Climate Change Bill
Final Impact Assessment

Revised for House of Commons introduction

April 2008
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What is the problem under consideration? Why is government intervention necessary?
Climate change is the result of the externality created by the emission of greenhouse gases to the atmosphere. Those who emit do not have to bear directly the full cost of their actions. The global causes and consequences of climate change, coupled with the long term and persistent nature of the impacts, highlights the need for government intervention. In addition, there may be barriers to optimal adaptation caused by, for example, uncertainty and lack of information about the impacts of climate change. The Bill will create a framework which enables the UK to meet its domestic targets as well as ensuring the UK can meet its existing and future international commitments for emissions reductions. It will also set a framework for domestic action on adapting to the impacts of climate change.

What are the policy objectives and the intended effects?
1. To avoid the impacts of dangerous climate change in an economically sound way. In particular by:
   - Demonstrating the UK's leadership in tackling climate change - to increase the chances of a binding international emissions reduction agreement that would stabilize concentrations of greenhouse gases at a level that would avoid dangerous climate change;
   - Establishing an economically credible emissions reduction pathway to 2050; and
   - Providing greater clarity and predictability for UK industry to plan effectively for, and invest in, a low-carbon economy.
2. To put in place a framework that commits the Government to assess and address climatic impacts so that the UK is better able to respond to the unavoidable impacts of climate change.

What policy options have been considered? Please justify any preferred option.
Current system of non-statutory targets does not provide sufficient predictability to households and firms about the level and timing of emissions reductions required to meet the UK's commitments to tackle climate change.

The Bill establishes a new framework for supporting emissions reductions. Provisions in the bill balance the need to provide greater predictability for households and firms to invest in a low-carbon technology, while retaining flexibility to allow for unexpected events and inherent uncertainty that may increase or reduce the cost of reducing greenhouse gases.

There is also no existing requirement for Government to regularly assess all the impacts from climate change holistically or to draw up a single programme to address them. The Bill gives the Secretary of State a duty to establish a programme but it does not specify policy interventions, so as to allow flexibility in the long-term.

The Government’s preferred approach in relation to public authorities and statutory undertakers is to create a power that allows the Government to ask for adaptation reports, rather than placing an automatic duty to do so. This reflects better regulation principles, the relationship between central and local Government and the fact that many authorities and undertakers are already taking action.
When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? Statutory annual reports will evaluate the UK’s progress in meeting its targets and carbon reduction budgets. The risk report and adaptation programme will be updated every 5 years. A mid-term review of the programme will also be conducted.

**Ministerial Sign-off** For final proposal/implementation stage Impact Assessments:

*I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.*

Signed by the responsible Minister:

…………..

………………………………………………….Date: 31 March 2008
### Policy Option:
Statutory targets and carbon budgets for emissions reductions. Formation of the Committee on Climate Change to advise on budgets.

#### Description:
- **ANNUAL COSTS**
  - **One-off (Transition)**
    - Yrs: 43
    - £: 
  - **Average Annual Cost** (excluding one-off)
    - £ 1.6 to 12.0 bn

- **ANNUAL BENEFITS**
  - **One-off**
    - Yrs: 43
    - £: 
  - **Average Annual Benefit** (excluding one-off)
    - £ 5.6 to 7.5 bn

#### Key Assumptions/Sensitivities/Risks
Figures presented are indicative estimates the impact of achieving the statutory 2050 target, not of achieving specific carbon budgets. The precise costs will depend on: fossil fuel prices; the cost and availability of low-carbon technologies; degree of multilateral action; choice of policies; and, when abatement occurs.

#### Price Base
- Year: 2007

#### Net Benefit Range (NPV)
- £ -95 to 52 billion

#### Net Benefit (NPV Best estimate)
- £ N/A see range

### Key:
- **ANNUAL COSTS**
- **ANNUAL BENEFITS**
- **COSTS**
- **BENEFITS**
- **Key Assumptions/Sensitivities/Risks**
- **Price Base**
- **Net Benefit Range (NPV)**
- **Net Benefit (NPV Best estimate)**
- **Key: Annual costs and benefits: Constant Prices (Net) Present Value**

### What is the geographic coverage of the policy/option?
- United Kingdom

### On what date will the policy be implemented?
- After Royal Assent

### Which organisation(s) will enforce the policy?
- Parliament/courts

### What is the total annual cost of enforcement for these organisations?
- £ N/A

### Does enforcement comply with Hampton principles?
- Yes

### Will implementation go beyond minimum EU requirements?
- N/A

### What is the value of the proposed offsetting measure per year?
- £ N/A

### What is the value of changes in greenhouse gas emissions?
- £ 82 to 110 bn

### Will the proposal have a significant impact on competition?
- Yes/No

### Annual cost (£-£) per organisation (excluding one-off)
- Micro
- Small
- Medium
- Large

### Are any of these organisations exempt?
- No
- No
- N/A
- N/A

### Impact on Admin Burdens Baseline (2005 Prices)
- Increase of £ N/A
- Decrease of £ N/A
- Net Impact £ N/A

**Key:**
- Annual costs and benefits: Constant Prices (Net) Present Value
1. Purpose and intended effect

1.0.1 This is an Impact Assessment of the proposed measures in the Climate Change Bill. Section 2 presents illustrative estimates of the costs and benefits of the UK reducing greenhouse gas emissions. Section 3 contains a detailed analysis of the impact of the measures proposed in the Bill.

1.1 Objectives

1.1.1 The Climate Change Bill is intended to create a legislative framework for the effective management and delivery of policies to tackle climate change, in particular by:

- establishing an economically credible emissions reduction pathway to 2050, by putting into statute medium and long-term targets and a system of carbon budgets which will constrain the total amount of emissions in a given time period;
- providing greater clarity and predictability for UK industry to plan effectively for, and invest in, a low-carbon economy;
- providing a strong evidence-base and expertise to underpin statutory targets;
- establishing a duty on the Government to regularly assess the risks from climate change and draw up a programme to address them; and
- creating a power for the Government to ask a range of public authorities or statutory undertakers to assess and address the impacts of climate change.

1.1.2 In addition, the Bill is intended to strengthen the UK’s leadership internationally to help raise the ambition and urgency of collective action to tackle climate change.

Supplementary provisions

1.1.3 In addition to the main framework provisions the Bill also contains supplementary provisions to enable some specific policies and powers that will contribute to tackling climate change. For example, the Bill contains provisions to reduce the administrative and compliance costs of the Renewable Transport Fuels Obligation, which aims to reduce the carbon emissions from road transport by obliging fuel suppliers to include 5% biofuels in transport fuels sold. Annex A summarises the impacts of the provisions relating to the Renewable Transport Fuels Obligation contained in the Bill. The Bill also provides a power to pilot local authority incentives for household waste minimisation and recycling, in order to reduce waste to landfill. The impacts of the Renewable Transport Fuels Policy are considered as part of a separate Impact Assessment, as are the impacts of the provisions in the Bill in relation to adaptation and reporting authorities.¹

1.1.4 The Bill also contains enabling powers to establish trading schemes, including specific powers relating to the introduction of the Carbon Reduction Commitment, which was announced as part of the 2007 Energy White Paper. Annex B provides a summary of the impacts from the specific powers in the Bill relating to the CRC.

1.2 Background

International and scientific context

1.2.1 There is an overwhelming body of scientific evidence highlighting the serious and urgent nature of climate change, largely due to emissions of greenhouse gases (GHGs) as a result of human activities such as the combustion of fossil fuels and changing patterns of land use. The most recent Intergovernmental Panel on Climate Change (IPCC) report shows conclusively that the debate over the science of climate change has moved on from whether or not it is happening to what we need to do about it.

1.2.2 The international community has already begun a coordinated response to the challenge. The UN Framework Convention on Climate Change (UNFCCC) has as its ultimate objective the "stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The Kyoto Protocol, which aims to reduce greenhouse gas emissions by ‘Annex I’ Parties (a number of industrialised countries including the UK, other European Union (EU) member states, Canada and Japan), was agreed in December 1997. Under the Protocol, Annex I Parties agreed to reduce their collective greenhouse gas emissions by 5.2% between 2008 and 2012 (compared to the year 1990). However, as the Stern Review amply demonstrated, it is now clear that international cooperation must go much further to stabilise greenhouse gases concentrations at levels which will avoid dangerous climate change.

1.2.3 The Kyoto Protocol, which aims to reduce greenhouse gas emissions by ‘Annex I’ Parties (a number of industrialised countries including the UK, other European Union (EU) member states, Canada and Japan), was agreed in December 1997. Under the Protocol, Annex I Parties agreed to reduce their collective greenhouse gas emissions by 5.2% between 2008 and 2012 (compared to the year 1990). However, as the Stern Review amply demonstrated, it is now clear that international cooperation must go much further to stabilise greenhouse gases concentrations at levels which will avoid dangerous climate change.

