

Building a low-carbon economy: implementing the Climate Change Act 2008

April 2009



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Foreword

Avoiding dangerous climate change is an increasingly urgent challenge. We need coordinated global action to ensure that a global economic recovery is built on sustainable low-carbon foundations. It is essential that we agree a post-2012 international framework if we are to have any chance of avoiding the worst social, economic and environmental costs of climate change. That is why we are working intensively with other countries to resolve the issues and remove the barriers to reaching an effective international agreement at Copenhagen later this year. We are determined to ensure that the UK's domestic emissions reduction effort contributes to achieving this global deal.

The Climate Change Act is a landmark piece of legislation. For the first time anywhere in the world, it establishes national medium and long-term emissions reduction targets and requires Government to set and meet five year carbon budgets that put the UK on the right trajectory to meet these targets. By enshrining in law the UK's commitment to tackling climate change, the Act both drives progress towards a low-carbon economy in the UK and supports our efforts to secure a satisfactory global deal on climate change. The independent Committee on Climate Change (CCC) established by the Act published its advice to Government on the level of the first three carbon budgets in December 2008. This paper announces the level of the UK's first three carbon budgets and sets out the Government's response to the CCC's advice on them.

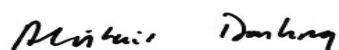
The carbon budgets announced today represent a step change in the Government's level of ambition on climate change. Meeting the budgets will be challenging. It will require action by all. That is why we are committed to developing a carbon budget management system that involves all Government departments. This will help ensure we meet the budgets sustainably, and will strengthen the requirement for all policy development to take proper account of the impact it has on emissions.

The key ingredients will be a cap on emissions in the power and industrial sectors through the EU Emissions Trading System; dramatic improvements in energy efficiency across all sectors; shifting to renewable sources of electricity, like biomass and wind power, and supporting carbon capture and storage (CCS); and switching energy demand in the heat and transport sectors to renewable and cleaner fuels. Driving investment in the energy networks to support this change will be crucial.

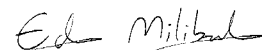
As this Budget sets out, the transformation to a low-carbon economy can provide opportunities for jobs and growth while saving money for businesses and households. Measures we take now to support investment in low-carbon technologies and infrastructure will lay the foundations for the green recovery needed to ensure we meet our emissions reduction targets.

In the summer we will present to Parliament a statement with details of the proposals and policies for meeting the carbon budgets outlined here, set in the context of our overall programme for delivering secure and low-carbon energy, transport and housing in a way which benefits the UK economy into the future.

Setting our carbon budgets in legislation represents an important step towards the global commitments needed to avert the serious threat of dangerous climate change. By seeking to meet these carbon budgets through domestic action, we will prepare for a future tightening of our budgets as part of a successful global deal, and put the economy on track to meet our long-term target to reduce greenhouse gas emissions by at least 80 per cent by 2050.



Rt Hon Alistair Darling MP
Chancellor of the Exchequer



Rt Hon Ed Miliband MP
Secretary of State for Energy and Climate Change

Executive summary

The Climate Change Act 2008 creates a new approach to managing and responding to climate change in the UK. At the heart of the Act is a legally binding target to reduce the UK's greenhouse gas emissions to at least 80 per cent below 1990 levels by 2050, to be achieved through action at home and abroad. To drive progress towards this target, the Act introduces five year "carbon budgets", which define the emissions pathway to the 2050 target by limiting the total greenhouse gas emissions allowed in each five year period, beginning in 2008.

The first three carbon budgets – for 2008-12, 2013-17, and 2018-22 – must be set by 1 June. In setting them, the Government must take into account the advice of the independent Committee on Climate Change (CCC) established under the Act to advise the Government on setting carbon budgets and to report to Parliament on the progress made in reducing greenhouse gas emissions. The CCC published its first report on 1 December 2008. Budget 2009 and this document provide the Government's high-level response to that advice.

The CCC has proposed two sets of carbon budgets for the UK, one to apply now before a global deal is reached ('Interim' budgets), and a more challenging set to apply once a global deal on climate change has been agreed ('Intended' budgets). **The Government agrees with this approach and today announces its intention to set carbon budgets now that are based on the CCC's Interim budgets, consistent with the UK's share of the EU's target to reduce greenhouse gas emissions to 20 per cent below 1990 levels by 2020.** As the package agreed at EU level to implement the 20 per cent target differs in some respects from that assumed by the CCC in producing its advice, the carbon budgets announced today are slightly tighter and therefore more challenging to achieve than those the CCC recommended.

Table 1.A: Proposed carbon budget levels

	Budget 1 (2008-2012)	Budget 2 (2013-2017)	Budget 3 (2018-2022)
Proposed budget (MtCO ₂ e)	3018	2782	2544
Annual equivalent percentage reduction below 1990 levels	22	28	34

The Government will also aim to ensure that all effort in the non-traded sector¹ is achieved through domestic emissions reductions, without the purchase of international offset credits, in line with the CCC's advice. Consistent with that, the Government is proposing to set the limit on the use of credits for the first budgetary period in the non-traded sector at zero. This level of domestic effort will prepare the economy for the move to a tougher 2020 target and tighter carbon budgets under a satisfactory global climate change agreement.

The CCC recommended that, in the event of a satisfactory global agreement, the UK should move to its Intended budgets. The Government agrees that as part of a successful global deal it should move to tighter carbon budgets. This will in part be determined by international negotiations on climate change under the auspices of the EU. **The Committee on Climate**

¹ The non-traded sector refers to sources of emissions that are not covered by the EU Emissions Trading System, and it does not therefore include emissions from the large electricity producers and energy-intensive industry.

Change will therefore be asked to review its recommended Intended budgets following a global deal and once proposals on sharing out of the EU target are agreed. The Government will amend the carbon budgets in the light of those discussions and taking into account the advice of the CCC.

The Government is also proposing to amend the target in the Act for emission reductions by 2020 so as to require the third carbon budget to be set at a level that is equivalent to a reduction in greenhouse gas emissions of at least 34 per cent below 1990 levels. This is consistent with the proposed third carbon budget, for the period 2018-2022.

Following consultation last year, the secondary legislation to implement a carbon accounting system for monitoring compliance with targets and carbon budgets and for keeping track of carbon units is also being tabled today. A summary of consultation responses is being published at the same time, as well as detailed guidance to provide full transparency about how the proposed system will work.

All sectors of the economy will need to play a part in meeting carbon budgets, through decarbonising electricity generation, improving energy efficiency in buildings and industry, and improving the fuel efficiency of road vehicles. The Government is acting to further strengthen this framework in a number of areas. Since publication of the CCC's report, the Government has secured agreement to a strengthened EU Emissions Trading System, providing a credible long-term cap on emissions in the power and energy-intensive industry sectors; agreed to an ambitious target to source 15 per cent of the UK's energy from renewables by 2020; published a consultation on a Heat and Energy Saving strategy to support energy efficiency and low-carbon forms of heating; published a consultation on the zero carbon standard for new homes; set out its vision for a low-carbon industrial strategy to highlight the opportunities for businesses, households and the public sector from the transition to a low carbon economy; and agreed with EU partners to set ambitious binding targets on carbon dioxide emissions from new cars.

In summer 2009, the Government will publish an energy and climate change strategy. This will set out a vision of a future that is low-carbon, prosperous and energy-secure, and it will detail the policies which can help to get there. It will respond in more detail to the advice received from the Committee on Climate Change at the end of last year, and meet the Climate Change Act requirement to set out our policies and proposals for meeting the first three carbon budgets. The strategy will draw on a number of recent and current public consultations, and will put the carbon reduction strategy in the context of the Government's overall programme for delivering secure low-carbon energy, transport and housing, in a way which benefits the UK economy into the future.

1

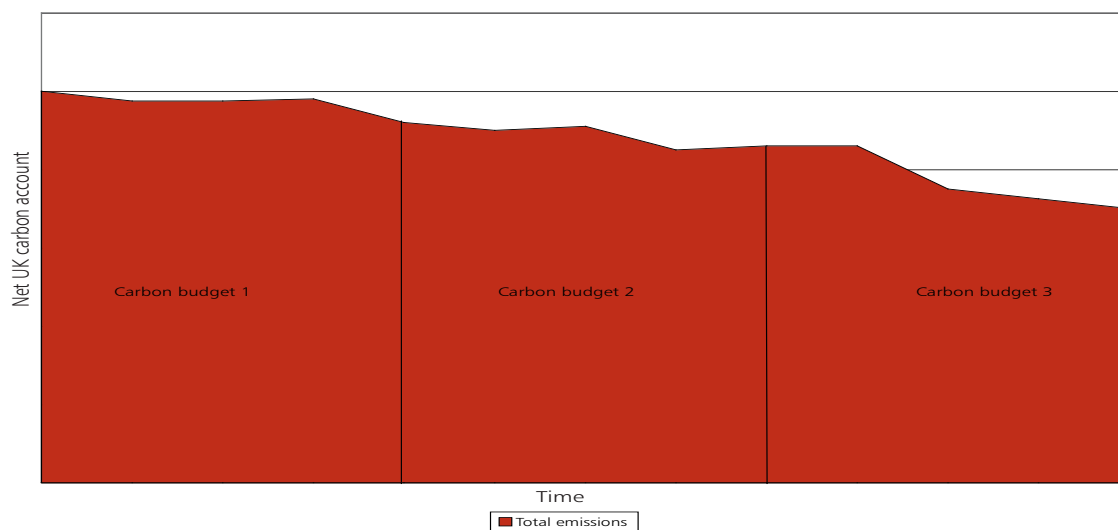
Introduction

Taking action on climate change

1.1 Climate change is the greatest environmental challenge facing the world today. The effects will be felt globally, as rising sea levels threaten the existence of some small island states and put millions of people at risk. Temperature increases, drought and flooding will affect people's health and way of life, and cause the irreversible loss of many species of plants and animals.

1.2 The Government's goal is to stabilise atmospheric greenhouse gas concentrations to avoid dangerous climate change, and to adapt to the climate change that is now inevitable. The UK has a vital role to play as a leader in the drive to tackle climate change, and the Government is working through the European Union, G8 and UN Framework Convention on Climate Change (UNFCCC) processes to reach global agreement on action. Without urgent and coordinated action across the world, the risks of climate change will become a dangerous reality for the whole planet. The UNFCCC conference in Copenhagen this year presents a crucial opportunity to develop a post-2012 framework.

Chart 1.A: How carbon budgets work: illustrative



The Climate Change Act requires the Government to set a limit on emissions of greenhouse gases over a five-year period. The limit is known as a carbon budget. The first three carbon budgets will cover the periods 2008-2012, 2013-2017 and 2018-2022.

Carbon budgets commit the UK to limiting greenhouse gas emissions and reducing them over time. They set a legal requirement on Government to put in place policies that ensure these budgets are met. They will require the UK to generate energy in lower-carbon ways - like wind-power - and use energy more efficiently - by insulating homes and developing cleaner cars. In this way carbon budgets will drive the transition to a lower-carbon economy and put the UK on track to meet the 2050 target of cutting emissions by 80 per cent required by the Climate Change Act.

The Climate Change Act 2008

1.3 The Government has established the world's first long-term legally binding national framework to tackle the dangers of climate change through the Climate Change Act 2008. The Act, which became law on 26 November, creates a new approach to managing and responding to climate change in the UK. The Act sets ambitious targets, takes powers to help achieve them, establishes clear and regular accountability to Parliament and devolved legislatures for progress towards the targets and improves the UK's ability to adapt to climate change.

1.4 At the heart of the Act is a legally binding target to reduce the UK's greenhouse gas emissions to at least 80 per cent below 1990 levels by 2050, to be achieved through action at home and abroad. To drive progress towards this target, the Act introduces five year "carbon budgets", which define the emissions pathway to the 2050 target by limiting the total greenhouse gas emissions allowed in each five year period, beginning in 2008.

1.5 The Government must set the first three carbon budgets before 1 June, and they must be set with a view to meeting the 2050 target and to complying with the UK's European and international obligations. The Act also specifies the minimum level for the third carbon budget (expressed as an annual equivalent percentage reduction below 1990 levels, which is why it is sometimes referred to as "the 2020 target"). In addition, the Government must set a limit on the use of carbon offset credits for each budgetary period, and this limit for the first budgetary period (2008-12) must also be set by 1 June.

1.6 The Act introduces powers to implement a system for carbon accounting through regulations approved by Parliament. A carbon accounting system is required to monitor compliance with targets and carbon budgets and to keep track of carbon units. In addition to the UK's own domestic emissions, any carbon units which are brought into the UK from other countries ("credits") or leave the UK ("debits") also need to be accounted for.

The Committee on Climate Change's first report

1.7 The Act established an independent, expert body, the Committee on Climate Change (CCC), to advise the Government on setting carbon budgets and to report to Parliament on the progress made in reducing greenhouse gas emissions. The CCC published its first report¹ on 1 December 2008. Budget 2009 and this document provide the Government's high-level response to that advice.

