

Chapter 1: Overview of progress towards meeting carbon budgets

Introduction and key messages

In our first report to Parliament we noted that emissions had fallen only slightly in the five-year period (2003-07) before the recession both for the economy as a whole and for each of the key emitting sectors. We therefore argued that a step change is required in order to deliver the sustained deep cuts in emissions required to meet carbon budgets. DECC accepted the need for a step change to deliver the emissions reductions in its Low Carbon Transition Plan, and the need for new policy approaches to drive this.

We presented analysis suggesting that the recession would result in a significant fall in emissions which would make the first carbon budget easier to achieve. However, we argued that it is important to implement measures to reduce emissions now, and to develop new policy frameworks. This will lay the foundations for sustained emissions reductions following a return to economic growth and mitigate risks to meeting the second and third budgets. Therefore we argued that the aim should be to outperform the first budget, supplementing emissions reductions due to the recession with implementation of measures.

We start this chapter by noting recent controversies in climate science, together with progress towards a global deal to reduce emissions. We then consider latest emissions data, focusing on the extent to which emissions have fallen during and as a result of the recession. We also provide a high-level overview of progress against our indicator framework, which includes both implementation of measures (e.g. number of lofts and cavity walls insulated, GW of wind generation entering construction, average emissions of new cars) and policy milestones to drive the required step change in emissions reduction. We compare our indicator framework with the monitoring framework in the departmental carbon budget delivery plans.

The main messages in the chapter are:

- The case for early action in the UK remains strong: the fundamental science is robust notwithstanding recent controversies; there has been some progress towards an international agreement; there are low-cost opportunities to reduce emissions and build a low-carbon economy in the UK.
- Greenhouse gas (GHG) emissions fell by 8.6% in 2009 largely due to the recession and other exogenous factors. We estimate that these impacts will reduce emissions across the first budget period in line with our 2009 projections (i.e. within the range 40-75 MtCO₂). We recommend that the aim should be to outperform the first budget and that outperformance should not be banked through to the next budget period. This recommendation was accepted by the previous Government.
- Our indicator framework envisaged limited progress on implementation of measures in 2009, based on modest ambitions in policies that were firm and funded in 2008. This has been confirmed, for example with progress on loft and cavity wall insulation, broadly in line with our indicators.
- However, our indicator framework also builds in a step change in the pace of implementation across the range of measures (e.g. residential and non-residential energy efficiency improvement, renewable heat, electric cars, renewable electricity) moving towards the second budget period. There is no evidence of broad outperformance on implementation of measures in 2009, and therefore a step change is still required. In the absence of a step change (i.e. based on the rate of implementation of measures in 2009) there would be a shortfall of around 35 MtCO₂ relative to the (legislated) Interim third carbon budget and 150 MtCO₂ relative to the Intended third budget.

- Progress has been made developing new policies for the power sector, buildings and industry, and transport. However, further detail is required to provide confidence that these will drive the step change and deliver sufficiently to achieve carbon budgets.
- The departmental carbon budget management framework is a key part of the governance framework for delivering emissions reductions and could be strengthened by including ambitious trajectories for key indicators against which future success in delivery can be assessed.

We set out the analysis that underpins these messages in five sections:

1. Context: the case for early action in the UK
2. Economy-wide emissions trends
3. Aviation and shipping emissions
4. Progress against the Committee's indicators
5. Departmental carbon budgets and delivery plans

1. Context: the case for early action in the UK

Before assessing UK progress in reducing emissions we consider the underpinning case for action in the light of recent scientific controversies and the outcome of global negotiations in Copenhagen in December 2009.

Scientific controversies and the robustness of the fundamental science

While there is high confidence in the link between GHG emissions and global warming, there are uncertainties in the exact level of warming and impacts that will result from a given future emissions path. This has implications for carbon budgets. Specifically, in our December 2008 report, we recommended that targets should be flexible to improvements in understanding and committed to review the science periodically, drawing out implications for carbon targets as appropriate.

There have been two recent and high profile controversies relating to climate science:

- **Leaked emails from the University of East Anglia's Climate Research Unit (CRU).** Large numbers of CRU emails were hacked and made public in November 2009, with the contents used to accuse CRU staff of manipulating scientific evidence in order to bolster claims of global warming. A series of independent reviews into the activity of CRU have since been carried out. Specifically, the Science Assessment Panel chaired by Lord Oxburgh concluded that there was 'no evidence of any deliberate scientific malpractice'¹.

¹ 'Report of the International Panel set up by the University of East Anglia to examine the research of the Climatic Research Unit'. Available at <http://www.uea.ac.uk/mac/comm/media/press/CRUstatements/SAP>

- **Inaccuracies in the IPCC 4th Assessment Report.**

In early 2010 media reports claimed errors in the IPCC's most recent assessment of climate impacts, adaptation and vulnerability. These claims refer to a small number of aspects (such as likely timescales for loss of Himalayan glaciers) within the large report by Working Group 2 of the IPCC on impacts, adaptation and vulnerability. None of these were cited as major conclusions in the overall assessment, and none of the claimed errors apply to the Working Group 1 report on the physical science basis of climate change. An independent inquiry is being carried out by the InterAcademy Council to evaluate the procedures and processes of the IPCC, and to ensure that factual errors are avoided in future, and is due to report later this year².

These controversies have not changed the fundamental science, which continues to support the case for early action:

- Global surface temperatures have increased on average by more than 0.15°C per decade since the mid-1970s. The 10 hottest years on record have occurred since 1997.
- It is very likely that most of the temperature increase since the mid 20th century is due to increasing concentrations of greenhouse gases in the atmosphere, which in turn can be linked to burning of fossil fuels and other human activities.
- There is significant risk of dangerous climate change and devastating consequences for human welfare on a business as usual emissions path.
- Central estimates of global temperature can be kept close to 2°C above pre-Industrial levels through early action such that global emissions peak by 2020, fall by about 50% in 2050, and continue to fall thereafter.

The Committee will set out a full review of these developments, plus other advances in climate science since 2008, as part of advice on the fourth budget (2023-27) to be published by the end of 2010.

- **Moving towards a global agreement**

Climate negotiations in Copenhagen in December 2009 were disappointing in that a legally binding deal on global emissions reductions was not achieved.

However, the Copenhagen Accord which resulted from the UNFCCC negotiations included at least four positive aspects:

- There was agreement that the objective should be to constrain global temperature increase to 2°C; this is broadly consistent with the objective and targets underpinning the UK's Climate Change Act as recommended by the Committee.
- There was agreement for developed countries to submit, by 31st January 2010, commitments for emission reductions in 2020 and for developing countries to submit intended mitigation actions that are quantifiable.
- There were commitments to provide finance for developing countries, approaching US\$30bn for the period 2010-2012 and US\$100bn a year by 2020.
- There was a commitment to support avoided deforestation by establishing a mechanism to enable mobilisation of financial resources from developed countries.

To date, over 70 countries covering around 80% of global emissions have signed the Accord. Preliminary analysis suggests that commitments under the Accord could result in peaking of global emissions by 2020, though further detailed analysis is required to establish this. Given significant emissions reductions post 2020, it is plausible that global emissions will be on a path broadly consistent with the 2°C objective.

² <http://reviewipcc.interacademycouncil.net/committee.html>

The case for early action

The case for early action in the UK therefore remains strong given scope for limiting risks of dangerous climate change, current low-cost opportunities to reduce emissions and potential co-benefits of measures to reduce emissions:

Climate change risk

- Together with the efforts of other countries, early action will limit risks of dangerous climate change.

Mitigation costs

- Emissions reductions can be achieved at affordable cost (e.g. less than 1% of GDP in 2020), with some of the measures required to meet carbon budgets resulting in cost savings (e.g. energy efficiency improvement in residential and commercial buildings).
- Costs for a given reduction in cumulative emissions increase if action is delayed, requiring greater emissions cuts in future when abatement costs are likely to be higher³.
- Early action precludes locking in to high-carbon assets (e.g. conventional coal-fired power generation) which would become stranded in a world of increasingly stringent carbon constraints.

Green economy

- There may be an opportunity to gain first mover advantage in developing low-carbon industries, leading to high value jobs as global demand for low-carbon technologies increases.

Co-benefits of mitigation

- There are a range of co-benefits from measures to reduce carbon emissions including security of supply, air quality and health.
 - Power and transport decarbonisation will reduce reliance on imported gas and oil from countries where there may be a high degree of geopolitical risk, therefore reducing risks of supply interruption and price volatility and the possibility of sustained high prices.

- Mitigation measures can reduce local air pollution (e.g. through ultra low-carbon vehicles, renewable electricity generation which does not involve combustion). A recent Defra report⁴ estimated that climate change policies could yield air pollution benefits worth £15-40 billion (net present value) in the UK by 2050.

