HM Government

CLIMATE CHANGE: TAKING ACTION

Delivering the Low Carbon Transition Plan
and preparing for a changing climate

Contents

Ministerial Foreword

The Earth's climate is changing. Recognising the challenge this presents to all aspects of our economy and daily activities, all major government departments have published their plans for contributing to reducing greenhouse gas emissions and action required to adapt to the effects of climate change.

Nobody knows for sure what the future will bring. But in terms of our climate, scientists are using increasingly sophisticated computer models to project plausible changes over the coming decades. These models have to cope with some uncertainties; for instance, how societies and economies around the world will alter over the next 50 years and what this could mean for global emissions of greenhouse gases. But our knowledge is constantly improving and the latest models shed a stronger light on our climate system than ever before.

Science moves forward by challenge and debate and this will continue. Some people disagree with the published evidence about climate change, or how it is interpreted, but the vast majority of leading climate scientists agree on the fundamentals – that climate change is happening and that increased greenhouse gas emissions as a result of human activity are now the major cause. We know enough to understand the need for nations, including our own, to take urgent steps to cut the level of greenhouse gas emissions going into the atmosphere, as much and as fast as possible, to avoid the more severe aspects of climate change. We must also prepare for the impacts of climate change, some of which are already inevitable.

The UK is a well established leader of international efforts to tackle the challenges of climate change. We are working with our EU and international partners to build consensus on the scale of action needed to stabilise the climate, to avoid the worst global scenarios, and ultimately to get agreement on a legally binding treaty to deliver those goals. In doing so, and to have real influence, we recognise the importance of demonstrating leadership though real action in the UK, both to reduce our domestic emissions and to identify and plan for the risks our country faces from the changing climate.

The UK Climate Projections 2009 show that past emissions are likely to make summers over 2°C warmer in southern England by the 2040s – more than enough to affect the way we live and work. And unless global emissions are successfully reduced, we could be faced by much more damaging impacts by the 2040s. Climate change will make life in this country tougher – through flooding, droughts and heat-waves, the loss of land to sea level rise and a rise in health problems. But there will also be some opportunities, for example from longer growing seasons, if we are ready to take them.

The Climate Change Act 2008 made Britain the first country in the world to introduce a long-term legally binding framework to tackle climate change with targets in legislation and five year carbon budgets. The Act requires the UK to reduce its greenhouse gas emissions by at least 34% below 1990 levels over the third budget period (2018 to 2022) and by at least 80% by 2050. The *UK Low Carbon Transition Plan*, published last July, set out how we would reduce emissions to meet our carbon budgets and announced that we were sharing the UK carbon budget between government departments to ensure that every part of government is involved in playing its part in reducing emissions.

The Act also introduced a framework for adaptation, including a UK-wide Change Risk Assessment every five years and a National Adaptation Programme from 2012 to address the most pressing climate change impacts.

The Government has more than doubled spending on flood protection since 1997, developed a heat-wave plan in the NHS, and is helping communities affected by coastal erosion. We have changed the rules so that every major public investment needs to be resilient to the climate over its lifetime. But we are not complacent. The country has to continue to act to adapt to changes that are coming and take action to stop these getting worse.

Today all major government departments are publishing their plans to show how they are taking practical action on climate change. This has never been done before by any government in the world.

The plans set out how each main government department will reduce emissions from their own estate and operations and, where applicable, in the sectors where they have an influence. They show how they will monitor progress to achieve reductions and illustrate how departments will cope with the effects of climate change that we can expect. And they set out the work being done to enhance the awareness, capacity and skills available within government to respond effectively to current and future risks.

By producing a series of individual departmental plans, linking each department's primary objectives to the challenges posed by climate change, government will lead by example. Such actions will facilitate a cut in emissions by around 700 million tonnes of carbon dioxide equivalent over the period from 2008 to 2022; encourage collaboration to ensure these goals are met; create employment through the shift to a low carbon, well adapted economy; and protect our country for the future.

These plans are by no means the last word, but they represent a sensible pathway towards a lower carbon society, whilst setting out actions that will help to reduce our vulnerability to current and future climate risks and exploit the opportunities that exist. The plans show how we will continue to work together across government and with the wider public sector to demonstrate how the challenges posed by climate change can become an everyday consideration in all our activities. There is no choice to be made between action to build a low carbon economy and planning for adaptation. We regard both as urgent and essential.

The Rt Hon Hilary Benn MP
Secretary of State for Environment,
Food and Rural Affairs

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

Executive Summary

Avoiding dangerous climate change is one of the greatest challenges facing the world. The UK is committed to playing its part and this document gives an overview of how government departments are taking a more co-ordinated approach to reducing emissions, through delivery of their departmental carbon budgets and embedding consideration of the need to adapt to a changing climate in their planning and decision making.

In June 2009 the latest set of UK Climate Projections (UKCP09) were published, which revised and expanded the available climate change projections from now until the end of the century. They provide the most detailed picture to date of the changes currently considered likely in the UK and show us a future that we must plan to avoid. It is clear from the Projections that the UK is likely to face hotter, drier summers; warmer wetter winters; sea level rise; and an increase in extreme weather events such as heavy rain and heat-waves. The severity of the change will depend on our success in reducing carbon emissions globally.

Some climate change is now inevitable whatever we do, but from the second half of this century the extent of change will depend greatly on how successfully the world cuts its greenhouse gas emissions. The world will also undergo demographic and socio-economic changes, for example population growth, so decisions taken now must take account of these wider trends as well as the impacts of climate change.

Avoiding dangerous climate change cannot be achieved by the UK alone: it is a global challenge which needs to be addressed through comprehensive and effective global action. The UK continues to work within the EU and internationally to secure a legally binding agreement for emissions reduction commitments from developed countries, mitigation actions from developing countries and the provision of financial and technology support that are consistent with an overall limit of two degrees in global warming. The Copenhagen Accord agreed in December 2009 was an important step forward towards reaching that international agreement. It also reinforced the need for strong action on climate change across the world.

The UK has already responded to this call. The Climate Change Act 2008 created a new approach to managing and responding to the challenge of climate change in the UK. It acknowledged and addressed the need to mitigate to avoid dangerous climate change and adapt to take account of the changing climate.

Mitigation

The Climate Change Act set greenhouse gas emission targets in legislation and set up a system of five year carbon budgets. The first three carbon budgets, covering the period 2008 to 2022, were announced at Budget 2009 and set in law in May 2009 following their approval by Parliament. These budgets require a 22% reduction in emissions below 1990 levels in 2008-2012, a 28% reduction in 2013-2017 and a 34% reduction in 2018-2022.

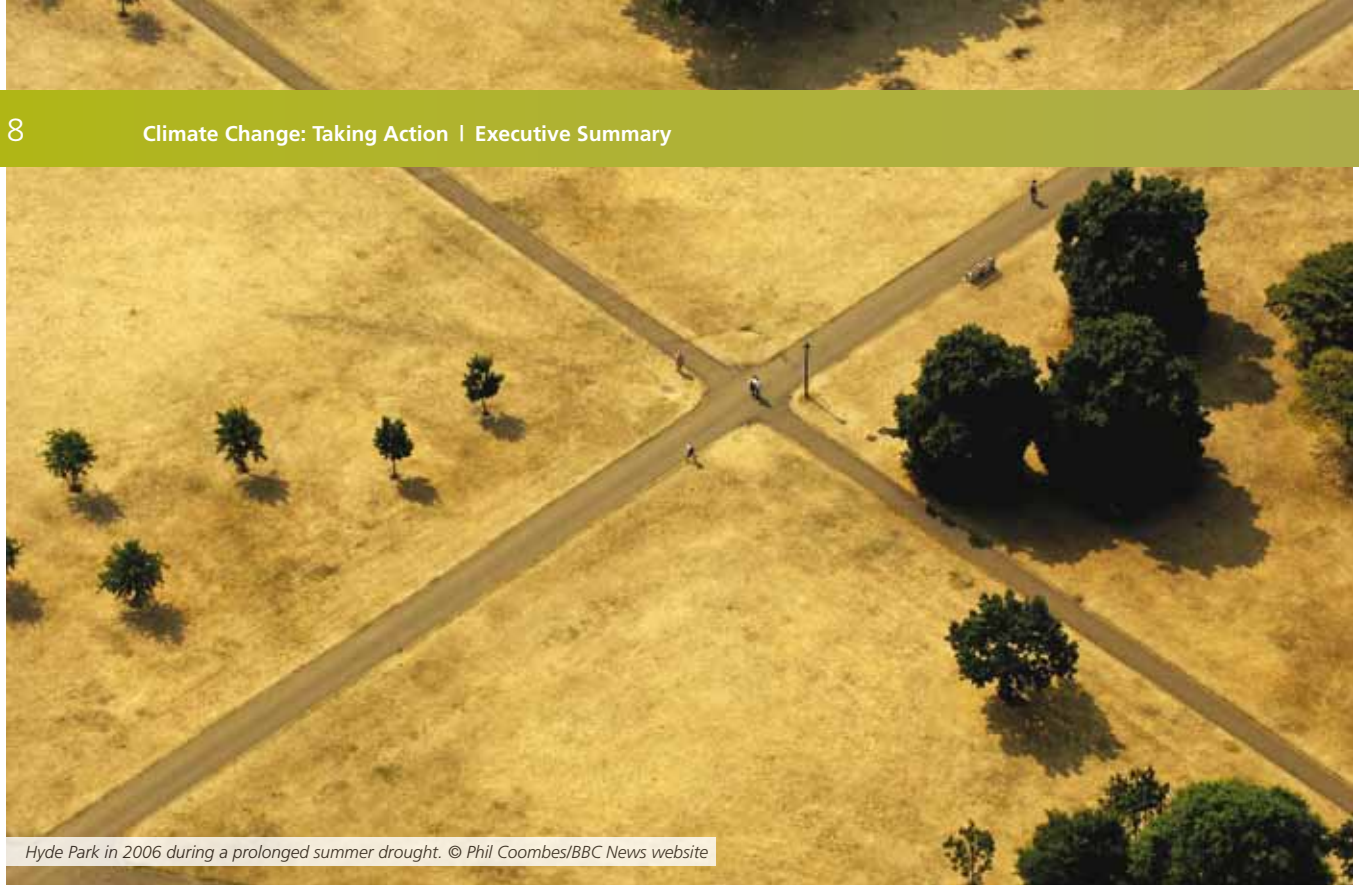
In July 2009, the government published *The UK Low Carbon Transition Plan* (LCTP). The Plan set out how, in order to deliver the necessary level of emissions reductions, government departments were to be given a share of the UK carbon budget which they would have responsibility for. Departments were given a share according to emissions from both their own estate and operations and sectors over which they have levers or influence to reduce emissions. It was recognised that the first budget would be a pilot for this new approach and lessons learnt would be taken into account in its future development. To underpin delivery of the required emissions reductions, the LCTP said that each department would produce a Carbon Reduction Delivery Plan setting out in detail the actions the department will take on its own and in collaboration with other departments to reduce greenhouse gas emissions.

This system of departmental carbon budgets, an international first, is a new and innovative way of delivering emissions reductions across the whole economy through sharing responsibility across government. This new system is designed to reinforce delivery of the UK carbon budgets and to ensure that every part of government is involved.

The Department of Energy and Climate Change (DECC) is the department at the heart of the carbon budget system and plays a central role in establishing and supporting all government departments as the system is developed. Part of this approach is to ensure the right performance management system is established that will create the right incentives to reduce emissions, monitor delivery through indicators and use that evidence base to underpin delivery of departmental carbon budgets.

Adaptation

The Climate Change Act 2008 sets out a framework for dealing with adaptation, recognising that the country needs to be prepared to deal with changes to the climate that we are already starting to face, and wider economic and demographic trends.



Hyde Park in 2006 during a prolonged summer drought. © Phil Coombes/BBC News website

The Climate Change Act 2008 created a new approach to managing and responding to the challenge of climate change in the UK.

Some of the most widely expected adverse impacts in the UK as a result of these changes include: an increased risk of flooding and coastal erosion which could disrupt essential services and businesses; increased pressure on drainage systems; habitat and species loss; summer water shortages and low stream flows; increased subsidence risk in subsidence-prone areas; increasing thermal discomfort in homes and buildings; possible increased disruption to infrastructure affecting the delivery of essential services; transport delays; and health issues due to flooding and to heat in summer. These effects would have a real impact on people's quality of life, the economy and the natural environment.

Central government will continue to play a major role in raising awareness, providing evidence and encouraging action at all levels. Through the Adaptation Reporting Power, introduced under the Climate Change Act 2008, government has required certain public bodies and utilities companies to identify and plan for future climate risks. Government departments will also play their part and demonstrate leadership by example. They will do so by visibly taking steps to identify and address the risks and opportunities presented by climate change: to their individual policy objectives and services, and to the buildings they work in. Departments will continue their work to embed adaptation into corporate processes and decision-making. They will also encourage and support the adaptation progress of the sectors that they sponsor, because this is key to delivering their wider policy objectives.

Action being taken by departments in response to the challenge of climate change

This document is published alongside departmental Carbon Reduction Delivery and Adaptation Plans. It explains:

For mitigation:

- the approach to departmental carbon budgets;
- action that departments are taking to deliver their carbon budgets;
- the process by which current and future progress will be monitored and evaluated; and
- initial thinking on an appropriate governance and performance management framework, which will be put in place to drive delivery.

Central government will continue to play a major role in raising awareness, providing evidence and encouraging action at all levels.

For adaptation, how government is:

- working with the private sector to improve awareness of climate risks, develop new skills, and encourage innovation to create new business opportunities;
- protecting our national infrastructure from climate risks – through the planning system, and by working closely with engineers and the construction industry;
- taking action to safeguard our natural environment, recognising the vital role it plays in offering protection from climate change to homes, infrastructure, livelihoods, and human life;
- making sure that our cities are designed and built, or adapted, to cope with the challenges of pollution and the urban heat island effect;
- improving our heat-wave plans to reduce the expected health impacts of climate change; and
- understanding the risks and opportunities that the UK faces as a result of climate impacts in other countries.

Climate Change: Taking Action

Part 1
Delivering the Low Carbon Transition Plan

The Climate Change Act 2008 created a new approach to managing and responding to the challenge of climate change and reducing greenhouse gas emissions in the UK.

INTRODUCTION

The Act[1] set a clear and credible long term framework for the UK to reduce its greenhouse gas (GHG) emissions including:

- a legal requirement to reduce emissions by at least 80% below 1990 levels by 2050 and by at least 34% in the period 2018-2022;
- compliance with a system of five-year carbon budgets, set up to 15 years in advance, to deliver the emissions reductions required to achieve the 2020 and 2050 targets;
- the setting up of a Committee on Climate Change (CCC) to advise Government on the level of the carbon budgets and how they might be met and report annually on progress.

The first three carbon budgets, covering the period 2008 to 2022, were announced at Budget 2009 and set in law in May 2009 following their approval by Parliament. These budgets require a 22% reduction in emissions below 1990 levels in 2008-2012, a 28% reduction in 2013-2017 and a 34% reduction in 2018-2022.

In July 2009, the Government published the 'UK Low Carbon Transition Plan (LCTP)'[2], alongside a suite of other publications including the 'UK Renewable Energy Strategy'[3], 'Low Carbon Transport: A Greener Future'[4], and the 'Low Carbon Industrial Strategy'.[5] The Transition Plan sets out how the UK will meet its carbon budgets, describing the policies through which emissions will be reduced in all sectors of the economy. The package of policies is expected to save around 700 million tonnes of carbon dioxide equivalent ($MtCO_2e$) over the three budget periods. While the cost of delivering these emission reductions is around £25 to £29 billion, they are substantially lower than the costs which would be incurred were there to be no action.

The LCTP also detailed how, in order to help delivery, each major government department had been given a share of responsibility for the total carbon budget, which it would be accountable for delivering. To underpin the delivery each department committed to producing a Carbon Reduction Delivery Plan (CRDP) setting out in detail the actions the department would take on its own and in collaboration with others to reduce GHG emissions.

1 http://www.decc.gov.uk/en/content/cms/legislation/cc_act_08/cc_act_08.aspx
2 http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx
3 http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/res/res.aspx
4 http://www.dft.gov.uk/pgr/sustainable/carbonreduction/
5 http://www.berr.gov.uk/whatwedo/sectors/lowcarbon/lowcarbonstrategy/page50105.html

This document is published alongside the CRDPs of 18 departments. It details the approach to departmental carbon budgets, the process by which the Government will monitor progress and initial thinking on an appropriate performance management framework to drive delivery.

The international context

Avoiding dangerous climate change is a global challenge which needs to be addressed through effective global action. The UK continues to work within the EU and through our overseas network of climate change attachés internationally to encourage low carbon investment in developed and developing economies and to secure a new legally binding agreement that will contain emissions reduction commitments that are consistent with an overall limit of two degrees in global warming. The Copenhagen Accord, which was agreed by major developed and developing countries in December 2009, is an important step forward. It sets a benchmark to limit global temperature increases to no more than two degrees in global warming, it also sets out:

- that developing as well as developed countries need to take action to reduce their GHG emissions,
- provisions for the international scrutiny and transparency of developed and developing country actions to ensure emissions reductions are being delivered,
- a commitment that countries provide up to US$10 billion (£6.5 billion) a year by 2012 to help developing countries respond to the challenges of climate change, as well as working towards a longer term financing of US$100 billion (£65 billion) a year by 2020.

The Copenhagen Accord reinforced the need for strong domestic action on climate change across the world, as the UK is itself doing through its LCTP. It is essential that the UK continues to take the action needed to become a low carbon economy. The Climate Change Act requires the UK to reduce its emissions by at least 80% by 2050 and the carbon budgets put us on the right trajectory to achieve that.

Taking action domestically also gives credibility to the role we play internationally in pressing for ambitious commitments from others. That does not mean that we now need to set ourselves higher targets and tighter budgets but, as recommended by the CCC, we should take the action needed domestically in order to ensure we are well placed to take on higher targets in the light of an ambitious international agreement.

The LCTP sets out how the Government will meet the budgets and the Government has committed to meet these budgets through domestic action and without the use of international credits in the non-traded sector. The departmental CRDPs set out how we will monitor and report on the progress we are making.

Our vision for the UK

As set out in last year's LCTP, the Government vision is for the UK to become a low carbon economy, cutting emissions whilst maintaining secure energy supplies, maximising economic opportunities and protecting the most vulnerable. To do this requires action in all sectors of the economy.

The challenge of reducing UK GHG emissions to extremely low levels by 2050 is likely to mean that emissions from the **power** sector will need to be reduced to almost zero, whilst ensuring we continue to enjoy secure, sustainable and competitively priced energy. Along with encouraging new nuclear capacity, a significant growth in renewables and clean coal we are reviewing the current electricity market arrangements and identifying the pathways to meeting our 2050 target and what that might mean for our energy supply. Government will also continue to provide support measures to drive investment in the development and deployment of low carbon technologies for energy generation, transmission and supply.

In the **workplaces and jobs** sector we have put in place a variety of measures to incentivise businesses to reduce their demand for energy and to switch to lower carbon technologies. A number of these measures, such as the Climate Change Agreements (CCA) and the CRC Energy Efficiency Scheme (CRC), will encourage

businesses to use energy more efficiently in both industrial processes and non-domestic buildings, but will also encourage the transition to low carbon fuel sources. Other measures, such as Feed in Tariffs (FITs) and Renewable Heat Incentives (RHI), will introduce a further incentive to boost small scale renewable electricity generation. We are also assessing how to address the need for energy efficiency in small and medium sized businesses.

Reducing the energy consumption and emissions from **homes and communities** is one of the most cost effective ways to reduce UK emissions. By 2050 we will need to have made housing near zero in emissions terms to achieve an 80% emissions reduction across the economy. To meet this challenge we are requiring high environmental standards for new homes with all new homes in England to be zero-carbon from 2016. And for existing homes we are significantly increasing the rates of delivery of measures like loft and cavity wall insulation and have committed to insulating all lofts and cavities where practical by 2015. We will also need to deliver large numbers of more expensive technologies such as solid wall insulation and low-carbon or renewable energy micro-generation systems. A number of schemes will help deliver the emissions reductions needed including the Feed in Tariffs (FITs) to be introduced in April 2010 aimed at low-carbon electricity technology for small scale installations, the Renewable Heat Incentive (RHI), starting a year later, which will support renewable heat at all scales, and the Pay As You Save (PAYS) pilots, launched in December 2009 which will enable households to invest in energy efficiency and microgeneration technologies in their homes with reduced upfront cost. The Warm Homes, Greener Homes Strategy sets out a strategic plan of how to achieve the longer term aims leading to 2020, including plans for new obligations on energy companies following on from the Carbon Emissions Reduction Target (CERT) and the Community Energy Saving Programme (CESP).

Our aim in the **transport** sector is to harness the full potential of low carbon technology across all transport modes. On the roads vehicles will be vastly more fuel-efficient by 2020, driven by ambitious EU Regulation. Ultra-low emission vehicles will have made the transition onto the mass-market through Government support for new infrastructure to support electric vehicles and provision of new consumer incentives. Individuals and businesses also need to think about the travel choices they make on a daily basis and so we are promoting walking and cycling as real alternatives and providing public transport that will be accessible, attractive, low carbon and an easy-to-use option for individuals and businesses. From 2012 emissions from aviation will be capped through the EU Emissions Trading System (EU ETS) and we will also continue to negotiate internationally for global agreements to reduce emissions from aviation and shipping.

Our aim for the **agriculture, forestry and land management** sector is to reduce emissions by as much as is technologically possible whilst still protecting an environmentally secure, global food supply. The LCTP identified the scope for 15MtCO_2e savings in England in the third budget period. We are working with the industry who have developed an action plan that identifies areas for emissions reductions. In the **waste** sector we are looking to continue to reduce emissions, building on the significant reductions already achieved. We will be looking in particular at the scope to prevent waste from being created and will be consulting on whether restrictions should be introduced on sending certain types of waste to landfill.

In the **public sector**, our aim is to lead by example, and to ensure that we continue to go further, faster. Even though the public sector is only responsible for a small proportion of overall emissions, its role in demonstrating leadership, bringing through new technologies, and embedding good practice is paramount. The public sector has set itself a stretching 2020 target but has already made good progress. Central government has already achieved a 10% reduction in CO_2 emissions since 1999/00 from its offices and has plans in place to achieve over 17% reductions by 2010/11. The health and education sectors are also grasping the challenge of emissions reductions and will have their own carbon budgets to manage and meet – ensuring that increasingly across the public sector action is being taken to deliver both carbon and financial savings.