Implementation of the Act

1.8 This document summarises the advice from the CCC, the outcome of discussions on the EU Climate and Energy package for 2020, and current progress towards securing a global agreement on climate change. In accordance with the Act, it sets out the Government's proposals for the levels of the first three carbon budgets and the limit on the use of carbon units from overseas for the first budget period. In addition, it sets out Government proposals for a revised 2020 target, a definition of international aviation and shipping, and the carbon accounting system. All of these proposals are subject to agreement by Parliament.

1.9 This document also fulfils the obligations in the Act to publish a statement setting out the reasons if the carbon budgets are set at a level different from that recommended by the CCC, and to publish a statement setting out whether and how the order setting the carbon budgets

¹ *Building a low-carbon economy - the UK's contribution to tackling climate change*, Committee on Climate Change, 2008. See <http://hmccc.s3.amazonaws.com/pdf/TSO-ClimateChange.pdf>

takes into account the views of the Devolved Administrations in Northern Ireland, Scotland and Wales. While this particular document is a UK Government publication, the Act is based on a partnership between the UK Government and Devolved Administrations.

2

UK, EU and international context

Summary of the CCC's advice

Setting a 2050 target to avoid dangerous climate change

2.1 The Committee on Climate Change advised the Government that there is a strong case for the UK to adopt a significantly more ambitious target than the 60 per cent reduction in carbon dioxide emissions set in the 2003 Energy White Paper. Recent developments in climate science, particularly in the analysis of the potential impacts of climate change, and the latest evidence on global emissions and atmospheric concentrations, mean that more radical and earlier action is needed to achieve the Government's climate objectives.

2.2 The Government therefore amended the Climate Change Bill during its final stages to set the 2050 target as a reduction in the UK's greenhouse gas emissions to at least 80 per cent below 1990 levels by 2050. The Bill was also amended so that the target, and the carbon budgets, now cover all the greenhouse gases covered by the Kyoto Protocol.

Achieving the 2050 target: technologies and costs

Low-carbon technologies

2.3 The CCC concluded that a range of technologies exist - in electricity generation, buildings and industry, and transport - that could deliver the required emissions reductions.

2.4 It noted that decarbonisation of the power sector - through technologies such as renewable generation, nuclear power, and carbon capture and storage (CCS), once proven - is key to achieving emissions reduction targets. It also concluded that there is major scope in the near term for significant emissions reductions from buildings (electricity and heat related) through greater use of renewable heat, energy efficiency improvements and relatively minor changes in behaviour. Further emissions reductions would require the introduction of new technologies based on electricity (e.g. heat pumps and storage heating) and the sustainable use of biomass. In industry, the CCC has advised that the application of new technologies to reduce emissions, such as CCS in cement and steel, is likely to be feasible and economically viable.

2.5 On transport, the CCC concluded that the main source of abatement potential is from improving the carbon efficiency of vehicles by developing and implementing new technology such as electric vehicles. It recommended that the UK Government should strongly support the development and subsequent implementation of the EU policy framework in this area. To supplement improvements in vehicle efficiency, the Committee identified further abatement opportunities from biofuels and demand-side measures such as eco-driving and better journey planning.

Economic cost of meeting an 80 per cent target in the UK

2.6 The CCC estimated that the costs of meeting an 80 per cent target would be in the order of 1-2 per cent of GDP in 2050, and advised that this cost should be accepted given the consequences and higher costs of not acting. This figure is consistent with cost estimates from

the Stern Review of the economics of climate change, the Intergovernmental Panel on Climate Change (IPCC), and other UK studies.

2.7 The CCC's modelling suggests that the least-cost path is likely to entail a major contribution from energy efficiency improvements in both buildings and surface transport between now and the mid-2020s, the radical decarbonisation of power generation by 2030, and the increasing application of electricity to surface transport from 2015 onwards and to heat production from the 2020s onwards.

2.8 The Government published its own estimate of the costs of meeting the 80 per cent target in the final Impact Assessment¹ on the Act. This estimate drew upon a variety of modelling work including the work commissioned by the CCC. It estimated the costs in 2050 as less than one per cent of GDP.

The first three carbon budgets

2.9 In advising on the appropriate level for the first three carbon budgets covering the period 2008-22, the CCC considered:

- the implications of the 2050 target for the appropriate pathway over the next fifteen years, and appropriate contributions by the UK to required global emissions reductions in 2020.
- the implications of EU emission reduction targets to which the UK is already committed.
- a bottom up, sector-by-sector analysis of feasible emissions reductions, likely costs, and the policies required to ensure they are achieved.

2.10 In making its recommendations, the CCC balanced a range of economic, environmental and social matters, as set out in the Act:

- scientific knowledge about climate change;
- technology relevant to climate change;
- economic circumstances, and in particular the likely impact of the decision on the economy and the competitiveness of particular sectors of the economy;
- fiscal circumstances, and in particular the likely impact of the decision on taxation, public spending and public borrowing;
- social circumstances, and in particular the likely impact of the decision on fuel poverty;
- energy policy, and in particular the likely impact of the decision on energy supplies and the carbon and energy intensity of the economy;
- differences in circumstances between England, Wales, Scotland and Northern Ireland;
- circumstances at European and international level; and
- the estimated amount of reportable emissions from international aviation and international shipping for the budgetary period or periods in question.

¹Available from www.defra.gov.uk/environment/climatechange/uk/legislation/docs.htm

2.11 The CCC has recommended that the appropriate carbon budgets for the UK should reflect the outcome of the Copenhagen and any subsequent international negotiations on a global treaty, and should be in line with the EU approach. It has therefore proposed two sets of budgets, one which it advised should apply now before a global deal is reached ('Interim' budgets), and a more challenging set to apply once a global deal on climate change has been agreed ('Intended' budgets).

2.12 The CCC also has a duty to advise on the appropriate balance between action at domestic, European and international level, for each carbon budget.

Achieving the proposed carbon budgets

2.13 The CCC advised that its proposed budgets could be achieved through energy efficiency improvement in buildings and industry and fuel efficiency improvement in road vehicles, combined with a significant shift towards renewable and nuclear power generation and renewable heat. It concluded that the current policy framework would deliver some of the required emissions reductions but strengthening of existing policies would be needed if they are to deliver the full abatement potential it identified. New policies would also be needed to support deployment of renewable heat and to reduce emissions from road vehicles. In addition, the CCC recommended a range of other areas where new policies should be considered, such as to support widespread solid wall insulation and the application of plug-in hybrid technologies to vans.

2.14 The CCC also recommended that the Government should not plan to purchase offset credits to meet the Interim budgets, but could reserve the possible purchase of international offset credits as an insurance option in the event that emissions are higher than anticipated. More generous use of offset credits, however, would be appropriate in transitioning from the Interim to the Intended budgets. If the Intended budget is adopted after a global deal, the incremental non-traded sector effort required could be achieved by purchasing credits up to the limit proposed within the EU's framework. In the traded sector, companies covered by the EU Emissions Trading System will be subject to EU-wide rules governing the purchase of EU allowances or offset credits.

2.15 Chapter 3 sets out the Government's response to the CCC's recommendations on the level of the carbon budgets, while Chapter 4 sets out how the Government's current and planned policy framework responds to the CCC's recommendations on how the budgets might be achieved.

EU Climate and Energy package

2.16 UK action to tackle climate change can be most effective if it forms part of a shared EU effort to reduce emissions. In January 2008, the European Commission put forward a package of proposals to deliver on the EU's ambitious commitments to tackle climate change and promote renewable energy up to 2020 and beyond. The European Parliament and Council reached agreement on the package in December 2008.

2.17 The EU is committed to reducing its overall greenhouse gas emissions to at least 20 per cent below 1990 levels by 2020, and to scale this up to as much as 30 per cent under a new global climate change agreement when other developed countries make comparable efforts. It has also set itself targets to increase the share of renewables in energy use to 20 per cent by 2020 and to save 20 per cent of EU energy consumption by 2020 through increased energy efficiency. The package sets out the contribution expected from each member state and proposes a series of measures to help achieve them.

2.18 Central to the package is a strengthened and expanded EU Emissions Trading System (EU ETS), to provide a credible, long-term carbon price. Emissions from the installations covered by the system – principally electricity generation, iron and steel production, mineral processing industries such as cement manufacture, and the pulp and paper processing industries - will be cut by 21 per cent by 2020 compared with levels in 2005. A single EU-wide cap on ETS emissions has been set, and auctioning of EU allowances (EUAs) will increase from about 3 per cent now to about 50 per cent from 2013. The cap will decrease annually in a linear manner, which will continue beyond the end of the third trading period (2013-2020).

Box 2.A: Emissions trading

The Stern Review highlights the need for a carbon price signal across countries and sectors to ensure that emissions reductions are delivered in the most cost-effective way.

Emissions trading, the UK's carbon price instrument of choice, ensures that the emissions from the sectors regulated are capped, while allowing emissions reductions to occur where they cost the least, thereby minimising economic impacts and maximising flexibility for industry. It is a key component in a comprehensive UK policy framework to mitigate climate change effectively.

The Stern Review also makes clear that a global carbon market is essential. The EU Emissions Trading System (EU ETS) could become the basis of a global carbon market, delivering the emissions reductions necessary to stabilise the concentration of greenhouse gases at a level to avoid the most serious impacts of climate change.

Links to project credits from developing countries through the Clean Development Mechanism (CDM) increase opportunities for emissions savings to be made at the point of least cost and, importantly, drive financial flows and investment in low carbon technology in these developing economies.

2.19 Emissions from sectors not included in the EU ETS – such as transport, housing, agriculture and waste – will be cut by 10 per cent from 2005 levels by 2020. Responsibility for meeting this target has been distributed between member states, primarily on the basis of GDP / capita. The UK's target is to reduce total emissions from these sectors ("the non-traded sector") to 16 per cent below 2005 levels by 2020, with a linear reduction path and annual binding emission limits in 2013-20. To help them meet their targets, member states may use credits, up to a specified limit, from the Clean Development (CDM) and Joint Implementation (JI) project-based mechanisms.²

2.20 Another UK target under the EU renewable energy framework is to source 15 per cent of its energy from renewables by 2020. This is very ambitious, but achievable. In 2006, only around 1½ per cent of the UK's final energy consumption came from renewable sources. One possible scenario suggests that, if 10 per cent renewable transport is feasible and sustainable, then delivering 15 per cent renewable energy in the UK in 2020 might require: 10 per cent renewable energy in transport (compared with less than 1 per cent today), 14 per cent in heat (less than 1 per cent today) and 32 per cent in electricity (less than 5 per cent today). After consultation last year, the Government will launch its Renewable Energy Strategy later this year.

2.21 From 2013, CO₂ captured and stored in compliance with the Directive on the geological storage of carbon dioxide shall be recognised as abated under the EU ETS, creating a long-term economic framework for deployment. Free allowances from the EU ETS New Entrants Reserve

² For further details on carbon credits, see box 3B

were also made available to support early commercial scale demonstration of this vital technology.

Progress towards a global agreement

2.22 2009 is a critical year in the negotiations on a global agreement that will put the world on an emissions pathway to address the risk of dangerous climate change. In December, parties to the UN Framework Convention on Climate Change (UNFCCC) will meet in Copenhagen with the aim of reaching such an agreement.

2.23 The Government believes action is needed to ensure that greenhouse gas emissions are reduced on a scale sufficient to prevent the planet from warming by more than 2°C above pre-industrial levels. This means global emissions peaking by no later than 2020, and achieving a reduction of at least 50 per cent by 2050 (compared to 1990 levels). In working towards this, an ambitious agreement at Copenhagen will need to deliver three key outcomes. Firstly, a deal should include ambitious emissions reductions from developed countries, including firm mid-term targets. Secondly, it should deliver a substantial deviation from business-as-usual emissions by advanced developing countries, while ensuring that these countries are able to fully realise their development objectives. Finally, it will need to mobilise significant sources of finance, both private and public, to support mitigation and adaptation actions - particularly in the most vulnerable developing countries.

2.24 The UK Government negotiates as part of the EU, and will be working with EU partners to take a leading role in the UN discussions during 2009. In addition, the Government will be working through other multilateral fora, and through bilateral relationships to help build the political conditions that will enable an ambitious and effective agreement to be reached. This will include discussions through the G8, under this year's Italian presidency; through the Major Economies Forum; and through the G20. The UK's ambitious domestic policies, combined with those which have been put in place at the EU level, put the UK and EU partners in a strong position to positively influence the outcome at Copenhagen.

Next steps

2.25 Internationally, the UK Government will continue to work towards the agreement of an ambitious global deal on climate change at Copenhagen in December. Key milestones in this process include the meeting of the European Council in June, the G8 summit in July and meetings of the Major Economies Forum throughout 2009.

3

Carbon budgets

Introduction

3.1 Carbon budgets set a binding legal limit on UK greenhouse gas emissions over consecutive five year periods,¹ with at least three budgets set at any one time. Budget 2009 announces the levels of the first three carbon budgets, for the periods 2008-12, 2013-17, and 2018-22; these budgets will then be set in secondary legislation by 1 June 2009 as required by the Act. By defining the emissions reduction pathway towards the target to reduce greenhouse gas emissions to at least 80 per cent below 1990 levels by 2050, carbon budgets will provide a clear, credible and long-term regulatory framework. This will help to bring forward investment in low-carbon and energy saving technologies, and will ensure that all major policy decisions take the impact on greenhouse gas emissions into account.

