreement with the EU - to reduce the carbon output of the average new car to 140gC/km by 2008/09
- The UK has suggested moving to compulsory targets: European standards have been used successfully to improve fuel efficiency in the past
- DTI projections suggest transport emissions, excluding international aviation, will decline after 2015

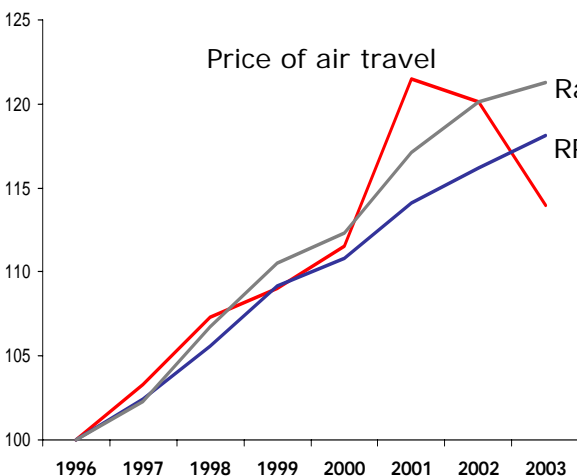
* SDC I Will if You Will (2006)

** IIASA

Increases in aviation emissions may affect the progress made through cuts in other sectors

The relative price of flying has dropped significantly in recent years

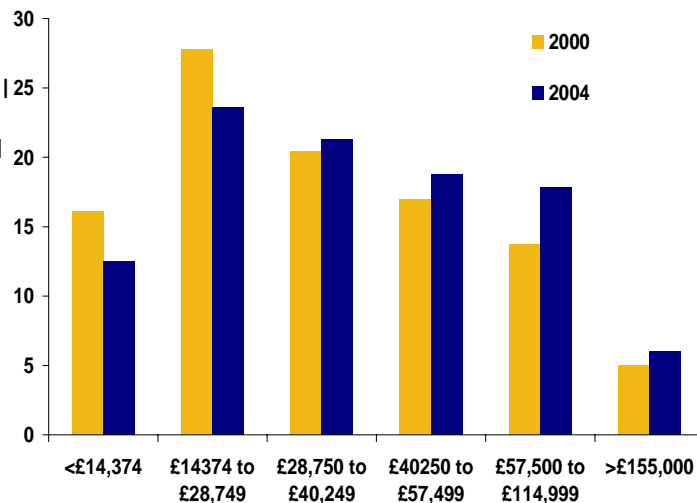
Change in cost of aviation (nominal index) 1996=100



Source: RPI and CPI ONS

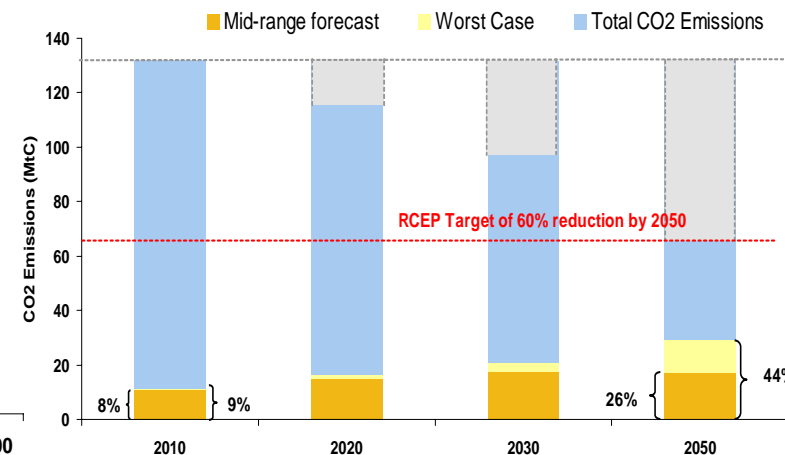
Growth in air travel is greatest among the better off – who already fly more often

% of international leisure trips made by UK residents by household income



Source: CAA/DfT

Although a small share of CO₂ emissions today, on current trends aviation could be equivalent to 26% to 44% of the UK's emissions target by 2050



Source: DfT (2004); Aviation & Global Warming

- Aviation will be included in the EU Emissions Trading Scheme from 2011, so helping to achieve guaranteed emission reductions
- Leisure flights have increased rapidly in recent years and now account for around 68% of flights in and out of the UK. Business flights have remained relatively steady since 2000 even as the economy has grown while the increase in leisure-related air travel has come mainly from the relatively well-off
- As yet there is no globally agreed method for allocating international aviation emissions but projections are that in 2050 aviation emissions associated with flights in and out of the UK could be the equivalent of 26%-44% of the total domestic UK emissions in that year if the 60% cut suggested by the Royal Commission on Environmental Pollution was achieved

Consistent international carbon pricing would support an efficient response to the climate change challenge

- Economic analysis of climate change suggest two guiding principles for an efficient policy response:
 - The price of emitting a tonne of carbon should be the same across the economy
 - That price should reflect the total damage caused by that extra tonne of carbon – the social cost of carbon
- The real world can only ever be an approximation to the theoretical ideal, but economy-wide, consistent carbon pricing could:
 - Encourage innovation and take-up of low carbon and energy efficient technologies
 - Promote a shift to low carbon lifestyles
 - Encourage abatement where it is cheapest
- A more consistent and harmonised carbon pricing regime would make it easier to reduce and simplify the array of policy instruments used to incentivise industry and consumer behaviour

The Social Cost of Carbon

Emissions of CO₂ contribute to global warming and thus have negative effects on the whole of society, however these costs are rarely borne in full by the emitter.