- Recent work on Health and Climate Change⁵ showed that substantial health benefits (including reduced cardiovascular disease, depression, diabetes and dementia) could be gained from more walking and cycling and less motor vehicle use.

The Committee will provide a full assessment of the international framework and implications for the UK, including possibly moving from the Interim to Intended carbon budgets, as part of the advice on the fourth budget (2023-27) to be published by the end of 2010.

2. Economy-wide emissions trends

In this section we consider emissions trends at economy-wide, sectoral and regional levels. We provide a high-level assessment of emissions reductions in 2008 and 2009 and, in particular, we consider the extent to which emissions reductions are due to the recession and other exogenous factors or to implementation of measures (e.g. energy efficiency improvement, improved fuel efficiency of new cars). We consider the implications for the approach to the non-traded sector in terms of aiming to outperform the first budget and not banking outperformance for use in the second budget. We also consider implications for the traded sector budget, which work primarily at the European level through the impact of the recession on the carbon price. At the economy-wide level (i.e. including non-traded and traded sectors), we consider the extent to which a step change in the pace of emissions reductions is still required. Finally, we present emissions at the Devolved Administration level.

³ For example, MARKAL analysis for our 2008 report showed costs rising to over £200/tCO₂ in 2050, compared to costs around £50/tCO₂ in 2020 under scenarios consistent with carbon budgets to 2020 and the 80% target for reducing economy-wide emissions by 2050.

⁴ Defra (2010), *Air Pollution: Action in a Changing Climate* <http://www.defra.gov.uk/environment/quality/air/airquality/strategy/documents/air-pollution.PDF>

⁵ The Lancet (2009), *Health and Climate Change Series* <http://www.thelancet.com/series/health-and-climate-change>

We set out our analysis in five sections:

- (i) Emissions trends in 2008 and 2009
- (ii) Implications for the non-traded sector
- (iii) Implications for the traded sector
- (iv) The need for a step change
- (v) Regional emissions

(i) Emissions trends in 2008 and 2009

Key emissions drivers

The context for 2009 emissions includes falling GDP, rising fuel prices (other than in transport), and lower temperatures but less cold days:

- Overall GDP fell by 4.9% in 2009 and within this manufacturing output declined 10%.
- Residential and industrial fuel prices generally rose in 2009, with residential gas prices up by 12% in real terms.
- Whilst average temperatures in December and January 2009 were lower than in the same period in 2008, overall 2009 had fewer days with temperatures below the heating threshold, with these two effects largely balancing in terms of energy demand.

Total emissions, CO₂ versus non-CO₂ and by sector

Since our 2009 progress report, new final emissions data is available for 2008, and preliminary data is available for 2009, suggesting that UK greenhouse gas emissions fell by 1.9% in 2008 and a further 8.6% in 2009 (Figure 1.1, Figure 1.2 and Figure 1.3):

- CO₂ emissions fell by 2.0% in 2008 and 9.7% in 2009, with sectoral reductions in energy supply (power generation and other energy supply), buildings (residential and non-residential), industry and transport.

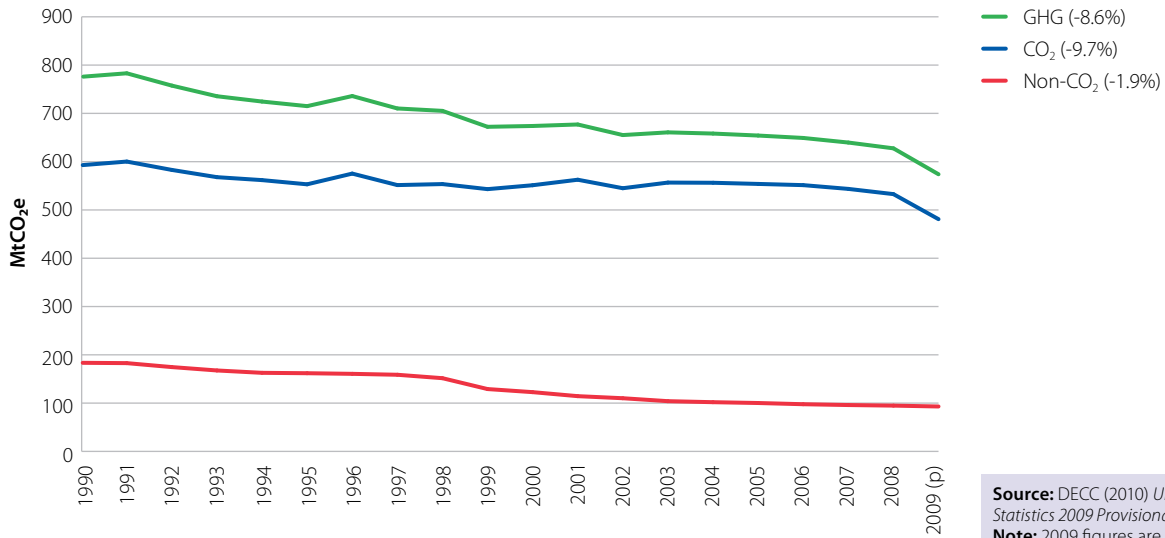
- Emissions from power generation fell by 2.6% in 2008 and 13.1% in 2009. The emissions reduction in 2009 was due both to demand reduction (particularly in commercial and industrial sectors) and return of nuclear plant which had previously been off the system.
- Emissions from other energy supply (refineries, off-shore gas etc.) fell by 4.7% in 2008 and 2.7% in 2009.
- Direct emissions (e.g. related to burning fossil fuels for heat) from buildings and industry were flat in 2008 and fell by 11% in 2009. The reduction in 2009 was driven by reductions in the residential (5%) and industrial (18%⁶) sectors.
- Transport emissions fell by 2.9% in 2008 and 6.5% in 2009. Road transport emissions fell by 3.5% in 2008 and 3.9%⁷ in 2009.
- Non-CO₂ emissions fell by 1.3% in 2008 and 1.9% in 2009, with reductions in most sectors in 2008⁸:
 - Emissions from agriculture fell by 1.1% in 2008.
 - Emissions from the energy sector fell by 3.0% in 2008.
 - Emissions from the industrial process sector fell by 1.3% in 2008.
 - However, emissions from waste fell by only 0.3% in 2008.

6 CCC estimate.

7 CCC estimate.

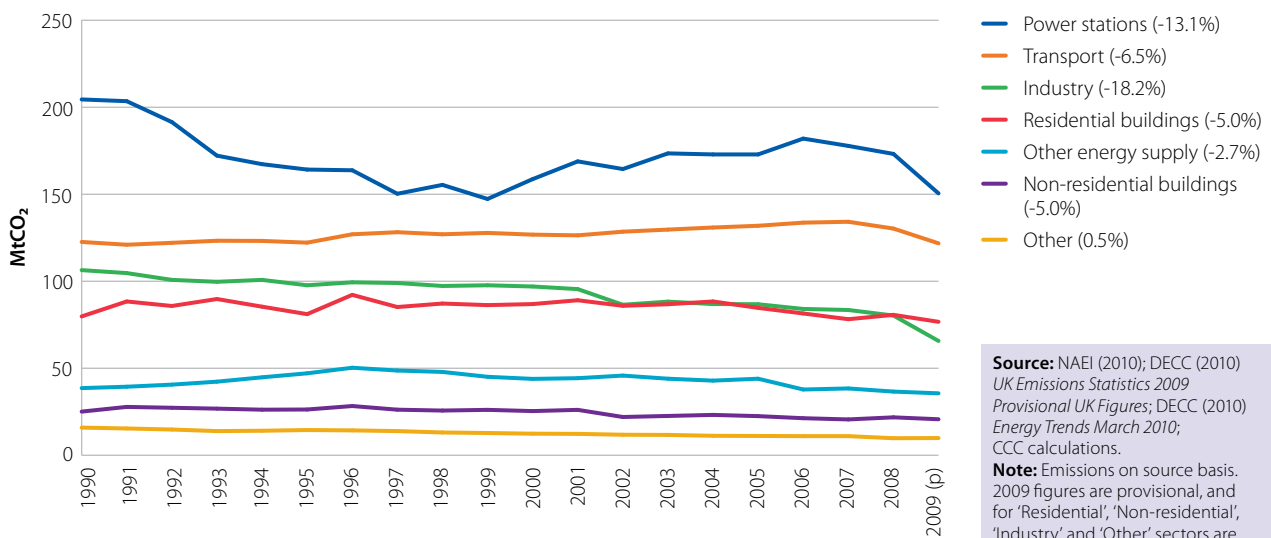
8 Provisional 2009 non-CO₂ emissions are not available by sector.