Committee on Climate Change's recommendations

3.2 The CCC has recommended that the carbon budgets for the UK should reflect the outcome of the UNFCCC conference in Copenhagen in December 2009, and any subsequent negotiations on a global treaty, and should be in line with the EU approach. It has therefore proposed two sets of budgets, one to apply now before a global deal is reached ('Interim' budgets), and a more challenging set to apply once a global deal on climate change has been agreed ('Intended' budgets). The CCC's recommended Intended and Interim budgets are summarised in the table below.

Table 3.A: Carbon budget levels recommended by CCC

	Budget 1 (2008-2012)	Budget 2 (2013-2017)	Budget 3 (2018-2022)
Interim budget (MtCO ₂ e)	3018	2819	2570
Intended budget (MtCO ₂ e)	3018	2679	2245

Government response

3.3 The Government agrees that the carbon budgets set now should be based on the UK's share of the EU's target to reduce greenhouse gas emissions to 20 per cent below 1990 levels by 2020. In meeting these Interim budgets, the Government will also aim to ensure that all effort in the non-traded sector is achieved through domestic emissions reductions, without the purchase of offset credits, in line with the CCC's advice. This level of domestic effort will prepare the economy for the move to a tougher 2020 target and tighter carbon budgets following a successful global agreement.

¹ After taking account of carbon units that have been brought into the UK, for example by being bought by other countries ("credits"), or have left the UK, for example by being sold to other countries ("debits").

3.4 The Government is required to take into account the matters specified in the Act when setting the carbon budgets. The annex to this document sets out some of the relevant considerations. The Act also requires the Government to take into account any representations made by the Devolved Administrations; these are summarised in the box below and further details are available on their websites.

Box 3.A: Views of the Devolved Administrations

The **Northern Ireland Executive** noted the CCC’s recommended carbon budgets, but did not comment further on the specific levels. It recognised the benefits of energy efficiency, low-carbon business opportunities, and reduced reliance on fossil fuels. The Executive did not comment on the 2020 target, the credit limit for the first budget period, or on the carbon accounting regulation.

The **Scottish Executive** welcomed the level of ambition recommended by the CCC and its approach in proposing two sets of carbon budgets. It committed to contributing towards meeting the interim target and budgets and noted that further advice from the Committee on Climate Change was needed on Scotland’s contribution. It supported the intention to adjust the Interim budget levels in the light of the final agreement on the EU’s 2020 climate and energy package, and to reconsider the levels following an international agreement. The Scottish Executive agreed that the 2020 target should be amended to apply to all greenhouse gases at the same time as setting the carbon budgets. It welcomed the level of ambition recommended by the CCC but did not comment on the specific level. It considered that the first budget should be met without the use of offset credits. The Scottish Executive confirmed that it was content with the proposed carbon accounting system.

The **Welsh Assembly Government** supported the levels recommended by the CCC but commented that the budget levels should be ambitious ahead of a new international framework being agreed. It welcomed the CCC’s recommendation to amend the 2020 target to at least a 34 per cent reduction in greenhouse gas emissions. The Welsh Assembly Government supported the proposals to meet the interim budgets through domestic effort, though it recognised the need to allow for the possibility to purchase credits for risk management. It confirmed that it was content with the carbon accounting proposals.

3.5 In producing its advice, which was published on 1 December 2008, the CCC had to make certain assumptions about the shape of the final EU Climate and Energy package, which sets the EU policy framework. The package that was agreed in Europe on 12 December differs in some respects from the European Commission’s original proposals, meaning that the UK’s share of the EU ETS cap is slightly smaller than the CCC had assumed.

3.6 As a result of this, the proposed carbon budgets announced today are slightly tighter and therefore more challenging to achieve than those the CCC recommended. The third carbon budget is 26 MtCO₂e lower than that recommended by the CCC, increasing the emissions reduction effort required between the first and third carbon budgets by five per cent.

Table 3.B: Proposed carbon budget levels

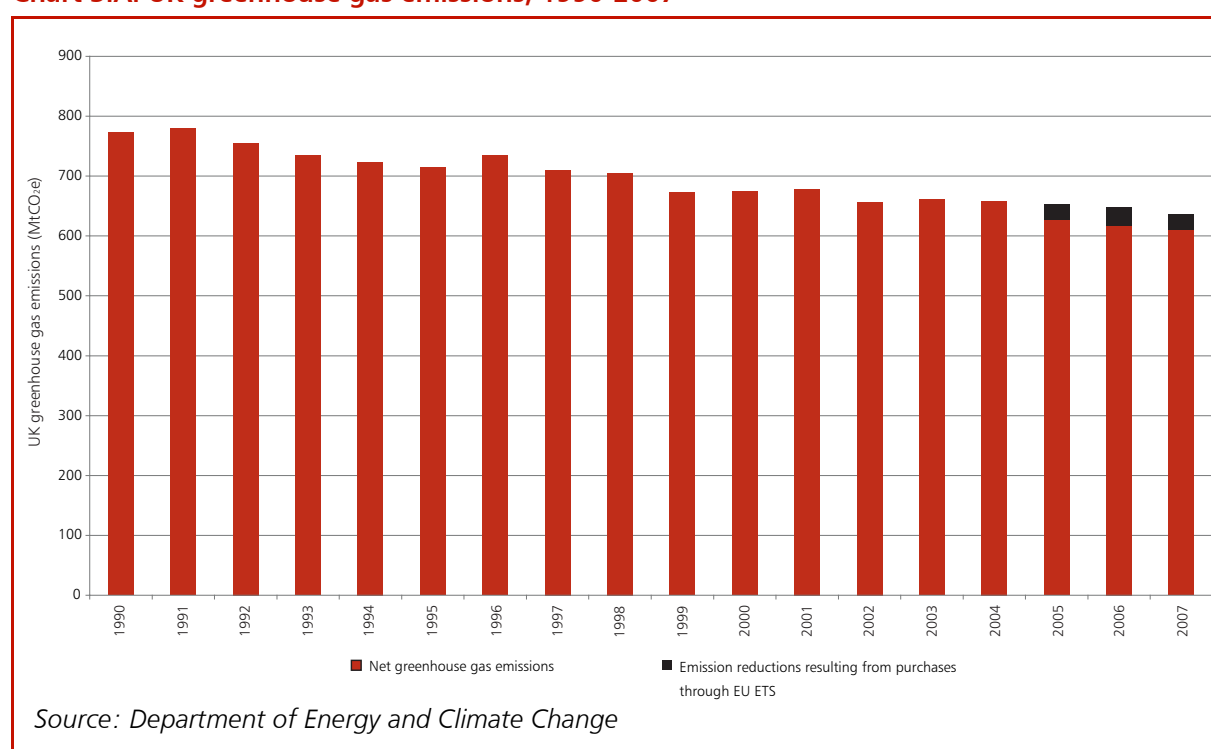
	Budget 1 (2008-2012)	Budget 2 (2013-2017)	Budget 3 (2018-2022)
Proposed budget (MtCO ₂ e)	3018	2782	2544
Annual equivalent percentage reduction below 1990 levels	22	28	34

Traded sector (MtCO ₂ e)	1233	1078	985
Non-traded sector (MtCO ₂ e)	1785	1704	1559

3.7 The CCC recommended that, in the event of a satisfactory global climate change agreement, the UK should move to its Intended budgets. As the UK negotiates internationally on climate change as part of the EU, the Government expects to agree the UK's emissions reduction target under any future international agreement at European level. **The Committee on Climate Change will therefore be asked to review its recommended Intended budgets following a global deal and once proposals on sharing out of the EU target are agreed. The Government will amend the carbon budgets in the light of those discussions and taking into account the advice of the CCC.**

UK greenhouse gas emissions

Chart 3.A: UK greenhouse gas emissions, 1990-2007

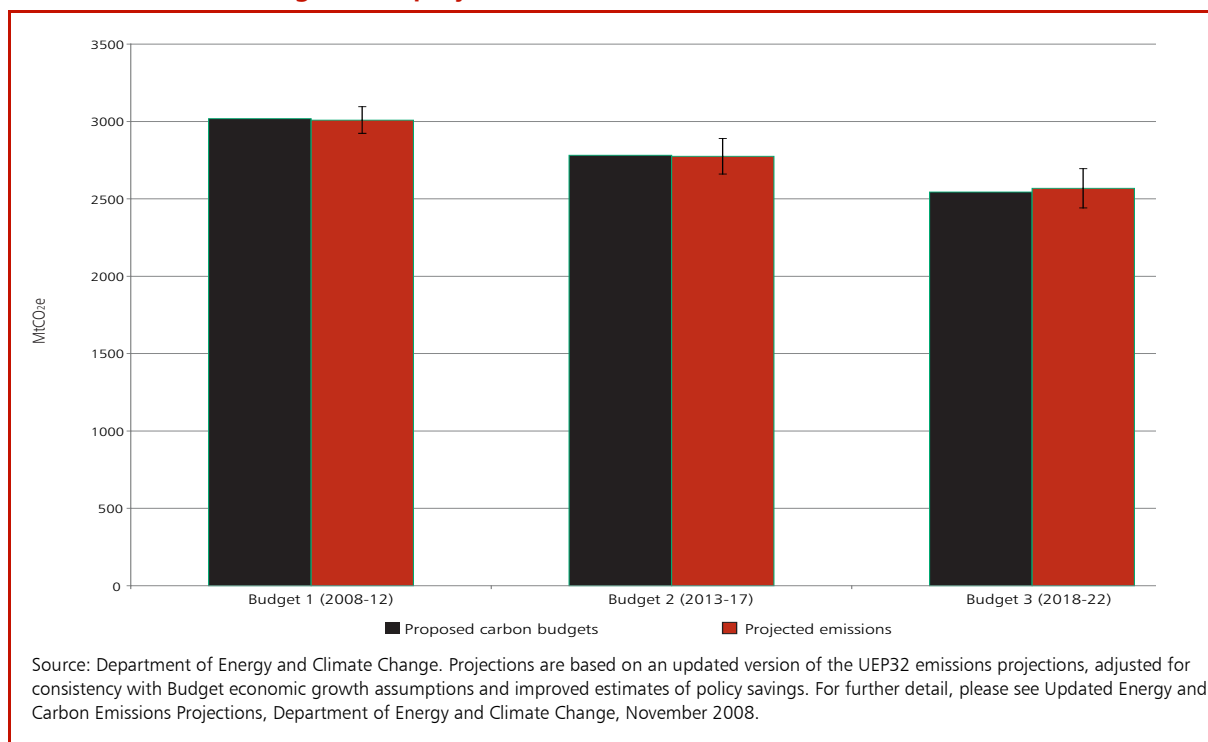


3.8 Chart 3.A shows UK greenhouse gas emissions since 1990. In 2007, net UK greenhouse gas emissions covered by the Act, including emissions reductions resulting from purchases through the EU ETS, were estimated to be 610.7 million tonnes carbon dioxide equivalent. This was 0.9 per cent lower than the 2006 figure of 616.2 million tonnes and 21.6 per cent lower in 2007 than in the base year, down from 779.0 million tonnes carbon dioxide equivalent.²

² These figures differ from those published in the latest statistical release (of 3 February 2009) due to the difference in emissions coverage under the Act (which applies to UK territorial emissions only) and reporting of emissions figures under international obligations (which also include emissions from Crown Dependencies and certain Overseas Territories).

Projected emissions

Chart 3.B: Carbon budgets and projected net emissions



3.9 The chart above shows the proposed carbon budgets and projected net emissions, with associated uncertainties, over each budgetary period. Projections are shown as a range, recognising the uncertainties inherent in projecting the future path of emissions. (The ranges shown here reflect a set of different scenarios of growth in the economy, of world fossil fuel prices, and of delivery of emissions reductions from existing policies and measures.)

3.10 These latest Government projections show that the UK is broadly on track to meet carbon budgets through domestic action. In the current central scenario, emissions are projected to be slightly higher than the proposed carbon budget in the third budgetary period. This, combined with the associated uncertainties, suggests that new measures are likely to be required to deliver additional carbon savings. The Act requires the Government to prepare proposals and policies for meeting the carbon budgets (and to do so with a view to meeting the 2050 target), and to lay before Parliament a report setting out those proposals and policies. The proposals and policies must, taken as a whole, also contribute to sustainable development. This summer the Government will publish an energy and climate change strategy, which will provide full details of its policies and proposals to meet carbon budgets, including new measures to drive further domestic reductions.

The 2020 target

3.11 The Climate Change Act currently requires that the five year carbon budget that includes 2020 must be set so that the annual equivalent of the budget for that period is at least 26 per cent lower than the 1990 baseline. This target is currently expressed in terms of carbon dioxide only. During passage of the Climate Change Act, both Houses of Parliament agreed that the target should remain in terms of carbon dioxide only, pending the Committee on Climate Change's formal advice on the level of the first three carbon budgets.

3.12 In advising on the 2020 target, the CCC took into account three factors: the level of emissions reduction in 2020 consistent with the UK being on the path to at least an 80 per cent reduction in 2050; the contribution by the UK to required global emission reductions in 2020;

and the UK's obligation under the recent EU Climate and Energy framework, both for the traded and non-traded sectors.