1.2.4 Our next key objective at international level is to secure in 2009 a global and comprehensive post-2012 agreement, which should build upon and, taking forward the Bali Action Plan (agreed at the 13th Conference of the Parties to the UNFCCC in December 2007), broaden the Kyoto Protocol architecture and provide a fair and flexible framework for the widest possible participation. All countries should be invited to contribute to the efforts under this framework according to their differentiated responsibilities and respective capabilities.

1.2.5 It is imperative to build on these international frameworks. Leadership must come from the major developed economies, such as the UK which have been responsible for the majority of the historic rise in greenhouse gas concentrations, generally have higher per capita emissions, and have income levels and the technological capacity to lead the necessary investment. The Stern Review estimated that developed countries should take responsibility for greenhouse gas emissions reductions of between 60 and 80% (compared with 1990 levels) by 2050.

1.2.6 At the March 2007 EU Spring Council, Heads of Government agreed an ambitious, independent binding target to reduce Europe’s greenhouse gas emissions by at least 20% by 2020 (compared to 1990 levels) and increase this commitment to a 30% reduction as part of an international agreement. The adoption of the 30% reduction target would be contingent on other developed countries committing themselves to comparable emissions reductions and economically more advanced developing countries contributing adequately according to their responsibilities and respective capabilities. EU Heads of

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2 A glossary of terms is provided in Annex C.
4 Article 2 of the 1992 United Nations Framework Convention on Climate Change
5 1990 is the base year for carbon dioxide, methane and nitrous oxide. For the other greenhouse gases in the Kyoto basket (known as F-gases) the base year is 1995
Government agreed the long-term objective of developed countries collectively reducing emissions by between 60% and 80% by 2050 compared to 1990.

1.2.7 The UK has been at the forefront of diplomatic solutions and policy development as well as in research to combat the threat of climate change, in particular by:
- putting climate change on top of its agenda for the dual presidencies of the G8 and the EU in 2005, resulting in the establishment of the Gleneagles Dialogue on Climate Change and Sustainable Development;
- working at all levels and in all relevant international fora, particularly the UNFCCC itself, to secure leadership in tackling climate change by the EU and other developed countries – including through UK Presidency of the EU at the 2005 Montreal UN Conference of the Parties and at the important Bali Conference in 2007;
- working with the World Bank and the multilateral development banks to drive investment in low-carbon energy sources, energy efficiency and adaptation to climate change in developing countries;
- promoting cooperation on technology transfer, for example as part of strategic “Dialogues” with India and China;
- accepting relatively high burden-sharing commitments under the Kyoto Protocol as well as in Phase I and Phase II national allocation agreements under the EU-ETS;
- encouraging development of wider EU policies to tackle greenhouse gas emissions including through regulation of certain fluorinated gases, and a suite of energy efficiency performance standards; and,
- developing our collective understanding of the costs and risks by sponsoring research into both mitigation and adaptation, for example by the recent Stern Review, and through funding (since 1997) of the UK Climate Impacts Programme, which brings together the scientific evidence for climate change impacts and adaptation in the UK.

Managing domestic policy in the context of international uncertainty

1.2.8 Currently, there is significant uncertainty surrounding the degree of climate change mitigation that will be undertaken in the future. This is, in part, because of the continuing negotiations on an international agreement beyond 2012 within the framework of the UNFCCC and Kyoto Protocol. In addition, the EU Commission have proposed significant changes to the EU Emissions Trading Scheme from 2013 and are currently being negotiated between Member States. Such uncertainty is likely to increase the returns required by households and particularly firms when making low-carbon investment decisions, risking continued high levels of investments in carbon-intensive capital.

1.2.9 The Bill proposes to enshrine domestic commitments in statute. It is essential that these commitments are reinforced by the implementation of credible policies, such as those set out as part of the 2007 Energy White Paper and those which will be set out in the proposals for meeting budgets. The combination of statutory emissions reduction targets and credible policies would in turn increase predictability for UK households and firms to plan and invest for a low carbon economy. Statutory commitments to reduce emissions by at least 60% will demonstrate the Government’s ambition to equip the UK with the conditions necessary for a successful transition to a low carbon economy.

1.2.10 The mitigation framework provided by the Bill aims to balance the objectives of facilitating ambitious policies, maximising the predictability for UK households and firms, and retaining sufficient flexibility to ensure that mitigation is not unnecessarily costly. Flexibility is required to mitigate the unpredictability around future emissions projections. Emissions could be higher or lower depending on a number of factors such as fossil fuel prices, carbon prices and the timing of policy delivery.
1.2.11 The Bill is structured to provide this flexibility, setting a framework to motivate and enable policy action without being prescriptive about how the framework should be applied. It provides flexibility by allowing unused quotas to be ‘banked’ to the next budget, and limited ability to borrow to bring forward emissions allocations from future budgets. The Bill also allows emissions reductions to be achieved overseas through trading and purchasing of international emissions reduction credits, thereby utilising least-cost global abatement options (these mechanisms are discussed further in Section 3).

**Rationale for Government intervention**

1.2.12 Climate change is the result of the externality created by the emission of greenhouse gases to the atmosphere. Those who produce greenhouse gas emissions do not face directly the full consequences of their actions. In addition, climate change has a number of features that together distinguish it from other environmental problems:

- it is global in its causes and consequences;
- the impacts of climate change are long-term and persistent;
- there are uncertainties and risks in the economic impacts; and
- there is a serious risk of major, irreversible change with non-marginal economic effects.

1.2.13 The nature of the externality suggests that individual efforts alone will not be sufficient to lead to an optimal reduction in emissions. Government intervention will be required to limit global emissions to a level that is consistent with avoiding dangerous climate change. The contrast between, in the long-run, the higher costs of inaction and the lower cost of action provide a fundamental rationale for the Government’s proposals in the Climate Change Bill.

1.2.14 The Stern Review estimates that the cost of inaction on climate change significantly outweighs the expected cost of coordinated global action. Without effort to tackle climate change, the Review predicts that the loss of GDP from climate change could cost the global economy significantly more than the global cost of action to stabilise atmospheric concentrations of greenhouse gases (at 550ppm carbon dioxide equivalent (CO₂e)). The Stern Review set out three essential elements of policy required for an effective global response:

i) **Establishment of a carbon price**: consumers and producers must bear the full cost of consumption or production decisions, including the external costs of climate change from emissions of carbon dioxide (CO₂) or other greenhouse gases, in order that markets encourage socially optimal economic behaviour. It is desirable that this price should apply universally as well as be credible, flexible and be subject to a degree of predictability over time. Credible, predictable policy frameworks are necessary to drive sufficient investment, essential for transition to a low-carbon economy. However, the underlying uncertainties that are inherent in understanding the problem of climate change means that any framework also needs to be flexible to allow decision makers to make adjustments in light of new information or unexpected events.

ii) **Promotion of innovation in low-carbon technologies**: technological developments are needed to increase cost effective mitigation potential in the long run. Uncertainties and costs surrounding the development and deployment of the technologies to address it (as well as the environmental risks associated with ineffective mitigation) are substantial. This points to the need for close cooperation between governments and industry to support the development and diffusion of a portfolio of low-carbon technology options.
iii) Overcoming market barriers and failures that restrict the transmission of incentives in markets affecting energy demand are needed to increase cost effective mitigation potential in the short and medium run, particularly in relation to uncovering greater energy efficiency savings. These include: hidden and transaction costs; lack of information about available options; capital constraints and misaligned incentives; as well as behavioural and organisational factors affecting economic rationality in decision-making.

1.2.15 In addition, the Stern Review recognised that adaptation is an important element in the toolkit for tackling climate change and minimising costs to society. Government has a role to play in providing the appropriate institutional framework to allow individuals and organisations to make efficient and cost-effective adaptation decisions. Stern identified three broad barriers to adaptation that Government may need to address: uncertainty and imperfect information over future climatic impacts; missing and misaligned markets, including public goods such as coastal protection; and financial constraints.

**Limits to the analysis in this Impact Assessment**

1.2.16 This Impact Assessment contains a high-level discussion of the costs and benefits of UK action to mitigate climate change to a degree consistent with the Government’s established medium and long term objectives, together with analysis of the key drivers and uncertainties surrounding these assessments which inform the detailed proposals within the Bill. However, the proposals contained within the Bill do not pre-judge the trajectory and specific policies required to achieve these goals.

1.2.17 The Government will set out its proposals and policies for meeting each of the five-year budgets. Any new policies put forward will be subject to a separate Impact Assessment at the appropriate time which will look in detail at the costs, benefits and impacts of the specific policy.