The UK carbon budget

The UK carbon budget is a cap on the total quantity of GHG emissions emitted in the UK over a specified time, set in tonnes of carbon dioxide equivalent (CO_2e). Under a system of carbon budgets, every tonne of GHG emitted between now and 2050 and beyond will count. Where emissions rise in one sector, we will have to achieve corresponding falls in another.

Each carbon budget covers a five-year period, with three budgets set at a time. The first three carbon budgets will run from 2008-12, 2013-17 and 2018-22, see Figure 1. The fourth carbon budget, covering the period 2023-2027, must be set in legislation by 30 June 2011. Carbon budgets set the trajectory to our 2020 and 2050 targets and provide a clear, credible, long-term framework for the move to a low-carbon UK economy, and give businesses and individuals the direction and certainty they need to play their part.

DEPARTMENTAL CARBON BUDGETS

Why have departmental carbon budgets?

The UK takes delivery of emissions reductions seriously which is why it has set targets and budgets in legislation in order to ensure they are met. Responsibility for meeting the obligations in the Climate Change Act in practice requires the involvement of all government departments. In recognition of this, the Government agreed that the UK carbon budgets should be shared between departments. By allocating departmental budgets not only is responsibility for managing GHG emissions shared but it should encourage increased collaboration between departments, especially where there is shared responsibility for emissions reductions in specific sectors.

What are departmental carbon budgets and how were they determined?

The Low Carbon Transition Plan (LCTP) set out the creation of a pilot system of departmental carbon budgets, illustrating how the UK carbon budgets can be shared out across Government. It gave departmental carbon budgets to relevant central government departments. In agreeing to these budgets all departments are committing themselves to managing the emissions associated with departmental policies and within the sectors for which they have some responsibility either directly or indirectly. Departments

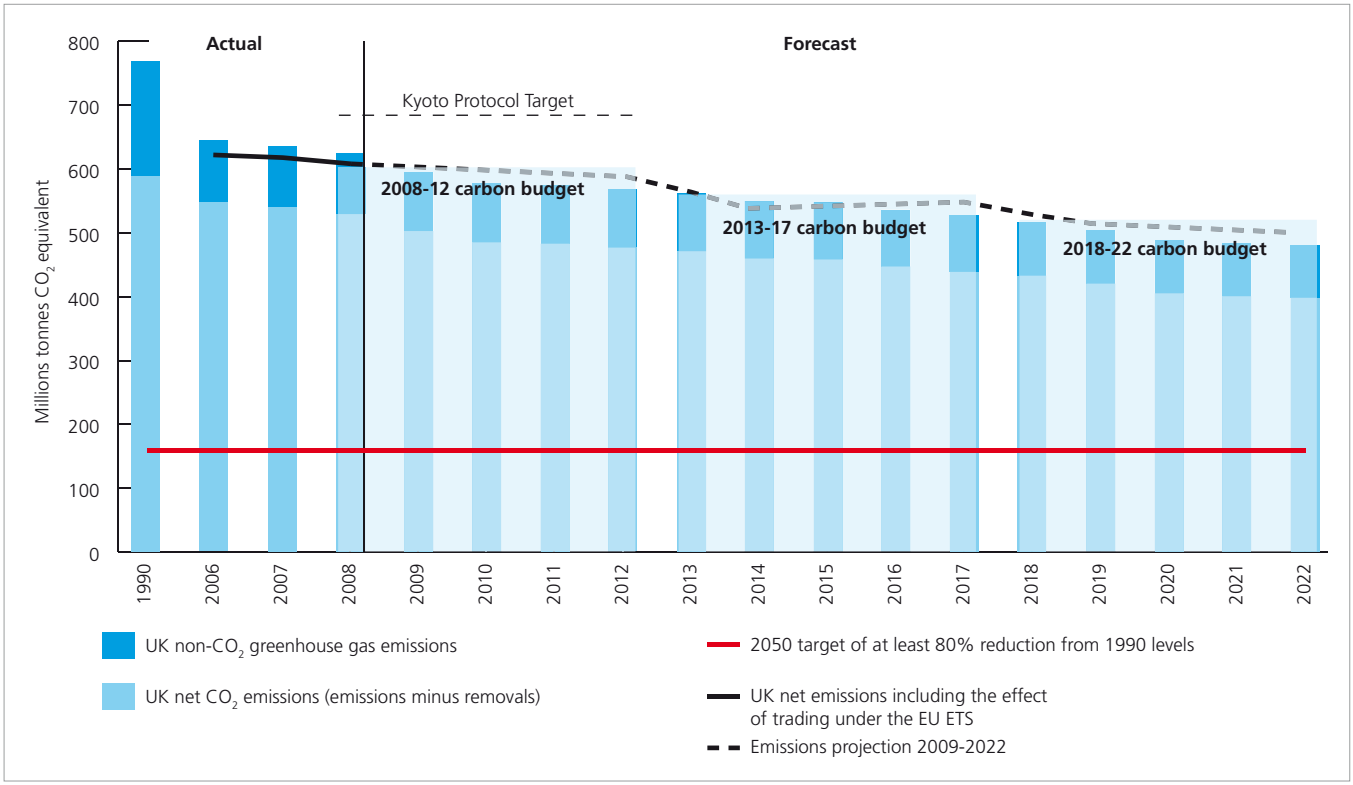


Figure 1: *Greenhouse Gas emissions projections to 2022*
Actual data up to 2008. For 2009 onwards data are based on projections under a central scenario.

will be held responsible for their contribution to the management of total emissions in the UK to ensure that we meet the UK budgets. Departmental carbon budgets will play an important part in our management of emissions across the economy.

The departmental budgets are made up of two elements:

- an allocation to all departments to reflect emissions from the departments' own estate and operations and;
- an allocation to a number of departments to reflect the policies available to them and/or the degree of influence they have in reducing emissions in various sectors of the economy.

The assignment of the *sectoral shares* of a carbon budget to departments cannot be calculated precisely, thus they are indicative rather than having been based on any precise calculation. They have been determined taking account of the following three elements:

Carbon reduction policies: This element was given the greatest weighting and took account of the department's ability to directly influence emissions through their policies. Where possible, the size of the department's share has been based on the projected emission reductions of their policies.

Other relevant policies (indirect): This element includes the effect of the department's own activities or those on sectors which they have ownership within Whitehall. These activities may increase or decrease emissions. Where possible, this is based on published data on emission sources and levels. For example, activities or policies in the tourism sector (sponsored by the Department of Culture, Media and Sports (DCMS)) may generate activity in the transport sector. Data on trips taken for leisure/day-trips was therefore used to inform calculation of a share of the transport sector emissions to DCMS.

Sponsorship and influence: This element was given the lowest weighting and takes account of the broad 'influence' or sponsorship role which departments have over particular sectors, recognising the potential for them to use their broader levers and influence to reduce emissions. This has been done largely on the basis of assigning a small notional percentage share in the absence of specific data to ensure that relevant departments have a representative share of the relevant sector to reflect their role. For example, the Department for Business, Innovation and Skills (BIS) clearly has a role in influencing the business community this is recognised in its budget allocation.

This methodology inevitably results in a broad approximation, rather than an exact measurement, of a department's relative degree of influence over a sector's emissions. The budgets are not designed to demonstrate the precise contribution that a department will make to reducing emissions from a particular sector. However what is important in the creation of departmental carbon budgets is that they bring departments together to work collaboratively by sector to reduce emissions.

The method used to assign the *public sector element of* departmental budgets differs from that for assigning sectoral emissions and is based on the existing Sustainable Operations on the Government Estate (SOGE)[6] framework. The public sector part of the carbon budget is derived from the projection for the SOGE carbon reduction targets, this covers CO_2 emissions from government offices and official car fleets[7]. The Ministry of Defence (MoD)'s share of the public sector is comparatively large as it reports on an expansive and diverse estate. DECC's share is also large since its allocation currently includes the wider public sector i.e. emissions beyond those covered under the SOGE framework (e.g. emissions from hospitals, schools and local authorities). The intention over time is to allocate these wider public sector emissions to their parent department's budget starting with schools, further and higher education and the NHS.

6 Launched by the Prime Minister and the Secretary of State for the Environment, Food and Rural Affairs in June 2006. The SOGE framework comprises targets and mandates that aim to improve energy, water and waste management, and reduce the Government's environmental impact through informed decisions about the procurement of goods and services. It is a mandatory framework that applies to all central government departments and their Executive Agencies.

7 The framework is expected to lead to a 12.5% reduction in carbon emission from offices by 2010/11 (on 1999 levels) and at least a 30% reduction by 2020. Emissions from road vehicles used for Government administrative operations are also included, with targets of a 15% reduction in emissions from vehicles by 2010/11 (on 2005/6 levels) and 30% by 2020.

Having identified each department's share of the UK's emissions the final stage was to set their budgets in line with the downward trajectory of the first three UK carbon budgets.

The LCTP explains that government will use the first budget period as an opportunity to pilot this new approach. Government will conduct a review of the system of departmental carbon budgets ahead of the second budget period, this will include an evaluation of the methodology for allocating budgets. Annexes 1 and 2 detail the departmental carbon budgets for budget periods 1, 2 and 3 (consistent with Annex B of the LCTP) and a summary of the factors taken into consideration in determining each departments allocation respectively.

The diagram below summarises the key steps that were taken to produce the departmental carbon budgets:

This system results in nine departments having a budget based on their share of public sector emissions [Cabinet Office (CO), Foreign and Commonwealth Office (FCO), Department for International Development (DFID), Department for Work and Pensions (DWP), HM Revenue and Customs (HMRC), HM Treasury (HMT), Home Office (HO), Law Officers' Departments (LOD) and Ministry of Justice (MoJ)] and nine departments having a share of both public sector emissions and emissions from specific sectors [Department of Energy and Climate Change (DECC), Communities and Local Government (CLG), Department for Environment, Food and Rural Affairs (Defra), Department for Transport (DfT), Department for Business, Innovation and Skills (BIS), Department for Culture, Media and Sport (DCMS), Department for Children, Schools and Families (DCSF), Department of Health (DH) and Ministry of Defence (MoD)]. This gives this second group of departments the

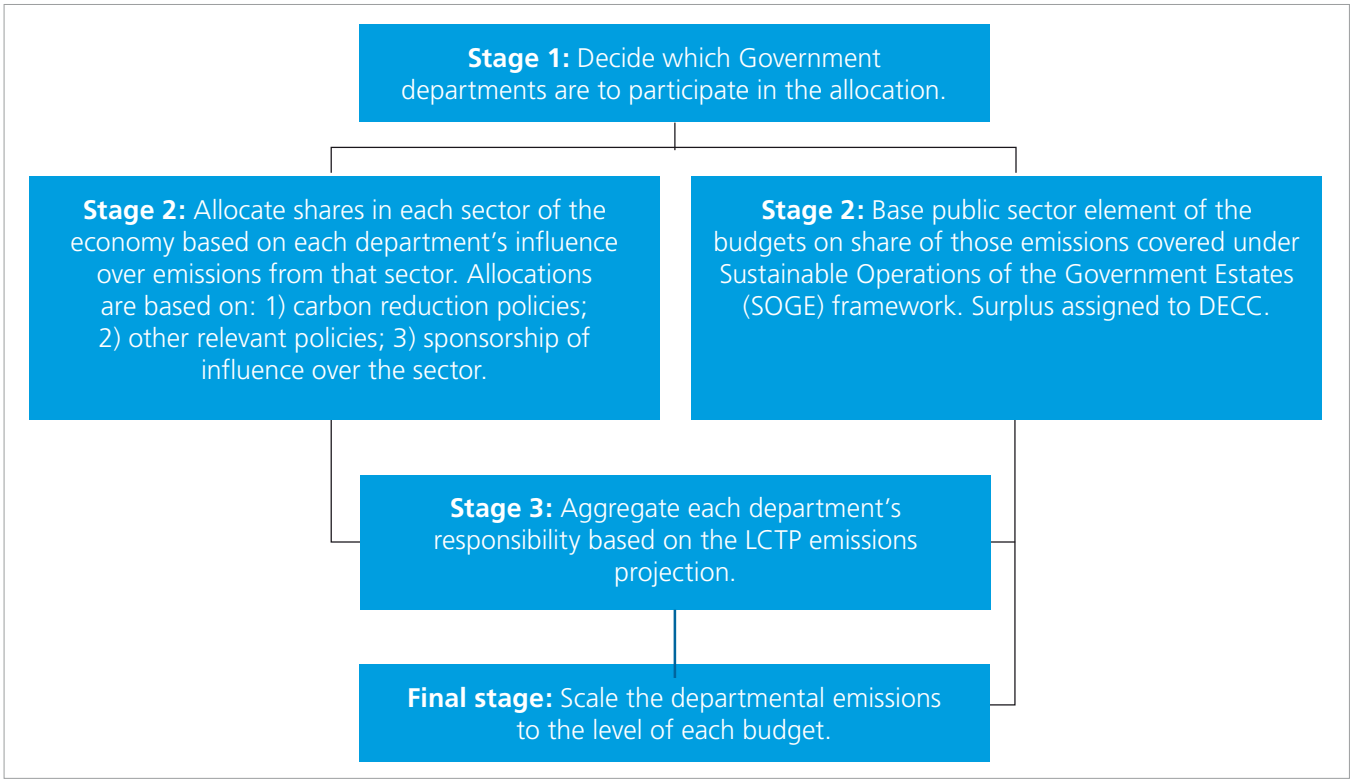


Figure 2: *Methodology used to determine departmental carbon budgets*

responsibility for helping deliver emissions reductions in those sectors of the economy where they have a share and encourages collective action (see figure 3 for details of which departments have a share of which sectoral emissions). For each sector one department has taken on the role of lead department in managing delivery for that sector's emission reductions. This is usually, but not always, the department with the biggest percentage share in that sector. The lead department will work in collaboration with other departments to ensure cost-effective emissions reductions are achieved within a sector and that new opportunities for abatement are identified. This should also encourage discussions on how and where further emissions reductions can be found in order to take account of new policies that may result in increased emissions.

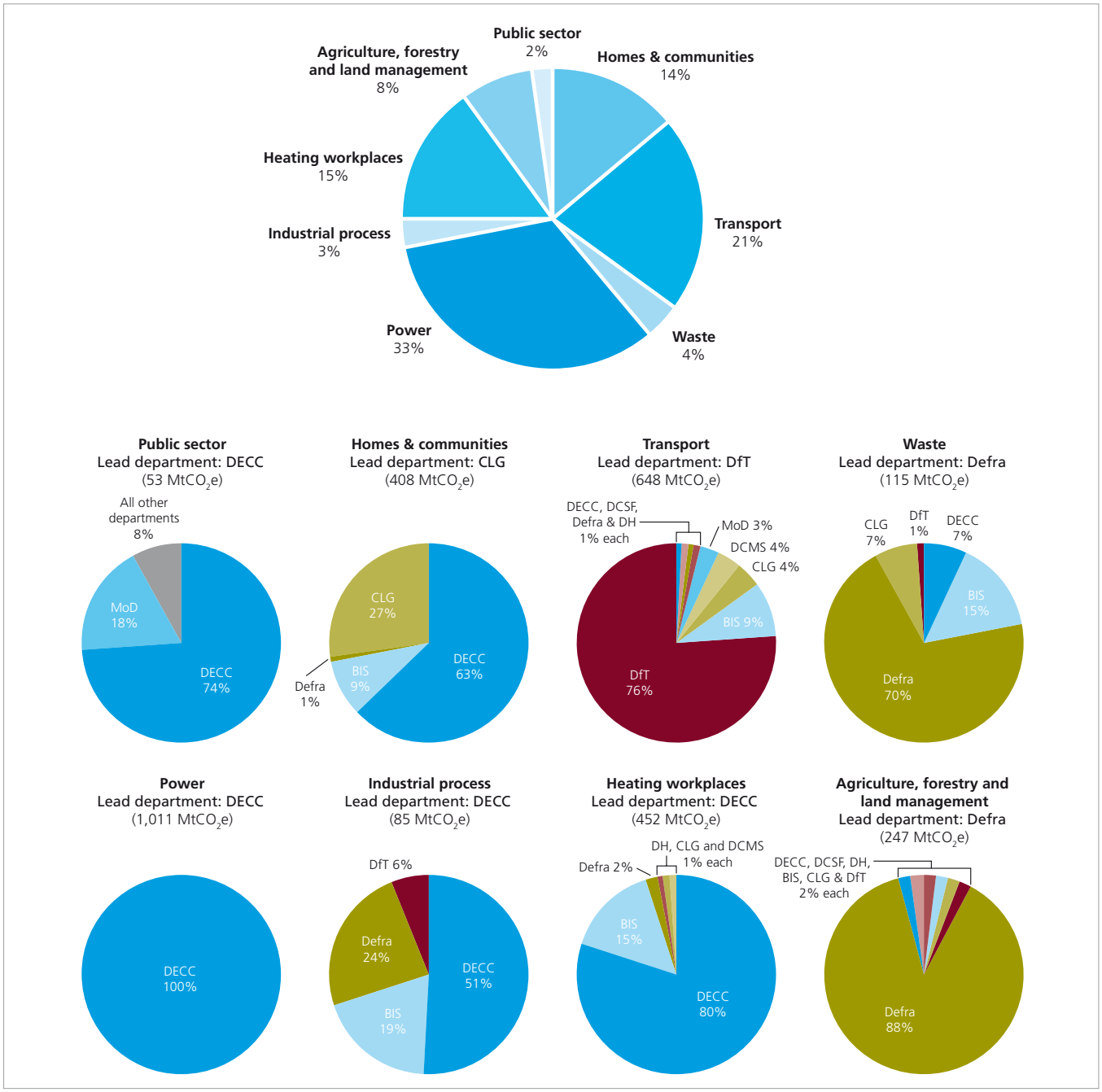


Figure 3: *Departments' share of each sector's emissions and the lead department for each*
The figures for the sector's represent indicative shares for their potential contribution to the first UK carbon budget attributed on the basis of the UK emissions projections.

The public sector

While the Sustainable Operations on the Government Estate (SOGE) framework is mandatory and applies to all central government departments and their executive agencies, only a few executive NDPBs and non-Ministerial departments have been included to date on a voluntarily basis. The scope and coverage of public sector targets in the first carbon budget will be the same as the SOGE target, i.e. all emissions from departments' own operations and office estate, and emissions from administrative transport.

New targets or changes resulting from the review of the SOGE framework will be reflected in departments' carbon budgets from period 2, once individual budgets have been recalculated and assigned to departments.

Currently, the SOGE framework has a number of targets measuring performance towards carbon reduction. As these targets expire, the carbon budget framework will provide the one over-arching target for central Government, to ensure that emissions are reduced in line with the requirements of the Climate Change Act. This framework will be supported by a number of indicators and milestones. The milestones are to reduce emissions from the office estate by 12.5% by 2010/11 and to reduce total emissions (from the estate and business-related transport) by 34% by 2020 on 1999/00 baselines. The full details of the indicators are being announced as part of the SOGE update. Reporting against the milestones will continue to be done annually via the Office of Government Commerce (OGC).

All parts of the public sector will need to take into account the growing evidence base about where and how carbon reductions can be made in the most cost-effective way. A major cross-cutting study into the low carbon potential of the public sector will inform energy efficiency planning and carbon budgeting, and will also help to deliver the commitment that £300m of financial savings will be found from energy efficiency measures across the public sector in 2012/13. As the findings from the study emerge, they may be used to inform future assessments of which parts of the public sector can achieve savings in the most effective way in each carbon budget period, as well as helping to identify actions to ensure the public sector is on track to meet carbon and financial savings.

Incorporation of the wider public sector

The health and education sectors have identified targets for emissions savings by 2020 and details are contained within the DCSF (for schools), BIS (for further and higher education) and DH (for health) CRDPs. The emissions allocations these sectors are responsible for will be added to the departmental carbon budgets for DCSF, BIS and DH in advance of budget period 2 and as part of a wider review of the budgets. For now they will be treated as additional to their carbon budgets in the LCTP.

Carbon Reduction Delivery Plans

The Low Carbon Transition Plan (LCTP) committed each department to publishing a Carbon Reduction Delivery Plan (CRDP) by Spring 2010. These plans underpin delivery of each department's carbon budget. The plans, which are published alongside this document, set out in detail the actions that departments will take, on their own and in collaboration with others, to reduce emissions in the sectors that they can influence as well as from their own estate and use of transport. These plans also include the indicators and milestones against which they will measure progress and ensure that action is taken.

A link to each department's plan can be found at http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/carbon_budgets/departments/departments.aspx.

Most of these plans also include action that they are taking in relation to adapting to the consequences of climate change.

In total there are 18 Delivery Plans. They can be considered in three different categories, with category 1 departments including in their plans an overview of each sector for which they have lead department status.

Category 1
DECC, Defra, DfT, CLG

Are a lead department for one or more sectors

Have shares in other sectors

Budget covers own estate and operations

Category 2
BIS, DCSF, DCMS, DH, MoD

Have shares in one or more sectors of the economy

Budget covers own estate and operations

Category 3
CO, DFID, DWP, FCO, HMRC, HMT, HO, LOD, MoJ

Budget covers own estate and operations only

Delivery Plans, where appropriate, include the following key components:

- Details of the aims of a department and how they relate to climate change and the size and components of their department carbon budget;
- Details of the policies and measures the department is and will be implementing to ensure delivery of emissions reductions and their carbon budgets;
- Indicators and milestones to be used to track and report on progress;
- Governance arrangements and how they will work with other departments, the devolved administrations and other delivery partners.

HMT will play a key role in the departmental carbon budget system, supporting the delivery of carbon budgets in keeping with its role at the centre of government. HMT's CRDP explains that this role involves:

- Helping to make the right policy choices, including formulating tax policy and the role of environmental taxes;
- Supporting efficient delivery across Government: overseeing the PSA (public service agreement) performance management framework and ensuring that departments plan for and allocate sufficient resources to delivery;
- Working towards an international deal to reduce emissions, including through the G20 process;
- Integrating climate change into fiscal and economic policy;
- Providing leadership on delivery of sustainability targets and sustainability reporting across Government through the role of the OGC;
- Reducing its own carbon footprint.

HMT will continue to work closely with all departments in reducing emissions through domestic action in the UK.