3.13 The CCC recommended that the carbon budgets and 2020 target should change to include all Kyoto greenhouse gases (GHGs), given that all GHGs cause climate change; the UK's international commitments are in terms of GHGs; and that including non-CO₂ GHGs provides additional options for meeting the budgets. Recognising that the appropriate targets for the UK should reflect the outcome of international negotiations and be in line with the EU approach, the CCC proposed two 2020 targets: an interim target of 34 percent reduction below 1990 levels, and an intended target of 42 per cent reduction below 1990, to be adopted in the event of a successful global deal. For each of these, it concludes that straight line trajectories to the 2020 target as set out in the EU framework are an appropriate basis for setting the UK's carbon budgets; these underpin its Interim and Intended budgets.

3.14 Having received and considered this advice, and considering the views of the Devolved Administrations,³ the Government now proposes that the 2020 target in section 5 of the Act should be amended to require the third carbon budget to be set at a level that is equivalent to a reduction in greenhouse gas emissions of at least 34 per cent below 1990 levels. This is consistent with the proposed third carbon budget, for the period 2018-2022. The Government is introducing today a draft order to make the necessary amendment to the Act.

Consistency with the 2050 target

3.15 The Act requires the carbon budgets to be set with a view to meeting the 2020 and 2050 targets. It also requires the Government to "have regard to the need for UK domestic action on climate change" when considering how to meet the UK's targets and budgets.

3.16 The CCC considered that, provided its Interim budgets were met through domestic emissions reductions, this would put the UK on a path to meeting the 2050 target. In setting the carbon budgets at the levels proposed here, the Government is aiming to ensure that all effort in the non-traded sector is achieved through domestic emissions reductions, without purchase of offset credits. The report in the summer will set out the Government's proposals and policies for achieving this. This level of domestic effort will also prepare the UK for the move to a tougher 2020 target, expected to be in line with any future EU commitment to increase its target to as much as a 30 per cent reduction under a new global agreement and when other developed countries make comparable efforts.

Carbon accounting regulations

3.17 The Act requires the Government to put in place a scheme for carbon accounting through regulations approved by Parliament. A carbon accounting system is needed to monitor compliance with targets and carbon budgets and to keep track of carbon units. This is necessary particularly because, in addition to the UK's own domestic emissions, the system needs to also account for any carbon units that are brought into the UK from other countries ("credits") or leave the UK ("debits") through emissions trading (see Box 3.B).

3.18 In October 2008, the Government consulted on its proposals for a carbon accounting system. Today, the Government is publishing a summary of responses to the consultation and laying draft carbon accounting regulations before Parliament for approval. As these are the first such regulations, the Act requires that the Government obtains and takes into account the advice of the Committee on Climate Change, and consults the Devolved Administrations, before laying the draft regulations before Parliament. The summary of responses, which is available on

³ Section 7(4) of the Act provides three months for the Devolved Administrations to submit their views to Government.

the DECC website, explains how these requirements have been met. In response to calls from respondents to the consultation for full transparency about how the proposed system will work, step-by-step guidance on the carbon accounting regulations and the process to be followed for each year and in each budget period has also been published.

Box 3.B: Carbon units

The carbon market is a key tool for reducing emissions worldwide. Analysis using the Office of Climate Change's GLOCAF model suggests that carbon trading can halve the mitigation cost of stabilising greenhouse gas concentrations.

While countries with commitments under the Kyoto Protocol to limit or reduce greenhouse gas emissions must meet their targets primarily through national measures, the Protocol also introduced three market-based mechanisms as an additional means of meeting these targets. The Kyoto mechanisms are:

- emissions trading;
- the Clean Development Mechanism (CDM);
- and Joint Implementation (JI).

The mechanisms are designed to stimulate sustainable development through technology transfer and investment, to help countries with Kyoto commitments to meet their targets by reducing emissions or removing carbon from the atmosphere in other countries in a cost-effective way, and to encourage the private sector and developing countries to contribute to emission reduction efforts.

JI enables industrialized countries to carry out emission reduction projects with other developed countries, while the CDM involves investment in projects that reduce emissions and promote sustainable development in developing countries.

The Climate Change Act requires that the carbon accounting regulations must specify the carbon units that are eligible to count towards meeting our budgets. The proposal is that the types of internationally-recognised units listed below should be eligible. Each unit represents one tonne of CO₂ or its equivalent.

- *Assigned amount units (AAUs)*: Countries with commitments under the Kyoto Protocol have accepted targets for limiting or reducing emissions. These targets are expressed as levels of allowed emissions, or assigned amounts, over the 2008-2012 commitment period. The allowed emissions are divided into assigned amount units (AAUs).
- *Certified emissions reductions (CERs)*: Certified Emissions Reductions (CERs) are generated by CDM projects in developing countries.
- *Emission reduction units (ERUs)*: Emission Reduction Units (ERUs) are generated by JI projects in developed countries. They are issued by the host country, by converting either AAUs or RMUs.
- *Removals units (RMUs)*: Removals Units (RMUs) represent a net removal of greenhouse gases through land use, land use change or forestry activity.
- *EU allowances (EUAs)*: EU allowances, which are converted from AAUs, are issued to participants in the EU emissions trading system (EU ETS) up to the limit imposed by the total cap on emissions.

Limit on the use of offset credits for the 2008-12 carbon budget

3.19 The Government is today introducing a draft order that will set the limit on the use of credits for the first budgetary period in the non-traded sector at zero, consistent with the aim of ensuring that that all effort in the non-traded sector is achieved through domestic emissions reductions, without the purchase of offset credits.⁴

3.20 The CCC has a duty to advise on the appropriate balance between action at domestic, European and international level, for each carbon budget. The Act requires the Government to set a limit on the use of credits for each budgetary period, by secondary legislation requiring debate in both Houses of Parliament, taking into account the CCC's advice and having consulted the Devolved Administrations. The limit for the first budgetary period must be set by 1 June.

3.21 The option remains of amending the credit limit for the non-traded sector in the event that domestic emissions reductions are not fully realised, consistent with the advice of the CCC that it would be prudent to reserve such an 'insurance option'. However, the Government is sending a clear message that it is seeking to achieve the interim budgets through domestic action without the use of credits, putting the UK on a path to achieving tighter carbon budgets as part of a global deal.

3.22 The CCC noted that in the traded sector, both EU allowances (EUAs) and project credits (CERs and ERUs) can be purchased but limits on the use of project credits already exist and are fixed for 2008-2012 as part of the UK's National Allocation Plan for the second phase of the EU ETS. The CCC felt that the use of offset credits in the traded sector up to the limit allowed in the EU ETS was acceptable. Given this, the Government has concluded that the limit on credits set under the Act should only apply to their use in the non-traded sector, in line with the CCC's views.

Indicative annual ranges

3.23 The Act places a duty on the Government to lay before Parliament a report setting out an "indicative annual range" for the net UK carbon account for each year within the budgetary period. This is designed to increase the Government's accountability to Parliament. The range will be set with reference to projected emissions for the budgetary period, the UK's targets under the EU Climate and Energy package, and the policies and proposals that are put in place, under section 13 of the Act, to meet the carbon budgets. Having consulted the Devolved Administrations⁵, this information will be included as part of an energy and climate change strategy that will be published in the summer.

International aviation and shipping

3.24 Emissions from international aviation and international shipping are not included in the targets and budgets in the Act, because of the lack of a globally agreed methodology for allocating emissions to countries. The Act does, however, require them to be taken into account in relation to carbon budgets. (The Government may also make regulations to provide for their inclusion and must do so, or say why not, by 31 December 2012.) The order published today proposes definitions for "international aviation" and "international shipping" that reflect current international reporting practice.

3.25 The CCC considered the feasibility of allocating international emissions both to the European and the UK level, the scope for global abatement in these sectors, and the

⁴ The limit does not apply to credits and debits as a result of the EU ETS and EUAs used by participants in the Carbon Reduction Commitment.

⁵ Required under section 12(4).

implications of allocation systems and appropriate policies for the treatment of the two sectors within the UK's carbon budget framework. It concluded that whilst aviation and shipping emissions are today both relatively small as a percentage of total global emissions, they are likely, if unconstrained, to grow to much larger shares. The CCC therefore considered it is essential either to curtail emissions growth significantly or to set more stringent targets for all other sectors which compensate for the difficulty of achieving cuts in these sectors.

3.26 The CCC concluded that **international aviation** needs to be covered by an international agreement. In the absence of a global deal the planned inclusion of international and domestic aviation within the EU ETS makes sense and there are few disadvantages to European unilateral action. Given that aviation is included within the EU ETS, the CCC considered that it is not essential that international aviation is included within the carbon budgets in order to ensure pressure for emissions reductions.

3.27 The CCC advised that inclusion of aviation in the carbon budgets on the basis of EU ETS allowances administered by the UK would not adequately reflect the UK's international aviation emissions. Inclusion on the basis of bunker fuels⁶, although fairer, would result in a confusing relationship between the UK's national budget and the accounting system for the EU ETS. In particular, the Government would not be able to determine how the UK bunker fuels data should be adjusted for trading within the EU ETS thus undermining the principal benefit of including international aviation in UK budgets – greater transparency of international aviation emissions. The CCC therefore recommended that international aviation is not explicitly included in the UK's carbon budgets at this stage.

3.28 The CCC also advised that, if emissions from international aviation are not included, the carbon budgets which are set for the other sectors will need, when combined with the trend in EU ETS aviation emissions, to be compatible with overall climate objectives. Aviation (both international and domestic) is included in the EU's greenhouse gas emissions reduction target. The CCC concluded that its carbon budget proposals, which are based on the EU framework, therefore take into account international aviation emissions.

3.29 Recognising the importance of including international aviation emissions in the UK's climate mitigation strategy, the CCC will report annually on UK trends in international aviation emissions (using a range of appropriate methodologies), their climate impact, developments in, and the success of, abatement efforts and appropriate policy levers. In January 2009, the Government announced a new target to reduce aviation carbon dioxide emissions in 2050 below 2005 levels, and the CCC has also been asked to advise on this target, including the best basis for its development and the scope for emissions reductions.

3.30 The CCC noted that there are not at present any firm plans to include **international shipping** in the EU ETS and applying a European-only approach to shipping could be undermined by carbon leakage effects. Moreover, it advised that shipping is a clear example of a sector where unilateral, national or even regional action is problematic, and where achieving a global sectoral deal is therefore a priority. The CCC concluded that it was not appropriate at this stage to include international shipping emissions within the carbon budgets system.

3.31 The CCC advised that the appropriate action would be for the EU's targets to take into account international shipping emissions when setting targets for other sectors, rather than for the UK to unilaterally adjust its carbon budgets. In the meantime, the CCC intends to report annually on trends in the UK's international shipping emissions (using a variety of different measures), their climate impact, developments in, and the success of, abatement efforts and appropriate policy levers.

⁶ Bunker fuel refers to either aviation jet fuel or marine fuel.

Box 3.C: Aviation and the EU Emissions Trading System

Emissions from all flights arriving at or departing from EU airports will be included in the EU Emissions Trading System (ETS) from 1 January 2012.

Emissions from the aviation sector will be capped at 97 per cent of average 2004 - 2006 emissions in 2012, and at 95 per cent from 2013 onwards. Carbon allowances will only be issued up to the level of this cap; emissions above it will be covered in one of two ways - either through mitigation within the sector or through the purchase of reductions from other sectors. (This would be the case regardless of whether this growth in emissions was from new airport capacity, the provision of new routes or extra services on existing routes.)

There will be no national allocation of emissions under the EU ETS, instead, allowances will be allocated directly to airline operators according to a process determined by the EU Commission. The purely administrative processes of allocation and monitoring for each airline would then be administered by the EU state from whom its Air Operators Certificate (AOC) is issued or, for non EU airlines, from which the airline carries out the majority of its operations.

The cap on aviation emissions is set at an EU-wide level, and Government is looking – with advice from the CCC – at how the UK's new target to reduce its aviation emissions by 2050 can best work alongside the inclusion of aviation in the EU Emissions Trading System.

Next steps

3.32 The three draft statutory instruments that are being laid before Parliament today to put the above proposals into secondary legislation - the Carbon Budgets Order 2009, the Climate Change Act 2008 (2020 Target, Credit Limit and Definitions) Order 2009, and the Carbon Accounting Regulations 2009 - are all subject to the affirmative resolution procedure. This means that they must be debated and approved by both Houses of Parliament before they become law. Subject to the approval of Parliament, all three orders will come into force on 31 May 2009, in line with the requirement of the Act that the first three carbon budgets are set not later than 1 June 2009.

4

Building a low-carbon economy

Introduction

4.1 The system of carbon budgets provides a clear and credible long-term framework to incentivise investment in energy saving and low carbon technologies. This chapter summarises the main elements of the Government's approach to ensure this framework drives the transformation required.¹ It focuses in particular on those sectors and policy areas identified as important by the Committee on Climate Change - decarbonising electricity generation, energy use in buildings and industry, and reducing domestic transport emissions.

4.2 The Government already has a comprehensive set of policies in place to tackle greenhouse gas emissions, set out in the 2006 Climate Change Programme and 2007 Energy White Paper. It is also taking action to strengthen policy in a number of areas, including through consulting on a Renewable Energy Strategy and a Heat and Energy Saving Strategy.