Economic theory suggests that if industry and consumers are made to face the true damage cost of each tonne of carbon they emit, they will produce the socially optimal amount, i.e. up to the point where abatement becomes more expensive than the damage caused by the CO₂.

Carbon trading schemes and taxes are both means of bringing those costs to bear on polluters.*

What is the social cost of carbon?

The global and diffuse nature of the impacts, and the long timescales and uncertainties involved make estimating this “social cost of carbon” difficult.

The Stern Review explains how the total social cost globally of a tonne of carbon varies depending on the context. Where CO₂ in the atmosphere is being stabilised at 550ppm the cost is estimated at £60/tC; in a business-as-usual scenario of ever-higher concentrations it could be £170/tC.

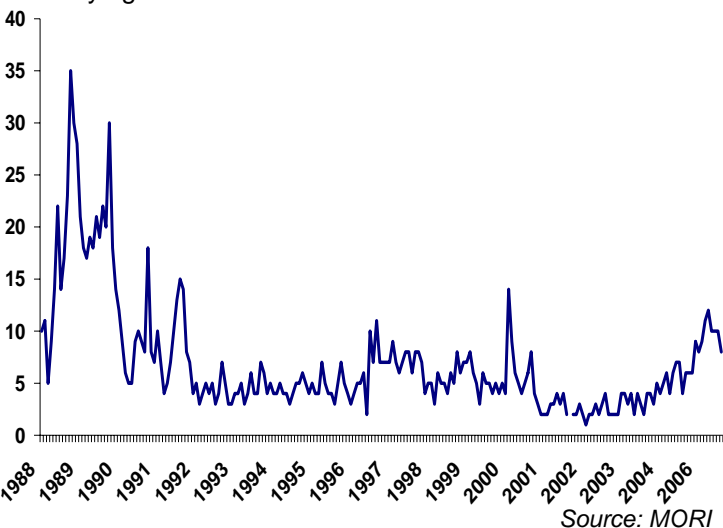
Current EU ETS prices are well below those of Stern's 550ppm scenario.

* With taxes the price can be set, but the quantity of emissions is uncertain. In contrast in carbon trading systems a cap is set on emissions and prices then reflect the difference between the demand and available supply of carbon allowances. More ambitious abatement targets mean fewer permits being issued, higher prices and so more cuts in carbon output.

Engaging public opinion in the case for tackling climate change will be a major challenge here and abroad in the years ahead

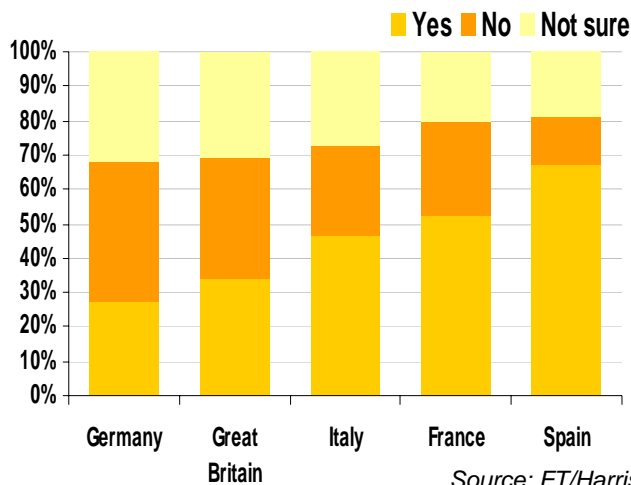
Concern about the environment is still relatively modest

Most important issues facing Britain: The Environment – % saying Pollution/Environment



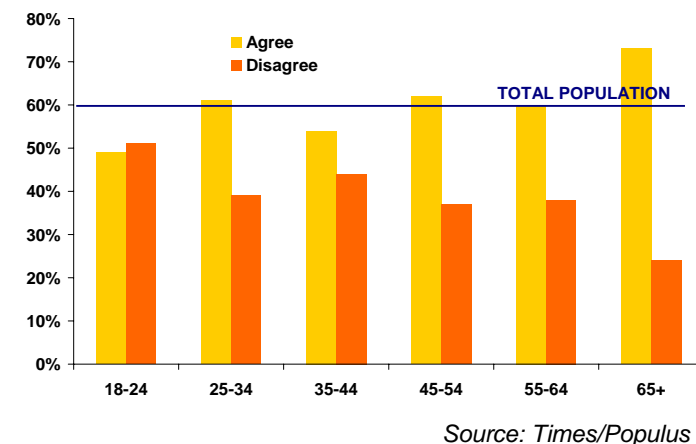
Less than 40% of Britons believe that climate change is a threat within their lifetime

Will global warming present a threat to you and your family within your lifetime?