1.2.18 Equally, this Impact Assessment does not contain an assessment of the costs and benefits for the adaptation programme. The specific polices and objectives which constitute the programme will be costed as part of standard policy development practices and further impact assessments provided (Annex D sets out the impact assessment of the adaptation measures in the Climate Change Bill). The document does, however, include information on the costs and benefits that result from the adaptation reporting power (see section 3.1.14) and the costs of the adaptation sub-committee of the Committee on Climate Change.
2. Illustrative Costs and Benefits of reducing UK emissions

2.0.1 This section sets out a high level discussion of the:
- illustrative benefits and costs of action to deliver the proposed statutory emissions reduction of at least 60% by 2050 and at least 26% by 2020 (compared to 1990 levels), through domestic and international effort;
- key uncertainties and sensitivities surrounding these assessments; and,
- potential distributional impacts across different sectors of the UK.

2.0.2 However, it is important to note again that the Bill does not provide for either the precise trajectory or the policy mix towards achieving these targets, rather it creates a framework for managing the transition to a low-carbon economy. The impacts of the Bill's provisions are likely to be influenced by detailed decisions regarding the size of overall carbon budgets and the balance of policies to deliver them. These will be the subject of further and more detailed Impact Assessments, which will be produced when designing individual policy measures to deliver emissions reductions.

2.1 Outlining the costs of UK action to reduce climate change

2.1.1 This section draws on a range of different modelling results applicable to both the UK economy and, in some circumstances, drawing on analogous mitigation cost studies in other developed countries. This includes research undertaken as part of the Stern Review, together with analysis conducted for the 2007 Energy White Paper (in particular, a newly developed MARKAL-Macro model which focuses on long run mitigation costs of meeting the 2050 target, as well as a study conducted by Oxford Economics to explore the potential short run adjustment costs of meeting a 2020 target). Technical issues surrounding the use of these and wider generic approaches to modelling mitigation costs are outlined in Box 1 below.

2.1.2 It is important to emphasise that projections based on models are inherently uncertain, especially over the long term. Therefore, the modelling results cited are intended only to illustrate possible costs rather than predict precise outcomes. As such, any results must be carefully interpreted when designing policy and the inherent degree of uncertainty surrounding these has implications for the desirable level of flexibility within the overall framework (discussed in Section 3).
Box 1: Using Modelling to Estimate Costs

Technology ‘bottom up’ models, such as the UK MARKAL and MARKAL-Macro models are useful in understanding long run costs of climate change mitigation. They are based on highly detailed assumptions regarding the potential costs of future technologies.

- The UK MARKAL model is a dynamic energy optimisation model that minimises the total cost of the energy system over a 50 year plus horizon. It provides valuable insights into the technical options and costs of carbon abatement between now and 2050. It has been substantially updated since 2003 with more detailed information and revised assumptions on technology costs and processes as part of a joint DTI/DEFRA sponsored project with the UK Energy Research Centre (UKERC) and Policy Studies Institute (PSI).
- This project also developed the MARKAL-Macro model, which links the detailed characterisation of the standard UK MARKAL with a ‘top down’ macroeconomic component. This model allows households and firms to reduce their demand for energy in response to higher prices (a response not available in the 2003 iteration). It also facilitates the explicit calculation of the macroeconomic variables such as GDP impacts, which was calculated ‘off model’ in the 2003 study.

The MARKAL and MARAL-Macro models are particularly useful in exploring the energy system in the long-term. As a UK only model, the MM model cannot capture trade and competitiveness impacts. In addition, the model describes the economy in equilibrium, and therefore is unable to capture transition costs that might occur as the economy adjusts to changes in energy policy. It is also somewhat limited in its ability to capture the obstacles that, in reality, can slow uptake of cost effective abatement or which make it more expensive, such as information barriers and policy costs. It may therefore be expected to produce lower-bound estimates of the costs of carbon abatement in 2050.

Macroeconomic models, whose focus is on the short-run dynamics, are better suited to capturing transitional costs as well as competitiveness effects associated with any policy change. As such analysis using a suite of models, developed by consultants Oxford Economics, explores the potential short-run adjustment costs associated with moving to a low-carbon economy up to 2020. However, insofar as macroeconomic models such as the Oxford Economic Models do not have the technological detail of ‘bottom up’ models such as the MARKAL they have the potential to overestimate the potential GDP impacts by overlooking the potential for cost-effective abatement options.

When considering the results of such macroeconomic models it is desirable to compare those which include induced technological change with those where this factor is exogenous. In the case of the former, mitigation commitment frameworks which establish a value for greenhouse gas reductions as well as incentives to increase Government or private sector expenditure on research and development, impact on the speed of technological development and the resulting abatement costs. The latter class of models, which do not account for these factors, tend to produce relatively higher cost assessments. A study commissioned by the Stern Review found that the inclusion of induced technical change could lower the estimated costs of stabilisation by one or two percentage points of global GDP by 2030.

Illustrating long run cost impacts up to 2050

2.1.3 The Stern Review concluded that, based on an extensive review of the current literature, the long run costs of global action to stabilise atmospheric greenhouse gas concentrations at 550ppm CO$_2$e are expected to be around 1% of GDP by 2050, within a range of +/-3%. Coordinated multilateral action, with good policy design and flexibility over where, when and what emissions are reduced are essential to keep costs this low.

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6 More detailed papers on the development of the MARKAL and MARKAL-Macro model available from the UKERC website http://www.ukerc.ac.uk/content/view/142/112/
This range is substantially lower than the expected costs of 'do nothing' to reduce climate change, estimated at between 5% and 20% of global GDP now and forever.  

2.1.4 The 2003 Energy White Paper used the ‘bottom up’ UK MARKAL model to estimate long run mitigation costs. It concluded that, based on a wide range of sensitivity analyses, the expected costs of reducing carbon emissions by 60% by 2050 were approximately equal to between a 0.5% and 2% permanent reduction in GDP in 2050. Since 2003, the MARKAL model has been substantially updated, and supplemented by the development of a new MARKAL-Macro model which allows for changes in energy demand as a result of variation in energy prices, and facilitates the explicit calculation of the macroeconomic variables such as GDP impacts (see Box 1 for details on both models).

2.1.5 Analysis using the MARKAL-Macro model indicates that the long run costs of reducing carbon emissions by 60% by 2050 are around 0.7% of GDP by 2050 in the central fossil fuel price scenario, falling to 0.3% of GDP by 2050 in the high fossil fuel price scenario.

2.1.6 As in the analysis for the 2003 Energy White Paper, the cost and availability of low-carbon technologies is important in keeping costs low: the new MARKAL-Macro analysis suggests that costs could rise up to 1.5% of GDP in 2050 if innovation is restricted. This is within the range of global costs indicated by Stern, though lower than the upper limit of the 2003 analysis. Two important factors affecting this are the potential for the model to capture the reduction in the demand for energy services (in response to energy price increases), and the impact of higher fossil fuel price forecasts (compared to those forecast in 2003).

2.1.7 It is possible to calculate the present value of the cumulative cost of reducing emissions by 60% by 2050. Expressed in terms of present value, the reduction in GDP (between 0.3% and 1.5% in 2050) using the range of assumptions presented above would be in the order of £30 to £205 billion. Higher fuel prices would decrease the costs of reducing emissions, while slower technological change would make tackling climate change more costly. As the MARKAL-Macro model represents only the UK energy system, these estimates assume that all emissions reductions happen in the UK, and no use of project credits is used to meet the UK targets. It is expected that the use of project credits would allow access to cheaper forms of abatement and therefore reduce the costs of meeting a given emissions reduction target.

2.1.8 The estimated monetary costs presented above represent only a partial estimate of the costs of reducing emissions. The costs of transitioning to a low-carbon economy are not included in this range and may be significant. Transition costs are discussed in paragraph 2.1.11 below. Due to differences in the modelling approaches between long-run and short-run costs it is not possible to provide an estimate of the transition costs on a consistent basis with the monetary value of the long-run costs given above. Therefore the monetary costs presented above must be treated with caution. The actual cost of

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9 The cost assessments outlined by the Stern Review are expressed in terms of a balanced growth equivalent. This measure the welfare of action or inaction in response to climate change arising from an impact on consumption over time, in terms of the amount of consumption today which would deliver the same amount of utility. As such, this is a slightly different measure from the GDP indicator used in relation to the UK long run and transition cost modelling.

10 In the 2003 analysis, GDP impacts were estimated 'off model' and are not directly comparable with the MARKAL-MACRO estimates (see Box 1).

11 All analysis done reflects a range of different scenarios and assumptions including scenarios where the option of investing in some technologies, for example new nuclear, is prevented. In particular, in the upper range scenario, post 2010 'vintages' of efficient end-use technologies and measures, as well as the power sector and other upstream technologies, are restricted from the model.