4.3 In summer 2009, the Government will publish an energy and climate change strategy. This will set out a vision of a low-carbon future that is prosperous and energy-secure, and it will detail the policies that will help get there. It will respond in more detail to the advice received from the Committee on Climate Change at the end of last year, and meet the Climate Change Act requirement to set out our policies and proposals for meeting the first three carbon budgets. The Strategy will draw on recent and current public consultations, and will put the carbon reduction strategy in the context of the Government's overall programme for delivering secure low-carbon energy at competitive prices and to the benefit of the UK economy into the future.

Policy framework

4.4 At a time of economic downturn it is particularly important that the policy framework enables individuals and businesses to reduce emissions cost-effectively and to seize the economic opportunities offered by the transition to a low-carbon economy. The Government follows the approach set out in the Stern Review on the economics of climate change. The Stern Review noted that the costs of moving to a low-carbon economy could be minimised with a policy framework that is credible, predictable and flexible, and that is built around three elements:

- **establishing a carbon price** associated with the emissions of greenhouse gases, so that businesses and individuals are able to factor the cost of damage caused by climate change into their decisions;
- **encouraging innovation in low-carbon technologies and infrastructure** through policies that address separately the market failures associated with innovation; and

¹ This chapter includes a mix of UK-wide and England-only policies/measures. In a number of areas the Devolved Administrations will be pursuing different policies and measures in their jurisdictions.

- **removing or overcoming barriers** that may prevent or deter individuals and businesses from taking cost-effective action to reduce their emissions, particularly on energy efficiency.

4.5 The Government is committed to ensuring the long-term environmental ambitions defined by carbon budgets are not jeopardised by short-term economic conditions. As Budget 2009 sets out, investment in environmental and low-carbon sectors can help to accelerate the transition towards a low-carbon economy by putting spare capacity in the economy to productive, low-carbon uses. Measures to support investment in low-carbon technologies and infrastructure will now lay the foundations for the green recovery needed to ensure emissions reduction targets are achieved, secure new jobs and new business in the low-carbon sector and place the UK at the forefront of worldwide green recovery.

4.6 The low-carbon and environmental goods and services sector in the UK is already worth £107 billion with potential to grow substantially, representing 3½ per cent of the global market. Driving demand for these goods and services will position the UK as a centre for low-carbon technology and manufacturing, as well as minimising the costs of the transformation to a low-carbon economy. On 6 March, the Government published the *Low Carbon Industrial Strategy: A Vision*, which set out how businesses, households and the public sector can benefit from these opportunities in four key areas:²

- saving business, consumers and the Government money through energy efficiency;
- putting in place the energy infrastructure for the UK's low-carbon future;
- making the UK a global leader in the development and production of low-carbon vehicles; and
- making the UK the best place in the world to locate and grow a low-carbon business.

Decarbonising electricity generation

4.7 With around a third of UK carbon dioxide emissions coming from electricity generation, the Government has put in place a long-term strategy for reducing emissions from the power sector. Central to this is the EU Emissions Trading System (EU ETS), which places an emissions cap on the large electricity producers and energy-intensive industries, creating a carbon price that drives abatement to meet the cap at least cost. The revised EU ETS Directive agreed in December 2008 provides longer-term certainty on the future of the system, including a clear trajectory for the level of the cap beyond 2020, as recommended by the CCC.

4.8 The CCC recognised that, in accordance with the Stern framework, targeted support in addition to a carbon price would be needed to overcome barriers to deployment of the three key technologies expected to contribute to decarbonisation of UK electricity generation – renewable electricity, nuclear power, and carbon capture and storage (CCS) fitted to fossil-fuel fired power stations. The Government has recently consulted on proposals that aim to achieve a significant increase in renewable electricity; is facilitating investment in new nuclear build; and is ensuring the UK plays a lead role in the development and demonstration of CCS technologies. In addition, Budget 2009 sets out a range of measures to continue to drive low-carbon and renewable energy investment through the downturn, enabling the UK to meet future carbon budgets at lower cost and at the same time improve the security of the UK's energy supply.

² Available at <http://interactive.berr.gov.uk/lowcarbon>

Renewable electricity

4.9 The Committee on Climate Change supported the need for additional financial incentives for deployment of renewable power generation, and emphasised the importance of the financial and non-financial support measures for renewable electricity set out in the Government's Renewable Energy Strategy consultation.³ The current financial incentive to produce renewable electricity comes from the Renewables Obligation (RO), which requires electricity suppliers to obtain a specified and increasing proportion of their electricity from renewable sources. Since it was introduced in 2002, renewable electricity generation has increased from less than 2 per cent in 2001 to 4.9 per cent in 2007. The RO was worth £873m to the renewables sector in 2007-8 and along with exemption from the Climate Change Levy will be worth around £1 billion per year by 2010.

4.10 The Energy Act 2008 and the Planning Act 2008 provide further support to renewables deployment. The banding of the RO, introduced in the Energy Act, will target support to encourage a wider variety of renewable technologies, while the 2008 Pre-Budget Report announced that the RO would be extended from 2027 to at least 2037 in order to maintain stability and increase investor confidence in the UK market. The Energy Act also enables the Government to introduce a system of feed-in tariffs for small-scale low carbon electricity generation (up to 5 MW). These should be in place by April 2010 and will encourage an increased uptake of renewables by schools, homeowners, hospitals and communities.

4.11 The Planning Act proposes a faster and fairer system for dealing with planning on nationally significant infrastructure projects for energy, including large-scale onshore renewables of over 50 MW, and 100 MW offshore, with decisions on individual applications taken by the new independent Infrastructure Planning Commission (IPC). The IPC's decisions will primarily be based on National Policy Statements, which will set out the strategic need for the infrastructure; considerations on location; how impacts should be assessed and weighed against benefits; and the mitigation of impacts. The Government has also announced the intention to launch an Office for Renewable Energy Deployment, one of a suite of new low-carbon offices, for business and other stakeholders, aimed at removing barriers to renewables deployment by supporting the development of the renewable energy supply chain.

4.12 In January 2008, the Government launched a feasibility study to investigate whether to support a tidal power scheme in the Severn Estuary and, if so, on what terms. The study is considering the costs, benefits, impacts and strategic case for the generation of Severn tidal power, which could provide roughly 5 per cent of UK electricity. The decision will be taken following public consultation, probably in 2010. In the meantime, the Government will announce in summer 2009 the scope of the Strategic Environmental Assessment and the shortlist of scheme proposals to be studied further, in its response to public consultation on these issues earlier this year. Funding to help develop and assess innovative technology proposals was announced in April 2009.

Nuclear power

4.13 Nuclear power has been part of the UK's energy mix for the past five decades and currently provides around 15 per cent of the electricity generated in the UK. In January 2008, the Government decided that new nuclear should have a role to play in the UK's future energy mix alongside other low-carbon technologies. The CCC concluded that there is a strong economic case for nuclear power in the UK. Nuclear power is low-carbon, dependable and safe, helping the UK respond to the twin challenges of climate change and energy security.

³ A summary of responses to the consultation was published in February 2009, available from www.renewableconsultation.berr.gov.uk.

4.14 It will be for energy companies to fund, develop and build new power stations in the UK. However, nuclear new build will not happen without significant, continued, Government action on several fronts, and the CCC highlighted potential limits to the feasible pace of nuclear deployment due to the timetable for planning consent, licensing and construction, and the need to address concerns on waste storage. The Government has established the Office for Nuclear Development to facilitate new nuclear investment in the UK. The Office is taking action in four main areas to enable new nuclear build: Generic Design Assessment, waste and decommissioning funding arrangements, strategic siting assessment, and justification. These steps are aimed at reducing regulatory and planning risks for investors, and ensuring that owners and operators have robust funding plans for waste management and decommissioning. The Government is committed to enabling nuclear new build as soon as possible, with the first new nuclear power stations expected to start generating electricity from around 2018.

4.15 In parallel, the Government is ensuring that there is a clear strategy and process for interim and long-term waste management. Before development consents for new nuclear power stations are granted, the Government will need to be satisfied that effective arrangements exist or will exist to manage and dispose of the waste they will produce. The White Paper *Managing Radioactive Waste Safely* also sets out a framework for managing higher activity radioactive waste in the long term through geological disposal, coupled with safe and secure interim storage and ongoing research and development to support its optimised implementation.

Carbon capture and storage (CCS)

4.16 Fossil fuels will remain a vital part of the UK's diverse electricity generation mix, as an essential contributor to our security of supply. CCS technology is currently the best option for delivering significant reductions in emissions from fossil fuel power stations - it has the potential to reduce emissions from power stations by up to 90 per cent.

4.17 The UK is a world leader in bringing forward this globally important technology. The Government has been instrumental in driving forward proposals in the EU to provide funding for CCS projects and the UK is one of the first countries in the world to be developing detailed regulatory arrangements for the storage of carbon dioxide, under the Energy Act 2008. The Government is reviewing its strategy for coal power stations and CCS, and will shortly make an announcement following a consultation on carbon capture readiness last year.

Grid access

4.18 New investment in electricity networks will be needed in order to connect new generating plant. Major network reinforcements typically take longer to develop than the new generation that will be connected. It is therefore important to make an early start in identifying and developing network investments. The Electricity Network Strategy Group has provided a vision for the network for 2020 that will provide an important input to the investment programme. Ofgem is working with the transmission companies to create new regulatory incentives that will encourage the companies to anticipate and plan for future need.

4.19 The Government will consult on a new National Planning Statement for Network Infrastructure to demonstrate that there is a need for strategic investments in electricity networks to meet national energy and climate objectives. A new licensing system will be introduced to drive £15 billion worth of investment in an offshore electricity network to harness the UK's offshore wind resource in the coming decades.

Preparing for the longer term

4.20 The CCC projects a substantial increase in electricity generation from the mid-2020s, continuing to 2050, as there is a shift to electric transport and heating. CCC modelling suggests

that electricity generation will need to increase by around 35 per cent by 2050 and generation capacity will need to increase by 70 per cent.

4.21 This possibility underlines the importance of bringing forward a diverse mix of low-carbon electricity generation technologies. Private sector investment in technology innovation in the low-carbon energy sector has in general been low in comparison with other sectors of the economy. As a result new energy technologies are unlikely to be developed and deployed at the pace necessary to avoid dangerous climate change, or at an acceptable cost without additional Government support. There are a number of market failures highlighted by the Stern Review, such as the time it takes for new technologies to reach the market, and new technologies facing significant displacement costs. There is a clear gap in terms of support for large-scale demonstration and pre-commercial deployment to help low-carbon technologies reach the market. In April 2008 the Government launched the Environmental Transformation Fund to address this gap, and to help accelerate technologies toward commercial competitiveness by integrating direct public support (such as capital grants, income support, revolving loans) with the fostering of private sector investment, alongside development of the accompanying policy, regulatory and market framework. It works closely with other organisations funding earlier stage research and development including the Energy Technologies Institute, Technology Strategy Board, and the Research Councils' Energy Programme.

4.22 The Government's strategy to bring forward new technologies, by capping emissions from the large industrial and power sectors and providing support for innovation in low-carbon generation as described above, offers the scope to deliver substantially larger supplies of low-carbon electricity, consistent with the Government's climate change and energy security objectives.

Reducing emissions from energy use in buildings and industry

Residential

4.23 Achieving the UK's 2050 target will require significant reductions in household emissions. The CCC concluded that emissions from households will need to be virtually eliminated by 2050. This will entail major improvements in energy efficiency and decarbonisation of the energy supply through use of renewable electricity and renewable heat sources such as biomass, solar and potentially biogas. Through the Supplier Obligation on energy companies and the Renewable Heat Incentive proposed in the recently published consultation on a Heat and Energy Saving Strategy, the Government has already taken substantial steps towards realising this vision.

4.24 In September, the Government announced an additional £1 billion for the **Home Energy Saving Programme** (HESP), which will deliver a package of measures to help families on middle and modest incomes permanently cut their energy bills. With this boost, HESP totals £6.9 billion over three years, expected to deliver annual carbon savings of around 5 MtCO₂ by 2011, and ensuring that measures such as loft and cavity wall insulation are now available to all households at a discount of 50 per cent.

4.25 The **Carbon Emissions Reduction Target** (CERT), which is part of the HESP and the principal driver of energy efficiency improvements in existing homes, is an obligation on energy suppliers to achieve targets for promoting carbon emissions reductions in the household sector. Since April 2008, when the current scheme started, over 800,000 loft, cavity wall and solid-wall insulation measures have been installed through CERT. The Heat and Energy Saving Strategy consultation is asking whether to extend this scheme to 2012 to align with future carbon budget periods. The previous phases of the obligation, the energy efficiency commitments, ran from April 2002 to 2008 and together saved 3.2 MtCO₂ per year. In addition to saving carbon, the obligation can also save people money on their household energy bills – up to £250 a year

for those households that install insulation. The Government also provides help through the Warm Front Scheme, which offers grants to private sector rented and owner households on certain benefits for heating and insulation measures; since April 2008, 234,000 households have been helped by the scheme.