Figure 1.1 UK greenhouse gas emissions (1990-2009)

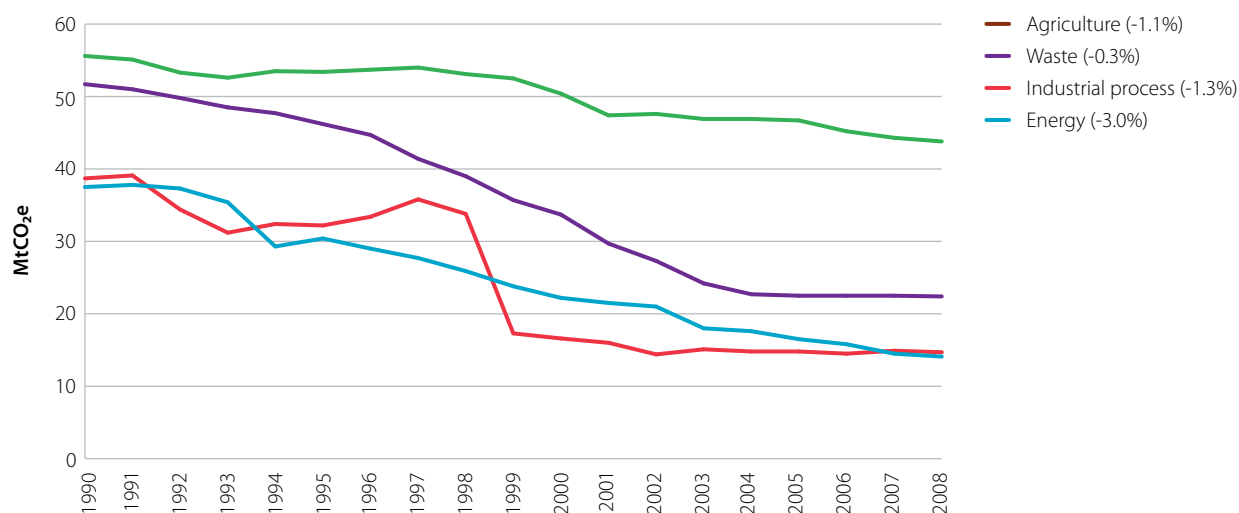


Source: DECC (2010) *UK Emissions Statistics 2009 Provisional UK Figures*.
Note: 2009 figures are provisional. Figures in legend show change in emissions in 2009.

Figure 1.2 UK CO₂ emissions by sector (1990-2009)



Source: NAEI (2010); DECC (2010) *UK Emissions Statistics 2009 Provisional UK Figures*; DECC (2010) *Energy Trends March 2010*; CCC calculations.
Note: Emissions on source basis. 2009 figures are provisional, and for 'Residential', 'Non-residential', 'Industry' and 'Other' sectors are CCC estimates. Figures in legend show change in emissions in 2009.

Figure 1.3 UK non-CO₂ emissions by sector (1990-2008)

Source: NAEI (2010).

Traded and non-traded sector emissions

The Climate Change Act distinguishes between the non-traded sector (not covered by the EU ETS e.g. heat, transport, non-CO₂) and the traded sector (relating to power generation and energy-intensive industry sectors covered by EU ETS). Emissions in 2009 fell in both the non-traded and traded sectors:

- Non-traded sector emissions rose by 0.4% in 2008⁹ but fell by 5.7% in 2009.
- Traded sector emissions fell by 4.8% in 2008 and 12.5% in 2009.

In our 2009 progress report we projected that emissions would fall in 2009 and that this would have important implications for the approach to the non-traded and traded sectors. We now revisit this analysis in light of new emissions data.

(ii) Implications for the non-traded sector

Our December 2008 advice on the appropriate level of the first carbon budget reflected emissions projections made prior to the recession. These projections therefore assumed annual economic growth of around 3% driving up emissions, which would be offset by implementation of measures under firm and funded policies (e.g. CERT, voluntary agreements for increased fuel efficiency of new cars, biofuels policy). The net impact of these effects and other assumptions (e.g. population growth, movements in fossil fuel prices) was a projected 0.9% annual emissions reduction in the non-traded sector through the first budget period.

In our 2009 progress report, we provided an assessment of the potential impact of the recession on non-traded sector emissions. We showed that the first budget could be achieved with limited emissions reduction effort once the impact of the recession is accounted for, and that implementation of measures envisaged for the first budget period could lead to outperformance of the first budget by up to 75 MtCO₂. We argued that it is important during the first budget to lay the foundations for meeting the second, third and subsequent budgets. We therefore argued that the aim should be to outperform the first budget by up to 75 MtCO₂ and not to bank this outperformance through to the second budget.

⁹ Including installations that opted out of the EU ETS before 2008.

Emissions data for 2008 and 2009 are consistent with the analysis in our 2009 progress report. Specifically, emissions reductions in the last two years, together with further reductions in 2010, are likely to result in emissions reductions over the first budget period in line with our 2009 projections. (Figure 1.4 and Box 1.1):

- Our 2009 emissions projections using the DECC Energy Model suggested cumulative emissions would be lower by 40 MtCO₂ (3%) than our 2008 projections as a result of the recession and other exogenous changes over the first budget period.
- Our 2009 emissions projections using the Cambridge Econometrics model, which assumes a greater responsiveness of demand to income than the DECC model, suggested cumulative emissions would be 75 MtCO₂ (6%) lower over the same period.
- Our new analysis reflecting the latest data for 2008 and 2009 suggests that, together with implementation of measures, cumulative emissions for the first budget period will be of the order 55 MtCO₂ lower than required to meet the budget (i.e. within the range 40-75 MtCO₂).

We have considered whether emissions reductions may be attributed to implementation of measures rather than the recession and other exogenous factors (e.g. increases in fossil fuel prices). However, our analysis suggests that policies have generally delivered at the

(modest) level expected rather than outperforming expectations (Table 1.1) and that the bulk of emissions reductions are therefore due to the recession/other factors rather than implementation of measures.

Going forward, it continues to be important to implement measures under current policies in order to prepare for meeting the second and third carbon budgets. Given successful implementation in addition to impacts of the recession, the result would be outperformance of the first budget. The aim should therefore be to outperform the first budget (e.g. by up to 75 MtCO₂, as projected by the Cambridge Econometrics model) and – in order to maintain incentives for sustained action – not to bank this outperformance.

Although one possibility would be to amend the first budget and build in this level of outperformance, however, we recommend that the budget should not be amended given uncertainties over the precise impact of the recession. However, given outperformance there is the possibility that the Intended budget could now be achieved at lower cost through domestic action, strengthening the case to move from the Interim to the Intended budget (Section 1(iv)).

Box 1.1 Impact on non-traded sector emissions due to the recession and other changes over the first budget period

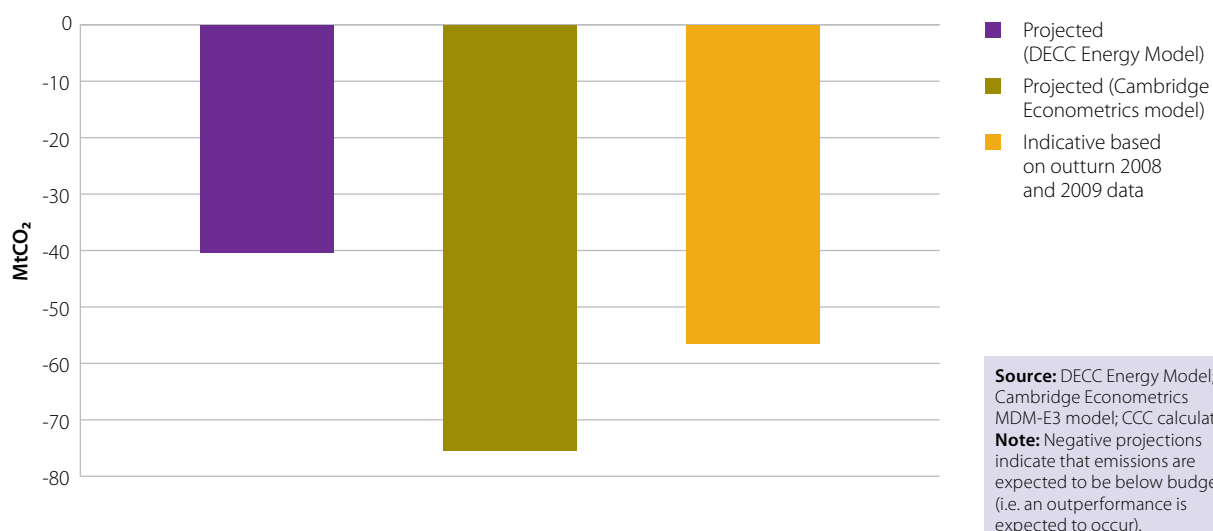
In our 2009 progress report, we reported new emissions projections from the DECC Energy Model and the Cambridge Econometrics model (MDM-E3). Both sets of projections showed a large impact of the recession and other exogenous factors on emissions in 2009, which persisted to 2012.