Carbon Budgets Review Process

All departments will undertake a major review of their Delivery Plans in the year before the beginning of the subsequent carbon budget period (i.e. in 2012, 2017, 2022, etc). Plans, or parts of plans, will also be updated where there are significant policy developments or amended UK budgets.

In addition, DECC in consultation with other government departments will conduct a review of the departmental carbon budget approach during budget period 1 which will in particular seek to refine the methodology for how budgets are allocated to departments and how they are monitored and managed. The review will consider a number of factors:

- How well departmental budgets help support the effective delivery of the UK's carbon budgets;

- How well the initial allocations reflect the real influence that each department has within each sector of the economy;
- How best to take account of the extent to which responsibility for different sectors of the economy is devolved in Scotland, Wales and Northern Ireland and the role of regional and local government;
- How best to capture the emission reductions that we want to deliver from across each part of the public sector and;
- How departmental carbon budgets should be managed.

DELIVERY OF DEPARTMENTAL BUDGETS

Monitoring of progress: The need for a comprehensive monitoring framework

The Government is putting in place a comprehensive monitoring framework to track progress towards meeting UK carbon budgets. As highlighted by the Committee on Climate Change (CCC) in its first annual report[8] there are a variety of external factors driving emissions which would not necessarily result in sustainable emissions reductions, such as milder winters than expected or an economic downturn. These factors could lead emissions to be lower (or higher) in any given year but they would not contribute to long term changes in emissions and could therefore send the wrong signal about overall progress towards lowering UK emissions. Secondly, some of our policies which will result in emissions reductions have long project lead times and so a mechanism which will track whether intermediate measures are being put in place to deliver the expected reductions is essential.

The Government also needs to ensure that it can identify the causes of changes in emissions, by keeping track of whether policies are being implemented in a timely fashion and delivering the expected emissions reductions. The system of departmental carbon budgets and the monitoring framework that will support them is intended to provide a means of effectively keeping track of progress and identifying the various factors that impact on it. Many of the elements of the CCC framework have been incorporated into this system.

The design of the monitoring framework and the role of the indicator pyramids

The monitoring framework has two main components: (i) a focus on overall UK economy emissions broken down by the different sectors of the economy, and (ii) on the delivery of policies that affect emissions. An essential part of the monitoring framework is understanding how progress in delivering policies affects changes in total sector emissions over time. The sector level indicator pyramid is a key analytical and communication tool which aims to bring these two components together and is a vital constituent of the monitoring framework.

Figure 4 illustrates the structure of the indicator pyramids, which have four tiers representing the links between emissions and policy. The lowest tier of the pyramid, tier 4, presents the relevant policies or policy outcomes,[9] with information on the specific milestones and policy indicators contained in the indicator pyramid tables. These policy indicators are linked to tier 3 of the pyramid by the way in which policies are expected to impact on the drivers of emissions within the pyramid. This may be, for example, through (i) a policy affecting the *level of demand* for energy used in an activity e.g. heating or car travel; or (ii) a policy causing a change in the *energy fuel mix* and therefore the associated amount of GHG emitted when undertaking the activity. Finally there are the changes in the tier 3 drivers which pick up the effects across the range of policies acting on them, and how they impact on the emissions within the sector at tiers 2 and 1.

8 http://www.theccc.org.uk/reports/progress-reports

9 Depending on the sector these are labelled within the pyramid as either the policy itself or the policy outcome – see individual indictor pyramids within sector lead CRDPs for details as to which approach has been chosen and why.

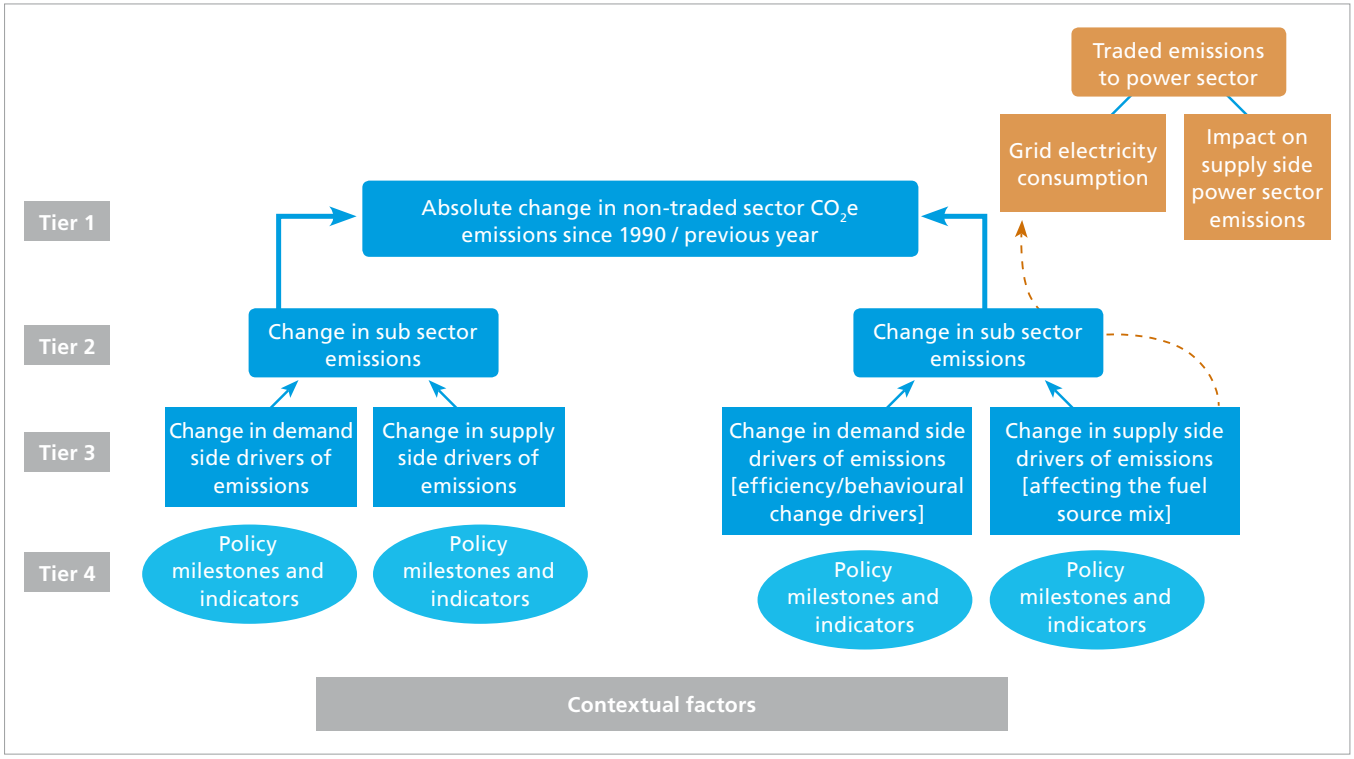


Figure 4: *Model indicator pyramid*

At the tier 4 policy level, the indicator pyramids focus on monitoring those things which the Government is actively doing or is intending to put in place to help reduce GHG emissions in the UK. For this reason, tier 4 policy indicators alone can only give a partial understanding as to the performance of the overall sector emissions. The impact assessment process will be used to identify policies that may decrease or increase a sector's emissions. In addition it will be necessary to track non-policy orientated external factors which can have a significant impact on emissions within any given sector such as weather or economic activity. There are other external factors too, which are more specific to a particular sector, such as the level of home working within the homes and communities sector. These external factors are captured within the indicator pyramids as 'contextual factors' and indicators have been developed for these.

Responsibilities of departments for indicators within the sector indicator pyramids and departmental carbon reduction delivery plans

There are six sector indicator pyramids which together form the overall monitoring framework for capturing progress with respect to the UK carbon budgets. The policies and other activities government departments are undertaking to reduce emissions are attributed to a sector based on where the emissions impacts are expected to occur. All relevant departments that have a share in the emissions from a particular sector, contribute through their policy milestones and indicators to the overall sector indicator pyramid. Figure 5 shows the different types of indicators within the indicator pyramid according to the tier they relate to and the responsibilities of departments for these.

Using the framework to track progress and measure success

The monitoring framework based around the indicator pyramids will build up an historic record across the four tiers. The policy indicators and milestones will provide a record of how policies are delivering and will provide a means of measuring performance against policy milestones. If policies are under-delivering, the framework will reveal potential risks to meeting the UK carbon budgets. It will also collect information on how the key drivers of a sector's emissions have responded over time; this will help to assess the contribution of policies to delivering emissions reductions.

Policy changes in one period will also affect emissions in *future* periods. The UK LCTP set out policies and proposals to meet the first three carbon budgets and a set of projections consistent with the emissions reductions expected to be delivered by them. Regular updates to the projections will enable us to track progress against the LCTP. And as new evidence on savings from existing policies becomes available, and new policies and proposals are announced, the monitoring framework will take account of these. Similarly, expected changes to contextual factors such as growth forecasts, weather patterns and household formation will be logged. In this way, expected performance against the LCTP across all carbon budgets will be monitored, changes to the projections will be explained, and it will be possible to identify whether there is a need for changes to the policy mix or introduction of new measures to ensure the reductions in emissions necessary to meet the UK carbon budgets.

The Low Carbon Transition Plan sets out the contribution that different sectors of the economy can make to help the UK achieve its overall UK carbon budgets, this is depicted in Figure 6. This document explains that departments have been set carbon budgets based on their ability to influence emissions in the different sectors of the economy. Responsibility for emissions reductions for the first budget period has therefore been shared across departments, on the basis of the LCTP projections, to create departmental carbon budgets.

The projections in the LCTP give an indication of the current expected emissions reductions potential from policies in different sectors of the economy to help in achieving the UK carbon budgets. These should not be viewed as sector specific carbon reduction targets – they are a useful tool to illustrate the potential impacts of policies across the sectors. The system of five yearly UK carbon budgets was created to enable flexibility in meeting the budget, so that higher emissions in any one year can be compensated by lower emissions in another over the five year period. In this way changes in expected emissions reductions or actual emissions above what was previously projected in one sector can be offset by additional reductions in another sector; what

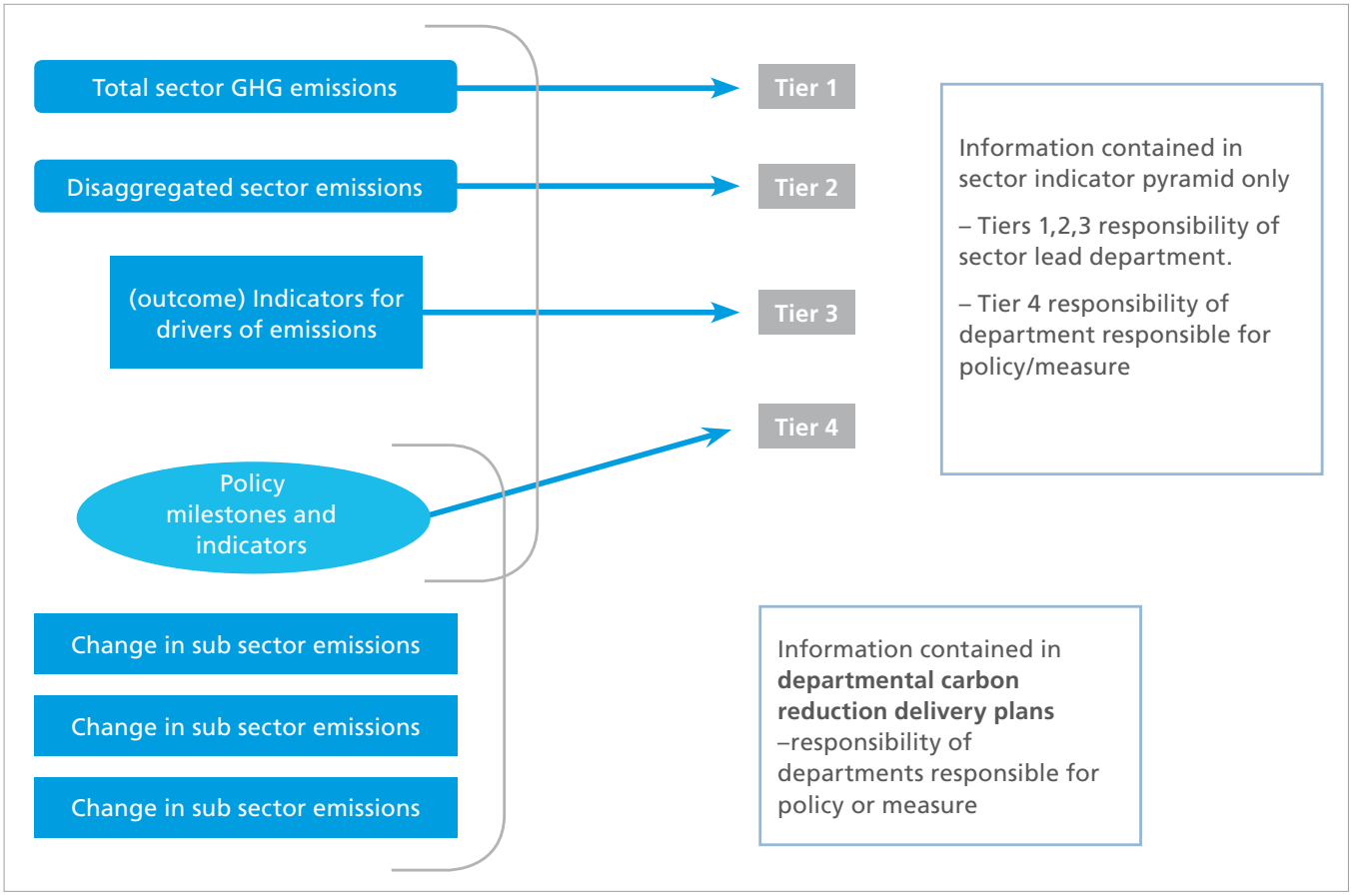


Figure 5: *Departmental and sector level indicators and departmental responsibility*

is important is how the UK is doing across the board. Monitoring progress and updating projections to reflect developments in different sectors is however necessary in order to understand the developments in the overall UK emissions figures and to identify where additional effort to reduce emissions should be concentrated.

Figure 6 presents the central case projections from the LCTP for the first three budget periods. There are, however, uncertainties associated with projections which are subject to change over time owing to changes in the underlying factors that determine them. The monitoring framework will help us track these changes and manage the uncertainties effectively. On the basis of the LCTP central projections the UK is expected to over-achieve its budget but given that projections are subject to revisions we must be vigilant and continue to ensure that overall our policies deliver as planned.

The individual CRDPs of the sector lead departments (DECC, CLG, DfT, Defra) contain more detailed information on how government will track progress within individual sectors. The indicators are not based around trajectories for individual policy measures, although for some policies the Government has set specific goals for their delivery and these are listed. Many of the UK's key policies for reducing emissions within the power sector and industry sectors, for example, are based on market mechanisms (e.g. the EU ETS, CCAs and CRC). This means the Government does not anticipate in advance the uptake of the various types of technology or abatement measures that could be promoted through the incentives these mechanisms provide.

In order to minimise the net cost to society of mitigating climate change, it is important that policies implemented to meet carbon budgets are cost-effective. Policy cost-effectiveness is therefore a key measure of success, which is assessed during policy development using estimates of the cost per tonne of emissions reductions with the Government's benchmark carbon values[10]. It is also important to note that non-monetised impacts (such as the long-term security of energy supplies, increased skills and innovation, other wider environmental and social issues and international leadership on climate change) are not included as part of these estimates and that qualitative assessments of these impacts may justify some policies that appear cost-ineffective in terms of their quantified effects. Cost-effectiveness assessments are updated when new evidence, for example from evaluations or from reappraisals, becomes available.

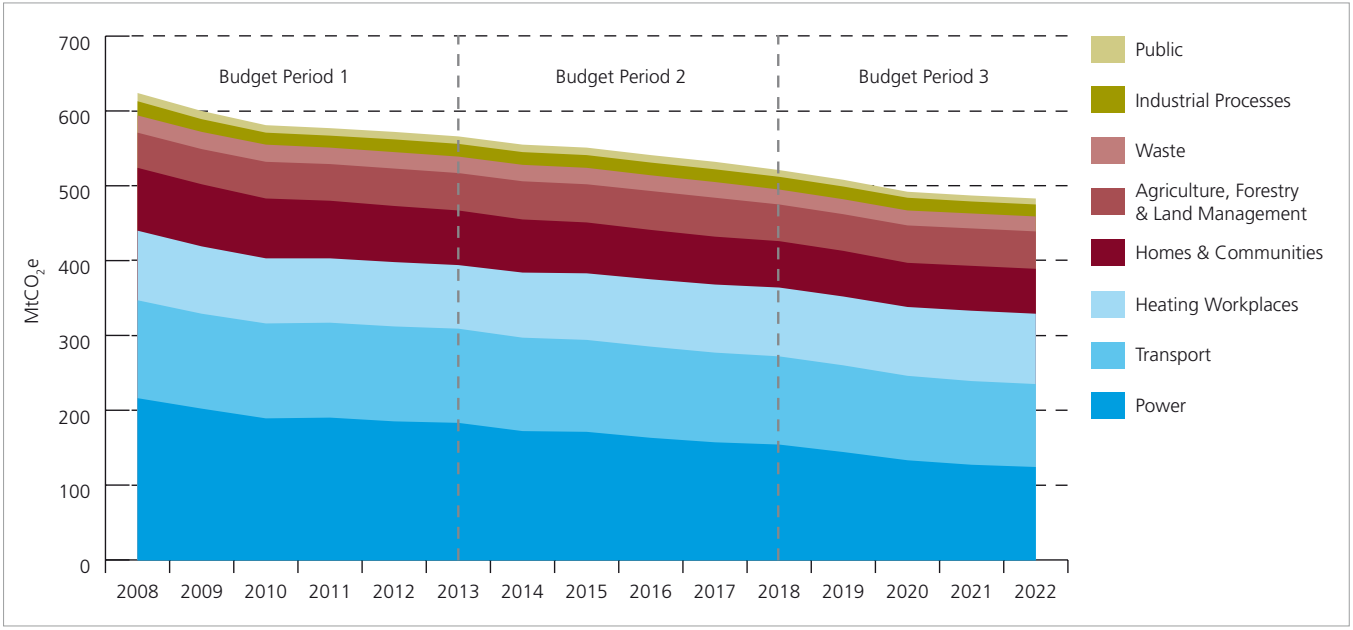


Figure 6: *Low Carbon Transition Plan emissions projections over the first three UK carbon budgets*

10 See Carbon Valuation – http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/valuation/valuation.aspx

Figure 6 continued

	LCTP Projections by sector		
	Budget 1 (2008-2012)	Budget 2 (2013-2017)	Budget 3 (2018-2022)
Power	988	851	686
Heating Workplaces	442	441	463
Industrial Processes	85	83	82
Transport	634	612	565
Homes & Communities	400	342	302
Public	53	49	41
Agriculture, Forestry & Land Management	242	255	247
Waste[11]	112	108	101
Total (LCTP projections excluding EU ETS)	**2,955**	**2,741**	**2,488**
EU ETS^	**-19**	**23**	**-17**
Carbon Budgets	**3,018**	**2,782**	**2,544**
Difference LCTP & Carbon Budgets*	**-44**	**-64**	**-39**

* Negative figures imply overachievement against budgets.
^ To account for the impact of the EU ETS in setting the level of the UK carbon budgets, the EU ETS cap is not factored in to these projections.

The traded and non-traded sectors in UK carbon budgets and the departmental carbon budgets monitoring framework

To achieve the UK's carbon budgets, effort is shared between emissions reductions captured under the EU Emissions Trading System (EU ETS), known as the traded sector, and all other UK emissions, known as the non-traded sector. The EU ETS covers CO_2 emissions from all large electricity producers and heavy industry. The distinction is important when referring to contribution to the UK carbon budget because it is the UK share of the EU ETS traded sector allocation (or cap) that is taken into account for the traded sector in calculating whether the UK has met its budget. In reality the UK's emissions may exceed or undershoot its fixed share of the EU ETS cap and be adjusted through buying or selling carbon units/credits. Whatever the actual level of emissions, they do not affect the contribution of the EU ETS traded sector towards meeting the UK's carbon budget.

This distinction between the traded and non-traded sectors is brought out in the monitoring framework though the indicator pyramids. The focus of the homes and communities, transport, workplaces, agriculture, forestry and land use management and waste sector pyramids are on non-traded emissions only as the emissions from these sectors' electricity use (traded emissions) are accounted for in the power sector. Sector emission allocations to departments from these sectors for the purpose of departmental carbon budgets are

11 Projections for the agriculture and waste sectors are currently highly uncertain due to the models and assumptions on which they are based. Defra is working with others to develop more sophisticated methodologies for measuring emissions from the two sectors, which will in turn improve the robustness of future projections – See Defra's Climate Change Plan for further details.

therefore, for the most part, related to non-traded emissions. The exception to this is the power sector in contrast which contains the emissions from the traded sector owing to electricity generation and DECC takes the full share of these emissions. When monitoring progress on emissions by sector, and the contribution of progress within these sectors to departments' carbon budgets, the focus in all sectors, apart from the power sector, is therefore on the non-traded emissions as it is reductions in these emissions that will contribute to departments meeting their budgets and ultimately the UK carbon budgets.

The monitoring framework measures what is happening to traded power sector[12] emissions through tracking the actual level of emissions in the power sector over time and not just simply the level of the EU ETS cap, see power sector overview below. The Government has set out policies for promoting low carbon generation sources in energy supply as well as demand side measures that will affect demand for different sources of energy and electricity consumption. These demand side measures are influenced by other sectors of the economy but will affect the level of power sector emissions. The impact of the demand side policies on the traded power sector emissions is shown separately within the individual sector pyramids with the link made to the power sector indicator pyramid.[13]

CARBON BUDGET SECTOR INDICATORS

Set out in this section are the key indicators and policy milestones that will be used to track delivery of policies and progress on reducing emissions. It presents for each sector an overview of sources of emissions and how department's policies may contribute to influencing a sector's emissions. The relationships between the policies, their indicators and expected drivers of change in emissions are explained in greater detail in individual departmental plans.

Power

The power sector includes emissions from a number of sources. Some 80% of the sector's emissions are from power stations with the majority of the remaining emissions coming from refineries (7%), oil and gas exploration (8%) and a number of smaller sources.