4.26 Another key element of the HESP is the £350m **Community Energy Savings Programme (CESP)** – due to come into operation in autumn 2009 - which will support around 100 new community based schemes in the most deprived areas of Great Britain, to deliver carbon emission reductions and fuel bill savings to around 90,000 households. This will be done through the installation of heating and energy efficiency measures in a ‘whole house’ approach. The Government believes that a whole house approach is the best way of reducing energy bills for some households and, by focusing on areas of disadvantage, it will also help to take hard-pressed families out of fuel poverty. CESP will be implemented through a new obligation on energy suppliers and electricity generators, and cooperation between suppliers/generators and local authorities, community groups and the third sector will be encouraged by a flexible design to allow for different partnership structures and a variety of participating bodies. The programme is expected to save almost 4 MtCO₂.

4.27 The **Heat and Energy Saving (HES) Strategy** consultation launched on 12 February 2009 proposes new policy options for upgrading existing homes, particularly exploring new ways to fund the up-front capital for more extensive retrofit solutions such as solid wall insulation. Over the next decade households will need to start installing increasingly expensive measures, which involve a more highly skilled labour force and longer installation times. The consultation is also looking at what delivery models will be required to tackle these new challenges.

4.28 The CCC’s report emphasised the importance of tackling behaviour change and other barriers to household investment in energy efficiency, including through measures to stimulate customer demand, and of continued Government support for improved EU level appliance standards. This advice is consistent with the Government’s approach of improving the efficiency of buildings themselves as well as the products and services within them, and providing people with information and advice on how to improve their energy efficiency. In order to help consumers manage their energy demand, the Government intends to mandate the roll out of **smart electricity and gas meters** for all households, with an indicative timetable to deliver this by the end of 2020.

4.29 The Government is actively negotiating in Europe on ambitious minimum and labelling standards for energy-using products. New or revised standards have recently been agreed for televisions, washing machines, fridges, set-top boxes, motors, circulators, domestic, street and office lighting, external power supplies, and stand-by functions used by all products. These standards will reduce energy bills for households and businesses, as well as reducing CO₂ emissions. Further standards for additional energy-using products (such as ICT, air conditioning, and boilers) will be agreed in Europe in the next couple of years. The **Market Transformation Programme** supports the development and implementation of objectives on energy-using products, including voluntary initiatives (such as the EU Code of Conduct on Data Centres) in the EU and UK.

4.30 Around one third of the housing stock that will be in use in 2050 has yet to be built. Reducing emissions from the overall housing stock therefore involves improving the carbon footprint of new homes as well as existing ones. The *Building A Greener Future* policy statement published by the Department for Communities and Local Government in July 2007 announced that all new homes would be zero carbon homes from 2016.⁴ To ensure industry is given a predictable framework within which to effect this major change in how new homes are built,

⁴ www.communities.gov.uk/publications/planningandbuilding/building-a-greener-future

the Department published in December 2008 a consultation on the definition of **zero carbon homes**.⁵ The consultation proposes a hierarchy of measures to be used for reaching the zero carbon homes standard, prioritising in turn energy efficiency, on-site carbon reductions (including connections to heat networks) and other (predominantly off-site) measures for dealing with the remaining emissions.

Non-residential buildings

4.31 The Carbon Reduction Commitment (CRC) and Climate Change Agreements (CCAs) will drive emissions reductions in much of this sector, complemented by facilitated loans to support energy efficiency improvements in business and the public sector. In addition, Budget 2008 announced the ambition for all new non-domestic buildings to be Zero Carbon from 2019, with earlier ambitions for public sector buildings from 2018. The Department for Communities and Local Government will consult later this year on the detailed definition of Zero Carbon for new non-domestic buildings.

4.32 The **Carbon Reduction Commitment (CRC)** is a mandatory emissions trading scheme to reduce emissions and promote energy efficiency within large non-energy intensive commercial and public sector organizations that are not already covered by Climate Change Agreements or the EU Emissions Trading System. The scheme will start in April 2010 and will provide a financial incentive to reduce emissions by putting a price on carbon emissions. The publication of participants' performances will also provide a reputational incentive. These incentives will raise energy efficiency up corporate agendas. Consultation on the draft order to implement the scheme began in March and will end in June 2009.

4.33 The **Climate Change Levy** encourages more efficient use of energy. It is charged on energy supplied to business and the public sector, but not, for example, on renewables or on good quality CHP plants. Fuel supplied for electricity generation and most fuels supplied for transport are also excluded. Independent analysis by Cambridge Econometrics estimated that the levy delivered cumulative savings of more than 60 MtCO₂ to 2005. It is estimated that the levy will reduce annual energy demand in the business and public sector by nearly 15 per cent by 2010.

4.34 Energy-intensive industry is encouraged to improve its energy efficiency through **Climate Change Agreements**, which provide an 80 per cent reduction in the Climate Change Levy in return for improvements in efficiency of energy use. In 2006, participants are estimated to have saved 16.4 MtCO₂ and £1,500m in energy bills. The current scheme ends in 2013 but, subject to State Aid approval, the scheme will continue to 2017. Consultation on the form and content of the new agreements began in March and will end in June 2009.

4.35 The Committee on Climate Change highlighted the need for policy instruments to improve energy efficiency in small and medium enterprises (SMEs) and non energy-intensive firms not covered by the schemes described above. To support these businesses, the Government funds the **Carbon Trust** to run the UK's main energy efficiency advice programme for business, helping organisations of all sizes to improve their energy efficiency. Through Salix, the Government provides interest-free loans for public sector organisations to invest in energy efficiency capital projects.

4.36 These financial incentives and support to reduce emissions are complemented by a number of **fiscal incentives** to enable businesses to make capital investments to improve their energy efficiency in the long term, including interest-free loans for SMEs and the Enhanced Capital Allowance scheme, which provides businesses that invest in designated energy efficient equipment with enhanced tax relief.

⁵ www.communities.gov.uk/publications/planningandbuilding/zerocarbondenition

Renewable and low-carbon heat

4.37 The Government agrees with the CCC's view of the importance of incentivising take up of renewable and low-carbon heat in the residential and commercial sectors, both to help meet the carbon budgets and to contribute towards the UK's share of the EU's renewable energy target. It has taken enabling powers in the Energy Act 2008 to introduce a **Renewable Heat Incentive (RHI)**. A significant increase in a range of renewable heat technologies will be required, with up to 14 per cent of heat demand needing to be met by renewable sources by 2020. The RHI will provide financial support to renewable heat generators across Great Britain at all scales: in households, at community level, or in industry. It has the potential to deliver a step change in the deployment of renewable heat.

4.38 The Government has put in place planning policies to encourage local heating schemes but more needs to be done to address non-financial barriers and to raise the relatively low level of awareness of renewable and low-carbon heat technologies at all levels, including households and some local and regional public sector actors. Taken together, these measures should trigger the interest and investment to make the shift to renewable heat on the scale required. The Government will also ensure that the increase in biomass burning will not jeopardise improvements in local air quality through appropriate technical standards and location of the new technologies.

4.39 Technologies such as **Combined Heat and Power (CHP)** also have considerable potential to reduce carbon emissions cost-effectively. While technical potential is high, developing accurate projections of the likely uptake of CHP is challenging because the risks associated with project development are often project specific. The Government is continuing to work with the CCC to calculate the contribution CHP might make to meeting carbon budgets.

Transport

4.40 The Government agrees with the Committee on Climate Change that meeting long-term emissions reduction targets will require the substantial decarbonisation of the transport system. A well-designed transport strategy must both support economic growth and tackle greenhouse gas emissions – the Government will work towards these goals through incentivising low-carbon behaviour such as walking and cycling, and providing support for technology innovation.

4.41 In December 2008, agreement was reached on the EU new car CO₂ regulation that will, for the first time, set tough binding targets for average CO₂ emissions from new cars from EU manufacturers, so as to meet an overall target of 130 gCO₂/km by 2012. During the negotiations, the UK lobbied strongly for an ambitious long-term target for 2020 to be added to the regulation. The final decision on a target of 95 gCO₂/km by 2020 gives industry a clear signal that further CO₂ reductions will be needed and will encourage manufacturers to continue investing in new, low-carbon technologies. This is one of the most ambitious targets on new car emissions in the world, demonstrating EU leadership in this field.

4.42 The European Commission is also expected to bring forward a proposal for regulating CO₂ emissions from new vans in 2009, and the Government looks forward to engaging actively in the negotiations.

4.43 Since 2001, the UK Vehicle Excise Duty (VED) rates have been based on the carbon dioxide emissions from cars - the first country in Europe to do so. The Government announced further reforms of VED at Budget 2008. These included an increase in the number of VED bands, reflecting changes in the fuel efficiency of vehicles and to provide a greater incentive for drivers to choose a lower-carbon version of car within their preferred class, whether purchasing in the new or second-hand market.

4.44 The Government believes that biofuels can play a key role in meeting EU and domestic greenhouse gas and renewable energy targets. However, policies need to promote production of the best sustainable biofuels. The UK has led the debate in Europe on the need for European biofuel targets to include sustainability criteria that take account of the indirect land use change impacts and help deliver greenhouse gas savings. The UK also secured a review of the sustainability and cost-effectiveness of biofuels, as the evidence develops further. This will help build on the existing UK mechanism (the Renewable Transport Fuels Obligation), which was one of the first systems in the world to establish sustainability reporting for biofuels, and has already provided much experience of their environmental performance. The Government is also funding research into new low-carbon technologies. For example, the Government recently provided £20 million for the launch of a Sustainable Bioenergy Centre, a hub of academic and industrial research partners.

4.45 The UK has the potential to be a world leader in the transition to ultra low-carbon vehicles – accelerating the development of that market in the UK - and to be a significant supplier of high value low-carbon products and green jobs to that market. The Government is therefore putting in a place a comprehensive package of measures including a Low Carbon Vehicles Innovation Platform to provide support for UK based research and development, and £100m funding for new projects including the Technology Strategy Board's ultra low-carbon demonstrator programme. This funding has been further bolstered by a £250m fund – the majority of which will be used to introduce consumer incentives to help reduce the up-front cost of these vehicles, which will be available as cars come to market in 2011. The Government will discuss how this should be delivered with the finance and automotive industries. £20m of this fund will be used to support the development of charging infrastructure in cities and regions, bringing together consortia of cities and companies.

4.46 The Government is also keen to make it easier for people to make sustainable travel choices, and provides information and support services such as the *Act on CO₂* campaign, the National Business Travel Network and Transport Direct journey planner. In addition, Government support for school, workplace and personal travel planning encourages people to consider alternatives to their cars. Funding for public transport alternatives included over £4bn for railways and £2.5bn for bus services in 2007/8, as well as the January 2008 announcement of a huge increase to Cycling England's budget to £140m over three years.

Reducing emissions of greenhouse gases other than CO₂

4.47 Emissions of non-CO₂ greenhouse gases covered by the Kyoto Protocol⁶ accounted for around 15 per cent of the UK's total greenhouse gas emissions in 2007. Emissions of these gases in 2007 were around 49 per cent below base year levels.⁷ (Emissions of methane and nitrous oxide, the main non-CO₂ gases, were 53 per cent and 40 per cent below 1990 levels, respectively, in 2007.) The main sectors responsible for non-CO₂ emissions in the UK are agriculture (47 per cent of UK total non-CO₂ emissions in 2007) and waste (24 per cent of total UK non-CO₂ emissions in 2007).

4.48 Between 1990 and 2007, total non-CO₂ emissions from the **agriculture** sector were reduced by some 21 per cent, partly due to a fall in livestock numbers and partly from reduced use of fertilisers. The Committee on Climate Change has identified further possible abatement potential through measures aimed at reducing emissions from crops and soils, livestock, and through the installation of anaerobic digestion plants converting agriculture waste to renewable energy. Given the early stage of analysis in this sector, the CCC described its results as tentative. Both the Government and the CCC are undertaking further analysis, to test what potential really

⁶ Methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆).

⁷ 1990 is the base year for methane and nitrous oxide; 1995 is the base year for the HFCs, PFCs and SF₆.

exists and to help identify the most cost-effective package of policy instruments to reduce greenhouse gas emissions from the agriculture, forestry and land management sector in England (within the overall UK context).

4.49 Methane emissions from the **waste** sector have been reduced by 58 per cent since 1990, driven by a range of UK and EU policies which reduce use of landfills and increase capture of landfill gases. One such policy is the landfill tax – by increasing the costs of sending waste to landfill, it encourages waste producers and the waste management industry to find more sustainable waste management options. The Committee on Climate Change identified further possible abatement potential, from anaerobic digestion and mechanical biological treatment in particular, but raised a question over the extent to which these emissions reductions could be regarded as realistically achievable. The Government is examining options to further reduce emissions from the waste sector, such as a shift to anaerobic digestion of food waste and the combustion of wood waste with energy recovery.

4.50 In 2007, UK emissions of the **fluorinated gases**⁸ had fallen by 39 per cent since 1995 (the base year). The key policy driver in this area is the EU F-gas Regulation.⁹ The European Commission's review of the legislation, which must be completed by June 2011, will be the main route through which further emissions reductions are delivered.