Outturn CO₂ emissions in the non-traded sector were 268 MtCO₂ in 2008 and 249 MtCO₂ in 2009:

- Cumulative 2008-2009 emissions were 14 MtCO₂ lower than the original (2008) projections on which the first budget was set and which did not reflect the impact of the recession.

- The 2009 outturn is between the levels we projected when using the DECC and Cambridge models for our 2009 progress report.

Assuming that emissions in 2010 to 2012 follow the shape of the trend projected by the DECC or Cambridge models (i.e. the impact seen in 2009 persists to the following years), cumulative emissions over the first budget period will be of the order 55 MtCO₂ lower than projected when the budget was set.

Figure 1.4 Projected outperformance of first budget (2008-2012) in the non-traded sector due to the recession and other changes**Table 1.1** Actual versus expected delivery of CO₂ emissions reduction measures in the non-traded sector in 2008 and 2009

	Uptake/improvement			Emissions reductions (MtCO ₂)		
	Expected	Outturn	Outperformance	Expected	Outturn	Outperformance
Domestic sector						
Loft insulation (professional)	1.0 m	1.6 m	0.6 m	0.2	0.3	0.1
Loft insulation (DIY)	0.0 m	0.9 m	0.9 m	0.0	0.2	0.2
Cavity wall insulation	1.1 m	1.1 m	0.0 m	0.6	0.6	0.0
Solid wall insulation	0.05 m	0.03 m	-0.02 m	0.1	<0.1	<-0.1
Efficient boilers	2.0 m	2.3 m	0.3 m	1.0	1.1	0.1
Road transport						
New car gCO ₂ /km	2% improvement	9% improvement	7%	0.1	0.4	0.3
Biofuels (by volume)	+1.9 percentage points*	+1.9 percentage points*	0 percentage points	2.0	2.0	0.0
Total						
				4.1	4.8	0.6

Source: Uptake – Insulation: Ofgem, DECC; Boilers: Heating and Hotwater Industry Council, CLG, CCC; New car CO₂: Society of Motor Manufacturers and Traders; Biofuels: HMRC. Emissions reductions – CCC calculations.

Note: *i.e. increase in share from 1% to 2.9% by volume. Uptake figures for insulation and boilers are cumulative installations in 2008 and 2009.

(iii) Implications for the traded sector

The 12.5% reduction in traded sector emissions, to 232 MtCO₂, in 2009 resulted from both emissions reductions in power generation and other energy-intensive industries:

- The 13.1% reduction in power sector emissions resulted due to:
 - A 7% fall in electricity demand between 2008 and 2009.
 - A reduction in coal generation due to low gas prices during 2009.
 - Two nuclear power stations coming back online after outages in 2008, increasing the share of nuclear generation from 14% in 2008 to 19% in 2009.
- There was an 11% reduction in emissions from other energy-intensive industries covered by the EU ETS.

These emissions reductions will not affect achievement of the traded sector budget: under the Climate Change Act traded sector emissions are accounted for on a net basis (i.e. net of purchases of European Union Allowances or offset credits), and the traded sector budget will therefore always be achieved by definition given that the traded sector is capped under the EU ETS. From 2008 to 2009 the UK cap remained flat at 246 MtCO₂. As such the fall in actual emissions to 232 MtCO₂ in 2009 meant that UK firms were able to sell more allowances into the EU market, or to bank them towards meeting future caps.

Our approach to the traded sector has been based on the principle that power sector decarbonisation is key to wider economy decarbonisation in the 2020s (e.g. both through the impact on power sector emissions, and the extension of low-carbon power to other sectors, notably road transport and heat). Therefore it is vital that progress is made towards power sector decarbonisation over the next decade, both through investments in low-carbon generation and the introduction of new arrangements to support a scaling up of low-carbon investment in the 2020s; we set out detailed indicators for the power sector and consider progress against these in Chapter 2.

One key lever to drive low-carbon investment both in the power sector and other energy-intensive sectors is the carbon price. However, we previously suggested that the impact of the recession would be to reduce the carbon price in the period to 2020:

- The carbon price depends both on the EU ETS cap and the emissions reduction required to meet this cap.
- The recession has reduced output and emissions in energy-intensive industries across the EU, therefore requiring less emissions reduction effort (e.g. fuel switching from coal to gas in power generation) to meet the cap.

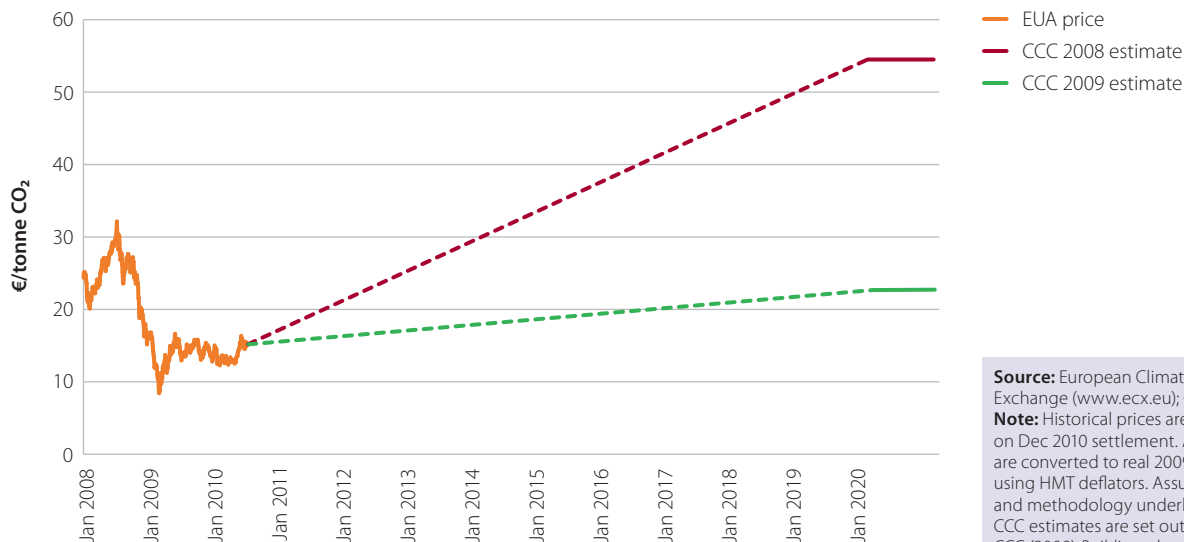
The projection that the carbon price will remain low to 2020 is supported by developments since our 2009 progress report:

- Latest data for the European energy-intensive sector suggests emissions have fallen by 12% in 2009 as a result of the recession.¹⁰
- Failure to agree a global deal at Copenhagen did not provide the confidence in future emissions reductions and global carbon markets that could have triggered a price increase.

The impact of these factors is manifest in carbon prices at a similar level in May 2010 (15 euros/tCO₂) as in our last report in October 2009 (14 euros/tCO₂), and most market analysts continue to project a carbon price for 2020 consistent with those we reported in October 2009 (now on average around €30) and still well below our pre-recession projection of €56 in 2020 (Figure 1.5, Figure 1.6).

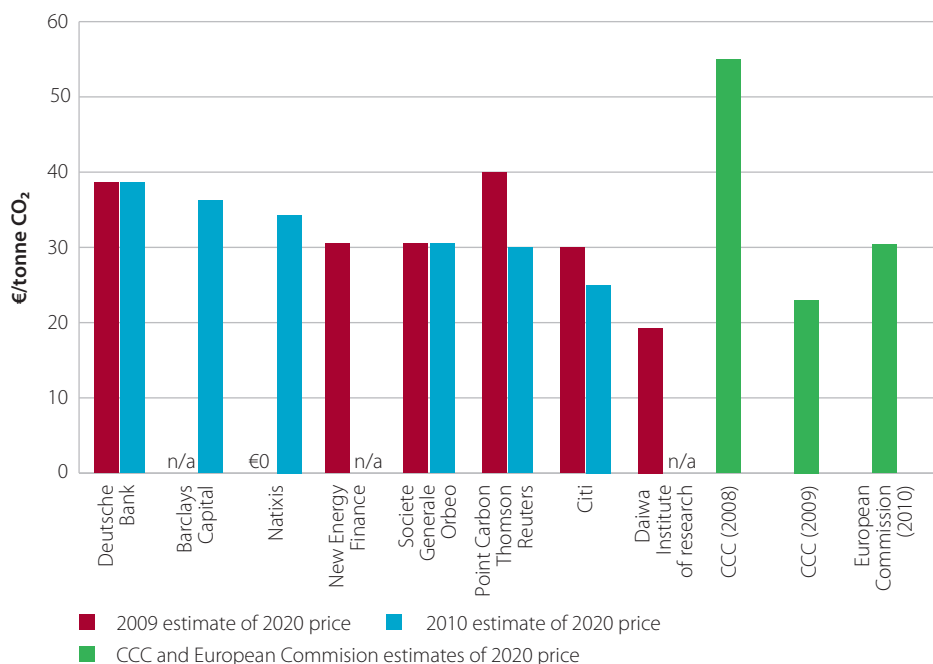
¹⁰ Source: Community Independent Transaction Log (CITL).