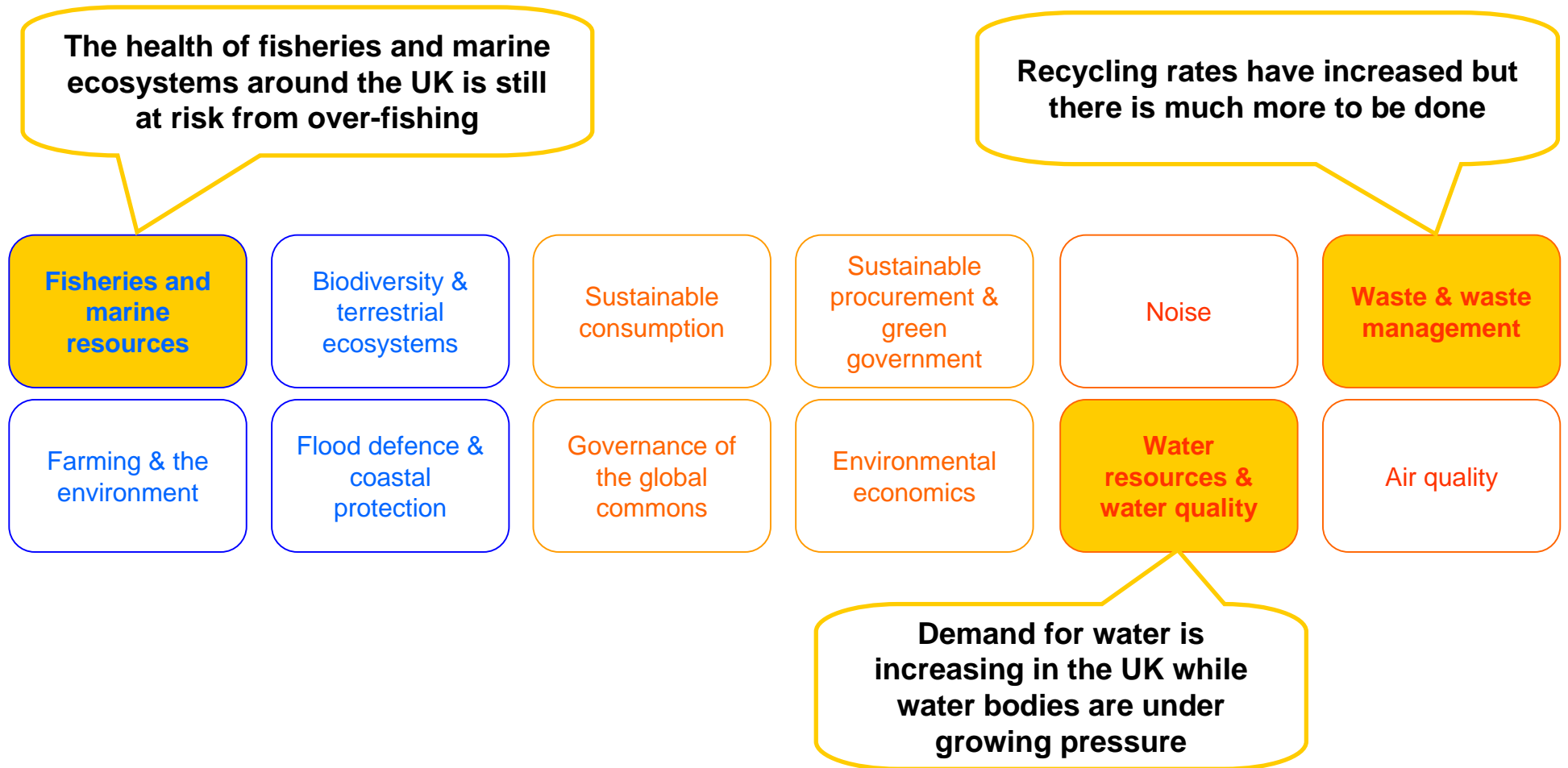
60% believe that there is little point in Britain acting unilaterally on climate change

% agreeing / disagreeing that unless the rest of the world are also going cut back on activities that contribute to climate change, there isn't much point in Britain doing so



- A recent MORI survey in the UK found that 91% believe climate change is happening. 77% believe that there are risks to people in Britain from climate change
- In balancing risks and benefits, 44% felt the risks of climate change far exceed the benefits, while 4% felt that benefits far outweigh risks
- 62% indicated that they “need more information to form a clear opinion about climate change”
- Only 14% felt confident that the UK Government adequately tackles climate change
- A key challenge is that the benefits of action now will not be seen for decades, and will be manifest as an absence of (negative) changes rather than an obvious improvement from baseline conditions

Beyond energy and climate change the UK faces other strategic environmental challenges, of which three are illustrated here



The health of fisheries and marine ecosystems around the UK is still at risk from over-fishing

- Sustained and excessive fishing pressure has heavily depleted cod, haddock and other species in the North Sea and fish stocks elsewhere around the UK
- The ecosystem effects of removing large quantities of fish that form the food for other species (e.g. sand eels) or predators (e.g. cod), are not well understood
- Nor are the effects of climate change on fisheries and marine ecosystems
- Fishing practice and regulation sustain high levels of waste and inefficiency (see box)