DECC has been allocated full responsibility for power sector emissions. This reflects the sector's focus (supply-side issues) as well as DECC's ownership of the key policy levers for managing sector emissions through the EU ETS and lead on energy policy. However, other government departments also have an interest in and an influence on this sector. For example, CLG has an important role to play in terms of planning policy, since much of the infrastructure needed to decarbonise electricity supply in the UK needs to be built and is subject to planning controls.

The vast majority of emissions in the power sector fall within the EU ETS and are therefore subject to an EU-wide cap. About 5% of the sector's emissions are from greenhouse gases other than CO_2. These are principally nitrous oxide and methane from power generation, refinery activities, gas leakage and mining and exploration. These gases are not currently subject to the EU ETS. The EU ETS additionally covers CO_2 emissions from heavy industry, which are included in the workplaces and jobs sector.

The existence of a cap guarantees that emission reductions will be achieved in this sector. However, both the LCTP and the first annual report from the Committee on Climate Change (CCC) make it clear that the EU ETS is not enough in itself. This is because other barriers exist to the early development and deployment of innovative energy technologies, including high development costs combined with uncertainty over future cost and revenue streams (including the carbon price), which mean that risks to investors are high. Government intervention is therefore necessary to overcome these barriers.

The table below details the leading indicators being used to track progress in delivering emissions reductions in this sector. There are also important policy and infrastructure development milestones within this sector which are set out in full in the DECC plan. For further details on this sector and full indicator pyramids please see the DECC CRDP.

12 The workplaces sector currently includes the part of heavy industry that is covered under the EU ETS as a result those departments with a share of the workplaces sector contain a small element of traded emissions.

13 See also DECC CRDP on the power sector for more information on the link between departments' demand side policies and the power sector.

POWER SECTOR INDICATORS	
Headline emissions indicators	
Power sector emissions	Absolute level and percentage change in total emissions from the power sector and projected emissions
Electricity generation	Absolute level and percentage change in total emissions from generation of electricity by Major Power Producers (MPP)
Non-electricity related emissions from power sector	Absolute level and percentage change in total emissions from sources other than generation of electricity by MPP covered by the sector (e.g. refineries)
Supporting indicators – drivers of emissions	
Electricity consumption	Total final electricity consumption in the UK
Electricity consumption by sector	Total final electricity consumption broken down by sector (Agriculture forestry and land management , Workplaces, Homes and Communities, Transport, Waste)
Carbon intensity of power generation	Carbon intensity of UK electricity generation (gCO_2/KWH)
Electricity capacity and generation	Total capacity and generation of UK power sector broken down by source (nuclear, gas and coal (with or without Carbon Capture and Storage (CCS) and renewables.)
Policy milestone and policy indicators	
Electricity capacity under construction	Total capacity under construction, broken down by source – nuclear/non CCS coal and gas/CCS coal/renewables
Electricity capacity in planning applications	Total capacity in planning, in application to IPC received and approved broken down by source – nuclear/non CCS coal and gas/CCS coal/renewable
Renewables obligation (RO)	Electricity derived from renewable sources on a RO basis
Combined Heat and Power	Total capacity and generation of Combined Heat and Power plants
Feed in tariffs (FITs)	Indicators under development
Grid	MW of generation connected to onshore and offshore grid
Planning	Total number of power sector applications considered by IPC and where available to TCPA
Planning	Proportion of energy applications to IPC that are not determined within statutory time limit

Workplaces and Jobs

The workplaces and jobs sector covers both the industrial processes and heating workplaces sub-sectors outlined in the LCTP. This sector accounted for 12% of UK GHG emissions in 2008 and covers emissions from the wide array of activities and processes associated with the workplace, primarily use of energy in the course of commercial operations and from industrial processes.

Most of the key policies that have an influence on the workplaces and jobs sector are DECC's responsibility, which is why the department leads on this sector. Examples of these are the EU ETS, CCA, the CRC and the RHI. In addition, BIS has a significant share of emissions for the sector as the department with overall sponsorship for business, while Defra and DfT have shares due to their role with regard to non-CO_2 emissions (in particular methane and fluorinated gases). Other departments have a smaller, notional share, to reflect the impact of their policy levers: CLG (Energy Performance Certificates, Buildings Regulations), DCMS (public events) and DH (impact of the NHS).

The success of these policies in reducing electricity demand will be vital in helping the UK achieve its targets within the power sector. The indicators within this sector have been designed to track how policies are encouraging businesses to make more effective and efficient use of energy in the course of their operations, either directly by reducing energy demand, or through the take up of specific technologies or practices.

The table below details the leading indicators and milestones being used to track progress in delivering emissions reductions in this sector. For further details on this sector and full indicator pyramid please see the DECC CRDP.

WORKPLACES INDICATORS	
Headline emissions indicators	
Reduction in overall workplaces emissions and industrial processes direct (non traded)	Absolute level and percentage change in Workplace and Industrial processes direct emissions (non-traded) and projected emissions
Energy consumption (supporting indicator)	Final non electricity energy consumption
Supporting indicators – drivers of emissions	
Improvement to energy efficiency of non-domestic buildings	Future Indicator: Improvement in average energy efficiency of non-domestic stock, as measured by EPC register (SBEM)
Improvement to energy efficiency of industrial activity processes	Ratio of energy use for process heat and other energy (minus grid electricity) for industry and services
Change in carbon intensity of fuel mix used by firms	Non electricity fossil fuel dependency of Workplaces-; Auto-generation using renewables by Workplaces; Volume and capacity of (*renewable*) CHP; Volume of renewable heat
Level of non CO_2 emitting industrial processes	Production of nitric acid

WORKPLACES INDICATORS continued	
Policy milestone and policy indicators	
Overarching policies CCAs and CRC	
Climate Change Agreements (CCAs)	Total emissions split electricity and other fuels; Total emissions saved split electricity and other fuels
CRC Energy Efficiency Scheme (CRC)	Total annual emissions split electricity and other fuels; Total emissions saved split electricity and other fuels; Incidences of non compliance
Change in the carbon intensity of fuel source – policy delivery indicators	
CHP and District Heating framework	Capacity of CHP (MWe and MWth) (fossil fuel) Capacity of CHP (MWe and MWth) (renewable) CO_2 savings due to decarbonising the heat supply through CHP
Renewable Heat Incentive (RHI)	Milestone information in main indicator table in DECC plan Indicator to be determined
Feed in tariffs (FITs)	Milestone information in main indicator table in DECC plan Indicator to be determined
Improvement in energy efficiency of non-domestic buildings: zero carbon new non-domestic buildings and Building Regulations	
Energy efficiency of new non-domestic buildings	Reduction in emissions from new build, demonstrated through better EPC rating
Energy efficiency of non-domestic stock	Future indicator: improvement in average energy efficiency of non-domestic stock, as measured by EPC ratings
Other cross-cutting policies	
Smart Meters	Indicator to be determined
Sustainable consumption and production (SCP) programme – Energy Using Products	Cumulative UK CO_2 emissions savings expected from EU Implementing Measures (minimum standards plus labelling) introduced to date
Carbon Trust support	Annual tonnes of CO_2 saved by CT projects; Annual cost savings delivered through the implementation processes of Carbon Trust projects; CO_2 saved per £ of DECC funding
Green innovation and Low Carbon Products	Number of Green or Environmentally friendly patents fast tracked; Level of economic activity in the emerging low carbon goods; energy management and building technologies sectors; Expenditure on UK based Chemicals and Mechanical Engineering Research and Development.

Non CO_2 – Indicators for F gas only	
F-gas Certification	All companies have to have full company certification by 4 July 2011
F-gas Guidance	Number of queries received and number of times F-Gas support's e-learning pack for regulators is accessed
International negotiations	Successful contribution to negotiations in Mexico aimed at securing progress towards a global deal on phasing down F-gas production and consumption; Conclusion of EU review of European F-gas regulations
Traded sector indicators	
Indirect (traded sector) emissions from electricity consumption	Change in CO2e emissions from grid electricity used in non EU ETS workplaces
EU ETS heavy industry emissions	Change in verified CO2e emissions from EU ETS firms consumption of energy

Transport

The transport sector emissions encompasses all UK road, rail and domestic aviation and shipping emissions, plus a small quantity of emissions from military aviation and naval shipping. It does not cover international aviation and shipping, though addressing emissions from these sectors through international forums is a key objective. DfT has lead responsibility for reducing emissions in the transport sector, other departments with a part share are: BIS (9%), CLG (4%), DCMS (4%), MoD (3%), DECC (1%), DCSF (1%), DH (1%) and Defra (1%). This sector accounts for 21% of all UK emissions.

DfT's carbon reduction strategy *Low Carbon Transport: A Greener Future*, published in July 2009, detailed actions to reduce transport carbon emissions against three themes:

The first theme, *Supporting a shift to new technologies and cleaner fuels*, includes legislation aimed at increasing use of sustainable biofuels across the transport sector, and regulations aimed at increasing the efficiency of cars and vans. These are supported by a range of other important policies, including consumer incentives and demonstration funding for ultra-low carbon vehicles; a major programme of rail electrification; funding for low carbon buses; and the development of a framework for low-carbon HGV technology.

The second theme, *Promoting lower carbon choices*, includes support for public transport, cycling and walking, and increasing integration between modes; better consumer information and promotion of travel planning; promoting sustainable travel through Sustainable Travel Town demonstrations; and providing support and tools for regional and local partners in reducing carbon emissions.

The final theme, *Using market mechanisms to encourage a shift to lower carbon transport*, includes work to reduce carbon emissions in the aviation and shipping sectors, especially through international negotiation, and the use of fiscal measures to encourage and incentivise environmentally-friendly behaviour.

The measures set out in the strategy mean that we project to save 17.7 million tonnes of CO_2 in 2020 in addition to our existing policies, equating to 85 million tonnes of CO_2 over the third carbon budget period from 2018-2022.

The following table details the leading indicators and milestones being used to track progress in delivering emissions reductions in this sector. For further details on this sector and full indicator pyramid please see the DfT's CRDP.

TRANSPORT INDICATORS	
Headline emissions indicators	
Overall transport emissions	Change in Transport GHG emissions since 1990 and previous year
Transport emissions by mode	Change in GHG emissions since 1990 and previous year (freight, buses, cars & vans, trains, aviation, shipping)
Supporting indicators – drivers of emissions	
Distance travelled	Total distance travelled (vehicle-km) for all passenger and freight modes except aviation and shipping. Number of flights for aviation. Tonne kms for shipping, and for other freight modes
Policy milestone and policy indicators	
Cars and Vans	
New Car CO_2 regulation	Average new car gCO_2/km emissions
New Van CO_2 regulation	Average new van gCO_2/km emissions (Future Indicator)
Complementary measures	Milestones set out in transport CRDP
Eco-driving	Number of drivers trained in smarter driving by the EST
Biofuels policy	Volume of biofuels supplied; target for 10% renewable energy in transport fuel by 2020
Electric Vehicles Support	Number of Electric Vehicles registered; key milestones set out in transport CRDP
Buses	
Green bus fund	Number of low carbon buses (future indicator); First low-carbon buses in service in Summer 2010
Eco-training for bus drivers	Consultation with option for mandatory eco-driving in driver CPC in March 2010
BSOG reform	BSOG replaced with per passenger incentive by 2020
Rail	
Electrification	Electrification in northwest of England 2013-16; Electrification of Great Western Mainline 2016-17
Freight	
Lower carbon HGVs	Framework to encourage uptake of Lower carbon HGVs in place Autumn 2011
Eco-driving	Consultation on increasing the uptake of eco-driving March 2010
Carbon measurement and reporting	Guidance produced summer 2010

TRANSPORT INDICATORS continued	
Aviation and shipping	
International negotiation	Milestones set out in transport CRDP
Sustainable Travel	
Sustainable Travel Towns	Sustainable Travel Town evaluation early 2010
Walking and Cycling	Milestones set out in transport CRDP
Local and Regional Work	Milestones set out in transport CRDP

Homes and Communities

The homes and communities sector covers emissions from all energy use in UK households and accounts for just under a quarter of all UK emissions. Most household emissions come from heating our homes and our water.

The Department for Communities and Local Government (CLG) leads on this sector. However, DECC has a very high level of interest due to the large number of specific policies on which it takes a lead. Broadly speaking, CLG leads on policies such as planning, the building regulations, and standards for new homes whilst DECC leads on policies that deliver carbon savings in the existing stock. Other departments with part shares in this sector are: BIS (9%) and Defra (1%).

DECC, along with other departments which share in responsibility for this sector, has a wide range of policies and measures aimed at reducing energy use in the home. The Government focus is on home insulation and heating in domestic policy, whilst DECC's focus specifically lies on existing housing stock. Roughly 70% of all homes that will exist in 2050 have already been built, which means DECC's policies to retrofit existing housing will account for most of the carbon savings during the first budget periods.

Key policies that drive down emissions in this sector include Carbon Emissions Reduction Target (CERT) (DECC's flagship household scheme, which since 2002 has delivered key insulation measures to some 7 million homes), Community Energy Saving Programme (CESP), and Warm Front (Government's main scheme for tackling fuel poverty). Warm Front has assisted nearly 2.1 million homes in England since 2000. The Renewable Heat Incentive and Feed-in Tariffs are new schemes aimed to deliver microgeneration technologies from small to large scale. Smart meters are also being rolled out with the aim of reaching every household by 2020. Further measures are in place to drive behavioural change through information and education driven by sponsorship of the Energy Savings Trust (EST) and the Act on CO_2 campaign.

These policies all help to deliver emissions reductions in the first budget period, however, looking to future budget periods, the Government has a number of other initiatives in train under its overall *Warm Homes, Greener Homes Strategy*, published on 2nd March. The strategy provides further detail of our targets in this area, and outlines the future delivery and financing landscape that is being put in place to meet the challenge for the period from 2013 to 2020 (i.e. Budget periods 2 and 3). Delivery through the strategy will be focused on three key areas: a continued supplier obligation, financing through a Pay As You Save model and improved standards for rental accommodation.

The table following details the leading indicators and milestones being used to track progress in delivering emissions reductions in this sector. For further details on this sector and full indicator pyramid please see the CLG CRDP.

HOMES AND COMMUNITIES INDICATORS	
Headline emissions indicators	
Overall residential CO_2e emissions	GHG (CO_2e) non-traded (direct) and traded (indirect) emissions from the residential sector
CO_2e emissions from gas used in homes	Change in emissions from domestic gas used in homes
CO_2e emissions from other fossil fuels used in homes	Change in emissions from other fossil fuels
Supporting indicators – drivers of emissions	
Energy efficiency of homes	Average energy efficiency rating of homes in England (SAP rating) – split by tenure, age; Specific energy consumption index (English housing)
Reducing the demand for energy in the home	Overall energy consumption in the UK – domestic: Split by fuel into gas and other fossil fuels, and electricity
Behaviour change	Monitored responses to the 'Survey of Public Attitudes and Behaviours towards the Environment'
Changes in the fuel source	Main fuel type for heating the home (broken down by tenure and age)
Policy milestone and policy indicators	
Insulation measures	All cavities to be filled where feasible by 2015 All lofts to be filled where feasible by 2015
	Cavity walls: number insulated, and uninsulated cavities remaining; Loft insulation: number of lofts that have: no insulation; up to 100mm insulation; 100 to 199mm; and 200mm or more; Solid wall insulation: number of homes with external or internal solid wall insulation installed, and number of uninsulated remaining
Uptake of energy efficient fossil fuel boilers	Number of energy efficient fossil fuel boilers installed (broken down by rating)
Energy efficiency of new homes	All new homes in England to be Zero Carbon from 2016
	Average energy efficiency (SAP) rating of new dwellings in England; Number of homes built to Code for Sustainable Homes level 3, level 4 and levels 5/6
Low Carbon Products	Cumulative UK CO_2 (non-traded) emissions savings expected from EU Implementing Measures (minimum standards plus labelling) introduced to date Level of economic activity in the emerging low carbon goods, energy management and building technology sectors Number of green or environmentally friendly patents fast tracked

HOMES AND COMMUNITIES INDICATORS continued	
Real Time Displays	Smart Meter roll out to 2012 – all homes to have smart meters by 2020
	Number of smart meter installations in homes (future indicator)
Communal heating schemes	Number of district heating schemes built (future indicator)
Renewable heat technologies	Number of installations and cumulative capacity (future indicator)
Informations Tools	Monitor on improvement of Energy Performance Certificates [EPCs] (future indicator)
Industry Capacity and competence	Level of qualifications within house building (Skills); Level of process innovation in Construction (Proxy for green innovation)
Amount of peat extracted	Change in the amount of peat extracted in the UK

Agriculture, forestry and land management (AFLM)

This sector (known as the farming and land sector in the LCTP) is responsible for emissions of about 7.7% of total UK GHG emissions. Most of these emissions are caused by livestock, fertilisers, and fuel use in farming. The remainder are from changes in natural carbon balances caused by the way land is used and managed. There are unique challenges to reducing agricultural emissions:

- There are large scientific uncertainties in estimating agricultural emissions and predicting the effects of changing practices;
- There are physical limits to how far emissions from agriculture can currently be reduced;
- The need to guarantee food security globally and in an environmentally sustainable manner.

Defra is the lead department in this sector with an 88% share because of the proportion of policy levers it is responsible for and its leading role in the sponsorship of the relevant sector interests. DECC, BIS, CLG, DfT, DH and DCSF all have an equal but small role (2% each) in this sector.

In the LCTP, the Government called on the agricultural industry to take action, so that in the third carbon budget period (2018 – 2022) annual agricultural emissions in England would be 3 $MtCO_2e$ lower than they would be if current practices continued. The agricultural industry's task force (National Farmers Union, Country Land and Business Association and the Agricultural Industries Confederation) has produced its Greenhouse Gas Action Plan[14] in order to respond to this challenge. The Plan details, sector by sector, how the wider adoption of resource-efficient farming and land management can reduce emissions and improve competitiveness, without compromising levels of productivity. The Action Plan focuses on using resources more efficiently through:

- Better use of nitrogen in animal and crop nutrition;
- Better management systems for livestock;
- Better use of on-farm energy and fuel.

The Government and the task force will work together, and with other industry stakeholders and delivery bodies, to take the action plan forward by spreading good practice across the industry. A successful voluntary approach makes sense both for the industry and for the

14 http://www.nfuonline.com/Our-work/Environment/Climate-change/GHG-emissions---reducing-agricultural-emissions/

Government. However, achieving the emissions targets required under the Climate Change Act is a legal requirement. If progress is insufficient to provide confidence that the industry-led approach is working, the Government will need to intervene more directly.

Other initiatives being developed by Defra and the other government departments with a share in this sector which will help us understand and drive down emissions in this sector include:

- launching improved low carbon farming advice in 2011;
- commencing a large scale research programme to understand better and measure more accurately emissions;
- implementing the new UK soils strategy;
- consulting on a new peat framework for action.

There are also a number of Government initiatives to support the development of bio-energy. Some of these may cause an increase in agriculture, forestry and land management (AFLM) emissions depending on what the land had been used for previously but these should be outweighed by emission savings elsewhere because of the substitution of fossil fuels with lower-carbon bio-energy.

The table below details the leading indicators and milestones being used to track progress in delivering emissions reductions in this sector. For further details on this sector and full indicator pyramid please see the Defra CRDP.

AGRICULTURE SECTOR INDICATORS	
Headline emissions indicators	
Total AFLM emissions	Change in non traded (direct) and traded (indirect) GHGs from the sector in CO_2 equivalent by gas
Agriculture emissions	Change in non traded (direct) and traded (indirect) GHGs from agriculture in CO_2 equivalent by gas
Forestry emissions	Total net emissions from forestry
LULUC emissions	Change in total net emissions from LULUCF excluding forestry
Supporting indicators – drivers of emissions	
Livestock	Indices of breeding livestock populations
	Intensity of GHG emissions from livestock (Indicator to be determined)
Nutrient use	Soil nitrogen balance for agriculture (Separate balances for livestock and crops under development)
Fuel use	Volume of fuel and electricity used in agriculture
Change in woodland area	Change in woodland area and new woodland – disaggregated for England and UK
Change in sequestration rate of woodland	Total GHG removals through growth and management of post 1919 woodland; disaggregated for England and UK
	CO_2 removals in forest biomass

AGRICULTURE SECTOR INDICATORS continued	
Policy milestone and policy indicators	
Breeding: longevity and fertility	Multiple indicators see CRDP
Animal health: mortality and disease	Multiple indicators see CRDP
Animal feed	Multiple indicators see CRDP
Nutrient management	Proportion of farmers testing nutrient content of soils and manures; Timing of fertiliser applications
Anaerobic digestion (AD)	Proportion of farmers using anaerobic digestion (AD)
Biofuels	Production and consumption of biofuels
Industry Action Plan	March 2010 – publication 2012 – Review (proxy indicators of success to be decided
Policy instruments to tackle GHG emissions from farming	2011 – consultation 2013 – implementation (subject to insufficient progress at time of review of GHG action plan in 2012)
Forest carbon projects	Consultation 2010 Implementation 2011
Amount of peat extracted	Change in the amount of peat extracted in the UK

Waste

In 2008, the direct GHG emissions from waste were 22.7 $MtCO_2e$, accounting for around 4% of total UK emissions. Around 90% of these emissions came from landfills where biodegradable wastes[15] decompose, often over many decades, to release landfill gas (typically 60% methane, 40% CO_2). A proportion of this gas is captured for energy recovery or flaring[16] (currently assumed to be 75%), however, a significant amount does escape into the atmosphere. The rest of the emissions from the waste sector come from the incineration of wastes (although not for energy, these emissions are covered by the power sector), or dealing with waste water from homes and businesses.

Defra is the lead department in this sector with a 70% share because of the proportion of policy levers it is responsible for and its leading role in the sponsorship of the relevant sector interests. Other departments with a share include BIS (15%), DECC (7%), CLG (7%) and DfT (1%).

Emissions from the waste sector have fallen by 57% since 1990 largely as a result of successful implementation of a mix of policy levers which provide strong incentives not to put waste into landfills. Emissions from waste are already projected to fall further to 21.1$MtCO_2e$ by 2020. But in the LCTP, it was estimated that even greater reductions, an additional 1$MtCO_2e$ by 2020, could be achieved through the introduction of additional policy measures.

As with the agriculture, forestry and land management sector, there are significant uncertainties in estimating waste emissions, e.g. in relation to the methane capture rate at landfill sites. Research projects have been put in place to try to understand these complex interactions better.

15 Organic materials, such as food, wood, paper, green waste, and textiles, which decay through the action of bacteria.
16 Methane flaring: the direct conversion of methane to carbon dioxide through burning, but without energy recovery.