12 The upper limit in the 2003 analysis was based on assuming restricted innovation on all technologies but also excluding some technologies altogether.
mitigation will depend on the policies implemented to reach the emissions reduction targets.

Illustrating transition costs in the short and medium term

2.1.9 Transforming the carbon intensity of all key markets affecting energy demand, such as electricity, heat, and transport, requires investment in new capital and processes as well as ongoing long run technological development. However, in addition to the long run costs illustrated in the previous section, it is likely that there will be short and medium run costs, in terms of reduced consumption, output and employment, for example:

- carbon intensive sectors of the economy are likely to contract from the imposition of more rigorous carbon constraints (although others may benefit); this may result, for example, in some structural adjustment in employment patterns;
- households and firms may need to replace capital prematurely in response to new financial incentives to conserve energy or switch fuels, increasing production and consumption costs; and
- households and firms may incur additional transaction costs associated with shifting patterns of production and consumption, for example arising from the need to acquire information or develop skills in relation to new technologies.

2.1.10 As outlined in Box 1, macroeconomic models which focus on the short-run dynamics are better suited to capturing these transitional costs than ‘bottom up’ models referred to in the previous section.

2.1.11 Macroeconomic analysis conducted by Oxford Economics as part of the 2007 Energy White Paper\textsuperscript{13}, is helpful in illustrating the potential short-run adjustment costs associated with moving to a low carbon economy up to 2020. In particular, it considers the potential economic costs of the introduction of a purely illustrative carbon price on all sectors sufficient to achieve constant annual reductions (i.e. a ‘straight line’ trajectory) towards an overall carbon emissions reduction of 30% by 2020 (based on 1990 levels). The analysis suggests that the transition costs could be 1.3% to 2% of GDP in 2020.\textsuperscript{14}

2.1.12 Any assessment of the UK transition costs needs to be put in the context of a wider (though limited) pool of analysis that focuses on the dynamic costs of mitigation policy in the UK and in other developed countries. Much of the analysis on transition costs has focused on the attempts of developed countries to meet their Kyoto Protocol targets. Based on a review of a wide range of studies, the IPCC concluded in its Third Assessment Report (2001) that the cost of implementing Kyoto in 2010 for Annex I countries was in the range 0.2 to 2% of GDP without the use of the flexible mechanisms (trading between Annex B countries\textsuperscript{15}) and 0.1 to 1.1% of GDP with these mechanisms in place. However, these figures may be over estimates, as they don’t allow for cost effective reductions in methane, nitrous oxide and fluorinated gases.

2.1.13 US studies of transition costs have tended to suggest that transition costs could be more substantial. One study of US Kyoto compliance costs indicated transition costs of as much as 3.4% by 2010 and 0.2% in 2020.\textsuperscript{16} However, it is likely that these are over estimates due to the fact that the analysis did not allow for induced technology changes, used high emissions baselines and assumed limited policy flexibility (not reflected in the Kyoto framework). Nordhaus famously estimated that the US would face a cost of

\textsuperscript{13} Available at http://www.berr.gov.uk/files/file38978.pdf
\textsuperscript{14} These costs show that GDP in 2020 would be 1% to 2% lower that under the baseline.
\textsuperscript{15} The group of countries included in Annex B of the Kyoto Protocol that have agreed to a target for their greenhouse gas emissions.
\textsuperscript{16} Energy Information Administration (1998)
meeting Kyoto which was more than the global total for the other Annex I countries. This high cost of the Kyoto Protocol to the US arose because CO\textsubscript{2} emissions were projected to grow much more rapidly in the US than in other regions, so containing emissions would prove much more expensive.

2.1.14 However, these short term costs will depend on a number of factors, including the absolute level of ‘effort’ required to achieve a target, the relative effort compared to other countries and regions, fossil fuel prices and the level of technological change and speed of adjustment to higher prices. The potential importance of these factors is discussed in the next section.

2.1.15 Analysis for the UK indicates that the long run costs of achieving significant reductions in CO\textsubscript{2} emissions are within the range identified by the Stern Review (which estimated that the long run costs of global action to stabilise atmospheric greenhouse gas concentrations at 550ppm CO\textsubscript{2}e are likely to be around 1% of GDP by 2050, within a range of +/- 3%).

2.1.16 Short and medium run (i.e. to 2020) transition costs could be in the upper end of the range indicated by the Stern Review, although these are highly dependent on the choice of transition path as well as the policy mix. It is important to note the substantial uncertainties surrounding assessments of the precise costs (which are outlined in Section 2.2).

2.2 Outlining the Key Cost Uncertainties and Sensitivities

2.2.1 This section outlines analysis surrounding the sensitivity of the cost assessments outlined in the previous section to a number of key uncertainties including the:
- choice of emissions reductions pathway;
- degree of international commitment to reduce greenhouse gas emissions including the relative effort between countries and regions;
- cost and availability of low-carbon or energy efficient technologies;
- cost of fossil fuels; and
- the level of the 2050 target for emissions reductions.

2.2.2 This is intended to inform more detailed decisions surrounding the development of the proposed carbon management framework.

Pathways to transition

2.2.3 The timing and pathway of emissions reductions towards an overall objective is likely to impact on costs. Results from the MARKAL-Macro model compare the long run costs of two different pathways to achieving a 60% reduction by 2050. In particular, a ‘straight line’ trajectory from 2010; and one where the model achieves 30% reductions (based on 1990 levels) by 2030, and thereafter falling in a straight line to 2050. These different pathways, and the difference in emissions from the Business As Usual (BAU) scenario are shown in the Figure 1.

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17 These constraints are applied in an attempt to replicate realistic options for abatement. Without any intermediate constraints the model might choose a path where all efforts are made towards the end of the period, which would, however, imply an unrealistic pattern of asset replacement and might also create some computational problems in the model.
2.2.4 These results suggest that following a tougher ‘straight line’ abatement profile could result in higher marginal and total costs in the short and medium term (i.e. up to 2030). However, the analysis suggests that if action to reduce carbon emissions is delayed then marginal costs in the longer run are expected to be higher. Furthermore, delaying action implies that less carbon is abated overall.

2.2.5 Analysis using the Oxford Economics model indicates a relatively high sensitivity of short and medium run adjustment costs to the choice of two different, purely illustrative, pathways to an overall CO$_2$ emissions reduction of 30% by 2020 (based on 1990 levels). It indicated that the total cumulative discounted GDP costs over the period 2007-2020 were over double (around 1.6% GDP) in the case of a ‘big bang’ scenario, in which a large immediate carbon price is imposed on all sectors, compared to the case of a smoothed introduction of a carbon price (around 0.8% GDP), designed to achieve a ‘straight line’ emissions reduction trajectory up to 2020.

**Degree of international effort**

2.2.6 The proposals within the Bill set unilateral targets in statute for the UK to take responsibility for a share of the global mitigation effort. However, it is likely that the resulting transition costs will be affected by the degree of wider international commitment as this may affect, for example, the size of markets for individual low-carbon technologies as well as the wider macroeconomic conditions affecting the UK. However, there remains some uncertainty surrounding the exact nature of the impact of differing degrees of multilateralism on mitigation costs.

2.2.7 Recent work for the Australian government$^{18}$ showed relatively low impacts of differing degrees of international commitment on domestic mitigation costs. However, research by the IPCC found relatively high risks of asymmetric mitigation action resulting in the transfer of productive capital to countries without carbon policies, known as ‘carbon leakage’.$^{19}$ It is likely that different approaches to modelling technological change account for some of these differences (outlined in Box 1).

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$^{19}$ IPCC (2001) Third Assessment Report, using Computational General Equilibrium models with exogenous technological change, estimated leakage rates for the first Kyoto period through uniform carbon taxes of between
2.2.8  The Oxford Economics modelling looked at the macroeconomic impacts on the UK of different degrees of EU and international effort by 2020. This work suggests that short run costs to the UK could be slightly magnified in the event of more symmetric European and international action, due to the initial negative impacts of foreign efforts on external demand for UK exports. However, in the medium run (i.e. by 2020) costs to the UK might be lower, due to smaller competitiveness effects.

Cost and availability of low-carbon or energy efficient technologies

2.2.9 Mitigation costs for a given emissions reduction trajectory are likely to be heavily influenced by the availability and costs of key abatement technologies. Furthermore, the speed of technological development is itself likely to be influenced by the decisions of policy makers regarding the overall commitment framework (which establishes a value to greenhouse gas reductions as well as incentivising Government or private sector expenditure on research and development). A study commissioned by the Stern Review found that the inclusion of induced technological change within modelling exercises could lower the estimated costs of stabilisation by one or two percentage points of GDP by 2030. 