Figure 1.5 Actual carbon prices (January 2008 to June 2010) and CCC carbon price projections for 2020



Source: European Climate Exchange (www.ecx.eu); CCC.
Note: Historical prices are based on Dec 2010 settlement. All prices are converted to real 2009 prices using HMT deflators. Assumptions and methodology underlying CCC estimates are set out in CCC (2008) *Building a low-carbon economy* and CCC (2009) *Meeting Carbon Budgets*.

Figure 1.6 Recent market projections of the EUA price in 2020



Source: Deutsche Bank (July 2009 and April 2010); Barclays Capital (April 2010); Natixis E&I (July 2009 and May 2010); New Energy Finance (July 2009); Societe Generale Orbeo (May 2009 and April 2010); Point Carbon Thomson Reuters (July 2009 and June 2010); Citi Investment Research and Analytics (July 2009 and April 2010); Daiwa Institute of Research (February 2009); CCC (2008) *Building a low-carbon economy*; CCC (2009) *Meeting Carbon Budgets*; European Commission (2010) *Analysis of options to move beyond 20% greenhouse gas emission reductions*.
Note: Estimates are taken either from published sources or supplied directly from analysts. N/A indicates that no estimate was available. Nominal forecasts were converted to real 2009 prices using an assumed annual inflation rate of 2%. The Natixis estimate does not incorporate an estimate of the cost of carry. The European Commission estimate is based on a 30% GHG target, with a reduction of 25% made within the EU and 5% through the use of international offsets. Point Carbon Thomson Reuters estimate is a probability weighted Phase III average.

Given the impact of the recession, the carbon price is therefore likely to provide a less robust signal than it otherwise would. There is a risk that at current levels the carbon price will be insufficient to support low-carbon investments. The new Government has recognised this and proposed to introduce a carbon price floor, which should – in combination with the EU ETS – provide a very clear signal for low-carbon investment (e.g. this should be pre-announced for a time period commensurate with asset life of low-carbon investments, rising to a level sufficient to cover cost differentials of low-carbon technologies versus conventional fossil fuel alternatives, possibly indexed on the gas price). Other options for strengthening incentives to invest in low-carbon power generation should also be seriously considered to complement strengthening of the carbon price; we consider these in more detail in Chapter 2.

Another means to strengthen the carbon price signal would be to tighten the EU ETS cap:

- This would strengthen incentives for investment in low-carbon power generation, and would strengthen incentives in other energy-intensive sectors without introducing risks of intra-European competitiveness impacts.
- It would also provide the basis for moving from the EU economy-wide 20% GHG emissions reduction target for 2020 to a 30% target, which will be required in the context of a new global emissions reduction deal; increasing the level of EU ambition could now be achieved at a lower cost than previously envisaged given the current abundance of low-cost abatement opportunities in the traded sector.

We will consider the case for a move to a 30% EU emissions target for 2020 in the context of our advice on the fourth budget, which will include an assessment of the evolving international framework, to be published by the end of 2010.

(iv) The need for a step change

In our 2009 progress report we argued that recent emissions reductions were far slower than those required going forward and therefore a step change was required:

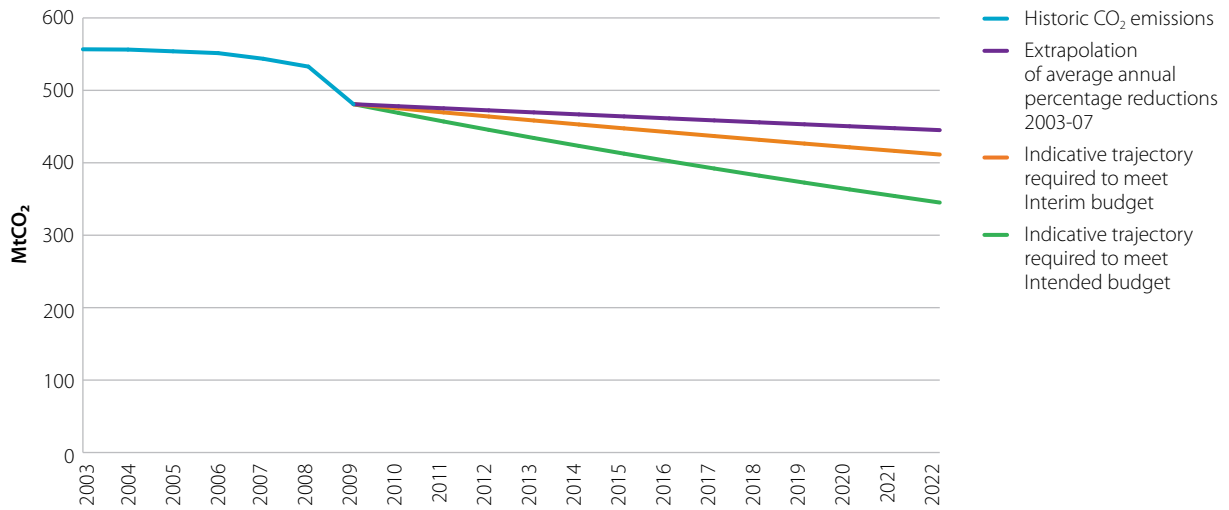
- Economy-wide GHG emissions fell under 1% per year on average from 2003 to 2007,

- Economy-wide CO₂ emissions fell 0.6% per year on average from 2003 to 2007,
- From 2008, GHG emissions would have to fall at 1.7% per year to meet the Interim budget and 2.6% per year to meet the Intended budget, with most of the fall coming from CO₂ given lower opportunities for reducing non-CO₂ emissions (e.g. our Extended Ambition scenario, incorporating feasible and desirable measures, models annual average reductions in CO₂ of 2.7%).

Given the emissions reduction in 2009, the required rate of emissions reduction to 2020 is reduced. However, a step change in underlying progress is still required if carbon budgets are to be achieved:

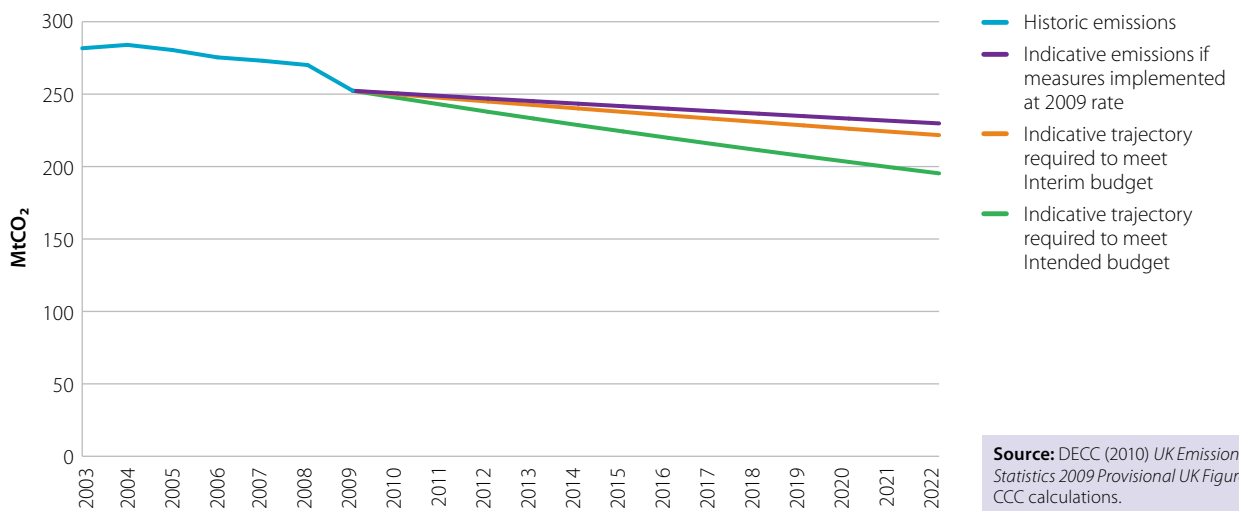
- Economy-wide GHG emissions would have to fall at 1.1% per year from 2009 levels to meet the Interim budget, or at 2.2% per year to meet the Intended budget, with the bulk of emissions reductions coming from CO₂ (i.e. more than the 0.6% per year falls in CO₂ for 2003-2007) (Figure 1.7),
- Furthermore, delivery of emissions reduction measures across the economy remains well below the level we have identified in our Extended Ambition scenario required both to meet the first three carbon budgets and to lay the foundations for meeting subsequent budgets (Table 1.2):
 - Less than 1 GW of new renewable electricity generation capacity was deployed in 2009, compared to over 3 GW required annually on average in the third budget period.
 - Uptake of solid wall insulation in homes under CERT was around 15,000 in 2009, compared to annual installations of over 250,000 required on average in the third budget.
 - Sales of electric vehicles in 2009 were negligible compared to the annual sales of over 80,000 required in the third budget and there was very limited progress on increasing sales of more efficient vans.