The Government's approach to managing waste is based on the 'waste hierarchy' (Figure 7). Options towards the top of the hierarchy tend to be more sustainable ways of managing waste than those lower down, e.g. preventing waste from being created in the first place is usually more resource and carbon efficient than recycling it or disposing of it in another way.

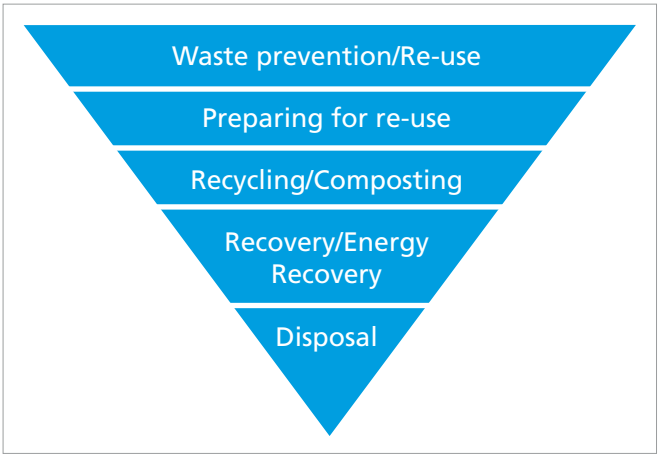


Figure 7: *The waste hierarchy*

Actions within the sector aiming to reduce emissions focus on three main areas:

- Reducing the amount of biodegradable waste produced especially food and wood waste;
- Diverting waste away from landfill by making the alternatives easier and more economic (supporting recycling and composting, supporting energy from waste, helping people to chose the right management options, etc) and ensuring that landfill becomes the choice of last resort;
- Capturing more methane emissions from landfill by supporting and promoting industry best practice.

The table below details the leading indicators and milestones being used to track progress in delivering emissions reductions in this sector. For further details on this sector and full indicator pyramid please see the Defra CRDP.

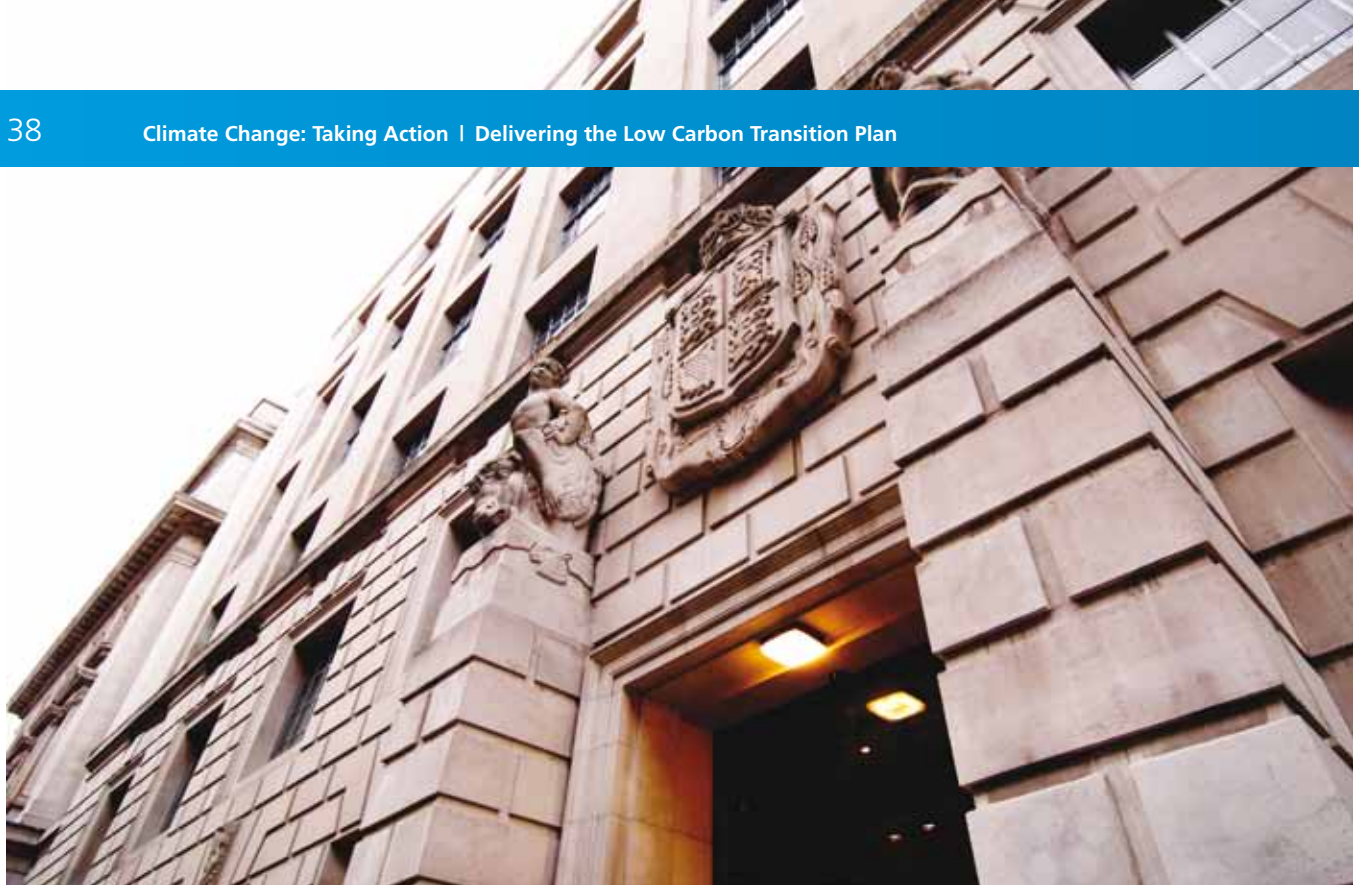
WASTE SECTOR INDICATORS	
Headline emissions indicators	
Total UK waste sector emissions	Change in non-traded (direct) waste and traded (indirect) sector CO_2e emissions since 1990/ previous year
Total non-traded emissions produced by the incineration of waste in the UK	Change in incineration emissions since 1990/ previous year
Total non-traded emissions produced by landfill sites in the UK	Change in landfill emissions since 1990/ previous year
Total non-traded emissions produced by the treatment of waste water in the UK	Change in waste water emissions since 1990/ previous year
Supporting indicators – drivers of emissions	
Change in volume of sewage sludge	Change in total wastewater sludge (thousands of tonnes of dried solids)
Carbon intensity of treatment process	Percentage of sewage sludge going to recycling
Total volume of incinerated waste in the UK	Change in volume of incinerated waste
Change in volume of biodegradable waste landfilled	Change in total biodegradable municipal waste sent to landfill in the UK
	Change in total biodegradable Commercial & Industrial waste sent to landfill

WASTE SECTOR INDICATORS continued	
Change in methane capture rate	National average percentage of total methane emissions released from landfill sites that is captured for energy recovery or flaring
Policy milestone and policy indicators	
Recycling levels	UK household green recycling (composting) rate; UK household dry recycling rate; Commercial and Industrial recycling rate.
Market incentives for EfW (FITs, ROCs,RHI, renewable fuels -RTFO)	Launch of FITs in April 2010; Uptake indicator of FIT in Great Britain
	Number of Renewables Obligation Certificates (ROC) claimed for EfW & AD in the UK
	Launch of RHI in April 2011; Uptake indicator of RHI in Great Britain
	The number of RTFO certificates issued for waste in the UK
Industry voluntary agreements	Measure of success of the following agreements – precise indicators to be determined: • Courtauld Commitment • Strategy for Sustainable Construction • Home Improvement Sector Commitment
Landfill audits and best practice	Number of technical reviews of landfill gas completed at operational landfill sites in England and Wales
	Additional amount of landfill gas going through engine or flared at operational landfill sites as a result of completion of the technical reviews/audits
Capacity of EfW facilities	The percentage of facilities for recycling and energy recovery as a percentage total of waste facilities granted planning permission (England)
	Existing and projected (by 2020) capacity of Energy from Waste facilities (including AD) in England

The public sector

Under the carbon budgets framework, the public sector is considered a sector in its own right on account of its scale and influence, as well as the strategic importance of understanding how Government and the rest of the public sector are reducing emissions. The Government can also play a key role in encouraging low carbon jobs and supporting new technologies though pioneering use of these skills and products across the public sector estate.

The public sector employs 6 million people, owns a tenth of all UK land and has significant purchasing power – around £150 billion per year. As a whole, the sector is directly responsible for around 3% of the UK's emissions, with £3.2 billion spent on electricity and gas last year.



Each main government department has been set a departmental carbon budget which includes an allocation for its own operational emissions. On account of its policy levers DECC currently has overall responsibility for the wider public sector's progress towards meeting its budgets.

Currently, the SOGE framework has a number of targets measuring performance against carbon reduction. As these targets expire, the carbon budget framework will provide the one over-arching target for central government, to ensure that emissions are reduced in line with the requirements of the Climate Change Act. This framework will be supported by a number of indicators and milestones. The milestones are to reduce emissions from the office estate by 12.5% by 2010/11 and to reduce total emissions (from the estate and business-related transport) by 34% by 2020 on 1999/00 baselines. The full details of the indicators will be announced as part of the SOGE update.

All parts of the public sector will need to take into account the growing evidence base about where and how carbon reductions can be made in the most cost-effective way. A joint HM Treasury/DECC review of the low carbon potential of the public sector will inform energy efficiency planning and carbon budgeting, and will also help to deliver the commitment that £300m of financial savings will be found from energy efficiency measures across the public sector in 2012/13. As the findings from the study emerge, they may be used to inform future assessments of which parts of the public sector can achieve savings in the most effective way in each carbon budget period. For further details on this sector please see the DECC CRDP.

PERFORMANCE MANAGEMENT

Governance

The Department of Energy and Climate Change has overall responsibility for Climate Change policy in the UK, however the UK's success in meeting its legally binding emissions reductions is the responsibility of all of Government. The governance structures in place (Figure 8) therefore reflect this shared responsibility, reinforced by the introduction of departmental carbon budgets. To ensure delivery:

- each department has appointed a Senior Responsible Owner (SRO) for its carbon budget who provides oversight for successful delivery of their carbon budget, supported by an individual or team, depending on the size and scope of the departments carbon budget;
- sector working groups consider the management of emissions at a sectoral level. These groups are led by the lead department and include members from other government departments with a part share;
- across Whitehall the management of departmental carbon budgets is brought together through the cross-Whitehall carbon budgets working group where cross cutting issues can be discussed and progress reviewed. It is also brought together through the cross-Whitehall Delivery And Strategy

High-level (DASH) board and the National Programme Board (NPB). The DASH board focus is on high level strategic risks often of a cross-cutting nature with the more specific delivery risks managed by the NPB;

- DECC supports all of these cross-Whitehall activities through its carbon budget management team which provides support and advice to all Departments.

Delivering emissions reductions in the UK is not the sole responsibility of departments and Whitehall officials but also depends on the actions of others including businesses and individuals. In most cases emissions reductions are achieved though the action and influence of delivery partners e.g. agencies, regional and local government and the devolved administrations to name a few. Each department's delivery plan sets out how the department will work with others. In particular the role of the devolved administrations in delivering emissions reductions by sector are detailed in the sector overviews contained in the CRDPs of the lead departments (DECC, Defra, CLG and DfT).

Building capacity across Government

Each department will be responsible for ensuring the right mechanisms are in place to deliver the policies and measures required to meet its carbon budget. A key means in achieving this is the building of capacity and knowledge across the department coupled with a demonstration of strong leadership from the top down. DECC is working with departments to consider what mechanisms will work best.

Reporting

Departments will report progress in meeting their carbon budgets:

- as part of the Government's response to the Committee on Climate Change' annual report in October each year;
- for the public sector the existing mechanisms under SOGE will be the means by which progress in meeting the public sector element of departmental carbon budgets will be reported. Reporting on progress will be made annually in the OGC's December report.

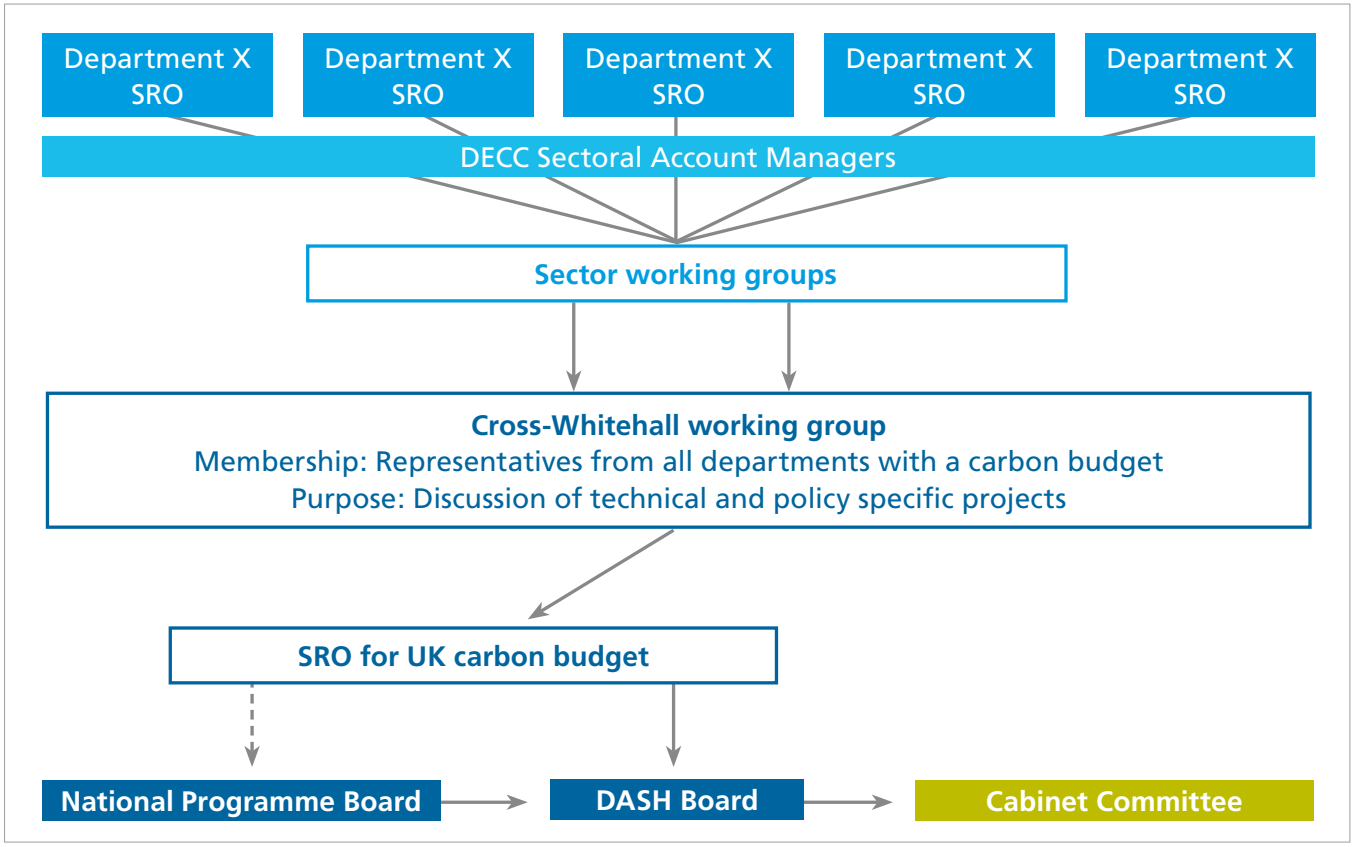


Figure 8: *The governance structures in place to manage departmental carbon budgets*

Climate Change: Taking Action

Part 2
Preparing for a changing climate

The Thames Barrier

Climate change presents everyone – central government, local authorities, other public sector organisations and the private sector – with an enormous challenge and also some important opportunities.

INTRODUCTION

The UK Climate Projections 2009 (UKCP09) show – through three different greenhouse gas emissions scenarios – how our future climate could change dramatically should the world fail to reduce its emissions. Based on a 'medium emissions' pathway, projections of summer average temperatures in the south-east are +3.9°C (+2.0 to +6.5°C) by the 2080s. Average summer rainfall in the south east decreases by 23% (-48% to +7%) and average winter rainfall in the north west increases by 16% (+3% to +34%) by the 2080s[17], with increases in the amount of rain on the wettest days.

Managing uncertainty

A further challenge – for all organisations – is to plan for the uncertainties that still exist over the impacts of climate change and keep options flexible if the climate or other socio-economic factors change faster or more slowly than we expect.

The UK Climate Projections 2009 (UKCP09) are based on the latest science from the Met Office Hadley Centre, and include observational data and information from other internationally recognised climate models. They show a range of possibilities for the country's future climate up to 2100 – using three different greenhouse gas emissions scenarios – with associated probabilities to indicate the strength of evidence in each case. Some processes that contribute to climate change (such as rising temperatures triggering the production of methane beneath the arctic permafrost) are not represented in current climate models and so the probabilities do not account for these. UKCP09 illustrates clearly that it would be wrong to plan a strategy to deal with just one single projection (such as the central estimate for the medium emissions scenario). Adaptation planning needs to recognise that uncertainties remain, and be sufficiently flexible to allow for modification in the light of new projections as they emerge.

For the future, a priority across government departments will be to ensure that UKCP09 is used effectively and appropriately to inform policy and investment decisions.

17 Figures given represent the 50% probability level followed by the 10%-90% probability level range in brackets.

Global emissions could be higher, with more severe consequences. Or alternatively through concerted international action we could put the world on a lower emissions pathway, resulting in less change.

Our water resources, health, coastal communities, cherished places and landscapes, even our food supply, face impacts from a changing climate that we need to prepare for. Government, local authorities, businesses and individuals all have a part to play in addressing this challenge.

The need for action

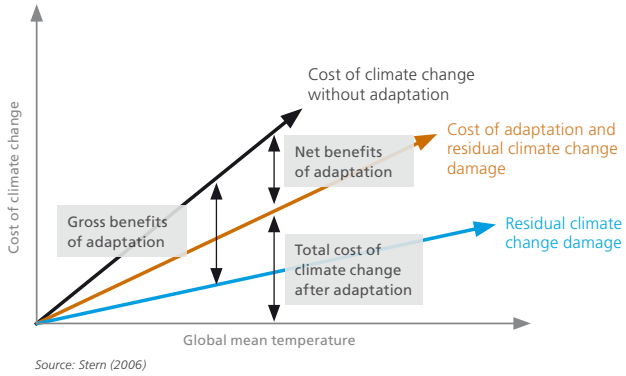
Although individual weather events cannot be directly attributed to climate change, we have seen how floods and heat-waves in recent years have tested the UK's emergency and local government services, businesses and resilience. The serious impact of the flooding in Cumbria in 2009 shows the effects of the extreme weather events and the kinds of challenges we will face in adapting to future climate change.

There are also some clear economic drivers that indicate the need to make progress on adaptation now, even though the future is uncertain. Adaptation, including appropriate risk management, is likely to be more effective and cost less if it is implemented at the appropriate time and this needs to be identified and planned for now. When organisations embed climate risk in their risk management processes and decision making, they are more likely to develop the evidence base which will allow them to make the appropriate and most sustainable adaptation decisions. Building up adaptive capacity will take time for all organisations, but we believe that early action will pay off.

Adaptation and the costs of climate change

The Stern Review of the Economics of Climate Change[18] demonstrated the value of applying economic analysis to one of the greatest challenges of our time. It showed that climate change is not solely an environmental issue: there is a convincing economic case for action to tackle climate change.

The graph below illustrates how the total costs of climate change without adaptation (top black line) contrast with reduced costs through adaptation (orange line). Adaptation incurs costs but results in benefits, i.e. it reduces the residual damages from climate change.



Source: Stern (2006)

DEPARTMENTAL ADAPTATION PLANS

Government has already made progress, for example by actively managing the impacts of flooding and coastal erosion, and the importance of planning ahead and preparing for climate risks is now much better understood. But there is still much more to be done. Adaptation is a continuing process and organisations are learning how best to incorporate it into their normal business practices. Some local authorities and businesses are really starting to embed adaptation in their work. But some are not and many parts of government are also at an early stage in developing their response to a changing climate.

18 http://www.hm-treasury.gov.uk/sternreview_index.htm

In June 2009, government departments committed to producing individual Departmental Adaptation Plans (DAPs)[19] by spring 2010. The central focus of the Plans is on looking at priority policy objectives and parts of the central government estate that are likely to be significantly affected by climate change, or where decisions will be taken in the short-term which have long-term consequences and therefore require immediate consideration (such as major construction projects).

All departments have conducted a high-level assessment of the potential implications of climate change for their policy objectives, key services and operations.

DAPs build on the initial success of the cross-departmental Adapting to Climate Change Programme in moving adaptation into the mainstream policy agenda. They will move us forwards towards a more co-ordinated, joined-up programme of government action on adaptation. For the first time, all departments have conducted a high-level assessment of the potential implications of climate change for their policy objectives, key services, and operations. The planning process is also helping to raise the profile of adaptation and awareness of the scale of the climate challenge right across government.

Departmental Adaptation Plans:

- are being published by major central government departments, and will be shared with their stakeholders and key delivery partners;
- are closely aligned with central government work to deliver targeted reductions in greenhouse gas emissions. In many cases, departments have produced combined Climate Change Plans, which set out an integrated approach to mitigation and adaptation;
- show that departments are making progress and will increasingly take climate change considerations into account in their planning and decision-making;
- focus on issues that are critical to get right in the next two years – for example, where departments are committing significant funds, or making decisions that will be difficult to change;
- will continue to be shared and discussed across government to ensure consistency and agree how to take forward issues which go beyond the remit of a single department;
- will help departments to ensure there is an increasingly resilient national infrastructure to cope with future climate change;
- will be an important building block in the development of the government's first National Adaptation Programme[20] in 2012;
- are only a first step – they will be reviewed annually, but more substantially in two years' time and again every five years, to ensure that further progress is being achieved in terms of government risk assessment, decision-making and capacity-building to deal with climate change; and
- show stakeholders the direction that departments are taking on adaptation and the levels of progress being made, to open the process up to comment and scrutiny, and to provide an example to other organisations which are starting to consider adaptation in their operations.