2.2.10 Results from the Oxford Economics modelling suggest that induced technological change can affect the magnitude of costs in the short-term of meeting a reduction in emissions by 2020. For example, sensitivity analysis in which faster technological change in response to carbon prices was assumed suggested that the cost of mitigation would be 13% lower. Conversely, if technological change is not responsive to higher carbon prices, costs of mitigation would be 7% more.

2.2.11 Analysis using the MARKAL-Macro model examined the sensitivity of costs in the long term to the level of innovation and availability of low-carbon technologies, including both end-use and generation technologies. This work suggests that the long term (to 2050) GDP impact could be significantly higher in a scenario where there were no developments in technological innovation beyond 2010, i.e. 1.5% compared with 0.7% in the central case.

The cost of fossil fuels

2.2.12 The long run levels as well as short term fluctuations in fossil fuel prices are key uncertainties affecting energy markets. In general, relatively low fossil fuel prices increase abatement costs as low-carbon alternatives become relatively more expensive, and as demand for energy increases in response to low prices. In the electricity generation sector the relative prices between the different fossil fuels, particularly coal and gas, is an important factor in determining which is used. Modelling these scenarios suggests:

- GDP costs of long-run mitigation to achieve a 60% reduction in emissions in 2050 are cut by more than half in the case of high fuel price scenarios, i.e. from 0.7%

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5-20%. Babiker (2005) produced much higher leakage estimates ranging from 25 to over 100%; implying significant losses of competitiveness for OECD countries using a global general equilibrium model. 

20 Barker T. et al. (2006)

21 This sensitivity analysis was conducted around a purely illustrative 30% reduction of emissions in 2020, meaning absolute changes in GDP are not comparable to the other transition cost figures cited.

22 The restricted innovation scenario, fewer efficient end-use technologies are available, and learning improvements in technologies are not allowed post 2010.
reduction in GDP by 2050 in the central case to a 0.3% reduction in the case of high prices;\textsuperscript{23} and

• short and medium run transition GDP costs in 2020 of achieving 30% emissions reductions could increase (up to 2% of GDP by 2020) under low fossil fuel prices but fall to 1.3% in the event of high fuel prices.\textsuperscript{24}

**Uncertainty and policy design**

2.2.13 The analysis presented in this section suggests costs of mitigation are highly sensitive to the choice of emissions reduction pathway as well as assumptions regarding technology costs and, in addition, are moderately sensitive to those regarding fuel prices. However, the underlying sensitivity of mitigation costs to differing degrees of mitigation by other countries is less well understood.

2.2.14 The extent of these sensitivities implies the desirability of a flexible policy framework which actively assesses, manages and, where necessary, reviews the optimal pathway and delivery of transition to a low-carbon economy in light of a wide range of factors including: the degree of international commitment to reduce greenhouse gas emissions; the cost and availability of low-carbon or energy efficient technologies; and the cost of fossil fuels. Detailed policy design issues are set out and discussed in Section 3 in the light of these uncertainties.

**The level of the 2050 target**

2.2.15 The level of the long-term emissions reduction target in 2050 will be the most important factor in determining the scale of the environmental, social and economic impacts of the Bill. The Bill places a duty on the Committee on Climate Change to advise by 1 December 2008 on whether the 2050 target should be amended.

2.2.16 A more stringent emissions reduction target may increase the chances of stabilising atmospheric concentrations of greenhouse gases within the range examined by the Stern Review. It will also demonstrate the UK’s commitment to tackling climate change and to take responsibility for emissions. The UK’s ability to demonstrate leadership may be important in helping to secure further international agreements to tackle climate change.

2.2.17 More stringent targets will require more aggressive policies to enable emissions reductions to happen sooner. This will create greater incentives for households and firms to increase energy efficiency and may drive further improvements in technological innovation. This may provide greater opportunities for the UK to benefit from the development of a low carbon economy.

2.2.18 Reducing emissions further is likely to increase the level and range of potential economic and social costs of mitigation. Further analysis following the 2007 Energy White Paper has examined the potential impact of a more ambitious emissions reduction target for 2050. Analysis using the MARKAL-Macro model has looked at the anticipated costs of meeting a 70% or 80% CO2 reduction from 1990 levels, through domestic abatement measures. Under an 80% reduction scenario, costs have been estimated to be between 1.1% to 2.6% of GDP in 2050, depending on the assumed level of future technological change, fossil fuel prices and availability of particular technologies. Limited sensitivities

\textsuperscript{23} Analysis using MARKAL-Macro. Conversely, however, the low fuel price scenario is the same cost as the central, 0.7% GDP in 2050. This is because, although all fuels are cheaper, the relative price change makes gas more competitive than coal resulting in lower emissions than in the central case.

\textsuperscript{24} Evaluated on the basis of a ‘straight line’ trajectory towards an overall carbon emissions reduction of 30% by 2020 (incorporating the continuation of the EU-ETS post 2012 in the baseline, contributing to a 17% reduction in emissions from 1990 levels).
have been conducted for a 70% reduction scenario. Using central fuel price assumptions the long run costs of reducing carbon emissions by 70% by 2050 are expected to be 1.1% of GDP in 2050, which is comparable with the 0.7% estimated for a 60% reduction.

2.2.19 The MARKAL-Macro model assumes that there is perfect information about future carbon prices available ensuring that the correct decisions are always taken about which technologies to use. This means the GDP impacts should be interpreted as the low end of the range of possible costs. As a UK only model, no competitiveness impacts are measured. This may become more significant if the UK adopts an emissions reduction target that goes significantly beyond the level of ambition of other countries.

2.2.20 Modelling results for more stringent emissions reduction targets must be interpreted with caution. Placing greater constraints on emissions in the MARKAL-Macro model will force the model to choose a different mix of technologies to meet energy demand. With a lower emissions target, existing high-carbon technologies can be used only to meet a smaller proportion of the energy demand. This increases the sensitivity of the results of the model to the assumptions used in the model regarding the future technical feasibility and availability of certain technologies. Therefore further analysis will be required to explore in more detail the technical implications of more stringent emissions reductions.

2.2.21 Given the uncertainty surrounding the implications of higher targets, the Bill proposes that the 2050 target be set to provide a reduction in emissions of at least a 60%. Insufficient analysis is currently available to allow a full consideration of the costs and benefits of moving to a more stringent target immediately. Moving to a higher target now, without understanding the potential impacts, increases the chances of setting carbon budgets that are unachievable, which would damage the certainty provided by the framework.

2.2.22 The Bill requires that the Government seeks the advice of the Committee on Climate Change (the Committee), to be established under the provisions of the Bill, before any amendment of the 2050 target. It also requires the Committee on Climate Change to advise by 1 December 2008 on whether the 2050 target of at least a 60% reduction should be amended.

2.3 Estimating Distributional Effects

2.3.1 The impacts of climate change mitigation policies are likely to be unevenly distributed across sectors and households. The distributional impacts will be affected by the extent to which the UK acts unilaterally and by the particular policy mechanisms used in each sector. As mitigating climate change is a relatively new objective for Government, there are not yet any substantial ex-post (i.e. retrospective) econometric analyses that illustrate the distributional and employment effects induced by mitigation policies. As such, much analysis of these potential effects is based on theoretical reasoning and simulation studies which must be interpreted cautiously. This section discusses the possible distributional impacts of achieving the headline targets proposed in the Bill.

Energy intensive industries

2.3.2 The Stern Review suggests that industrial sectors which have high energy-intensities of production and that are highly exposed to international competition are likely to experience the most adverse impacts on output and employment. The Stern Review analysed the potential effects of implementing a carbon price of £70/tC on the UK economy using input output tables.\(^{25}\) It found that energy intensive sectors are most

\(^{25}\) Stern Review, Chapter 11.
likely to be adversely affected by mitigation policies. However, it also found that only six\textsuperscript{26} of the 123 UK sectors were projected to face an increase in variable costs of 5% or more from higher energy costs as a result of carbon pricing. This is because many sectors tend to trade mostly inside the EU. For example, trade intensity falls seven-fold in the cement industry when restricted to non-EU countries and four-fold in pulp and paper, plastics and fibres. As such, mitigation through the EU-ETS (and other policies such as EU wide regulation) which establish a single carbon price across the trading block have the potential substantially to substantially reduce the risk of competitiveness impacts.

2.3.3 Overall, research undertaken as part of the 2007 Energy White Paper suggests that the imposition of carbon constraints may cause some structural adjustment in the economy, with output and employment re-allocated from energy intensive to non-energy intensive sectors. The analysis suggests that working cooperatively, and especially through the EU-ETS, minimises the effects on those sectors exposed to international competition. Further analysis, considering the impact under a scenario where a carbon price is imposed more symmetrically across the EU, which better reflects the UK’s current mitigation strategy which places primacy on the EU-ETS for these sectors, shows reduced structural effects and competitiveness risks.