Over-fishing in the North Sea

Most stocks of the commercial fish species in the North Sea are in a seriously endangered condition

Between 30% and 40% of the biomass of these species is caught each year

About 70% of two-year-old cod die before reaching sexual maturity; fishing causes 80% of premature mortality

Source: European Environment Agency, North Sea report

Unseen harvest – discards in modern fishing

- Unofficial estimates are that on average a quarter of the fish caught are discarded because they are of an unmarketable species or size, or because the vessel does not have a quota for that species. In certain north east Atlantic fisheries the discard rate has been estimated at 50%*
- Discarded fish rarely survive and do not appear in fishery data (which are based on landed catch)
- Trawling has severe effects on life on the ocean floor - international research found that the level of beam trawling activity in some of the North Sea (at 10 or more trawls per year) might be comparable to dredging for marine aggregate**

Environmental groups such as WWF and Greenpeace are campaigning to reduce fish by-catch using photos such as this, illustrating 'discards from a bottom trawler'



Photo: Greenpeace

Recycling rates have increased but there is much more to be done

- Waste contributes about 25% of the UK's methane emissions and about 3% of UK's overall greenhouse gas emissions
- Commercial and household waste is growing; commercial waste is forecast to increase 13% by 2010 from 2002, municipal waste is likely to grow at 1.5%/yr
- Commercial waste is a particular problem since there are few current policy levers to tackle it but household waste is also a problem given current levels of local authority investment
- The UK has significantly improved its recycling rate but still makes much more use of landfill than many other European countries

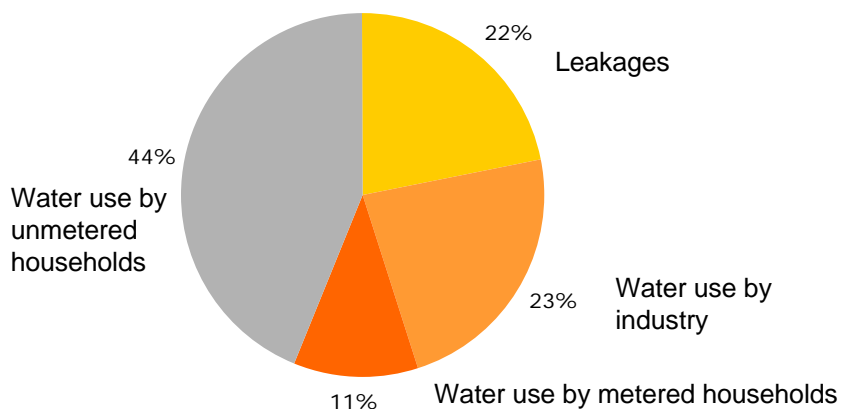
The Landfill Tax Escalator is reducing use of landfills

- The landfill tax escalator raises the landfill tax annually by £3/t
- The current landfill tax stands at £21/t and the escalator will raise the tax until it reaches £35/t in about 2011
- The tax has been successful on a number of levels:
 - It is successfully diverting commercial and industrial waste from landfills (about 248 kt in 2006)
 - It is revenue neutral and most revenues are recycled to help local authorities and businesses comply with environmental regulations
 - It is efficient

Demand for water is increasing in the UK while water bodies are under growing pressure

- There is rising pressure on water supply, particularly in the South East, that is compounded by changes in the seasonal distribution of rainfall
- Treatment and supply of water is energy intensive and rising demand will exacerbate this (8100 GWh of energy were used and 4.1 Mt of greenhouse gases emitted in 2004)
- About 22% of water abstracted for public supply is currently lost through leakages*
- Only about 28% of households currently possess meters; metering reduces demand by around 10%

60% of water entering the supply is either unmetered or lost through leakages

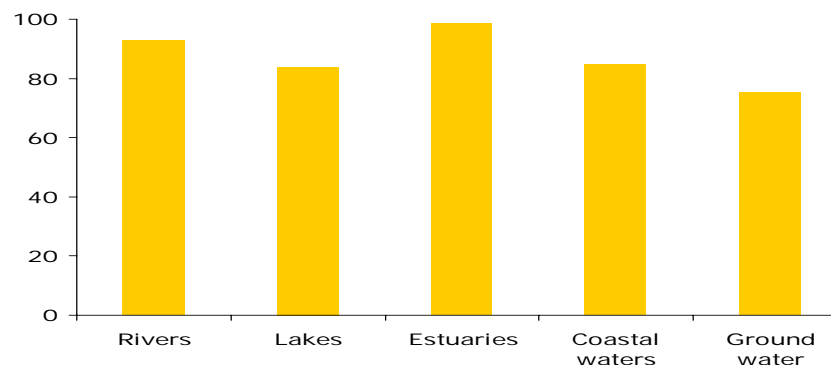


Water quality in the environment is still an issue

- The overall quality of rivers has improved over the last decade
- But the new EU Water Framework Directive, which uses a wider set of outcome measures, raises the bar and will require holistic plans to achieve its challenging objectives
- The main issues are: diffuse pollution from both agricultural and non-agricultural sources (primarily pesticide and phosphate pollution); water abstraction; and physical changes to water bodies