19 http://www.defra.gov.uk/environment/climate/programme/across-government.htm
20 http://www.defra.gov.uk/environment/climate/programme/objectives.htm

Assessing climate risks and building adaptive capacity

All organisations need to take a systematic approach to identifying climate risks and opportunities and to plan how best to respond to these. In developing their adaptation plans, government departments have made progress in:

- examining how their business and operations have been affected by extreme weather events in the past;
- considering a wide range of possible risks to their business – including any indirect impacts, such as disruption to their supply chains, or changing customer needs;
- examining which of these are the priority risks that require an early adaptation response (these include significant risks that departments are already facing, and those where it is important to take steps now because it could take some time to plan and implement an effective response);
- identifying areas where the immediate priority is for further research and analysis to understand impacts and build a stronger basis for future decision-making;
- considering which of the risks they are dealing with could best be taken forward in conjunction with their delivery partners, other stakeholders or with other departments; and
- improving their organisational capability through embedding adaptation risk management into their existing corporate processes and ensuring staff have access to relevant information and training.

At the same time, the plans start to define the actions needed to build organisational capacity and a stronger evidence base within departments to deal systematically with climate change for the longer-term.

A review[21] carried out by the National Audit Office for the House of Commons Environmental Audit Committee in spring 2009 showed that awareness and understanding of climate change varied considerably between departments. Previous work has often been driven by events; for instance, through the response to immediate problems affecting the delivery of particular services such as the hot summers of 2003 and 2006, or the severe flooding events of 2007 and 2009. Government recognises the need to embed a more systematic approach to the assessment and management of climate risks that looks to and plans for the future. The development of DAPs is a key milestone on this journey.

Severe flooding can have a devastating impact on communities, homes and businesses.
© Environment Agency / www.petersmith.com

21 http://www.nao.org.uk/publications/0809/adapting_to_climate_change.aspx

Responsibility for adaptation

Adaptation is a devolved issue. In England, the Department for Environment, Food and Rural Affairs (Defra) has lead responsibility for adaptation through the cross-government Adapting to Climate Change (ACC) Programme[22]. Other departments are responsible for many individual services and policies which may be affected by climate impacts, and need to systematically assess the significance of these risks and the steps required to manage these.

The ACC Programme is facilitating further work by all government departments, as well as key organisations in the public and private sectors. Its objectives are to: develop a more robust and comprehensive evidence base about the impacts and consequences of climate change; raise awareness of the need to take action and help others to take action; work across government at the national, regional and local level to make sure the need to adapt is embedded into government policies, programmes and systems; and evaluate progress and take steps to ensure effective delivery of the Programme's objectives.

However, work on adaptation is the responsibility of a much wider range of people and organisations. Whilst the evidence base and a framework for risk assessment and response is being provided by government, adaptation is the responsibility of all and will bring benefits to those organisations and individuals who respond to climate change appropriately.

Key adaptation principles

Many departmental operations, policies, investments and buildings will be directly or indirectly affected by a changing climate. Central government – as well as organisations in the wider public and private sectors – is considering climate change and taking account of good adaptation principles:

- Any adaptation needs to be **sustainable**. This means that our responses should not add to climate change, or limit the ability of other parts of the natural environment, society or business to carry out adaptation elsewhere. Our responses must avoid any detrimental impacts on other parts of society, the economy or the natural environment.
- Actions should be **flexible**. Although there is still uncertainty over the future climate, we should consider options now and make decisions that maximise future flexibility – in many cases it is failure to take decisions that locks us into inflexible pathways.
- Action needs to be **evidence-based** – making full use of the latest research, data and practical experience so that decision-making is well-supported and informed.
- Our response to climate impacts should be **prioritised** – for example, by focusing more attention on policies, programmes and activities that are most affected by the weather and climate, those which have long-term lifetimes or implications, where significant investment is involved or high values are at stake, or where support for critical national infrastructure is involved.
- Adaptation measures need to be **effective** (reducing the risks from climate change without introducing perverse effects), **efficient** (the long-term benefits of adaptation actions should outweigh the costs), and **equitable** (the effects of the activity on different groups and where the costs should fall should be taken into account).

22 http://www.defra.gov.uk/environment/climate/programme/index.htm

DELIVERING PRACTICAL ACTION

Through their adaptation plans, departments have considered the need to manage risks and opportunities in a wide range of areas; in particular, the risks to business and the economy, national infrastructure, the built environment, transport, agriculture, food security, the natural environment, homes, buildings and communities, and public health.

Some significant activity is already taking place across government – including updating planning policy on climate change, improved management of risks from flooding and coastal erosion, water resource management, health advice and heatwave management. DAPs are an opportunity to review these activities, to assess how far current efforts are contributing to successful adaptation to climate change, and to identify what more needs to be done.

DAPs set out the actions that government will be taking over the next two years to address key climate risks and to take their adaptation planning to a more advanced level.

Climate resilient investment

The Government is committed to making sure that all new publicly funded assets are resilient to climate change over their lifespan.

In future, all departments will ensure that their major policy and investment decisions take account of the latest supplementary guidance[23] to the HM Treasury's *Green Book: Appraisal and evaluation in central government*[24]. This gives advice on when and how to consider climate change risks and adaptation responses in major policy decisions and procurements; how to test the long-term costs and benefits of different options; and effective monitoring and evaluation. It provides a framework to ensure that public funds are spent on activities that provide the greatest net benefits.

Departments' use of the guidance will be reviewed in 2010-11.

Chiswick Park, London. Blinds and a central garden area, with a lake and trees, create a well adapted working environment. © Chiswick Park

Whilst the Plans have been developed by individual departments, there are a number of important cross-cutting areas where co-ordinated action will be necessary.

Business and the economy

Climate change is likely to have a major impact on businesses and on economic growth. There is a risk to many businesses if they fail to plan ahead for a changing climate. Extra costs will be incurred by those who are poorly adapted, who rely on vulnerable supply lines or processes, or are affected by fluctuations in global commodity prices as a result of climate change in other countries. This could mean higher prices for consumers and even business failure. Businesses, from small and medium-scale enterprises through to global blue-chip companies, need to understand their exposure to climate change and how to respond to risks or take advantage of the new opportunities that a changing climate will bring. Investors will be increasingly concerned with the long-term resilience of companies.

23 Accounting for the Effects of Climate Change: http://www.defra.gov.uk/environment/climate/documents/adaptation-guidance.pdf
24 http://www.hm-treasury.gov.uk/data_greenbook_index.htm

Impacts on the economy

Climate risks can become financial risks for UK businesses and may affect:

- **Assets:** impacts on premises, building design, construction, maintenance and facilities management;
- **Logistics:** vulnerability of supply chain, utilities and transport arrangements;
- **People:** implications for workforce, customers and changing lifestyles;
- **Process:** impacts on production processes and service delivery;
- **Markets:** changing demand for goods and services; and
- **Finance:** insurance costs, availability and cost of finance.

Climate change also offers opportunities for British businesses, both at home and abroad:

- **Agriculture:** increased yields for some crops and opportunities to diversify into new varieties;
- **Construction:** opportunities to exploit expertise in retrofitting buildings with flood resistant measures, install natural cooling systems, construct flood defences on the coast, etc.;
- **Domestic tourism:** as summer temperatures increase, the country could become a more popular destination for domestic and overseas tourists;
- **New markets:** development and manufacturing of new products and services to cope with a changing climate, such as water harvesting/ conservation technology, risk management, sustainable construction;
- **Skills and knowledge economy** – developing the right skills and knowledge to deal with adaptation will be essential, from using climate change models to developing and making use of more practical skills such as engineering, planning and architecture.

Climate change will present new challenges to all parts of the economy. Many different skills are needed to help in building a climate resilient economy, for instance, degree-level skills in risk management and strategic planning, architecture, planning and design, or more practical skills to do with retrofitting and manufacture. Business leaders, managers and workforces in all sectors need to develop their skills and knowledge to deal effectively with opportunities and climate risks.

The issue of skills development has been identified through the DAPs as a priority area for government action. Across government, work is being done to identify and address skills needs on a priority basis, including through the National Skills Strategy (published in December 2009) and the new Low Carbon Skills Strategy (published in March 2010). Government will continue to work with the Sector Skills Councils and with the UK Commission for Employment and Skills to support this process.

The UK Climate Impacts Programme (UKCIP)[25] is mainly funded through the ACC Programme to provide essential information to help decision-makers plan their response to the impacts of climate change. UKCIP provides free support and online tools to organisations in the public and private sector to help them assess their vulnerabilities and understand the latest scientific information. UKCIP works through trade associations and directly with some companies. It is also involved in steering research, including through the Adaptation and Resilience to a Changing Climate (ARCC)[26] research programme.

All sectors need to develop their skills and knowledge to deal effectively with opportunities and climate risks.

25 http://www.ukcip.org.uk/
26 http://www.ukcip-arcc.org.uk/

Working with business

Departments are working directly with a range of key business sectors, including:

- **Construction:** The Department for Business, Innovation and Skills (BIS) is working closely with the construction industry and the relevant Skills Councils to boost understanding and awareness of climate risks. Through the Technology Strategy Board[27], a new £4.9 million 'Design for Future Climate Change' competition will be launched in 2010, to encourage further innovation in this sector and to deal with the risks and opportunities of a changing climate both to new and existing buildings.
- **Agriculture:** Farming Futures[28] is a collaboration between the main agricultural representative bodies and research groups. Co-funded by Defra, this initiative provides farmers with a range of practical information and advice on how to prepare for the impacts and opportunities of climate change. A series of events and workshops on adaptation will be held throughout England during 2010. Some of the opportunities for farm businesses as a result of a changing climate are illustrated on page 49.
- **Retail:** BIS is working with the British Retail Consortium to develop a *Guide to Adaptation for Retailers*[29]. This will include advice on identifying and managing climate risks, as well as future business opportunities. The Guide will be distributed in 2010 through Business Link.
- **Insurance:** Insurance is an industry in which Britain has a global lead. The Insurance Industry Working Group (co-chaired by the Chancellor of the Exchequer) has published its *Vision for the Industry in 2020*[30]. This recognises that government and the insurance industry already work together to improve outcomes, for example to reduce floods, crime and road accidents. The report sets out an agenda for government to work with industry and seek new ways of co-operating, sharing data and expertise.
- **Opportunities in overseas markets:** The transition to a low carbon, well-adapted, global economy could create hundreds of thousands of new, sustainable 'green' jobs. Through the UK Low Carbon International Marketing Strategy, UK Trade and Investment is promoting the country's reputation as a world leader in low carbon goods and services. Early successes include agreements to market sustainable and environmental technology solutions in three Chinese cities: Wuhan, Chongqing, and Changsha. With a combined population of almost 50 million, the three cities offer British companies major opportunities for low-carbon and sustainable construction, as well as retrofitting existing infrastructure to address the impacts of climate change.

27 http://www.innovateuk.org/
28 http://www.farmingfutures.co.uk/
29 http://www.brc.org.uk/
30 http://www.hm-treasury.gov.uk/d/fin_insuranceindustry270709.pdf

FUTURE OPPORTUNITIES FOR FARMING

The Adapting to Climate Change Programme has developed a series of images to show what a well-adapted world might look like by the 2030s. Developed with stakeholders, this illustration shows a range of priority adaptation measures which may help farm businesses to address some of the key risks and opportunities of climate change. These will not be relevant in all cases, and will depend on the location and circumstances of a particular farm. To allow inclusion in the illustration some features are shown closer together than they might ideally be situated.

Changes to crops

Diversification of crops grown (eg. olives, grapes) to make the most of longer growing seasons and reduced frost. Changes to existing varieties, planting and harvest times to cope with hotter, drier summers.

Land management

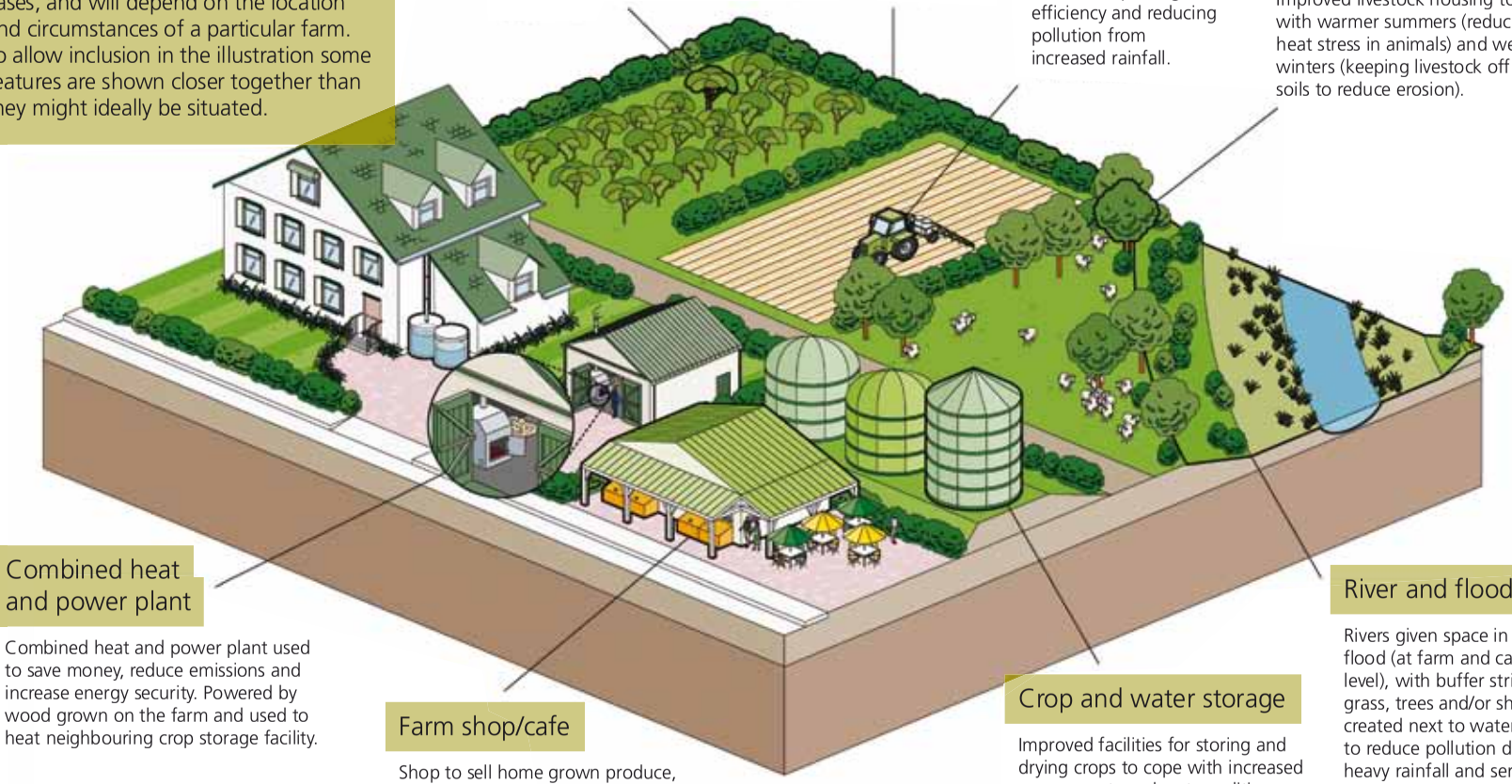
Improved land management to prevent soil erosion and ensure drainage can cope with increased rainfall eg. by planting trees and creating sustainable drainage such as porous surfaces and ponds.

Improved technology

Advances in technology will enable farmers to apply pesticides and fertilisers only where needed, improving efficiency and reducing pollution from increased rainfall.

Livestock management

Trees planted to provide shade for animals, act as a source of renewable fuel, windbreaks and provide woodland habitat. Improved livestock housing to cope with warmer summers (reducing heat stress in animals) and wetter winters (keeping livestock off wet soils to reduce erosion).



Combined heat and power plant

Combined heat and power plant used to save money, reduce emissions and increase energy security. Powered by wood grown on the farm and used to heat neighbouring crop storage facility.

Farm shop/cafe

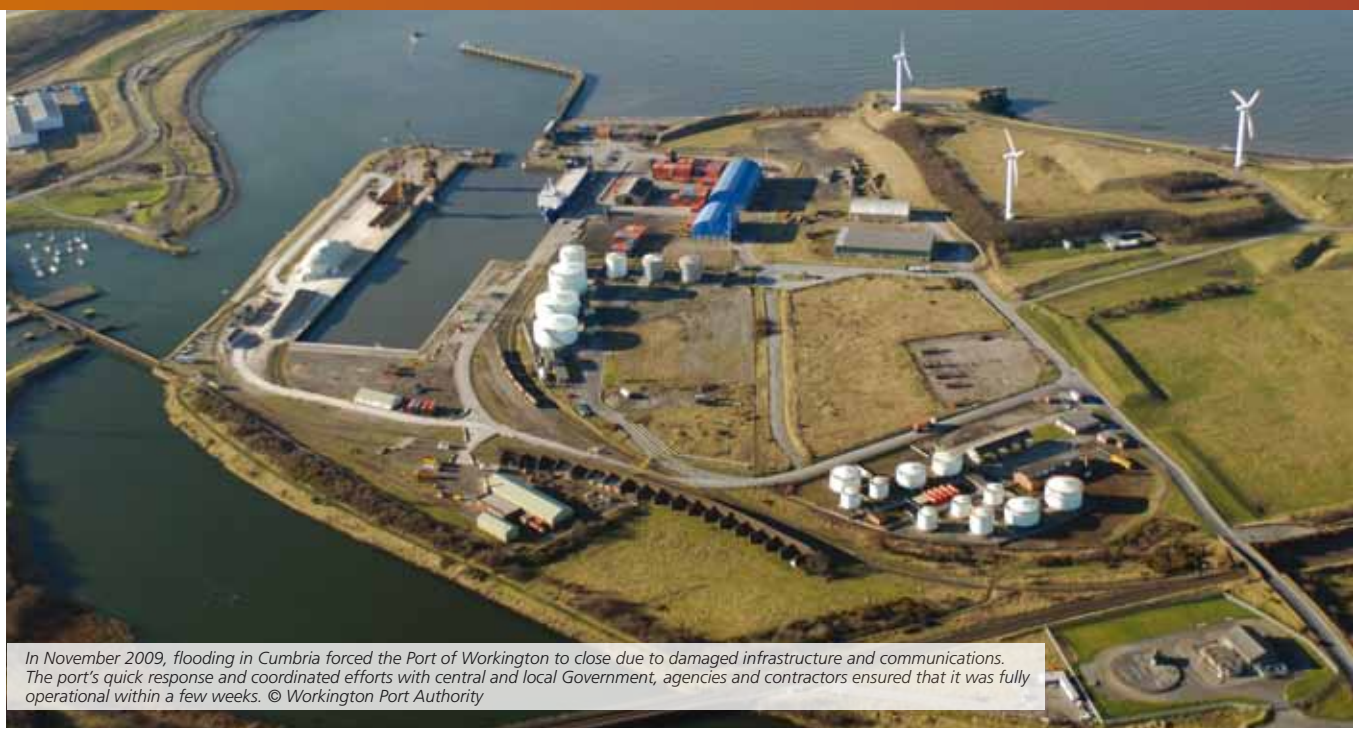
Shop to sell home grown produce, raise public awareness of sustainable farming, and cafe to take advantage of increased domestic tourism.

Crop and water storage

Improved facilities for storing and drying crops to cope with increased or new pests and wet conditions. Rain water captured and stored for use around the farm.

River and flood plain

Rivers given space in which to flood (at farm and catchment level), with buffer strips of grass, trees and/or shrubs created next to watercourses to reduce pollution during heavy rainfall and serve as habitats for wildlife.



In November 2009, flooding in Cumbria forced the Port of Workington to close due to damaged infrastructure and communications. The port's quick response and coordinated efforts with central and local Government, agencies and contractors ensured that it was fully operational within a few weeks. © Workington Port Authority

Infrastructure

Infrastructure is vital to the country – transport, energy, water and electronic communication networks move key resources around the UK and provide our global links. A high quality national infrastructure is essential for supporting economic growth and productivity, attracting globally mobile businesses to the UK, and promoting social well-being. Yet our national infrastructure, much of it built in the Victorian era, is increasingly at risk from the impacts of climate change. Recent extreme weather events – heat-waves and floods – illustrate the impact that climate change can have on our infrastructure and economy.

Infrastructure is usually designed to last for decades, so it is important to consider adaptation when planning and building new assets as well as in the routine maintenance, renewal and replacement of existing infrastructure. This approach will minimise the risk to key services and functions and reduce the possibility of long-term disruption and extra costs to the UK economy. Some sectors, such as the engineering profession, also have the opportunity to lead the way in developing new strategies and techniques.

Impacts of climate change on infrastructure:

- **Higher temperatures:** effects on road surfaces and rail lines, sewage treatment, power supply efficiency, and IT systems
- **Drought:** pressure on water supplies, especially in the south east
- **Flooding and sea level rise:** higher risks for transport, water treatment, electricity substations and power stations
- **Storms:** affecting power and telecommunications networks and operations at ports and airports

Increasingly, action is underway to support well-adapted national infrastructure:

- Government is embedding adaptation into National Policy Statements (NPS)[31] and the decision-making of the new Infrastructure Planning Commission[32], which will consider planning applications for all new nationally important infrastructure. The Department for Energy and Climate Change (DECC) has already produced a suite of Energy NPSs for consultation, and the Department for Transport (DfT) has

31 http://www.nationalpolicystatements.org.uk/
32 http://infrastructure.independent.gov.uk/

produced an NPS for the Ports sector. In both cases, applicants will need to consider the impacts of climate change when planning the location, design, build and operation of new infrastructure. Future NPSs on National Networks and Airports (DfT) and Water – Supply and Treatment – and Hazardous Waste (Defra) will be issued over the next two years.

- The UK's engineering sector is vital to tackling the challenge of climate change and is well-placed to lead in designing and engineering climate resilient and low carbon infrastructure for global markets, as well as the UK. The "Engineering the Future" group (which brings together organisations from the professional engineering community to promote the contribution of engineering to the UK's economy and the wellbeing of society) is working with government to identify opportunities for the country's engineering sector to take a global lead, the barriers preventing action, and further development of engineering skills.

- By establishing Infrastructure UK within HM Treasury, government is taking a more strategic view of the country's infrastructure needs across a range of sectors, and improving the way that we plan, prioritise, finance and deliver the required investment. Infrastructure UK has developed, and published at Budget 2010, the UK's first *Strategy for Infrastructure*. This looks ahead over the next 5 to 50 years and examines the need for resilience to future pressures such as the impact of climate change.