Management framework

4.51 Ensuring that the carbon budgets are met will require careful monitoring of progress, to ensure that the policies and proposals to be set by the Government are delivering the intended reductions. Equally, working within the budgets further strengthens the need to ensure that the effects of any new policies that could increase emissions are carefully considered, and corresponding reductions found elsewhere if this is necessary to meet the budget. A number of processes are already in place to help ensure that this is done systematically, in particular through the requirement for an assessment of the carbon impact of all new policies within the overall impact assessment.

4.52 The Climate Change Act establishes a robust system of accountability through requiring annual reporting of actual emissions, through scrutiny by the Committee on Climate Change, which will report to Parliament annually on progress against the budgets and long-term targets, and through a requirement on Government to respond. In addition, there will be a need for a strong internal mechanism within Government to ensure that every department has a clear responsibility to play its part. The Government expects to be able to set out more about how this will work alongside the publication of the report on policies and proposals.

Next steps

4.53 The Government sought views in summer 2008 on how to drive up the use of renewable energy in the UK, as part of the overall strategy for tackling climate change and to meet the EU target to source 15 per cent of the UK's energy from renewable sources by 2020. The Government will publish the UK Renewable Energy Strategy in response to this consultation shortly.

4.54 In summer 2008, the Government consulted on how best to ensure that new fossil fuel power stations were constructed in such a way as to ensure it is feasible to retrofit carbon capture technology once the technology is commercially available. The Government is reviewing

⁸ The main UK sources of f-gases are refrigeration, air conditioning, aerosols, MDI and one component foams.

⁹ EC Regulation No 842/2006 on certain fluorinated greenhouse gases.

its strategy for coal power stations and CCS, and will shortly make an announcement following a consultation on carbon capture readiness last year.

4.55 The Government plans to publish a strategy for reducing greenhouse gas emissions from transport in the summer, building on existing measures such as European new car emissions targets. The strategy will identify potential emissions reduction pathways for transport, looking at the full range of options for putting transport onto a less carbon-intensive path, including different types of journeys and transport modes.

4.56 The Government also wants to maximise the economic opportunities for the UK from the move to a low-carbon economy and is currently seeking views from industry and others on how to ensure all of the levers available to Government work together to complement the market in achieving this.¹⁰

4.57 Together these various strategies will inform an energy and climate change strategy setting out the proposals and policies for meeting the carbon budgets, which will be laid before Parliament in the summer. The report will put the Government's carbon reduction strategy in the context of the overall programme for delivering secure and low-carbon energy, transport and housing, in a way which benefits the UK economy into the future.

¹⁰ Available at <http://interactive.berr.gov.uk/lowcarbon>

A Matters to take into account in connection with carbon budgets

A.1 The Government took the following matters, specified in section 10 of the Climate Change Act, into account in coming to the decisions on carbon budgets that are summarised in this document. The sections that follow set out some of the relevant considerations for each of them.

Scientific knowledge about climate change

A.2 The Intergovernmental Panel on Climate Change's (IPCC)¹ Fourth Assessment Report, published in November 2007, concluded the following:

- **Warming of the climate system is unequivocal and the role of human activities in the observed changes is now clearer than ever.** The world is already committed to further warming from past emissions alone;
- The net effect of greenhouse gases and aerosols due to human activities since the pre-industrial era is one of warming (+1.6 Wm⁻²). This is substantially greater than natural warming or cooling effects over the same period, due to solar changes and volcanoes;
- **In the absence of effective international effort, greenhouse gas emissions will continue to grow rapidly over the coming decades.** On current projections, this would most likely result in a global average warming of between 1.8°C and 4.0°C over 1990 levels by 2100, depending on the level of emissions; but warming of up to 6.4°C is possible;
- **Rising temperatures will be accompanied by many other changes to the Earth system, affecting food and water supplies, human health, biodiversity and the economy.** All areas of the world will be affected, although the scale of impacts will vary considerably by region and depend on the existing vulnerability. The extent and severity of negative impacts will rise with temperatures, as will the risk of triggering major effects over which there is no control. Better estimates of the magnitude of these effects are now available;
- **An important new finding is the observed and projected ocean acidification** due to increased carbon dioxide concentration;
- The report identifies **five strong "reasons for concern"** for the international community to take note of. These include the fact of new and stronger evidence about the risks to **specific communities** and systems, higher levels of vulnerability to **extreme weather events**; stronger evidence that the **poorest countries** will be most vulnerable to climate change; that the risks of **large-scale, irreversible events** could hit the world if we continue as we are; and the fact that all these point to the likely **costs to our global economy** from climate change being higher than ever-

¹ www.ipcc.ch

confirming the findings of the Stern Review, that **the costs of inaction and postponing outweigh the costs of action**;

- **A portfolio of adaptation and mitigation measures can reduce the overall risks associated with climate change.** Adaptation is essential to reduce the effects of climatic changes and is the only means to respond to the impacts from historic emissions. But there are limits to what adaptation can deliver. Mitigation is the only way to curb climate change;
- **Global emissions must peak in the next decade or two and then decline to well below current levels by the middle of the century if we are to avoid dangerous climate change.** This is economically and technically feasible, and can be achieved with technologies available now. Postponing action to cut emissions will make it more difficult and costly to reduce emissions in the future, as well as creating higher risks of severe climate change impacts;
- All sectors can contribute to cost-effective emissions reductions, but a **mix of policy instruments will be required** to make the most of this potential; and
- **Our actions in the next decade will have a large impact on opportunities to avoid dangerous changes.** Low-carbon technologies are available, but without global agreements on emissions and the introduction of effective policies to put technologies in place, emissions will increase rapidly. Putting a price on carbon, so that polluters pay the price of their emissions, is critical. Governments must also **invest more in energy RD&D** to deliver technologies that supply the growing demand without emitting greenhouse gases.

Technology relevant to climate change

A.3 Stabilisation of greenhouse gas concentrations in the atmosphere will require the deployment of low-carbon and high-efficiency technologies on a global scale. A range of technologies is already available – to decarbonise power generation, to reduce emissions from energy use in buildings and industry, and to reduce emissions from domestic transport - but most have higher costs than the higher-carbon alternatives currently in use. Others will need to be developed. Ensuring that a range of technologies, which are competitive enough, with a carbon price, are brought forward in a timely and cost-effective way is an urgent priority.

Decarbonisation of power generation

A.4 Renewables will play a significant part in the progressive decarbonisation of power generation in the UK. The UK has the largest potential wind energy resource in Europe and **wind power** is currently one of the most developed and cost-effective renewable energy technologies. While offshore wind is more technologically challenging and more expensive than onshore wind, it has huge potential due to the UK's excellent offshore wind resource, which is stronger and more consistent than the wind resource onshore, leading to higher power outputs per turbine and more hours spent generating each year.

A.5 Due to the direction of the prevailing winds and the size of the Atlantic Ocean, the UK has wave power levels that are among the highest in the world. **Wave energy** has the potential to provide as much renewable energy as the wind industry, but the development of wave technology is currently at the same level as the wind industry was 10 years ago.

A.6 Although **tidal power** is variable, it is reliable and predictable and could potentially make a valuable contribution to the diversity, and therefore security, of the UK's electricity system. The technology required to harness tidal energy is well established; however, tidal power remains expensive and there are relatively few applications worldwide. The large tidal range along the west coasts of England and Wales provides some of the most favourable conditions in

the world for tidal barrages. Tidal stream technology is still in its infancy and there are no projects currently contributing to electricity supplies in the UK; however, development work is still ongoing. At least 30 suitable tidal stream locations have been identified around the UK, and the UK is at the forefront of the development of these technologies.

A.7 There is only one **geothermal power** plant in operation in the UK, in Southampton. There is more limited potential for further geothermal plants in the UK as sites need hot rock relatively near to the surface and which is sufficiently fractured to allow the passage of (heated) water. There are areas of hot rocks in the North Pennines, parts of southern England and Derbyshire.

A.8 Ground-source heat pumps are becoming more popular, with an increasing number of heat pumps installed throughout the UK in homes, commercial buildings and swimming pools. There are currently around 250 ground-source heat pumps installed in the UK every year. Since 1992, around 3,000 heat pumps have been installed in single family homes. Some estimates suggest that there are more than 1,500 large industrial sites in the UK where heat-pump systems could be installed, with an average size of 800 kilowatts of thermal power.

A.9 The costs of **solar** PV systems are falling as the efficiency of solar panels increases and the cost of manufacturing declines due to the introduction of new technologies, such as thin-film solar and dye-based PV. Low yields may keep costs (relatively) high in the UK but the likely costs of alternative technologies in practice in small-scale installations may make PV the best option in certain domestic and off-grid applications.

A.10 **Nuclear power** can help the UK to meet its objectives on climate change and energy security. It is already cost competitive, but its contribution is constrained by the feasible build rate. **Carbon capture and storage (CCS)**, which involves capturing the carbon dioxide emitted from burning fossil fuels, transporting it and storing it safely in secure spaces such as geological formations, including old oil and gas fields and aquifers (natural underground reservoirs) under the seabed, will always be more expensive than conventional fossil fuel generation. But it is a technically feasible solution, with the potential to reduce carbon dioxide emissions from fossil fuel power stations by as much as 90 per cent.

A.11 New generation sources will also have major implications for how the grid is developed and controlled in the longer term. And the expected significant increase in demand from electric vehicles, and possibly from electric heat pumps, will provide both challenges and opportunities for grid management.

Transport

A.12 The main source of abatement potential in **transport** in the near future is from improving the fuel efficiency of vehicles by developing and implementing new vehicle technology. The Government strongly supports and encourages the further development of the EU policy frameworks in this area. To supplement improvements in vehicle efficiency, there are further abatement opportunities from sustainable biofuels and their technological development.

A.13 In the medium term, electrification of transport through battery electric, hybrid or fuel cell vehicles provides opportunities for reducing the carbon emissions from light vehicles in particular.

Energy use in buildings and industry

A.14 Emissions from **energy use in buildings and industry** can be reduced through energy efficiency improvements, measures to reduce energy service demand and avoid waste, and the introduction of new energy supply technologies, as well as the decarbonisation of grid electricity or gas. In the **domestic sector**, there will be a need to decrease demand for energy in existing housing by improving insulation and replacing inefficient boilers as well as measures to help householders change behaviour. Some technologies that help achieve this, such as cavity wall insulation or condensing boilers, are well established and are already being deployed in large

numbers. Others, such as solid wall insulation, are being deployed in much smaller numbers, though this may change as technological and non-technological barriers are addressed. New housing is already relatively energy-efficient, and this is projected to improve further with the move towards zero-carbon homes. Deeper emissions cuts in the domestic sector will probably require a range of low-carbon and renewable technologies.

A.15 The challenge of deploying appropriate technologies to decrease emissions from non-domestic buildings is greater than in the domestic sector, partly due to the diversity of non-domestic uses, but also due to the complexity of heating and ventilation systems, for example in office buildings. As with the domestic sector, the provision of real-time information on energy use and better control of energy using systems are important.

A.16 Emissions cuts that go beyond short-term efficiency improvements will require the introduction of new technologies based on electricity (e.g. heat pumps, storage heating) and the use of sustainable biomass. In industry, there is an even greater variety of different processes that have potential for improvement. In the medium to long term, application of new technologies to reduce emissions (e.g. CCS in cement and steel) may become feasible and economically viable.

Economic and fiscal circumstances

A.17 The world economy was hit by a succession of shocks during 2007 and 2008. Initially, credit conditions tightened across advanced economies. Then, the rise in global commodity prices squeezed real incomes, pushing advanced economies into recession. Finally, the intensification of the credit shock into a global financial crisis delivered a severe blow to an already weakened world economy, precipitating a steep and synchronised global downturn. In 2009, the world economy is forecast to contract in the year as a whole, for the first time in the post-war period. The UK, like other advanced economies, has seen a steep fall in output, with GDP down 1.6 per cent in the final quarter of 2008 and industrial production down 4.5 per cent.

A.18 The Government judges that the Committee on Climate Change headline assessment that the macroeconomic costs of meeting interim carbon budgets will be less than 1 per cent of 2020 GDP is broadly correct.

Social circumstances

A.19 Delivering the carbon budgets will incur costs. Although significant abatement can be achieved through measures that carry a net financial benefit (particularly through improved energy efficiency), meeting the budgets will require policies that carry a net financial cost. Further one-off costs will arise in the short-term as the economy makes the transition to a low-carbon economy.

A.20 The social implications of meeting the carbon budgets will depend on how these costs are distributed; who bears the costs will depend on the policies that are used to deliver carbon budgets, full details of which will be contained in the summer report. In principle, policies can be designed that minimise the overall impact on the levels of fuel poverty, although targeting of the fuel poor is always likely to be approximate. In addition, these efforts may imply extra cost in terms of meeting the primary objective of reducing carbon emissions. Consideration of who bears the cost of the UK's climate change policies will therefore continue to be an important consideration in the development of the package of proposals and policies to meet the carbon budgets.

A.21 The Government's objective is to identify the most cost-effective policies to deliver our climate change goals. Whether a household is in fuel poverty (defined as needing to spend more than 10 per cent of its income on fuel to maintain a satisfactory heating regime) or not is determined by the interaction of a number of factors, but three are particularly important: the energy efficiency of the property, the cost of energy, and household income.