Water bodies are still some way from being sustainably used

% of England & Wales water bodies at risk of failing to meet good status by 2015



Source: DEFRA, Water Strategy 2006

* Source: IPPR, 2006

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Progress and achievements

Trends and challenges in the next decade

How other countries are responding

Existing foundations - policies and strategies

Other countries are also looking beyond fossil fuels for their energy supplies, with potential benefits for energy security & climate change

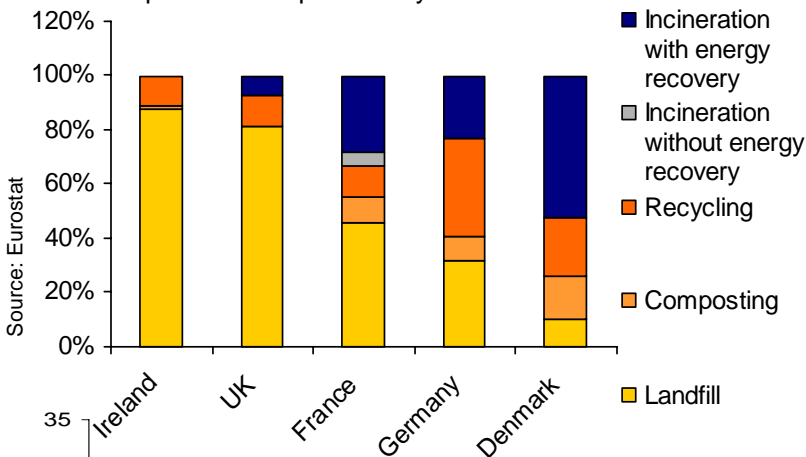
Other countries' response

Energy & climate security

Many EU countries have integrated energy supply with their waste strategies

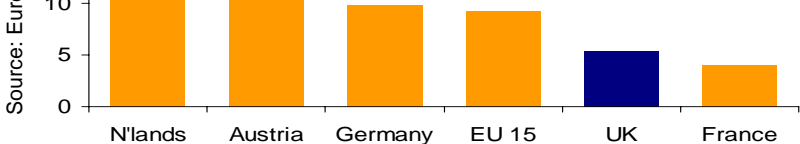
Energy recovery from waste is much more common elsewhere in the EU

Municipal waste disposal % by method



Their use of combined heat and power generation is also higher

% gross electricity generation, 2002



The US and Brazil are among the countries looking to biofuels to substitute for oil

- **Brazil** has long been a world leader in the use of sugar-based biofuels: neat and blended fuel is sold nationwide. Three quarters of all new cars can accept either type
- Ethanol production in the **US** has been expanding rapidly. Facilities under construction are planned to increase the current 17 billion litres capacity by a further 7 billion
- **China** has been steadily increasing its use of ethanol since 2001. Since 2004, China has been promoting ethanol blends in 9 provinces. It is now the world's 3rd largest producer of ethanol*
- The **EU** lags behind on use of biofuels, but the EU and in particular **Germany** leads the world in the production of bio-diesel**

Adoption of non-fossil fuel technologies is spreading in emerging markets

- China and India are using increasing amounts of coal for electricity generation but also turning to other energy sources
- **China** plans to build non-fossil fuel alternatives for electricity generation to contribute to its predicted 65% increase in energy use by 2020
 - expansion of nuclear capacity from 7GW to 30-40GW
 - expansion of wind generation from 0.8GW to 30GW
 - more than doubling of hydro capacity from 104 to 250GW
- **India** is also increasing its use of renewable energy sources. It ranks 4th in the world in cumulative wind power capacity (3.5 GW) and is making significant investment in biogas projects and solar photovoltaic lighting systems***

*Worldwatch, 2005 **EU, Biofuels in the EU, 2006

*** Renewable Energy Access, 2005

Use of economic incentives to shape consumer choice and behaviour has been extended to markets beyond those tested in the UK

Other countries' response

Economic incentives

Road pricing is a reality in other countries

- The **German, Swiss and Austrian** governments have introduced a distance-based truck toll for all heavy commercial vehicles
- Registered users are fitted with an on-board unit which records journeys and a monthly invoice is issued

Household waste charges are well established in the EU and US

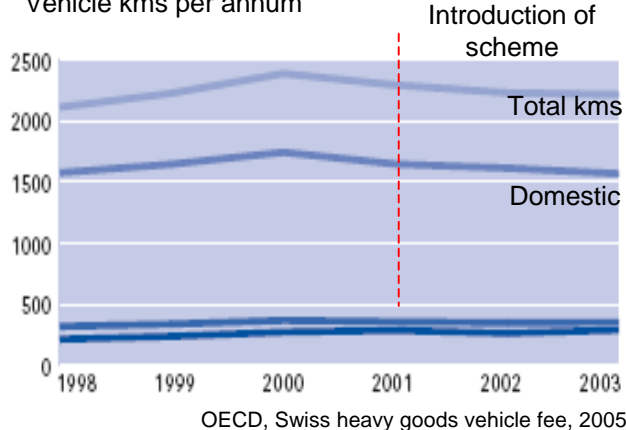
- **Many countries in Europe**, and the **US**, use variable rate charging on household waste
- Affordability concerns are addressed through tariff structures and provision of recycling options
- Variable charging typically cuts waste volume by 10% and increases recycling