Figure 1.7 Indicative economy-wide CO₂ reductions required to meet budgets versus pre-recession trend (2003-2022)



Source: DECC (2010) *UK Emissions Statistics 2009 Provisional UK Figures*; CCC calculations.

Figure 1.8 Indicative non-traded sector CO₂ emissions based on rate of implementation of measures achieved in 2009 versus budget requirements (2003-2022)



Source: DECC (2010) *UK Emissions Statistics 2009 Provisional UK Figures*; CCC calculations.

Note: Based on projected split of emissions between the traded and non-traded sectors in 2020.

- Non-traded sector CO₂ emissions would fall by around 0.7% annually if progress implementing measures in 2009 could be sustained. However, this would not be sufficient to achieve the third carbon budget for the non-traded sector, which would require annual CO₂ reductions from 2010 of 1.0% under the Interim budget or 1.9% under the Intended budget (Figure 1.8). Sustaining progress in 2009 (e.g. in energy efficiency improvement, new car fuel efficiency, biofuels) through the first and subsequent carbon budget periods would itself be challenging and would require new policies.

Therefore emissions reductions in 2008 and 2009 cannot be regarded as evidence of the step change in progress required to meet the second and third carbon budgets. We discuss, at a high level in section 5 below

and in more detail in Chapters 2-5, the progress that has been made in putting in place new policies to drive the step change in delivery, and identify areas where further development is required.

If this step change in delivery is achieved, and the emissions reduction in 2009 is permanent (Box 1.2), our analysis shows that it could now be possible to meet the Intended budget through domestic effort alone and, specifically, through implementation of measures in our Extended Ambition scenario (Figure 1.9). This raises a question about whether and how it is appropriate to move to the Intended budget, which we will consider in detail in the context of our advice on the fourth carbon budget, to be published before the end of the year.

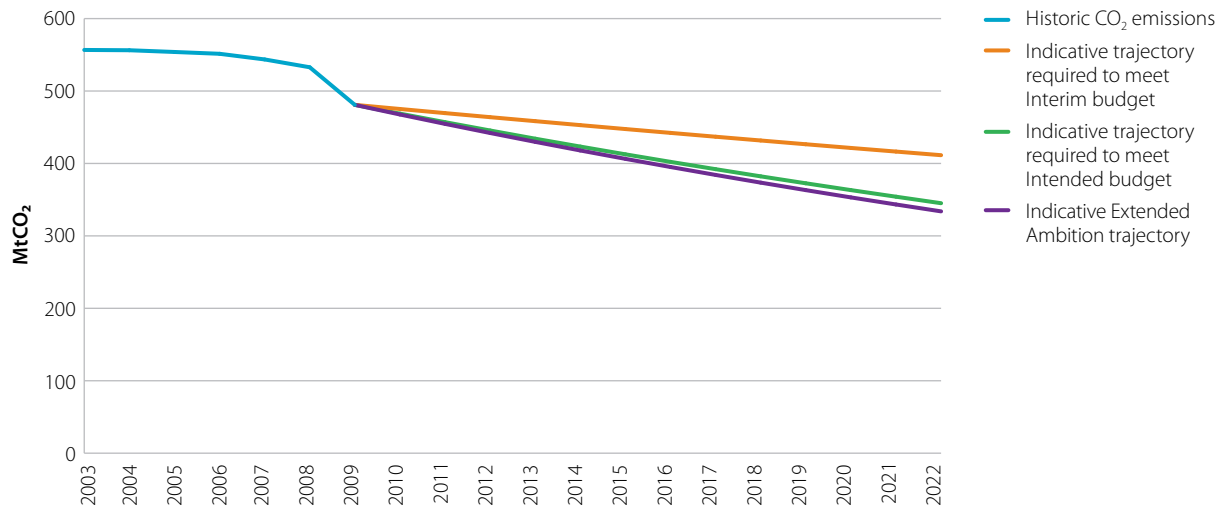
Table 1.2 Implementation of measures in 2009 compared to rate required in second and third budgets

		Annual uptake/improvement		
		Outturn 2009	Budget 2 average	Budget 3 average
Power				
Capacity (GW)	Onshore wind	0.4	1.0	1.4
	Offshore wind	0	1.0	1.8
Domestic buildings				
Loft insulation (CERT professional)		0.80m	2.08m*	—*
Loft insulation (DIY & other schemes)		0.62m		
Cavity wall insulation		0.59m	1.41m*	—*
Solid wall insulation		0.02m	0.15m	0.22m
Efficient boilers		1.15m	0.87m	0.66m
A++ rated cold appliances		~0.5 pp	2.9 pp	5.4 pp
A+ rated wet appliances		~2.0 pp	4.7 pp	3.7 pp
Renewable heat				
Renewable heat penetration		n/a	0.8pp	2.3 pp
Transport				
New car gCO ₂ /km		5.4%	4.5%	4.4%
Biofuels (by volume)		0.6pp	0.7pp	0.4pp
Total EV sales		140	50,000	86,000
Car drivers undertaking eco-driving		~20,000	340,000	340,000

Source: Outturn – Wind capacity: DECC; Insulation: Ofgem, DECC; Boilers: Heating and Hotwater Industry Council, CLG, CCC calculations; Appliances: Market Transformation Programme, CCC calculations; New car CO₂: SMMT; Biofuels: HMRC; EV sales: Society of Motor Manufacturers and Traders; Eco-driving: Energy Saving Trust. Budget 2 and 3 averages – CCC modelling.

Notes: *maximum uptake is achieved by 2015 under the Extended Ambition scenario. pp= percentage points.

Figure 1.9 Indicative economy-wide CO₂ Extended Ambition trajectory incorporating additional recession impacts versus budget requirements (2003-2022)



Source: DECC (2010) *UK Emissions Statistics 2009 Provisional UK Figures*; CCC calculations.

(v) Regional emissions

The 2007 emissions data reported in our 2009 progress report remains the most up to date available for the Devolved Administrations. While we cannot directly assess recent regional emissions at present, consideration of the drivers of emissions suggests it is likely that regional emissions will have broadly followed the downward UK trend over 2008 and in to 2009.

- The various available indices for GDP, manufacturing, production, construction and services, and labour market data for 2009 suggest similar trends for the UK and Devolved Administrations. Therefore to the extent that emissions in the UK as a whole have fallen due to the recession, emissions will also have fallen in the Devolved Administrations.

- The latest electricity and gas sales data available for Wales and Scotland¹¹ show that in 2008, sales of electricity and gas to all consumers (domestic, commercial and industrial) fell across Scotland and Wales in similar proportions to Great Britain as a whole.

Going forward, each of the Devolved Administrations will have to implement measures to reduce emissions in order both to meet domestic climate change goals, and to make their contribution to meeting UK carbon budgets (Box 1.3). In the near term, this will require ongoing implementation of existing policy with the limited ambition that this entails. Beyond the near term, new policies will be required to drive the required step change to meet national and UK emissions targets. More details on implementation of measures are provided in chapters 2-5.

¹¹ Source: DECC 'Sub-national energy consumption statistics 2008'.

Coverage is currently for GB only due to prior disclosure concerns in Northern Ireland. Following changes to the market in Northern Ireland in November 2007, DECC aims to publish electricity consumption data for the whole of the UK from December 2010.

Box 1.2 Permanence of emission reductions due to the recession

The latest GDP forecasts from the Office for Budget Responsibility (OBR) imply that, whilst the economy would return to growth, the recession would lead to a permanent loss of output compared to pre-recession projections¹². The substantial reduction in emissions in 2009 suggests that emissions remain linked to growth and, therefore, a permanent reduction in output may be taken to imply a permanent reduction in emissions.

At least some of the recessionary impact in 2009 is likely to be permanent:

- As GDP has been permanently reduced, so manufacturing output and domestic incomes will be lower in 2020 than previously anticipated. As firms produce less goods and households have less to spend, so the demand for energy from each is likely to be lower.
- There have been some permanent closures of major emitting industrial installations and shifts of production to more efficient plant (e.g. in the cement sector).
- In transport, there is evidence of a shift towards purchase of more fuel-efficient vehicles (Chapter 4), which will remain in the fleet for some time.