- The Cabinet Office is carrying out an assessment of the resilience of critical national infrastructure to flooding and other natural hazards[33] and is working with lead departments, economic regulators and operators to reduce existing vulnerabilities. For example, the Energy Resilience team in DECC is working with Cabinet Office to address risks to energy supplies. In the coming months, work will focus on enhancing the resilience of power stations, and DECC will publish a revised Sector Resilience Plan in December 2010.

The impact of climate change on the railways

© Richard Hargreaves

Climate change is likely to increase the severity of wave, tide and wind effects on coastal defences. At Dawlish, in Devon, the railway line and station are built close to the sea wall, and are vulnerable to storm damage and sea level rise.

The Rail Safety and Standards Board, Network Rail and the Environment Agency have joined forces to investigate the impact of climate change on the railway assets at Dawlish and the reliability of trains. Their report[34] provides recommendations for future action and highlights likely investment requirements. Its findings are being used to identify infrastructure and assets elsewhere in the UK which are also vulnerable to extreme weather at the coast. The report will also influence the development of new engineering strategies to deal with the effects of climate change.

33 http://www.cabinetoffice.gov.uk/ukresilience/news/sfps-consultation.aspx
34 http://www.rssb.co.uk/pdf/reports/research/T643_rpt_final.pdf

The natural environment

Future climate change could have a major impact on our natural environment, including wildlife and the habitats they rely on. Yet to cope with climate change we will increasingly rely on the effective functioning of natural processes within the environment; for instance, the free flood control and storm buffering benefits provided by coastal habitats like salt marsh and sand dunes have been estimated at over £1 billion per year. Conserving a healthy natural environment is a fundamental and cost-effective way to prepare our country for the impacts of climate change ahead. We need to ensure that adaptation planning is underpinned by cross-government action so that the natural environment can continue to provide these essential services.

For example, the Government is:

- preparing for the recommendations of a major independent review, which is exploring whether England's collection of key wildlife sites continues to represent a coherent and robust ecological network capable of responding to the challenges of climate change and other pressures. The review will present its findings by June 2010;
- establishing marine conservation zones, under the Marine and Coastal Access Act 2009[35]. These will help to address the impacts of climate change, such as coastal erosion and habitat loss, which represent an increasing threat to the marine environment. This approach can help to conserve thousands of species that inhabit UK waters and reduce pressures on vulnerable populations;
- working with the Environment Agency to ensure that adaptation is taken into account in the delivery of new River Basin Management Plans as part of the Water Framework Directive. Integrated river basin management is an important vehicle for adaptation, which will allows us to take action to respond to any climate change impacts on water resources; and
- seeking views from industry, Non-Government Organisations (NGOs), and government bodies at a senior level through the Rural Climate Change Forum (RCCF)[37]. The RCCF was created to provide advice, greater awareness, and a clearer view of future research needs on climate change and other rural land management issues. Defra hosted a joint stakeholder event, Agricultural Adaptation to Climate Change – Meeting the challenges to 2020 and beyond[38], in December 2009 which will inform the Forum's work programme for 2010 onwards.

The National Ecosystem Assessment

Government is currently undertaking a UK-wide National Ecosystem Assessment (NEA)[36] to assess how terrestrial, freshwater and marine ecosystems across the whole of the UK have changed in the past and how they might continue to change in the future.

The Assessment will help to quantify the state and value of the natural environment and the services it provides to society. It will assess policy and management options to ensure the integrity of natural systems in the future, and help raise awareness of their central importance to human well-being and economic prosperity. The NEA involves and is relevant for a range of research funders, government departments, academia, NGOs and private institutions.

Throughout 2009, the NEA has looked back 60 years to understand how our ecosystems and the services they provide have arrived at their current state and value. In 2010, the assessment will look forward 50 years, developing scenarios to illustrate how our ecosystems may change in future and how climate change is likely to affect them. The NEA will consider how society might respond to these changes to maintain and enhance the benefits, including adaptation benefits, that our natural environment can provide in a changing climate.

35 http://www.defra.gov.uk/environment/marine/legislation/index.htm
36 http://uknea.unep-wcmc.org/
37 http://www.defra.gov.uk/foodfarm/landmanage/climate/rccf/index.htm
38 http://www.defra.gov.uk/foodfarm/landmanage/climate/rccf/documents/rccf-10-01.pdf

Lundy Island Marine Conservation Zone

Jewel Anemones, Lundy. © Sally Sharrock

Lundy is an island off the north Devon coast. Its surrounding waters became England's first Marine Conservation Zone (MCZ) on 12 January 2010, under the Marine and Coastal Access Act. The healthy marine habitats provided by natural reefs, sandbanks and sea caves host a wide variety of wildlife including grey seals and many different species of coral.

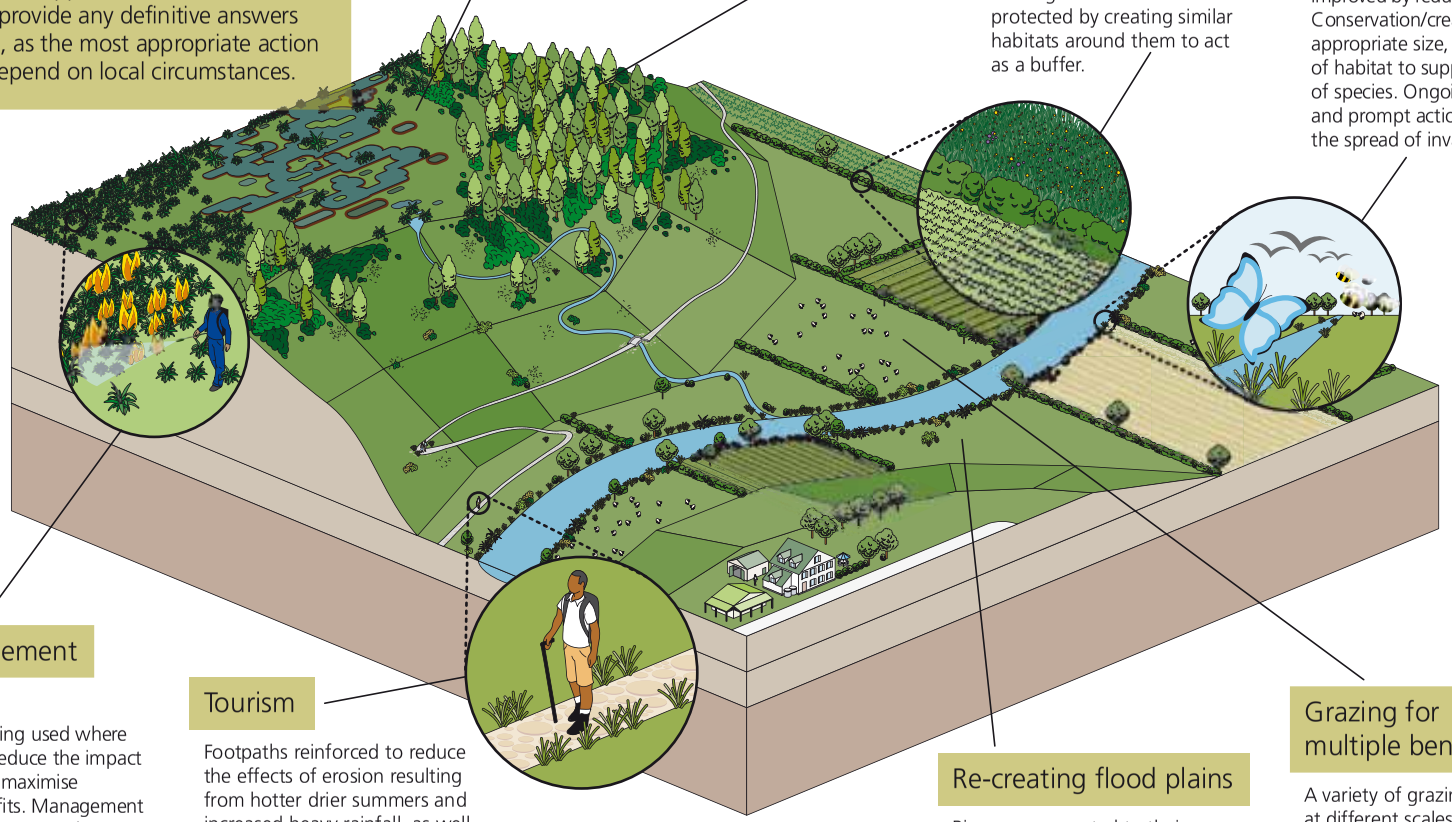
The Act allows local byelaws to be put in place to protect the marine life within the MCZ from the potentially damaging effects of human activities and from pressures such as climate change. MCZs can be changed or moved over time. This will help us to respond if, for example, the effects of climate change alter the distribution of species.

In March 2010 Defra will publish a discussion document on the natural environment and adaptation, building on work with stakeholders and partners to consider the importance of 'whole systems' approaches. This recognises that the resources and services which we receive from our environment cannot be adequately understood in isolation from one another. Instead, we are more likely to find efficient and effective solutions to the challenges of climate change by considering water, biodiversity, agriculture and landscape as parts of a highly complex and interdependent network of natural systems. The document highlights the need for ongoing discussion with a range of experts, stakeholders and delivery partners, and for evidence-based approaches.

To cope with climate change we will increasingly rely on the effective functioning of natural processes. A healthy environment is a fundamental and cost-effective way to prepare for the challenges ahead.

2030s COUNTRYSIDE

This illustration is designed to provoke thought about what good adaptation could entail for our natural environment. It features measures designed to minimise the negative impacts of climate change and exploit the opportunities. It does not attempt to provide any definitive answers or solutions, as the most appropriate action will often depend on local circumstances.



Peat bogs

Artificial drainage ditches in peat bogs blocked and bare soil vegetated to slow water-flow, limit soil erosion and carbon loss, improve water quality and reduce likelihood of wildfires.

Retained and increased woodland

Woodland and scrub develops in appropriate locations to reduce soil erosion, improve water quality, increase biodiversity, store carbon and for use as a renewable fuel.

Diversity and resilience of habitats

Semi-natural habitat patches created in a range of different locations to increase variety of microclimates and soil conditions. Existing conservation habitats protected by creating similar habitats around them to act as a buffer.

Biodiversity

Species given the best possible chance to adapt by minimising the effect of both climate-driven pressures and existing pressures that may be exacerbated by climate change. Potential for species dispersal to new habitats improved by reducing fragmentation. Conservation/creation of appropriate size, variety and quality of habitat to support a wide range of species. Ongoing monitoring and prompt action taken to control the spread of invasive species.

Fire Management Planning

Controlled burning used where appropriate to reduce the impact of wildfires and maximise ecological benefits. Management of countryside access and more information on risks used to reduce likelihood of wildfires. Improvements to emergency access, staff training and water storage for fire-fighting, to reduce impact of wildfires in hotter drier summers.

Tourism

Footpaths reinforced to reduce the effects of erosion resulting from hotter drier summers and increased heavy rainfall, as well as an increase in the numbers of tourists visiting the countryside. More information made available to the public to raise awareness of what they can do to benefit the countryside and how they can enjoy it without damaging it.

Re-creating flood plains

Rivers re-connected to their flood plains to hold water during flooding and release it more slowly at drier times. Flood plains otherwise used for occasional grazing, water-tolerant crops, or to create wetland and water meadow habitats.

Grazing for multiple benefits

A variety of grazing livestock used at different scales and intensities to achieve benefits such as food, habitat diversity and water quality improvement.

The built environment

Adapting the built environment (our homes and offices, green spaces and local transport routes) is vital to ensure that the UK as a whole is adapting well. Most of the UK's population lives in urban areas. We need to make sure that our cities are designed and built, or adapted, to cope with the challenges of flood risk, pollution problems and the urban heat island effect; for example, the temperature difference between London and the surrounding areas can be as high as 10°C. The 2007 floods across the UK and the heat-wave of 2003 in London underline the importance of adapting our urban areas.

Throughout 2010, the ACC Programme – in conjunction with the Department for Communities and Local Government (CLG), Defra, other departments and a range of external interests – will be scoping and designing a new project looking at the impacts of climate change on the built environment. This will focus on reviewing the latest research evidence, proposing new evidence gathering and approaches to address key knowledge gaps (particularly around the urban heat island effect and heat-waves), and developing new policy and delivery options. It will work alongside the planned review of building regulations, the Code for Sustainable Homes and the work of the Retrofit Consortium on public sector refurbishment.

Government is already taking more specific and practical action, for example by:

- embedding adaptation into the planning system – in particular, the Climate Change Supplement to PPS 1[39] sets out a clear expectation of how adaptation will be integrated into the preparation of regional spatial strategies and local development frameworks, and in decision-making on planning applications. A revised PPS was published for consultation on 9 March;
- working to promote adaptation in new homes and buildings through a comprehensive review of adaptation challenges: as part of its rolling programme for reviewing the building regulations; through further development of the Code for Sustainable Homes[40]; and through work with BIS and the Technology Strategy Board[41] to promote good adaptation through design;
- launching (in 2010) a new Retrofit Consortium of key public and private sector partners with large property portfolios and procuring power, to facilitate energy efficiency, low carbon and adaptation measures at scale. This supports a collaborative approach to research, development and mainstreaming of mitigation and adaptation technologies to get better value, more robust testing and greater effectiveness in practice;
- taking forward further work with stakeholders to agree a Warm Homes standard for the management of England's existing four million properties in the social housing sector, to complement the Decent Homes standard. This will include appropriate measures to adapt to climate change; and
- publishing, in spring 2010, a *Vision Statement on the Historic Environment for England*. Climate change presents a unique challenge for the historic environment, both in terms of adapting to impacts and finding ways to reduce energy emissions. Government, working with English Heritage, the Heritage Lottery Fund and other partners, will promote ways to reduce emissions which are sensitive to the historic environment, develop responses to ensure that the historic environment is adapting well, and examine in more depth the existing evidence about the relationship between the historic environment and climate change.

We need to make sure that our cities are designed and built, or adapted, to cope with specific challenges, including the urban heat island effect.

39 http://www.communities.gov.uk/publications/planningandbuilding/ppsclimatechange
40 http://www.communities.gov.uk/planningandbuilding/buildingregulations/legislation/codesustainable/
41 http://www.innovateuk.org/

All departments also recognise the importance of responding to the impacts of climate change on buildings within their specific remits, including hospitals, schools and government offices:

- Starting in 2010, the Ministry of Defence (MoD) plans to roll out a new Climate Impacts Risk Assessment Methodology (CIRAM)[42] across priority operational sites to better understand the risks to its existing operational estate and guide its response to climate impacts. This methodology – which makes use of UKCP09 – will enable MoD site managers to make more informed decisions about the resilience and continuity, future planning and development of their sites, the location and design of new buildings, and priorities for future work.
- In 2010, the Department for Children, Schools and Families (DCSF) will commission new research on the impact of warm weather on staff and pupils in schools and the measures needed to reduce overheating. This will inform new guidance to support the adaptation of existing schools and improve the designs of new school buildings and their grounds, to ensure they can cope with future climate change. By 2012, DCSF will develop a range of demonstration projects to showcase best practice adaptation.

Green infrastructure

A green roofed office in farm business park, Aylesbury, Bucks.

Climate change will have a significant impact on our wildlife and the habitats they rely on. But a healthy natural environment is also our safety net, delivering vital services to mitigate the adverse effects of climate change; for example, urban green spaces can help to cool surrounding built up areas by up to 4°C, while trees can provide shady areas

High quality places are typified by safe, attractive and well managed parks and other green spaces. They will also have ample 'green infrastructure' – the 'nature' between, around and on buildings, streets and squares, including trees, waterways, ponds and lakes, paths, gardens, green roofs and terraces, and nature reserves. The last few years have seen a growing appreciation of the value of green infrastructure and the need to do more to protect and increase it.

Existing planning guidance on biodiversity, geodiversity, landscape and green and open spaces has been revised and consolidated as a new draft Planning Policy Statement. The proposed new PPS aims to provide a clearer, more strategic national policy framework for the protection and enhancement of the natural environment. In bringing these policies together it provides planning policy on the provision of green infrastructure. It expects regional strategies to address biodiversity, landscape protection and green infrastructure, particularly in areas of growth and renewal where substantial amounts of development will be delivered and in areas where the population will be most vulnerable to the impacts of climate change, such as flooding and overheating. It also requires local development frameworks to set out a strategic approach for the creation, protection and management of networks of green infrastructure, particularly in locations where it will assist in reducing the impacts of climate change by providing flood water storage areas, sustainable drainage systems, urban cooling and local access to shady outdoor space. This builds on existing policy to emphasise the importance of green infrastructure in tackling climate change.

42 http://www.mod.uk/DefenceInternet/MicroSite/DE/WhatWeDo/Property/AdaptationToTheImpactsOfClimateChangeOnTheModEstate.htm

Dragonfly House

© Appleyards

Dragonfly House in Norwich provides offices for the Broads Authority, the Environment Agency and Natural England. The new building is clad in sustainably sourced timber, with *brise soleil* sunshades to provide natural cooling. Air drawn through an earth duct helps to warm the building in winter and cool it in summer. Rooftop solar panels heat up to 35% of the water used in the building and water efficiency will be increased by collecting rainwater that falls on the building roof and filtering and storing it for use in flushing toilets. A sustainable drainage system is in place to reduce the risk of flooding and protect water quality.

Evidence of health impacts

A new study, published in September 2009 by the Health Protection Agency, analyses temperature, population, death rates and climate change projections for the West Midlands region. The report suggests that a changing climate could lead to more food poisoning, water-borne diseases, extreme weather events and changes to the quality of drinking water. The study also found that the most deprived people in the West Midlands will be the most susceptible to climate change impacts, because of the location of many of these people in hotter city centres and the fact they have less opportunity to adapt their behaviours and lifestyles.

People and Health

The potential impacts of climate change on human health are complex and diverse (and not all negative). Hotter drier summers, milder wetter winters and more frequent extreme weather events could mean a decrease in cold-related winter deaths, but also an increase in heat-related summer deaths. We could also see an increase in diseases carried by ticks and mosquitoes, and more cases of sunburn and skin cancer as people spend more time outdoors.

The whole health sector will potentially be affected by these impacts, and it is important to improve the current level of preparedness and awareness. Ultimately, the requirement to assess and address the impacts of climate change will form part of the NHS regulatory framework, which will also need to be aligned with the NHS Operating Framework. The priorities for the NHS have been set for the Comprehensive Spending Review period for the remainder of 2008-11. The Department of Health (DH) will work during this period to see how the need to assess and address the impacts of climate change can form part of the next regulatory framework.

Climate change could exacerbate health problems, or create new ones. For example, the experience of flooding can lead to stress and mental health issues. New Horizons: A shared vision for mental health[43] is a cross-government programme of action, led by the Department of Health. In 2010, the programme will identify and explore the implications of linkages between weather events and mental health.

The Department of Health is actively supporting the development of programmes for the NHS workforce, equipping them with the knowledge, awareness and skills to take action on preparing for climate change. This includes the establishment of the NHS Sustainable Development Unit (SDU) and the development of a pack on climate change awareness, advocacy and action for public health trainees.

43 http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_109705

There are simple steps that all of us can take to cope with hotter summers.
© Department of Health Photo Library

A key priority for the Department of Health is to ensure that national and local adaptation plans are in place to address the expected health impacts from climate change (such as the National Heatwave Plan[44]) and to ensure that plans are fully implemented with regular evaluation. The Heatwave Plan was triggered at the end of June 2009, including media messages and specific actions for health professionals to help protect vulnerable people. The Health Protection Agency[45] is conducting an evaluation of excess deaths and hospital admissions to inform and improve future Heatwave Plans. This will report later in 2010.

Some of the groups most vulnerable to the effects of climate change may also be the least able to adapt. The Department for Work and Pensions (DWP) recognises the need for ongoing research to fully understand climate change as a problem for the most vulnerable people in society. In the meantime, DWP is working closely with DCSF, DH and the Cabinet Office (CO) to address climate impacts on children and on child poverty objectives and initiatives.

In government decision- and policy-making, the consequences of different responses to climate change need to be carefully analysed to take account of the effects of any proposed activity on different social groups. The latest *Green Book* methodology provides a framework for economic assessment of the social costs and benefits of all new government policies, projects and programmes.

Climate and health in London

The London Climate Change Partnership[46] (LCCP) was set up to help London and Londoners prepare for the impacts of climate change. The Greater London Authority (GLA), on behalf of the LCCP, is commissioning a project to develop a Health and Social Risk Assessment and Action Plan for London. Reporting in spring 2010, the project will: identify the specific climate impacts on health for the region; map out the adaptation responsibilities of different health and social organisations; and provide local, regional and central government with a series of future actions to consider.

44 http://www.dh.gov.uk/en/publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_099015
45 http://www.hpa.org.uk/HPA/Topics/EmergencyResponse/RespondingToConventionalHazards/1246260037969/
46 http://www.london.gov.uk/lccp/

Flooding and coastal erosion

Flooding and coastal erosion can cause significant damage and disruption. Around 5.2 million properties in England are currently at some risk of flooding from surface water (e.g. rainwater running across land), rivers and/or the sea. Flooding also presents a risk to many government objectives, and is likely to become more severe and frequent with climate change.

Flooding in Cockermouth, Cumbria (November 2009); 900 homes and businesses were inundated. © Environment Agency/www.petersmith.com

Investment in flood and coastal erosion risk management has reduced the risk for many communities around the country, and the level of investment has risen in previous years from £394 million in 2002-3 to £800 million in 2010-11. Defra works with other departments and stakeholders to reduce both the likelihood of flooding from all sources and the impact of flooding when it does occur.

The Flood and Water Management Bill will alter the responsibilities for flood risk management and put the country in a better position to cope with the additional challenges posed by climate change. The Bill will give local authorities the lead role for managing local flood risk, including surface water and groundwater flooding. Defra is investing over £15 million to support the work of local authorities to develop surface water management plans, and to fund immediate actions to manage and reduce surface water flooding. Climate risks are an important factor in the development of these plans. Approximately £2 million is being invested to develop and share local authority expertise and build capacity.