Carbon taxes have been used to reduce demand and emissions

- The **Nordic** countries used carbon taxes to reduce emissions by households and industry
- **Sweden** introduced a wide-ranging carbon tax in 1991 which led to cut domestic demand and is generally perceived to have reduced emissions

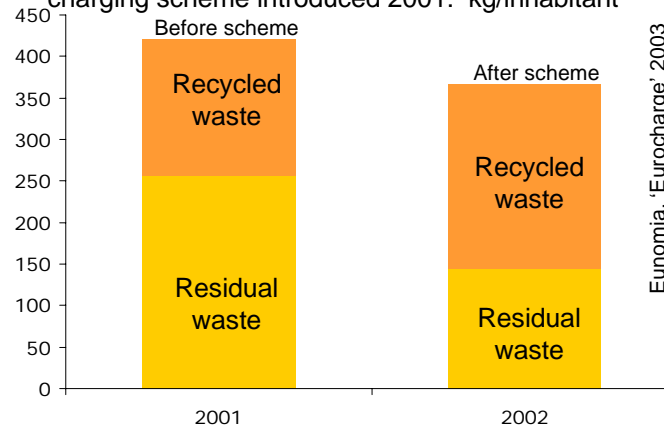
Road user charging can reduce road usage

Swiss heavy vehicle road charging scheme
Vehicle kms per annum



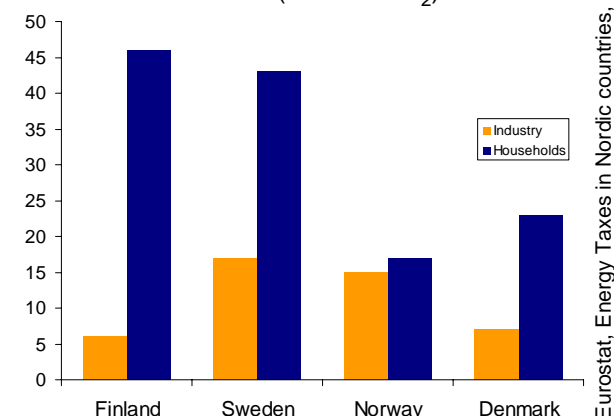
Experience elsewhere suggests variable waste charging can reduce overall waste and encourage recycling

Waste produced by a sample Italian variable charging scheme introduced 2001: kg/inhabitant



Carbon taxes in Scandinavia were used to change household demand

Effective CO₂ tax rates for industry and households in 1999 (€/tonne CO₂)



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The Policy Review should draw on and complement key reviews and processes that have recently been completed or are underway

There are important policy initiatives in progress that are of particular relevance to the theme of 'Energy and the Environment'

These include:

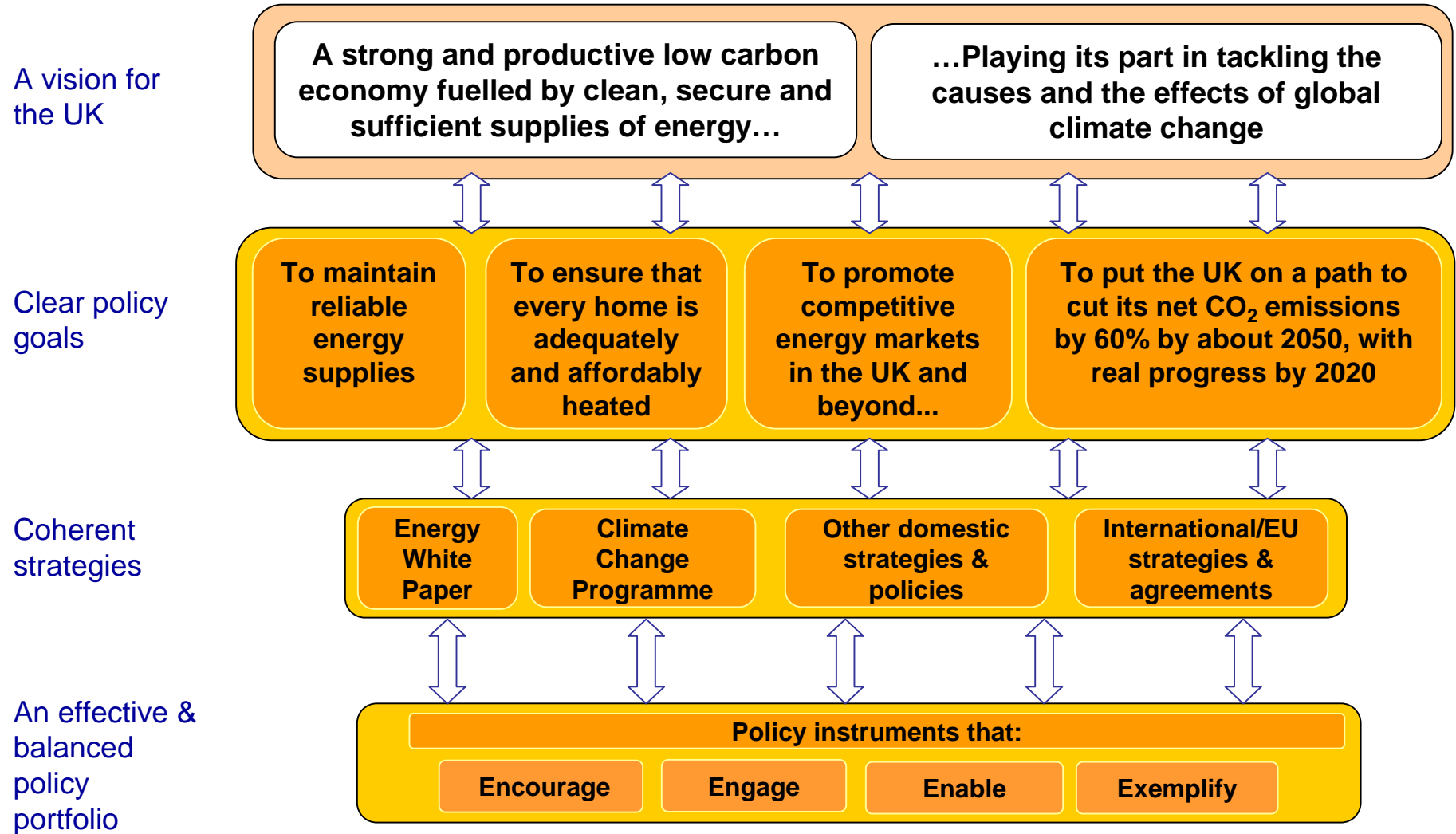
- the drafting of the [Energy White Paper and the Climate Change Bill](#)
- preparations for CSR07, including the Long Term Challenges and Opportunities document
- further development of [climate change policy](#) by Defra/OCC, e.g. on adaptation
- [international processes](#) relating to Kyoto, EU-ETS, Gleneagles Dialogue, G8+5 and others
- [Defra's Strategy Refresh](#) and sectoral strategy reviews on waste and air quality