**Non-energy intensive sectors**

2.3.4 Climate change mitigation policies may have some impact on less energy intensive areas of the economy, predominantly those in the service sector. However, the extent of this impact is likely to be limited by the fact that these sectors typically have a very low ratio of energy costs to output - often less than 2% (compared to typical labour costs in the region of 26%).\textsuperscript{27} As such, a marginal increase in energy prices as a result of the introduction of a carbon price is unlikely to have a substantial impact on overall production costs, especially when considered in the context of natural fluctuations in the fuel markets (see next section on energy prices and consumers). Any cost increases could be offset partially by inducements to innovate and use energy more efficiently (see section in on encouraging innovation and resource efficiency).

2.3.5 Some sectors of the UK may be well placed to benefit from its early action, such as environmental consultancy services. As a major provider of financial services, it is likely that the UK, and particularly London, will benefit from growth in an international carbon market: city industrial and financial experts have quickly developed expertise in forecasting and hedging carbon prices and developing futures markets which support the operations of the EU-ETS.

**Consumers and energy prices**

2.3.6 Carbon abatement will entail some costs and can therefore increase energy prices. The existence of the EU-ETS is, for example, having an impact on electricity prices in the UK because electricity generators can pass on the cost of carbon allowances to consumers. Overall costs can be minimised by setting the right policies in place to incentivise the most cost-effective methods of mitigation. The size of the impact depends on the scale of effort to deliver carbon savings across the EU, when these emission reductions occur, and the degree of pass-through of the carbon price.

\textsuperscript{26} Sectors identified were gas supply and distribution; electricity production and distribution; refined petroleum; cement; fertilisers; and fishing.

\textsuperscript{27} 2005 estimate in Annual Business Inquiry (see http://www.statistics.gov.uk/abi/)
2.3.7 Climate change mitigation policies will affect the users of energy intensive products as, ultimately, all costs of energy price rises will be borne by consumers. However, analysis conducted by the Stern Review suggests that cost increases may not necessarily be that large for households. The input output analysis identified a 0.9% long run increase in consumer prices arising from a £70/tC carbon price.\textsuperscript{28} Furthermore, climate change mitigation policies may incentivise the take up of cost effective energy saving technologies among energy users. While it can be argued that measures to mitigate climate change will increase the number of households exposed to fuel poverty, the extent of this could be limited by energy efficiency inducements as well as carefully targeted policies to address such secondary effects. The Committee (in advising on carbon budgets) and the Government (in setting them) will have regard to this issue when implementing the framework.

\textit{Encouraging innovation and resource efficiency}

2.3.8 The potentially negative impact of mitigation policies as a result of higher energy prices (leading to a potential increase in fuel poverty) and reduced growth may be offset by induced improvements in energy efficiency. Analysis attributed positive macroeconomic effects to energy efficiency policies implemented as part of the Climate Change Programme in the form of lower inflation and higher output, in particular: a 0.3% reduction in the annual growth rate of prices (i.e. lower inflation) for 2005-10 and a 0.1% increase in the annual GDP growth rate for 2005-10.\textsuperscript{29} Analysis in the 2007 Energy White Paper identified significant cost effective abatement potential across the UK economy. It is likely that further policies could help uncover further economic benefits. For example, analysis of the potential impacts of the Carbon Reduction Commitment\textsuperscript{30} suggested that there was significant, untapped cost effective potential for emission reductions in large, non-energy intensive organisations (up to 11% of current emissions from the sector). Energy efficiency measures are clearly an important policy tool, with reduced energy use having not just macroeconomic benefits but important co-benefits such as reduced fuel poverty and increased energy security. Such considerations are key when considering the unilateral nature of the emissions reduction framework.

2.3.9 Furthermore, some academics challenge the traditional theoretical view that early adopters of climate change mitigation policies adversely impact on their industries by creating additional costs. Porter identifies examples of environment regulation/policies which lead to innovation by creating pressures that encourage firms to look for ‘cleaner’ and/or more efficient production technologies and processes.\textsuperscript{31} Denmark’s success in wind energy is often cited as a case of regulation-led innovation, creating both local jobs and expertise that has been exported globally. The overall costs of regulation depend on the precise policy context. However, it is likely that performance standards induce the creation and adoption of new technologies although at some real opportunity cost.\textsuperscript{32}

\textit{The choice of policy mix}

2.3.10 The choice of policy instrument is also likely to have a significant distributional effect: regulation, market mechanisms or fiscal measures will have divergent distributional impacts. However, even within these particular tools different designs are likely to have

\textsuperscript{28} Stern Review Chapter 11.
\textsuperscript{30} ‘Energy Efficiency and Trading Part II: Options for the implementation of New Mandatory UK Emissions Trading’. NERA consulting 2006.
markedly different sectoral impacts. For example, the allocation methodology used by an emissions trading scheme will have large distributional impacts. When allowances are grandfathered\textsuperscript{33} there is scope for some emitters to make windfall profits by passing on the (opportunity) cost of the allowances despite receiving costless emissions allocation rights. Analysis by the Department for Business, Enterprise and Regulatory Reform (BERR) has estimated that the large electricity generators could have gained £1.2 - £1.3 billion in 2005 arising from grandfathering of emission allowances under the EU-ETS.

2.3.11 Overall, the distribution of impacts from implementing the proposed carbon management framework is likely to be uneven. A small number of energy intensive industries (particularly those exposed to international competition), may be affected potentially more significantly while less energy intensive areas of the economy, such as services and residential, are likely to be much less affected. Other sectors, such as environmental consultancy and financial services, may have opportunities to benefit from more robust mitigation frameworks, especially if these are replicated internationally.

2.3.12 The degree to which UK mitigation is replicated internationally is likely to have an important influence on the distribution of costs, particularly for sectors which are exposed to high degrees of international competition.

2.4 Potential size of benefits from reducing CO\textsubscript{2} emissions

2.4.1 For indicative purposes only, it is possible to use the Shadow Price of Carbon\textsuperscript{34} to place an indicative monetary value on the emissions reductions that would occur under a 60% emissions reduction target. The Shadow Price of Carbon captures the damage cost of climate change caused by each additional tonne of greenhouse gas emitted. These calculations rely on the profiles of emissions reductions taken from the MARKAL-Macro modelling to give the cumulative benefits of lower emissions from the targets set in the Bill. This suggests the present value\textsuperscript{35} of the benefits, using a 5% sensitivity range, would be in the order of £82 to £110 billion, depending on assumptions regarding the level of technological change and the prices of fossil fuels. However, this does not capture the full benefits from the measures proposed in the Bill, but simply provides an indicative estimate of the lower bound benefits to the UK of the emissions reductions, using the Government’s established methods for valuing changes in greenhouse gas emissions.

2.4.2 It is important to note however that this range does not capture the full potential benefits of reducing climate change. By demonstrating leadership in establishing statutory commitments to reduce emissions, the UK may increase the probability that a multi-lateral agreement can be reached that sets targets which are consistent with a stabilisation trajectory which would avoid dangerous climate change. However, the estimates above do not include any allowance for additional emissions brought about by such an agreement.

\textsuperscript{33} Grandfathering involves allocating allowances to firms on the basis of their past emissions. Firms that polluted more in the past would have larger shares. Grandfathering has the disadvantage of favouring existing firms and creating barriers to entry by new firms wanting to set up.

\textsuperscript{34} See DEFRA’s interim guidance at http://www.defra.gov.uk/environment/climatechange/research/carboncost/step1.htm

\textsuperscript{35} The value of future emissions reductions has been discounted at 3.5% per annum according to the method required in the Shadow Price of Carbon guidance.
2.4.3 In addition, no estimate of the benefits from greater predictability to households and firms has been attempted. The value of this will depend on the mix of policies implemented by Government to meet the agreed carbon budgets. No assessment of the potential ancillary effects from domestic mitigation policy, such as improved public health, increased energy security, and reduced fuel poverty, has been estimated.

2.4.4 Overall, analysis suggests that there is a strong case for making emissions reductions, compared to the potential costs of doing nothing to combat climate change. The exact costs and benefits from reducing emissions will depend on the trajectory of emissions reductions and the mix of policies chosen to reduce climate change. There is a strong case for a more robust policy framework to provide greater clarity and predictability for UK industry to plan effectively for, and invest, in a low-carbon economy. The Bill will demonstrate the UK’s leadership internationally, to help foster the conditions for broader and deeper international cooperation. A more stringent 2050 target for emissions reductions would increase the level of benefits, while also increasing the cost of mitigation.
3. Detailed Analysis of Measures

3.0.1 This section sets out a detailed assessment of the impacts from the provisions contained in the Bill to establish a framework for the management of climate change policies. Detailed analysis of the impacts of the Government’s preferred solutions are presented. The Partial RIA for the draft Bill provided an analysis of the full range of options considered as part of the development of the provisions in the Bill. Further details on the impacts of the Renewable Transport Fuels Obligation\textsuperscript{36} and the Waste Incentives for Local Authorities can be found in their respective Impact Assessments.