Protecting our capital

The Environment Agency's Thames Estuary 2100 (TE2100) project sets the strategic framework for the on-going delivery of flood and coastal risk management for London, taking account of future climate change and sea level rise. The project has developed a number of 'flexible pathways', mapped against future scenarios of sea level rise, which can be implemented depending on the severity and extent of observed climate change over the next century. The on-going monitoring and evaluation of sea level rise in the Thames will play a crucial part of informing future decisions needed to manage risks. For example, the project found that the existing Thames Barrier is currently thought fit for purpose until approximately 2070, at which point a decision will need to be made as to whether or not an 'outer barrage' will be necessary to protect London. Management of the Thames Barrier will continue to take account of the latest data on climate change, ensuring that London continues to remain safe from flooding. The Environment Agency's work helped inform the development of the *Green Book Supplementary Guidance* on adaptation and is a good example of its practical application.

In summer 2009, Defra consulted on how coastal communities can successfully adapt to the impacts of coastal change[47], and how the government can support them. The consultation recognised that successful adaptation depends on producing solutions for a wide variety of socio-economic conditions; for instance, some locations will have high levels of social well-being, with other locations facing greater levels of deprivation.

Planning policy on development and flood risk (PPS 25) is an important part of the approach to climate change adaptation. This provides a risk-based approach to managing future changes in flood risk to new development. It is being supplemented by new planning policy on coastal change which will provide a framework to help affected communities to manage risk and adapt to an ever changing coastline.

Approaches to managing flooding and coastal erosion risks on the coast are being developed and delivered through Shoreline Management Plans (SMPs). These outline the agreed management policies for each section of the coast for the next 20, 50 and 100 years, taking account of increased sea level rise from climate change. SMPs are currently being revised and will be published throughout 2010-11.

International impacts of climate change

Engaging at the international level is crucial for the UK. The country will face further challenges as a result of international climate change impacts which make other parts of the world less habitable and productive. These could include economic impacts, such as changes to the availability of food and energy supplies, risks relating to migration, both legal and illegal, and security, such as increased conflict overseas, exacerbated by international climate change.

The Foresight programme, delivered by the Government Office for Science, helps government to think systematically about the future. Several ongoing Foresight studies are making use of the latest scientific evidence and analysis to help decision-makers understand future international challenges:

Support for developing countries

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DFID works extensively with developing countries around the world, supporting both practical action and research. Much of DFID's support for adaptation to climate change is done through bilateral aid programmes. These are increasingly focussed on climate change.

Nepal is one of the most vulnerable countries to climate change, facing the melting of the glaciers in the Himalayas and erratic monsoon rains. This means droughts, floods and landslides. The impact of climate change in the Himalayas will affect 27 million people in Nepal and another 500 million in India and Bangladesh. In November 2009, the Government announced £50 million over 10 years to combat climate change in Nepal. Of this, £40 million will support a long-term National Forestry Programme, with £10 million used to help the poorest people adapt to climate change.

£100 million will be invested by DFID in climate change research over the next 5 years. New approaches to managing soil fertility, improving water retention and diversifying crops are being tested across 34 African countries. In Kenya, new ways of communicating weather forecasts by radio to poor farmers are being trialled and in Morocco new community water agreements are being tested to help manage possible conflict over increasing water scarcity.

47 http://www.defra.gov.uk/corporate/consult/coastal-change/index.htm

- **Global Environmental Migration**[48]: this project is exploring the global patterns and impacts of migration over the next 50 years arising from environmental change (including climate change), the challenges and opportunities that could result from changing migration patterns and how these might be addressed. Its report is due in 2011.
- **Global Food and Farming Futures**[49]: this project is considering the challenge of how a future global population of 9 billion people can all be fed healthily and sustainably. The project will also look ahead to 2050 and take a global view of the food system, considering issues of demand, production and supply as well as broader environmental issues such as the effects of climate change on agriculture and marine production. The project's findings are due to be launched in October 2010.
- **International Dimensions of Climate Change**[50]: this project will improve the understanding of how climate change occurring in other parts of the world may affect the UK. The output of the project, due in 2010, will be used to augment the evidence base of the UK's First Climate Change Risk Assessment (CCRA).

The FCO is using both its Science and Innovation Network (shared with BIS) and its network of Climate Change Attachés, to support the Foresight Project by looking for partners abroad who may be able to help the research. Embassies and High Commissions have already contributed a number of climate impact studies and assessments from around the world to inform Foresight's thinking. Following publication, Departmental Adaptation Plans will also be shared with other governments so that they can draw on our analysis and planning when developing their own adaptation plans, facilitating the exchange of best practice and collaboration.

In 2008, the UK was one of the first countries to adopt a national adaptation strategy. The Climate Change Act (2008)[51] was the first legally binding framework in the world to address mitigation and adaptation to climate change. According to the Partnership for European Environmental Research[52] the UK is seen as a "frontrunner country in many respects: [with] a comprehensive approach, strong scientific and technical support, attention to legal framework, implementation and review."[53]

Climate change adaptation will need to be embedded through relevant EU policies and programmes, and the UK will continue to work with the EU Commission and other member states to achieve this. The EU Commission President has emphasised the importance of adaptation, and it is important that the new DG Climate Action will now have the cross-cutting responsibility for developing adaptation to climate change within the EU, ensuring it is reflected in all relevant community policies.

Sharing knowledge and expertise

© Kew Photo Library

In some of the world's poorest countries, changes in land use, population growth and climate change all threaten the ability of communities to harvest the plants they have traditionally relied on for food, shelter and medicine. Sponsored by Defra, the Royal Botanic Gardens, Kew holds the world's greatest concentration of knowledge about plants. Kew's scientists work globally with other botanic gardens and partners to help reduce the extent and impact of climate change, to rescue species and habitats from destruction, and to offer help in growing locally appropriate species for a changing world.

48 http://www.foresight.gov.uk/OurWork/ActiveProjects/EnvironmentalMigration/Migration.asp
49 http://www.foresight.gov.uk/OurWork/ActiveProjects/FoodandFarmingFutures/FoodandfarmingProjectHome.asp
50 http://www.foresight.gov.uk/OurWork/ActiveProjects/climatechange/climatechangeprojecthome.asp
51 http://www.opsi.gov.uk/acts/acts2008/ukpga_20080027_en_1
52 http://www.peer.eu/
53 Quoted from: Peer Report 1. Europe Adapts to Climate Change: Comparing National Adaptation Strategies, page 19. http://www.peer.eu/publications/europe_adapts_to_climate_change/


© Mark Potter

The DAP process has reinforced the need for close working between departments on international challenges. The ACC Programme will facilitate this work.

BUILDING THE GOVERNMENT'S CAPACITY TO ADAPT

Government has an important role to play in supporting and encouraging public and private sector organisations to adapt to climate change. Each department is considering how best to drive progress and support capacity-building in the sectors which they are responsible for.

Equally, departments' delivery of key policy objectives in the longer-term will depend on their ability to identify, assess and manage the risks arising from the impacts of future climate change.

The primary areas where departments are working to boost their own knowledge, skills, organisation and capacity to respond to climate change are summarised below.

To enhance internal leadership:

- Departments have identified 'senior owners' to take responsibility for adaptation across their portfolio, and ensure Board-level awareness of the main climate risks affecting their business.
- Most departments now have a dedicated adaptation team, who will ensure that actions within their DAPs are delivered and work to continue strengthening the profile and improving the co-ordination of climate change adaptation with their policy and operational colleagues.

To ensure that adaptation is increasingly embedded in mainstream policy and decision-making:

- The government is taking steps to ensure that the new Green Book supplementary guidance – *Accounting for the Effects of Climate Change*[54] is used by all departments and will monitor and evaluate progress later in 2010.
- All departments have carried out systematic work through the development of their individual DAPs to identify climate change risks to their individual policy areas, and will continue their work to respond to those risks.

To ensure that departmental staff are better equipped and supported to manage climate change risks:

- Following the successful Projections in Practice events (which were attended by around 5,000 people) the ACC Programme will continue to run training events in 2010-11, in partnership with UKCIP. These will provide further information and guidance on the UK Climate Projections 2009 to people working in key sectors and government departments.

54 http://www.defra.gov.uk/environment/climate/documents/adaptation-guidance.pdf

- UKCIP provides a wide range of web-based tools and learning materials to help policy-makers better understand how climate change can affect their areas of responsibility, and will be refining and adding to the available suite of tools in response to feedback from users.
- Many departments are now developing their own programmes aimed at further developing staff awareness and providing training for policy-makers and operational teams. The Cabinet Office is also leading work with the National School of Government to develop climate change training for senior civil servants.

To ensure that departments have effective processes to deal with climate risks:

- The ACC programme and the Office of Government Commerce have jointly produced guidance to government and the wider public sector on how adaptation can be embedded into the public procurement process. This is being published alongside DAPs.
- A new target for adaptation across the government estate will be introduced from April 2010 through the new Sustainable Development in Government framework[55]. All departments will be required to undertake risk assessments and to develop and implement action plans which will improve the resilience of their estate to climate impacts. Progress will be reviewed on an annual basis.

To support more effective working with partners:

- Departments have consulted their main delivery partners in developing their plans and will continue to work collaboratively and share best practice with key organisations and suppliers in addressing future climate risks. In many cases, these government agencies have a crucial role to play in developing guidance and standards and influencing the sectors and industries that they regulate or engage with.
- The statutory Adaptation Reporting Power[56] is a new mechanism that will support engagement with regulators (including Ofcom, Ofwat and Ofgem) and other key bodies in the wider public sector. Departments have an important role to play in working with their sectors to encourage robust risk assessment, analyse actions proposed in the context of their current policy aims and objectives, and discuss emerging barriers to sustainable adaptation.
- The Local and Regional Partnership (LRAP)[57] Board – funded by Defra via the ACC Programme – will continue to facilitate action on climate change adaptation at a local and regional level by highlighting best practice, enhancing skills, providing toolkits, and encouraging joint working between local and regional agencies.

To ensure the continued development of a robust and comprehensive evidence base about the impacts and consequences of climate change on the UK:

- Government will continue to fund relevant research to provide policy makers with the evidence they need to help with informed, cost-effective and timely decisions on preparing for a changing climate.
- Foresight projects, activities carried out under the Living With Environmental Change (LWEC)[58] research partnership and through the UK research councils[59], and the specific research portfolios of individual departments will further enhance the emerging evidence base. In addition, the production of the UK Climate Change Risk Assessment (CCRA[60]) by 2012 will tell us more about the likely impacts of climate change, providing government with a more robust and reliable basis for decision-making.

55 http://www.defra.gov.uk/sustainable/government/gov/estates/index.htm
56 http://www.defra.gov.uk/environment/climate/legislation/reporting.htm
57 http://www.defra.gov.uk/environment/climate/action/local-authorities.htm
58 http://www.lwec.org.uk/
59 http://www.rcuk.ac.uk/default.htm
60 http://www.defra.gov.uk/environment/climate/adaptation/assess-risk.htm

Birling Gap marks the start of the Seven Sisters, the continually eroding iconic white cliffs on the south coast. The risk of coastal erosion could be exacerbated by climate change.

NEXT STEPS

Through the process of developing their initial plans, all departments have considered how they should respond to the challenges that climate change presents – the immediate risks that we can already foresee, and the uncertainties which are yet to be resolved.

There are a number of ways in which the process of planning and responding to climate risks will now be taken forward:

- an analysis of the risks and policies identified in DAPs will be one of the sources of evidence used to inform the CCRA. In turn, the evidence gathered from other sectors and organisations for the CCRA will be one of the inputs to future departmental plans;
- alongside the CCRA, a suite of indicators will be developed to measure progress, including advances made by government departments in implementing their plans;
- the CCRA will inform development of the National Adaptation Programme to be put in place in 2012;
- the ACC Programme will provide an annual update of how departments are delivering against the actions promised in DAPs. This will be reported to Ministers and published on the ACC website so that stakeholders can hold government to account; and
- all departments will prepare a second round of DAPs for 2013-2018.

The UK Climate Change Risk Assessment (CCRA)

The Climate Change Act (2008) commits the UK Government to carry out an assessment of the risks for the UK of climate change every five years. The first cycle is required to report to Parliament by end of January 2012.

The CCRA will provide evidence and analysis which will enable all UK Administrations to:

- understand the level of risks (both threats and opportunities) posed by climate change including their likelihood and the potential scale of their economic, social and environmental impact;
- compare the risks of a changing climate with other pressures that the Government needs to consider; and
- prioritise adaptation policy geographically and in sectors.

The CCRA will include an economic assessment of possible adaptation measures. This will give an overall indication of the scale of the challenge and help to identify priority areas for action.

Annex 1 Departments' Carbon Budgets

	HOMES AND COMMUNITIES 2008-2012		TRANSPORT 2008-2012		WASTE 2008-2012		POWER 2008-2012		WORKPLACES & JOBS 2008-2012			
									INDUSTRIAL PROCESS		HEATING WORKPLACES	
	%	$MtCO_2$	%	$MtCO_2$	%	$MtCO_2$	%	$MtCO_2$	%	$MtCO_2$	%	$MtCO_2$
DECC	63	257	1	6	7	8	100	1011	51	43	80	361
DfT	0	0	76	493	1	1	0	0	6	5	0	0
Defra	1	4	1	6	70	80	0	0	24	20	2	9
BIS	9	37	9	58	15	17	0	0	19	16	15	68
CLG	27	110	4	26	7	8	0	0	0	0	1	5
DCMS	0	0	4	26	0	0	0	0	0	0	1	5
DH	0	0	1	6	0	0	0	0	0	0	1	5
MoD	0	0	3	19	0	0	0	0	0	0	0	0
DCSF	0	0	1	6	0	0	0	0	0	0	0	0
CO	0	0	0	0	0	0	0	0	0	0	0	0
DFID	0	0	0	0	0	0	0	0	0	0	0	0
DWP	0	0	0	0	0	0	0	0	0	0	0	0
FCO	0	0	0	0	0	0	0	0	0	0	0	0
HMRC	0	0	0	0	0	0	0	0	0	0	0	0
HMT	0	0	0	0	0	0	0	0	0	0	0	0
HO	0	0	0	0	0	0	0	0	0	0	0	0
LOD	0	0	0	0	0	0	0	0	0	0	0	0
MoJ	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**100**	**408**	**100**	**648**	**100**	**115**	**100**	**1,011**	**100**	**85**	**100**	**452**

AGRICULTURE, FORESTRY & LAND MANAGEMENT 2008-2012		PUBLIC SECTOR			ALLOCATION			% SHARE OF TOTAL CARBON BUDGET PERIOD 3
		2008-2012	2013-2017	2018-2022	2008-2012	2013-2017	2018-2022	
%	$MtCO_2$	$MtCO_2e$	$MtCO_2e$	$MtCO_2e$	$MtCO_2e$	$MtCO_2e$	$MtCO_2e$	%
2	5	39.47	37.48	30.2	1731.38	1542	1358.2	53
2	5	0.16	0.14	0.13	503.92	482.41	447.17	18
88	217	0.19	0.17	0.15	337.80	343.76	347.17	14
2	5	0.07	0.07	0.06	201.18	191.74	186.53	7
2	5	0.14	0.12	0.11	153.83	135.74	123.25	5
0	0	0.02	0.02	0.02	30.47	29.27	27.62	1
2	5	0.05	0.04	0.04	15.99	15.88	15.76	1
0	0	9.51	8.95	7.61	28.96	27.18	24.80	1
2	5	0.07	0.07	0.06	11.49	11.44	11.11	0
0	0	0.03	0.03	0.03	0.03	0.03	0.03	0
0	0	0.01	0.01	0.01	0.01	0.01	0.01	0
0	0	0.99	0.89	0.79	0.99	0.89	0.79	0
0	0	0.06	0.05	0.05	0.06	0.05	0.05	0
0	0	0.88	0.80	0.71	0.88	0.80	0.71	0
0	0	0.04	0.03	0.03	0.04	0.03	0.03	0
0	0	0.15	0.13	0.12	0.15	0.13	0.12	0
0	0	0.07	0.06	0.05	0.07	0.06	0.05	0
0	0	0.76	0.68	0.60	0.76	0.68	0.60	0
100	**247**	**53**	**49**	**41**	**3,018**	**2,782**	**2,544**	**100**

Annex 2 The Rationale for Departmental Allocations

DEPT	RATIONALE BY SECTOR		
	Homes and Communities	Transport	Waste
DECC	Ownership of key policy levers over residential emissions (energy efficiency measures).	Responsibility for emissions associated with energy-related freight transport.	Lead Department on issues such as energy generation from waste.
DfT		Holder of main policy levers and influence.	Facilitates development of using energy from waste in the transport sector.
Defra	Ownership of policy levers on product standards and behavioural change.	Responsible for emissions from agriculture related travel.	Sector sponsorship and Policy levers to reduce emissions from Waste Sector.
BIS	Influence through regulatory reform and encouragement of lower emission products and construction. Influence on innovation and skills in industry capacity & competence for reducing emissions.	Influence on emissions from business-related freight and car transport. Impact of innovation and skills on transport emissions.	Emissions from commercial, Industrial and construction waste, and a notional share of 'pull' measures to represent BIS's influence over the regulatory framework. Influence on innovation and skills which help to reduce emissions. (originally allocated to DIUS and BERR)
CLG	Sectoral sponsorship and ownership of levers for reducing residential emissions (building regulations/planning)	Influence via planning levers.	A notional share to represent the impact of planning policy, and emissions from municipal waste.
DCMS		Responsible for emissions from leisure related travel.	
DH		Responsible for health related travel (e.g. to and from hospitals).	
MoD		Responsible for military transport, aviation and shipping.	
DCSF		Responsible for emissions from school-run and education related travel.	

RATIONALE BY SECTOR continued			
Power	**Workplaces and Jobs: Industrial Process**	**Workplaces and Jobs: Heating Workplaces**	**Agriculture, land & forestry management**
DECC takes all of this sector as owner of the main policy levers and emissions sources.	DECC holds all of the 'traded' element of this sector as owner of the EU ETS levers.	Impact of policy levers and emissions from sponsored sectors. Impact of policy levers including Climate Change Levy.	Impact of bio-energy policy.
	Responsible for a share of implementation of EU level agreements on non-traded.		Facilitates development of using energy from biofuels in the transport sector.
	Responsible for regulations relating to fluorinated gases (except in the transport sector), and nitrous oxide and methane emissions from industrial processes.	Responsible for policy to encourage sustainable consumption and production.	Holder of main levers and sectoral sponsorship. Oversight of procurement through OGC's sustainable procurement policy.
	Responsible for implementation of EU agreements on non-traded fluorinated gases. Influence on innovation and skills which help to reduce emissions.	Overall sponsorship and Influence of the business sector, including share of emissions for business sub-sectors. Indirect policy levers to influence improved technology and skills.	Innovation and research.
		Impact of policy levers including buildings regulations.	Planning (affecting land-use change, and also applications for on-farm bio-energy).
		Emissions from sponsored sectors including recreation and sporting activities.	
		Mainly emissions from pharmaceuticals sector.	Procurement/impact on demand, and sponsorship of FSA.
			Procurement and influence on consumer behaviour.

Annex 3 Glossary

ACC	Adapting to Climate Change
AD	Anaerobic Digestion
AFLM	Agriculture, Forestry and Land Management
ARCC	Adaptation and Resilience to Climate Change
ASHPs	Air Source Heat Pumps
BIS	Department of Business Innovation and Skills
CCA	Climate Change Agreements
CCC	Committee on Climate Change
CCP	Climate Change Programme
CCRA	Climate Change Risk Assessment
CCS	Carbon Capture and Storage
CERT	Carbon Emissions Reductions Target
CESP	Community Energy Saving Programme
CHP	Combined Heat and Power
CIRAM	Climate Impacts Risk Assessment Methodology
CLG	Department for Communities and Local Government
CO	Cabinet Office
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CRC	CRC Energy Efficiency Scheme
CRDP	Carbon Reduction Delivery Plan
DAP	Departmental Adaptation Plan
DCMS	Department for Culture,Media and Sport
DCSF	Department for Children, Schools and Families
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
DFID	Department for International Development
DfT	Department for Transport
DG	Directorate-General (European Commission department)
DH	Department of Health
DWP	Department for Work and Pensions
EST	Energy Saving Trust
EU ETS	EU Emissions Trading System
FCO	Foreign and Commonwealth Office
FITs	Feed-in Tariffs
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GLA	Greater London Authority
HMT	Her Majesty's Treasury
HMRC	Her Majesty's Revenue and Customs
HO	Home Office
IPC	Infrastructure Planning Commission
LCCP	London Climate Change Partnership
LCTP	Low Carbon Transition Plan
LOD	Law Officers' Departments
LRAP	Local and Regional Adaptation Partnership
LWEC	Living with Environmental Change
MCZ	Marine Conservation Zone
MoD	Ministry of Defence
MoJ	Ministry of Justice
$MtCO_2e$	Million tonnes of carbon dioxide equivalent
NAO	National Audit Office
NAP	National Adaptation Programme
NEA	National Ecosystem Assessment
NGO	Non-Governmental Organisation
NHS	National Health Service
NPS	National Policy Statement
Ofcom	Office of Communications
Ofgem	Office of the Gas and Electricity Markets
Ofwat	Water Services Regulation Authority
OGC	Office of Government Commerce
PFI	Private Finance Initiative
PPS	Planning Policy Statement
PSA	Public Service Agreement
RCCF	Rural Climate Change Forum
RHI	Renewable Heat Incentive
RO	Renewables Obligation
ROC	Renewables Obligation Certificate
SCP	Sustainable Consumption and Production
SDAP	Sustainable Development Action Plan
SDU	Sustainable Development Unit
SMP	Shoreline Management Plan
SOGE	Sustainable Operations on the Government Estate
TE2100	Thames Estuary 2100
UKCIP	UK Climate Impacts Programme
UKCP09	UK Climate Projections 2009
WRAP	Waste & Resources Action Programme

Further information

Carbon Reduction Delivery Plans and Departmental Adaptation Plans are publicly available from individual departments' websites.

All Carbon Reduction Delivery Plans can also be accessed from the DECC website:
http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/carbon_budgets/departments/departments.aspx

All Departmental Adaptation Plans are available on the Adapting to Climate Change Programme website:
http://www.defra.gov.uk/environment/climate/programme/across-government.htm

Feedback

Government's collective adaptation planning is at an early stage. Your feedback would be appreciated as your views will influence the way ACC delivers, and will feed into future adaptation planning. Feedback can be sent to **Acc.Mailbox@defra.gsi.gov.uk**, or to:

ACC Mailbox
Adapting to Climate Change Programme
Area 3A, Defra
Nobel House
17 Smith Square
London SW1P 3JR

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