The Policy Review should seek to:

- avoid repetition and overlap with recent and parallel work-streams
- add value and complement work elsewhere, filling gaps where necessary
- help in drawing out key conclusions and common themes, and in resolving difficult questions

The vision: the UK as a productive and successful low carbon economy in a world that is effectively addressing the causes and effects of global climate change

Existing foundations
Vision for energy security and climate change



The 2006 Climate Change Programme has defined policies to further abate UK emissions and plans for securing international consensus on climate change action

Existing foundations
Climate Change Programme

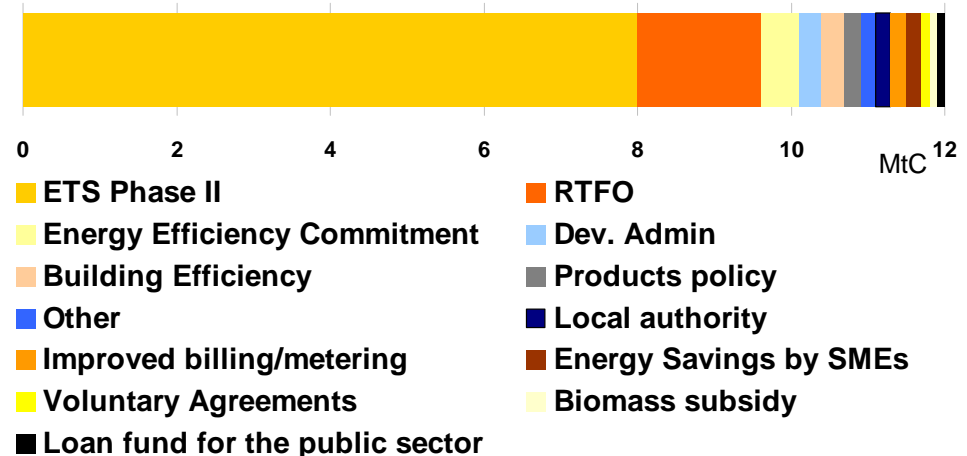
While the UK has made significant progress against international targets, it has a long way to go to reach its long term self-imposed domestic targets

- The UK has two domestic carbon targets:
 - a reduction in CO₂ of 20% relative to 1990 levels by 2010
 - a reduction in CO₂ of 60% relative to 1990 levels by 2050
- The Programme makes a case for immediate action to give the UK a chance of reaching these levels

CLIMATE CHANGE PROGRAMME PROPOSALS

- Use EU-ETS to achieve carbon savings of 8MtC
- Introduce a renewable fuel obligation in the transport sector
- Further develop Building Regulations and extend the Energy Efficiency Commitment for demand side management in homes
- Introduce a package of measures to drive action at local authority level

The Climate Change Programme is projected to generate up to 12MtC carbon savings per annum by 2020, most from the EU Emissions Trading Scheme



Source: UKCCP (2006). Figures are MtC of carbon savings

The 2006 Energy Review Report addressed energy security and climate change, recognising the need for more low carbon power sources and increases in energy efficiency