3.0.2 In addition, an amendment was incorporated into the Bill very late in its passage through the Lords which gives the Secretary of State powers to issue statutory guidance to companies on the disclosure of their greenhouse gas emissions. The time available has not allowed for a considered analysis of the costs and benefits of the measure at this stage, but we will make a separate analysis available before the issue is considered by the House of Commons.

3.1 Establishing a framework for Climate Change policy

3.1.1 The Bill proposes a clear framework for the management and delivery of climate change policies and for adapting to the likely impact of climate change on the UK. The framework is intended to support the ambitious targets for emissions reductions outlined in Section 2.

Creating greater predictability for investors

3.1.2 Policy instruments such as taxation, trading schemes or regulation create a price for emissions. This price provides an incentive for investment in less carbon intensive capital as well as innovation in the development of longer term technological and behavioural solutions. If there is uncertainty around the future price for emissions, firms may require a higher return on low carbon investments. Firms may therefore choose to continue to invest in carbon intensive plant, which may be inefficient as it will result in higher levels of carbon intensive capital in the future.\textsuperscript{37} This is an especially important factor in markets which are currently investing heavily in long lived capital, such as electricity generation and buildings. This may result in the need to undertake potentially expensive early capital retirement programmes or abate more aggressively in other sectors at higher cost in the future. In such cases, Government can help signal expectations about the future carbon price through a credible, flexible framework for climate change policy.

3.1.3 The Bill proposes to enshrine domestic commitments in statute. This would reduce uncertainty surrounding the intention of Government to institute domestic policies to realise these goals. As such, it would increase predictability for UK households and particularly firms investing in the UK. However, it is essential that these commitments are reinforced by the implementation of credible policies, which clearly demonstrate capacity to deliver these objectives.

\textsuperscript{36} Details of the impacts of the RTFO provisions contained in the bill are set out in Annex A.

3.1.4 In short the Bill will help households and firms form expectations as to the long run existence of a carbon price, but there are limitations to its capacity to confer certainty on this issue.

**Promoting conditions for international cooperation through domestic leadership**

3.1.5 Climate change is an international collective problem which requires cooperation in order to minimise both environmental risk and mitigation costs. However, cooperation is affected by market failures which lead to the under-provision of public goods\(^{38}\) where individuals or countries face an incentive to free-ride on the actions of others.\(^{39}\) This leads to the risk that countries will try and avoid reducing emissions (and incurring associated costs), while benefiting from mitigation commitments of others.

3.1.6 Game theory, and in particular the Prisoner’s Dilemma game, illustrates that countries have the incentive to free ride on the abatement of others, with the result being that everybody is worse off than if they had cooperated. However, analysis of this game also suggests it is possible to sustain cooperation if the game is repeated, for example where a series of commitment phases are required to stabilise atmospheric greenhouse gas concentrations.

3.1.7 By placing domestic commitments in statute, the UK Government is signalling its intention to seek a low greenhouse gas concentration outcome and not to free ride on any commitments of other countries. This may help influence overall global outcomes, particularly if the strategy is replicated by others, for example across the wider EU.

3.1.8 Stabilising atmospheric greenhouse gas concentrations is likely to require cooperation across multiple commitment phases. There is evidence that countries are starting to adopt strategies of conditional co-operation, in which they contribute more to the provision of a public good the more others contribute: for example, at the Spring European Council on 8/9 March 2007, EU Heads of Government agreed an ambitious, independent binding target to reduce Europe’s greenhouse gas emissions by at least 20% by 2020 (compared to 1990 levels) and increase this commitment to a 30% reduction as part of an international agreement. The UK can help build consensus within the EU, and to a lesser extent internationally, aimed at creating a critical mass towards such deeper cooperation.

3.1.9 The Stern Review suggested that developed countries should take responsibility for greenhouse gas emissions reductions of between 60 and 80% from 1990 levels by 2050. Without such commitment from developed countries, securing a future multilateral global framework will be impossible.

3.1.10 The UK, along with other developed countries, therefore has an important opportunity to build a consensus towards strong international collective action.

**Strengthening the framework for adaptation**

3.1.11 The Bill requires the UK Government to take two main steps in relation to adapting to the impacts of climate change:

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\(^{38}\) A public good is a good that is non-rival where the consumption of such a good by one individual does not reduce the amount of the good available for consumption by others. The term public good is often used to refer to goods that are non-excludable as well as non-rival. This means it is not possible to exclude individuals from the good's consumption.
• Publication of a UK risk report at least every 5 years; and
• Publication of an adaptation programme covering England and reserved matters, which must contribute to sustainable development. This will be produced to respond to the 5 yearly risks report and will be reviewed every 30 months.

3.1.12 The Bill places a duty on the Government to regularly report on the risks of the impacts of climate change for the UK, and on the Government’s proposals and policies for adapting to climate change. This will provide a framework for making clear the actions being taken to tackle the now unavoidable effects of climate change, and to provide greater predictability for UK households and firms.

3.1.13 The publication of an adaptation programme which would take the identified risks into account and was then implemented fully could have significant long-term benefits, minimising environmental, social and economic impacts related to climate change.

3.1.14 A quantitative analysis of the associated benefits of potential adaptation measures is not provided here, as the duty relates to the reporting of measures rather than their implementation. It is envisaged that significant adaptation measures would themselves be accompanied by Impact Assessments before implementation.

3.1.15 The Bill also provides the Secretary of State a power to ask public authorities and statutory undertakers to assess and address the risks from climate change. A separate Impact Assessment has been produced relating to this measure.

3.2 Provisions for the Management of Climate Change policy

3.2.1 This section provides a qualitative description of the impacts of the package of measures proposed in the Bill. This is principally because the detailed quantitative costs and benefits will depend on the precise emissions reduction pathway and carbon budgets set, and the ways in which this reduction pathway is intended to be met. It is therefore crucial that on recommending and setting budgets, the Committee and Government respectively provide an assessment of the costs and benefits of achieving the budgets.

Issue 1 – Provisions for establishing the long term targets and trajectories.

3.2.2 It is desirable that the Government’s framework should establish credible, flexible and predictable mitigation objectives. Credible policy frameworks are needed to drive sufficient low-carbon investment which is essential for the transition to a low-carbon economy. However, the underlying uncertainties outlined in Section 2.2 mean that any framework needs to be flexible to allow decision-makers to respond to unexpected circumstances or revised information affecting the relative costs of actions and inaction.

3.2.4 The current system of non-statutory targets arguably does not provide a strong enough framework to give UK households and firms an unquestionable assurance that the Government is committed to ensuring long-term emissions reductions. This is likely to reduce the willingness of firms and households to make the investments needed for the transition to a low-carbon economy, and may increase the cost of mitigating climate change.

3.2.5 The Bill proposes a statutory target to reduce CO\(_2\) emissions by at least 60%, through domestic and international effort, by 2050 (compared to 1990 levels) and, in addition, a system of statutory five-yearly ‘carbon budgets’, to be placed in secondary legislation for at least three periods (15 years) ahead, in order to provide a medium-term trajectory
towards the delivery of the 2050 target. The “carbon budget” would place a limit on the aggregate quantity of CO\textsubscript{2} emissions permitted over a five year period.

3.2.6 Carbon budgets would initially be established for the periods 2008-12 (consistent with the first Kyoto Protocol commitment period), 2013-17 and 2018-22. The budget for 2018-22 would be set consistent with the Government’s existing target of at least a 26% cut in emissions by 2020, providing a firm legislative boundary for the trajectory to 2050.

3.2.7 The Government of the day would be directly accountable to Parliament for the delivery of both the 2050 target and the achievement of the five-year budgets. In the event that either budgets were exceeded or the target not met, the Government would be required to lay before Parliament a report setting out proposals and policies to compensate in future periods for the excess emissions. In addition, placing these objectives in legislation means that Parliamentary approval would be required in order to amend them. More detailed analysis of the circumstances in which these targets and budgets might be amended is provided in Issue 3 below.

3.2.8 The Bill requires the Government to publish ‘indicative annual ranges’ for the net UK carbon account in each budget year. This provision provides further information to indicate the expected level of emissions and create the right signals for investors, while retaining the flexibility for the net carbon account to vary from the expected trajectory within the budget period. Indicative ranges are preferred over annual targets because they strike the balance between providing certainty over the long term trajectory for emissions with allowing flexibility for emissions in any one year to vary by a small amount from the intended trajectory. Box 2 below discusses annual targets in more detail.