A.22 The Government already has a range of policies in place to mitigate the impact of rising prices, such as the Warm Front Scheme, CERT and Winter Fuel Payment. It will continue to consider the distributional impact of any proposals or policies to ensure that any additional costs do not fall disproportionately on the fuel poor.

A.23 Existing policies to reduce carbon dioxide emissions are already having an impact on energy prices: increasing the share of renewable electricity under the Renewables Obligation (RO) to the levels anticipated in the Renewable Energy Strategy (RES) consultation will further increase electricity prices. The EU ETS also affects UK electricity prices as electricity generators pass on the market value of allowances.

A.24 A combination of Government policies on energy efficiency, rising incomes and a framework that led to falling energy prices resulted in a reduction of fuel poverty numbers in the UK between 1996 and 2006 by around 2¼ million vulnerable households (one that contains children, the elderly or somebody who is disabled). However, rising energy prices in recent years have inevitably had an impact, and 2006 was the second consecutive year in which the number of fuel poor households in the UK rose. In 2006, there were approximately 3½ million households in fuel poverty, an increase of around 1m households since 2005.

A.25 Climate change policies can add to electricity and gas prices where the costs are passed on by energy suppliers to their customers. This impact will increase after 2015 and make achieving statutory targets to eradicate fuel poverty in England by 2016 more challenging. As renewable energy deployment increases and once all applicable households have loft and cavity wall insulation, options such as the installation of solid wall insulation will be needed to reduce the impact of these price rises. There is a wide range of policies and programmes in place that contribute to tackling fuel poverty. This includes Warm Front, CERT and the Decent Homes programme, primarily addressing the energy efficiency of households, and Winter Fuel and Cold Weather Payments, to increase household incomes. Since 2000, £20 billion has been spent on these benefits and programmes. The Government is currently reviewing progress towards its fuel poverty goals, including examining whether existing measures could be made more effective or new policies introduced.

A.26 Other relevant social considerations are social inclusion and personal security in transport policy, looking at the influence of ethnicity, disability, gender and age on transport needs. The Government aims for a transport system that balances the needs of the economy, the environment and society. It will ensure that policies to contribute towards achieving the carbon budgets will be consistent with achieving this overall aim.

Energy policy, and in particular the likely impact of the decision on energy supplies and the carbon and energy intensity of the economy

A.27 The level of emissions reductions required to meet the Government's proposed carbon budgets will require action across all areas of the economy, including the electricity, oil and gas sectors. The overall impact should be to reduce energy usage, reducing the energy intensity of the UK economy.

A.28 The main policy for reducing emissions from electricity generation is the EU Emissions Trading System (EU ETS). The proposed budget levels are consistent with the cap set for the EU ETS and so should not have any additional direct impacts on electricity security of supply.

A.29 The level of the budget set in the non-traded sector should lead to decreased demand for gas and oil as well as making lower carbon energy sources in these sectors, e.g. renewables, relatively more attractive. This will increase the diversity of fuels used for heating and transport which can positively impact energy security so long as reliable supply chains are established.

A.30 The Government's consultation on the Renewable Energy Strategy last June noted the potential challenges from higher levels of intermittent generation and the need to develop secure supplies of biomass. The Government will consider such impacts in developing policy.

Differences in circumstances between England, Wales, Scotland and Northern Ireland

A.31 There are a range of factors that influence the scale and scope of abatement in the different parts of the UK, for example the scope for energy efficiency improvements given the current condition of the housing stock, and the cost-effective opportunities for expanding public transport networks in rural areas.

A.32 The CCC carried out an initial analysis of the differences in circumstances but noted that further work would be required to underpin any national carbon budgets and climate strategies. At this stage the CCC focused on two aspects of carbon budgets in relation to the national authorities of Wales, Scotland and Northern Ireland:

- a high level assessment of potential for reducing emissions in buildings and industry, road transport, power generation and non-CO₂ greenhouse gases and the capacity of the national authorities to unlock this potential;
- wider impacts of carbon budgets, particularly as these relate to competitiveness and fuel poverty, and how these impacts are likely to vary by nation.

A.33 In relation to abatement potential, the Devolved Administrations have an important role to play given the balance of devolved and reserved powers. The Devolved Administrations in Northern Ireland, Scotland and Wales hold a number of key policy levers which influence emissions reduction potential. These include powers over planning for infrastructure investments, promoting energy efficiency and, in Scotland, setting building standards.

A.34 To take a specific example, much of the renewable deployment necessary for achieving UK targets and longer-term goals will be in Scotland, Wales and Northern Ireland. The Devolved Administrations have responsibility for a number of key policy levers for facilitating this. The UK Government and Devolved Administrations will therefore need to work closely together in order to meet shared goals of increasing renewable energy use and meeting our share of the EU 2020 renewable energy target.

A.35 Actions are also being taken more generally. The Climate Change (Scotland) Bill, for example, which was introduced on 4 December 2008, will set a target to reduce all Kyoto greenhouse gas emissions by 80 per cent by 2050 from a 1990 baseline, as well as introducing a credible framework of annual targets to ensure early and sustained action, and strong annual reporting requirements. The Scottish Executive will publish a high level discussion paper setting out an overview of strategic options for achieving the emissions cuts later this year.

A.36 The economic and social impacts of carbon budgets in Northern Ireland, Scotland and Wales are unlikely to be evenly distributed.

A.37 Further consideration will be needed on how these impacts will be distributed and their effects mitigated.

Circumstances at European and international level

A.38 The EU is committed to reducing its overall greenhouse gas emissions to at least 20 per cent below 1990 levels by 2020, and to scale this up to as much as 30 per cent under a new global climate change agreement when other developed countries make comparable efforts. Central to this is a strengthened and expanded EU Emissions Trading System (EU ETS). Emissions from the sectors covered by the system will be cut by 21 per cent by 2020 compared with levels in 2005, and emission reductions will continue at a rate of 1.74 per cent per year beyond 2020.

A.39 Emissions from sectors not included in the EU ETS – such as transport, housing, agriculture and waste – will be cut by 10 per cent from 2005 levels by 2020. In meeting these targets, Member States and companies may use credits, within specified limits, from the Clean

Development (CDM) and Joint Implementation (JI) mechanisms. The EU has also set itself targets to increase the share of renewables in energy use to 20 per cent by 2020 and to save 20 per cent of EU energy consumption by 2020 through increased energy efficiency. The UK's legally binding share of the renewables target is to source 15 per cent of our energy from renewables by 2020.

A.40 At international level, the UN climate change conference in Poznan in December 2008 marked the half way point in a complex negotiation process towards a global agreement on climate change that will conclude at the UN climate change conference in Copenhagen this December. Overall UK/EU objectives for Poznan were met, the level of ambition remains high and the Government is optimistic of securing a global deal for addressing climate change at Copenhagen.

A.41 The proposed levels of the first three carbon budgets, covering the period from 2008 to 2022, are consistent with the UK's share of the overall EU target to reduce greenhouse gas emissions to 20 per cent below 1990 levels by 2020. The split between the traded and non-traded sector portions of the budgets is consistent with the expected respective contributions to the emissions reduction required in the UK from the EU ETS and from other sectors under the EU agreement (though these will be subject to amendment as the detailed implementation of the revised EU ETS is worked through over 2009 to 2011). Furthermore, like the EU targets, the Government will set tighter carbon budgets following a successful outcome of the Copenhagen negotiations, after the Committee on Climate Change has reviewed its recommended budget levels.

Estimated emissions from international aviation and shipping

International shipping

A.42 The Department for Transport has produced the following projections for "the estimated amount of reportable emissions from international shipping" for the first three budget periods:

Table A.1: Estimated amount of reportable emissions from international shipping

Budget Period 2008-2012						Aggregate for 2008-2012
	2008	2009	2010	2011	2012	
	6.2	6.2	6.2	6.2	6.2	31.0
Budget Period 2013-2017						Aggregate for 2013-2017
	2013	2014	2015	2016	2017	
	6.2	6.2	6.2	6.2	6.2	31.0
Budget Period 2018-2022						Aggregate for 2018-2022
	2018	2019	2020	2021	2022	
	6.2	6.2	6.2	6.2	6.2	31.0

A.43 The figures above are those reported to the UNFCCC in line with IPCC guidance. They have been calculated by projecting an average of National Atmospheric Emissions Inventory (NAEI) observations, from the period 1979 to 2006, forward each year to 2022. Projections of CO₂ emissions from international shipping, when employing a fuel sales-based method of allocating emissions, require consideration of the UK oil refining industry capacity to supply residual fuel oil to international maritime users. Both a Department of Trade and Industry review of the UK refining industry and Department for Transport forecasts of UK port traffic suggest that UK refinery capacity growth is unlikely in the near future. Supply of residual fuel oil from UK refiners

to international maritime users is thus likely to continue to evidence flat growth to 2022 and beyond. Therefore CO₂ emissions from international shipping reported by the UK will likely remain flat to 2022.

A.44 There are several limitations in using this method of estimating international shipping emissions to be reported by the UK. Firstly, there are challenges associated with using a fuel sales-based method of allocating CO₂ emissions from international shipping to the UK. The accuracy of this method is reliant upon UK refiners’ best estimates of the final use – UK domestic or UK international navigation – to which maritime bunker fuel is put. Some fuel oil is traded through third parties. So, refiners have only partial knowledge of the final use to which such marine bunker fuel is put. Secondly, as the projections presented above are only based upon the 2006 NAEI fuel sales-based baseline measure of emissions from international shipping and so do not take into account growth in demand for international shipping services to and from the UK. Estimates of emissions in 2022, which account for both forecast growth in UK foreign port traffic to 2022 and global fleet efficiency improvements (see below), suggest that projections based solely on a UK refining industry supply constraint underestimate CO₂ emissions from international shipping to be reported by the UK in 2022 by approximately 1.6 million tonnes.

Table A.2: Estimated amount of reportable emissions from international shipping, accounting for forecast growth in UK foreign port traffic and global fleet efficiency improvements

Budget Period 2008-2012	2008	2009	2010	2011	2012	Aggregate for 2008-2012
	6.9	7.0	7.0	7.1	7.2	35.2
Budget Period 2013-2017	2013	2014	2015	2016	2017	Aggregate for 2013-2017
	7.2	7.3	7.3	7.4	7.5	36.7
Budget Period 2018-2022	2018	2019	2020	2021	2022	Aggregate for 2018-2022
	7.5	7.6	7.7	7.7	7.8	38.3

A.45 These different methodologies demonstrate the difficulties of estimating CO₂ emissions from UK international shipping and projecting them to 2022, and the risk of actual emissions varying significantly from those estimated.

A.46 Exhaust gas emissions remain the primary source of emissions from ships, with CO₂ the dominant greenhouse gas emission. Refrigerant emissions are already regulated by the International Convention for the Prevention of Pollution from Ships (MARPOL), while methane (CH₄) and nitrous oxide (N₂O) are only emitted in relatively small amounts: emissions of CH₄ from international shipping are estimated by the IMO to total 240,000 tonnes per year, while emissions of N₂O are estimated at 30,000 tonnes.

International aviation

A.47 The Department for Transport has produced the following projections for “the estimated amount of reportable emissions from international aviation” for the first three budget periods. For comparison, emissions in 1990 were 15.7 MtCO₂; in 1995, 20.2 MtCO₂ and in 2005, 35.1 MtCO₂.

Table A.3: Estimated amount of reportable emissions from international aviation

Budget Period 2008-2012	2008	2009	2010	2011	2012	Aggregate for budget period 2008-2012
	36.1	36.7	38.4	39.8	40.8	191.8
Budget Period 2013-2017	2013	2014	2015	2016	2017	Aggregate for budget period 2013-2017
	41.7	42.4	43.3	44.1	44.5	216.2
Budget Period 2018-2022	2018	2019	2020	2021	2022	Aggregate for budget period 2018-2022
	45.4	46.1	47.1	47.8	48.0	234.4

A.48 These figures are drawn from the Government’s updated forecasts as published in “UK Air Passenger Demand and CO₂ Forecasts” in January 2009 and represent the latest published forecasts. However, they will need to be revised in due course, as they do not assume a specific Government target in relation to aviation emissions. It assumed fuel efficiency improvements in the form of both improvements to air traffic management and improvements in line with the EU manufacturers’ target for fuel efficiency improvement for new aircraft by 2020, and that these aircraft form a larger share of the fleet over time. The forecasts do not assume any major new technological developments, nor the adoption of sustainable alternative fuels. The industry has suggested these have the potential to offer significant reductions.

A.49 Since the generation of these forecasts, the Government has announced a new target to reduce aviation carbon dioxide emissions in 2050 below 2005 levels, which would mean emissions would be no more than 37.5 MtCO₂ in 2050. The CCC has been asked to advise on this target, considering the scope for emissions reductions, including those from technological improvements, and the best basis for its measurement. The Government will have regard to the CCC’s advice when updating its forecasts of aviation CO₂ emissions. The figures quoted above, therefore, represent only the estimated amount of reportable emissions from international aviation, under current assumptions which are likely to be revised. The forecasts will therefore need to be updated following the CCC’s advice.

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