Existing foundations

Energy Review

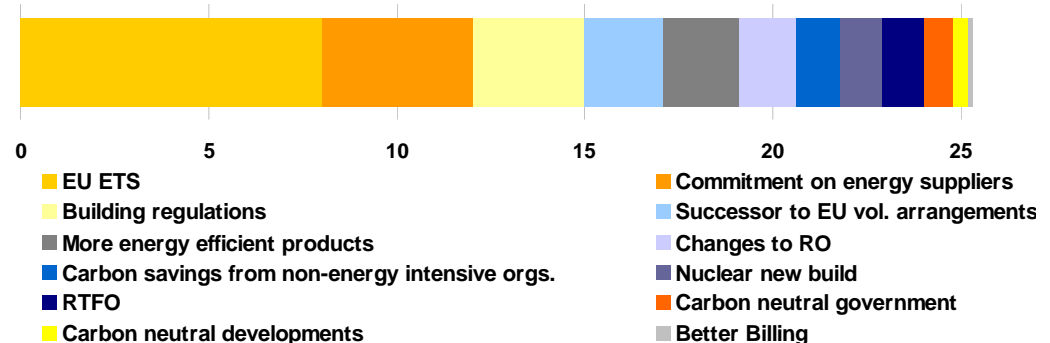
The UK needs to be more efficient in its use of energy and to secure low carbon power in order to address the energy security and climate change challenges of the years ahead

- The market's response to the retirement of 25GW of ageing power stations will determine the UK's energy diversity, import dependency and carbon intensity for decades to come
- And timely investment in capacity and networks is needed to ensure power supplies continue to be reliable
- The Review's multi-track strategy builds on the Climate Change Programme and 2003 Energy White Paper
- If all the Energy Review proposals are implemented and confirmed in the 2007 Energy White Paper, the measures could off cuts of:
 - 19-25MtC by 2020 – 13-17% of emissions without the changes
 - 12-20 bcm (or 11-17%) of expected 2020 gas consumption

ENERGY REVIEW REPORT KEY PROPOSALS

- Endorsement of the **EU-ETS**, and consultation on a new scheme for businesses and public services
- Consultation on policy frameworks under which developers can make proposals for new **nuclear** power stations
- To extend the **Renewables Obligation (RO)** to 20% when progress justifies it and to consult on changes to the RO to provide greater support to renewable technologies that are further from the market
- Maximisation of economic **recovery from the North Sea**, a review of the **security of gas supply** (storage etc.) and encouragement for **distributed energy** sources
- Research on carbon sequestration and storage: **clean coal**
- International efforts to sustain **competitive markets**

Energy Review policies are projected to generate up to 25MtC savings a year*



Source: Carbon Savings from DTI Energy Review (2006) Figures are MtC

* NB these savings include the savings from policies introduced in the Climate Change Programme so are not additional to those savings

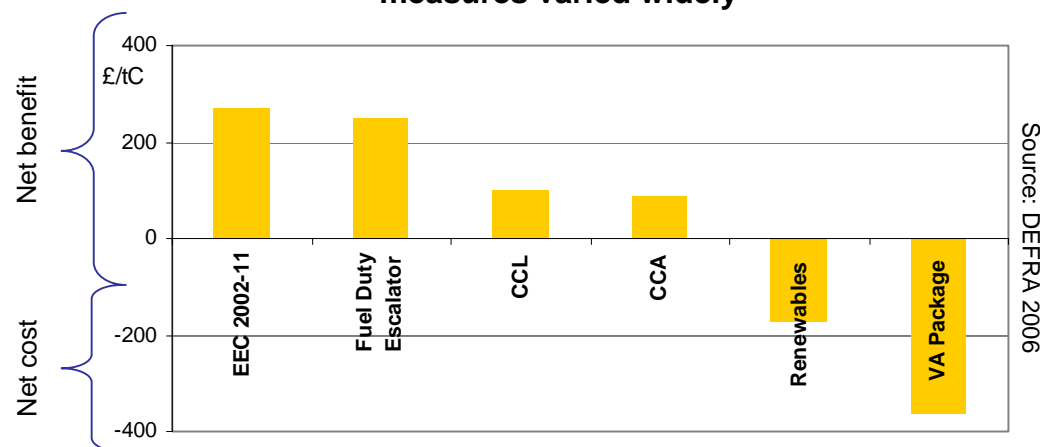
Current policies aim to cut carbon emissions from the UK by 25% on 1990 levels by 2020

Existing foundations

Forecasts

- Further policy iterations must continue to be cognisant of costs as well as benefits
- New technologies will emerge and efficiency increase, but 2020 is now within one product lifespan for much of our installed energy, and transport infrastructure, such as boilers, ships and cars
- As opportunities for low cost energy efficiency improvements and cheaper renewables are exhausted, domestic abatement costs will rise if there is not significant technological progress
- Carbon trading systems, such as the EU ETS and Clean Development Mechanism, allow UK businesses to buy abatement overseas if it is cheaper, within the constraints imposed by trading scheme rules

Economic benefits and costs of measures in the first Climate Change Programme measures varied widely



Key to chart:
 EEC= Energy Efficient Commitment for suppliers investment in household energy efficiency
 CCL = climate change levy; CCA = climate change agreements
 "VA package" = Vehicle excise duty + company car tax + car sector voluntary agreement