It is also possible that the full impact of the recession on emissions has not yet been seen. For example, it may take some time for lower incomes to filter

fully through to consumer product choices (e.g. cars and appliances are not replaced every year) or to behaviours (e.g. turning down thermostats and eco-driving). 2010 GDP growth is also projected to be below trend (OBR's central projection is 1.3%).

However, some of the emission reduction in 2009 may be transitory, and emissions may "bounce back" to higher levels. For example:

- There is likely to have been some reduction in existing inventories, that may lead to re-stocking as output returns to growth, and hence a larger swing in production from energy-intensive manufacturing.
- Some industrial sectors (e.g. steel) reduced output without permanent closures, and through the mothballing of plant that may reopen in the longer term.
- Consumers may have implemented temporary changes in behaviour, and could revert to previous behaviours in energy use as economic growth resumes.

There is limited evidence available on how emissions respond after the initial impacts of a major recession. In our 2009 work, both the DECC and Cambridge Econometrics models projected a slight lag before the full impact of a recession is felt, rather than a bounce-back in emissions. We will continue to monitor this issue as part of our regular reporting on progress.

¹² Office for Budgetary Responsibility (June 2010) *Pre-Budget forecast*.

Box 1.3 Recent developments in Climate Change policy in the Devolved Administrations

Scotland

Subsequent to the Climate Change (Scotland) Act receiving Royal Assent on 4th August 2009, Scottish Ministers asked the Committee for advice relating to a number of the key provisions of the Act, specifically:

- The highest achievable interim target for 2020,
- Annual targets for 2010-2022,
- The methodology for including international aviation and shipping emissions in targets and use of non-CO₂ multipliers,
- Use of offset credits to meet Scottish targets.

In providing the advice, which was published in February 2010, the Committee also developed a methodology for apportioning Scotland a share of the UK EU ETS cap, a set of reference emissions for Scotland, and analysed the abatement potential in Scotland.

These provisions and the Committee's advice were reflected in a package of secondary legislation laid before the Scottish Parliament on 21st April 2010. Amongst other things this package reaffirmed the Scottish Government's commitment to reduce emissions of all greenhouse gases in Scotland by 42% by 2020 and proposed annual targets for 2010-22.

In May 2010 the Scottish Parliament voted against the statutory instrument setting annual targets and the Scottish Government is now convening a short-life cross-party working group to consider the issue further. The Committee has agreed to provide advice to this group. After the group completes its consideration, a new statutory instrument will be introduced. A Report on Proposals and Policies to achieve the required emission reductions will also be published later in 2010.

Wales

Throughout 2009, the Welsh Assembly Government consulted on both its Climate Change Strategy policy statement and Programme of Action. These two elements set out targets to reduce greenhouse gases by 3% p.a. in areas of devolved competence from 2011, and consulted on the policy developments to achieve this target. In response to a request by the Welsh Assembly Government, the Committee provided advice in October 2009 in relation to the level of ambition set out in the strategy and on the abatement policy measures outlined in the programme of action. A final strategy for Wales is due to be published in autumn 2010.

Northern Ireland

As noted in last year's report Northern Ireland aims to reduce greenhouse gases by 25% on 1990 levels by 2025. In November 2009 the Northern Ireland Assembly's Environment Committee reported on its inquiry into climate change. The inquiry remit was to understand the implications of climate change for Northern Ireland and to make recommendations on government policies to mitigate the impacts of climate change, examine economic implications and identify suitable adaptation initiatives. The Assembly Committee's report agreed that Northern Ireland should make a fair and proportionate contribution to UK greenhouse gas emission targets and develop an implementation strategy to address both mitigation and adaptation. In May 2010, the Northern Ireland Executive agreed to a proposal by the Minister of the Environment to establish a Cross Departmental Working Group on greenhouse gas emissions. This group aims to produce an agreed mitigation programme by December 2010.

3. Aviation and shipping emissions

(i) Aviation emissions

Emissions Trends

Aviation emissions (on a bunker fuel basis) fell by 4% in 2008 as passenger demand fell 2%. In 2009, demand fell by a further 7%, due to the recession, suggesting that aviation emissions will show a significant decline for 2009 when the data is released in 2011.

There have been emissions reductions in both international and domestic aviation (Figure 1.10):

- International aviation emissions fell by around 4% in 2008 from 35.4 MtCO₂ to 34.1 MtCO₂,
- Emissions from domestic aviation dropped by 5% in 2008 from 2.3 MtCO₂ to 2.2 MtCO₂.

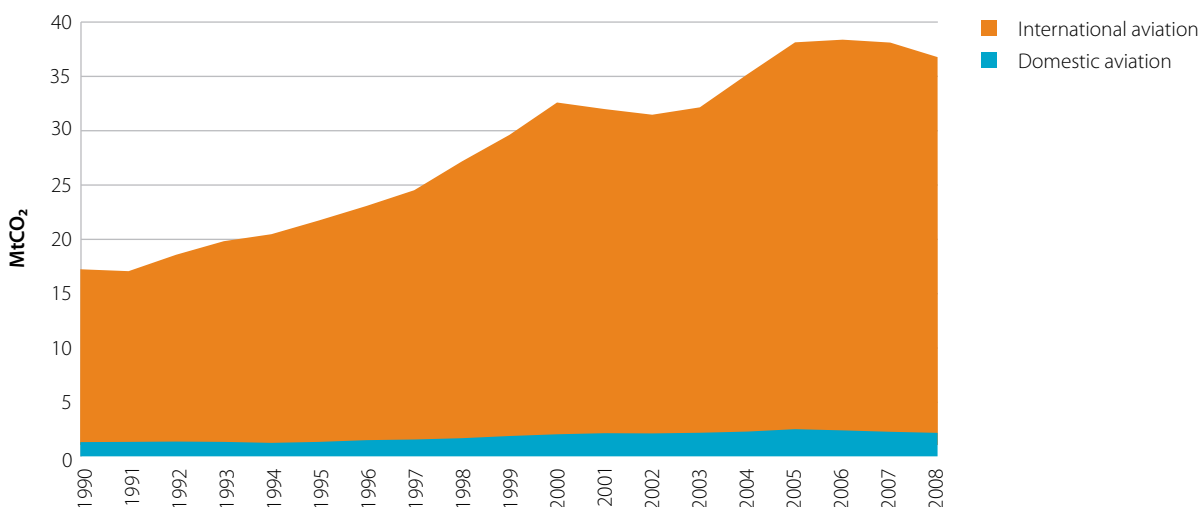
Growth in demand and emissions is expected to resume as GDP returns to growth. Analysis for the Committee's review of UK aviation emissions¹³ suggests that there is scope for limited demand growth (e.g. 60%) in the period to 2050 consistent with the economy-wide 80% emissions reduction target:

- The emissions impact of demand growth could be offset by improvements in the carbon intensity of flying.
- Given likely improvements in carbon intensity, demand growth of up to 60% would be compatible with returning aviation emissions to 2005 levels in 2050. Higher levels of demand growth would be possible if more rapid improvements in carbon intensity occur.
- With aviation emissions at 2005 levels, and together with deep cuts in other sectors (e.g. 90% in domestic CO₂ emitting sectors), this could achieve an 80% emissions cut economy-wide in 2050.

We noted that the 60% passenger demand increase could be consistent with a range of policies as regards capacity expansion at specific airports and carbon taxes. The new Government has announced plans to cancel runway expansion at Heathrow and Stansted and is considering whether to replace air passenger duty with a per-plane tax; further analysis is required to establish whether these approaches could limit demand growth to 60%.

We expect that the Government will respond to the Committee's recommendations on the aviation sector in 2010.

Figure 1.10 UK aviation CO₂ emissions (1990-2008, bunker fuels basis)



Source: DECC (2010) UK Emissions Statistics 2008 Final UK Figures.

¹³ CCC (2009) *Meeting the UK aviation target – options for reducing emissions to 2050*.

Carbon budgets and the EU ETS

We previously advised that international aviation emissions should be reflected but not explicitly included in the first three carbon budgets, pending resolution of potential discrepancies between current UK emissions estimates (on a bunker fuels basis) and possible EU ETS allocation methodologies. Since 2008, the monitoring and verification of aviation in the EU ETS has been finalised suggesting that inclusion of international aviation emissions in budgets will be appropriate in the near future:

- From 2012, aviation emissions (both domestic and international) will be covered by the EU ETS,
- The reporting framework suggests that emissions will be reported both by airline (for administration) and by Member State (for auctioning),
- Reporting by Member State is likely to be on the basis of all departing flights and as such could be consistent with the bunker fuels methodology,
- Explicit inclusion of international aviation emissions in carbon budgets would therefore be appropriate, subject to data availability and accuracy.

The Committee will consider this issue in more detail in conjunction with possible revisions to the first three budgets given the changing international framework, either later in 2010 or in 2011, or as part of specific advice required under the Climate Change Act on inclusion of international aviation and shipping in the net carbon account, due by 2012.

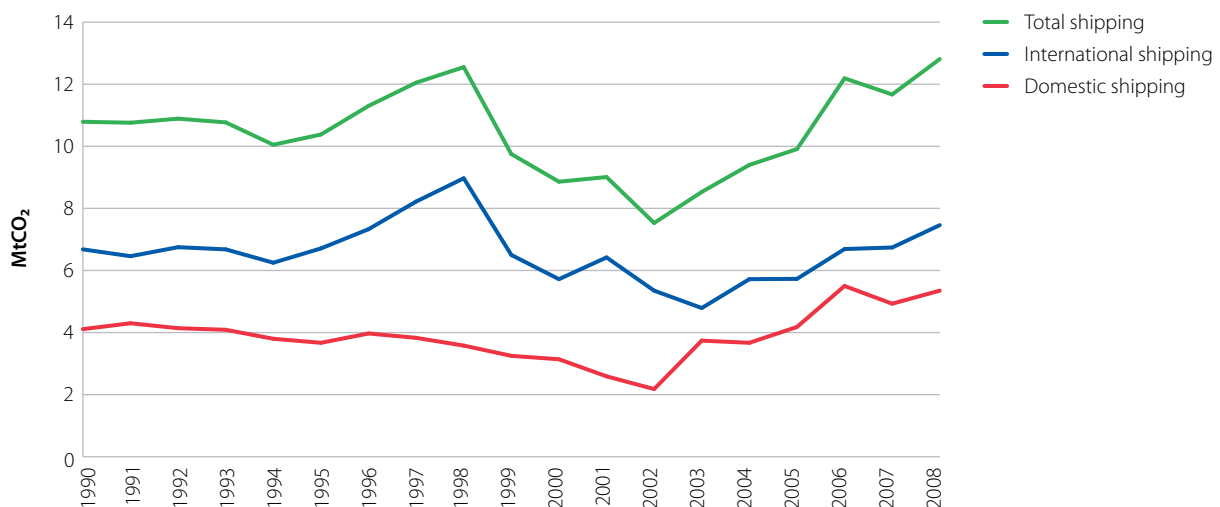
(ii) Shipping emissions

Emissions Trends

Shipping emissions as measured on a bunker fuels basis rose by 10% in 2008 to 12.8 MtCO₂ (Figure 1.11). Emissions rose in both international and domestic shipping:

- International shipping emissions rose by around 11% in 2008 from 6.7 MtCO₂ to 7.5 MtCO₂.
- Domestic shipping emissions grew by around 9% in 2008 from 4.9 MtCO₂ to 5.4 MtCO₂.

Figure 1.11 UK shipping CO₂ emissions (1990-2008, bunker fuels basis)



Source: DECC (2010) UK Emissions Statistics 2008 Final UK Figures.

Box 1.4 Allocating shipping emissions

Bunker fuels is the methodology used to report shipping emissions as a memorandum item to the UNFCCC. However, it is not clear that bunker fuel estimates of shipping fuels present an accurate picture of shipping emissions at the UK level, particularly for international shipping given scope for bunkering for fuel at multiple ports along shipping routes. For example, over the period 1990-2008, international traffic to/from UK ports grew by 32% whereas international shipping emissions on a bunker fuels basis grew by only 12%, suggesting that increasing UK activity is not being fully picked up in emissions estimates due to international bunkering patterns and UK refinery capacity.

Recent major studies at Global, EU and UK levels have all used methodologies based on shipping activity (e.g. estimates of actual fuel used onboard ships for movements), and these have found significantly higher emissions compared to bunker fuels.

The Committee will continue to monitor developments in emissions methodologies for shipping, with particular emphasis on evolving analysis on activity-based estimates and forecasts.

We have previously noted concerns with bunker fuels as a measure of emissions for shipping, suggesting that this may actually understate UK emissions, given that ships delivering to the UK may bunker for fuel elsewhere (Box 1.4).

Given the importance of shipping emissions in the context of the 2050 target, we will consider alternative methodologies for allocating emissions as part of a broader shipping review to be carried out in 2011. This will underpin advice on whether and how international shipping should be included in the net carbon account to be provided by 2012 as required under the Climate Change Act.

It will be important that growth in shipping emissions is constrained in order that climate change goals are achieved. In our December 2008 report, for example, we showed that the 80% emissions reduction target for 2050 could be achieved with shipping emissions in

2050 at around 2005 levels on a bunker fuel basis, and with cuts above 80% in other sectors. Conversely it is not clear how the 80% target could be achieved with significant growth in shipping emissions.

Levers for reducing emissions

We have previously argued that the ideal lever for constraining shipping emissions is a global sectoral agreement, with an EU-only approach as a second-best solution. However, there has been limited progress on implementing a global market-based instrument, notwithstanding IMO progress on energy efficiency design and operational indices for ships. In parallel, the EU has made a commitment to include international shipping in its climate and energy package and targets by 2013 if the IMO have not achieved an international agreement by end-2011.

We will consider appropriate levers further in the context of our review of shipping emissions to be carried out in 2011.

4. Progress against the Committee's indicators

Our October report set out a framework of indicators against which progress reducing emissions could be monitored, and which would provide early warning of risks around missing carbon budgets. The indicators should not be seen as fixed targets but as an evolving framework to be developed in the light of new analysis. The framework included both measures to be implemented (e.g. houses insulated, GW wind generation added, new car emissions) and policy milestones required to support sustained and deep emissions cuts through the first three budget periods and beyond.

In this report we apply the indicator framework to data for 2008 and 2009. Our analysis suggests that implementation of measures is generally on track. However, the level of ambition underpinning indicators for the first budget period reflected policies in place in 2008 which our analysis suggests are neither sufficiently ambitious nor provide sufficiently strong incentives to drive the required step change in the pace of emissions reduction.

Going beyond the first budget, new policies with increased ambition underpinned by stronger incentives will be required to drive the step change. In this respect, there has been progress developing a high-level policy framework for meeting carbon budgets.

However, further work is required to develop a detailed implementation framework in order to provide sufficient confidence that carbon budgets will be achieved. Specific areas where policy development is required include reform of the electricity market arrangements, design of an implementation framework to reduce emissions in the residential buildings sector, and setting of a medium/long-term vision for the electric car/plug-in hybrid market.

We consider progress against indicators for implementation of measures and policy milestones in detail in Chapters 2-4.

5. Departmental carbon budgets and delivery plans

The first set of departmental carbon budgets and delivery plans was published in March 2010. These form the basis of a governance framework to ensure that each department delivers emissions reductions identified in the Low Carbon Transition Plan.

We have been asked to comment on the departmental budgets and plans, and in doing this we focus on the extent to which these match the scope of and level of ambition in our indicators:

- **Power sector:** DECC's indicator framework covers the appropriate range of technologies – renewables, nuclear and CCS (although only for coal, not for gas) – and the full range of facilitative areas such as transmission and planning. The level of ambition for 2020 is broadly consistent with the level of ambition in the Committee's indicators.
- **Buildings and industry:** The overall ambition for these sectors is broadly consistent with the Committee's Extended Ambition scenario although ambition for individual measures, where specified, is lower in some cases (e.g. loft and cavity wall insulation). In addition, a number of key indicators remain to be defined, e.g. ambition for renewable heat, minimum EPC ratings.
- **Transport:** The emissions trajectory for transport is less ambitious than our Extended Ambition scenario. In addition the delivery plan does not commit to a level of ambition for key measures (e.g. aiming to achieve the EU target for new car emissions, ambition on electric cars, ambition for rolling out Smarter Choices).
- **Agriculture:** our analysis suggests that a higher level of ambition is likely to be achievable in the agriculture sector than currently targeted, both in England and in the Devolved Administrations.

Therefore we conclude that the level of ambition both for emissions reductions and for specific measures could be increased in some areas (we discuss appropriate ambition in detail in chapters 2-5).

In addition, the departmental plans do not set out trajectories for emissions reduction measures for the years to 2020. This is problematic given that there is no basis in the plans for assessing whether sufficient progress is being made towards 2020 goals. We therefore recommend that trajectories for specific measures are defined, against which departments' progress can be monitored, and that these should be consistent with the trajectories in our indicator framework (see chapters 2-5).

In order to drive progress along these trajectories and to achieve appropriate emissions reductions in 2020, new policy approaches will be required (e.g. for energy efficiency improvement, more efficient vehicles, low-carbon power generation). We recommend that milestones corresponding to these new policies are included in the departmental delivery plans, and that progress developing policies is therefore a key part of the wider process of monitoring progress reducing emissions. We set out a high-level assessment of new policy approaches in key areas in chapters 2-5.