Benefits:

3.2.9 A system of statutory targets, supported by five-yearly carbon budgets established three periods (15 years) ahead, will enhance the level of predictability for households and firms making longer term investment decisions and actions to reduce their CO\textsubscript{2} emissions. This system would establish a more clearly defined trajectory towards a low-carbon economy, and may allow emissions reductions to be achieved at a lower cost. Statutory targets will also provide Parliamentary controls over the long-run emissions targets and their revision. This is particularly important given the current lack of an international agreement extending beyond 2012.

3.2.10 Carbon budgets will be set with a view to achieving an appropriate balance between social and economic costs and benefits (illustrative impacts of different trajectories on mitigation costs are outlined in Section 2.2). They thus retain some inherent flexibility to allow Government to manage policy in response to, for example variations affecting energy demand (particularly if such unexpected events occur early in a budget period), whilst at the same time ensuring that every tonne of CO\textsubscript{2} counts towards the budgets. Section 3.3 considers mechanisms for the provision of additional flexibility. The first Kyoto phase and Phases I and II of the EU-ETS are also expressed in terms of average annual emissions over a five-year period (2008-2012).

3.2.11 Furthermore, this approach creates a policy framework to enable the UK to demonstrate leadership, thereby helping to foster the conditions for further international cooperation, in a way which is consistent with international emissions reduction obligations under the Kyoto Protocol and as part of the EU-ETS. The UK’s demonstration of leadership may increase the chances that a multi-lateral agreement can be reached that is consistent with the long-term aim of avoiding dangerous climate change.
Costs:

3.2.12 The likely range of cost associated with achieving long run emissions reductions is discussed in detail in Section 2. The cost of making a binding commitment will depend on the level of flexibility that is retained in the framework to mitigate the impact of the uncertainties, such as fuel prices and unexpected events that could result in higher or lower emissions than expected. The costs and benefits of the flexibility mechanisms are discussed in Section 3.3. These mainly relate to the administration cost of amending a target if required in the future, in the light of significant developments in climate science or in international law of policy.

Box 2: Setting annual targets for emissions reductions.

The length of time over which the budget is set will determine the flexibility and credibility of the framework.

Binding annual targets would constrain the discretion of policy makers to respond to changes in both the medium and long run expected cost of mitigation. In the short-term, actual emissions are affected by a large number of factors that can cause emissions to rise or fall unexpectedly (such as an unexpectedly cold winter leading to higher-than-expected heating fuel demand). These fluctuations might require the Government to adopt additional measures at short notice to ensure that annual emissions budgets are met. Purchasing additional emissions reduction credits at short notice to cover annual fluctuations may increase the overall cost of mitigation. This has the potential to reduce the credibility in the policy framework because households and firms may perceive that a Government has an incentive to focus on short term mitigation objectives rather than consider longer term policies that would tackle climate change more cost effectively.

A longer period of 5 years for carbon budgets is therefore preferred, as this balances the need to provide short term flexibility with long a run commitment to emissions reductions.

Issue 2: Establishment of the Committee on Climate Change

3.2.13 There are potentially a number of different pathways to the proposed statutory targets in 2020 and 2050. The choice between these pathways is likely to impact on the overall costs of mitigation and the achievement of a range of other economic, social and policy objectives, as well as the UK’s ability to show international leadership in climate change mitigation. Balancing these considerations is a complex and technical task – evaluating climate change costs and uncertainties is a rapidly developing area of research and one which requires highly specialised skills.

3.2.14 In establishing mitigation objectives, the Government needs to balance evidence from a range of sources on the potential costs and benefits of action, factoring in the impacts on wider policy objectives such as maintaining secure energy supplies and promoting economic prosperity.

3.2.15 The Committee will advise Government on the level of the carbon budgets and therefore the shape of the optimal trajectory towards the achievement of the 2020 and 2050 targets, based on detailed analysis of the dynamic costs and benefits of abatement.

3.2.16 In forming its advice, the Committee will be required to consider a broad set of factors (which the Government itself will take into account when actually setting the budgets). It is envisaged that this broad range of factors will ensure that the Committee’s advice is comprehensive and does not seek to achieve emissions reductions at the expense of economic growth or other objectives. In order to increase transparency and accountability the Committee will be required to publish its advice and supporting
analysis to Government on the level of the carbon budgets, as well as the minutes of the Committee’s meetings.

3.2.17 As well as advising the Government on the optimal trajectory, the Committee will be required to advise the Government in relation to:

- As its first task, whether the 2050 target should be amended (including – although this is not specified in legislation – the question of whether other greenhouse gases should be included in the target, and the impacts of including emissions from international aviation and shipping);
- any further Government review of the targets in the Bill;
- the balance of emissions reduction effort to be achieved overseas and domestically;
- the respective contributions towards meeting the budgets of those sectors covered by trading schemes, and other sectors, and those sectors of the economy in which there are particular opportunities to reduce emissions;
- any use of banking and borrowing facilities; and
- any other issue on request from the Government.

3.2.18 The Government will also be required to seek the Committee’s advice before:

- introducing the first set of regulations on the use of carbon credits;
- making regulations to include international aviation or international shipping emissions in the UK’s targets and budgets;
- determining the base year for greenhouse gas emissions other than carbon dioxide and before making regulations; and
- recognising new types of carbon units as valid, or changing the value of carbon units.

3.2.19 The Committee, through the work of a dedicated sub-committee, will also advise the Government on progress on its adaptation work, specifically:

- the adequacy of the adaptation programme to address the risks;
- the contribution of the adaptation programme to sustainable development;
- progress on implementation of the adaptation programme; and
- directions issued to reporting authorities on adaptation.

Benefits:

3.2.20 The establishment of the Committee to advise on the pathway towards the achievement of the 2020 and 2050 statutory targets will have a number of key potential benefits. It will strengthen the institutional structure through which to improve the way the UK manages carbon in the economy by:

- increasing transparency surrounding the determination of a carbon abatement pathway (a process currently influenced by a range of different stakeholders in a way which is not always visible to the public); and
- ensuring broad and explicit representation from a range of stakeholder groups to ensure a full understanding of the complex matrix of costs, benefits and risks associated with action to mitigate climate change.40

40 It is intended that the Committee would be staffed by a highly analytical Secretariat, and a Board made up of members reflecting expertise in areas relevant to calculating the abatement pathway: business competitiveness; climate change policy; climate science; differences in circumstances between England, Wales, Scotland and Northern Ireland and the capacity of national authorities to take action in relation to, climate change; economic analysis and forecasting; emissions trading; energy production and supply; financial investment; technology development and diffusion.
3.2.21 The establishment of an adaptation sub-committee will have a number of potential benefits. It will strengthen the institutional structure through which to improve the way the UK responds to the impacts of climate change by:

- looking across the broad range of adaptation issues to identify gaps, maladaptation, co-benefits and risks;
- ensuring that the adaptation programme contributes to sustainable development;
- maximising transparency on how the Government is addressing the risks from climate change; and
- identifying the organisations that are essential if the UK is to adapt well to climate change.

3.2.22 In addition, the Committee will provide independent advice to Parliament on the progress that has been made towards meeting the statutory emissions reductions (considered later under Issue 10).

Costs:

3.2.23 There will be resource costs associated with the establishment of a new independent body to cover, for example, remuneration and related costs of committee members and its secretariat, and the management of office facilities. Overall, for the Committee on Climate Change’s work on mitigation, these are estimated to be in the region of £1.6 million in 2007/08 (while the Committee is in shadow form as a non-statutory body) and £2.73 million in 2008/09 (this includes provision of £150,000 for establishing the Committee’s corporate identity). The budget for 2009/10 onwards is estimated to be approximately £2.6 million. The Committee will be funded by the UK Government and the Devolved Administrations. Table 1 below provides a short breakdown of these expected costs.

**Table 1: Outline of Estimated First Year and Ongoing Costs of Committee on Climate Change**

<table>
<thead>
<tr>
<th>Function</th>
<th>2007/08 (Shadow Committee)**</th>
<th>Ongoing costs - (post Royal Assent)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secretariat</td>
<td>£680,000</td>
<td>£1,300,000</td>
</tr>
<tr>
<td>Committee</td>
<td>£62,000</td>
<td>£210,000</td>
</tr>
<tr>
<td>Research</td>
<td>£750,000</td>
<td>£500,000</td>
</tr>
<tr>
<td>Running costs</td>
<td>£132,000</td>
<td>£300,000</td>
</tr>
<tr>
<td>Accommodation</td>
<td>-</td>
<td>£270,000</td>
</tr>
<tr>
<td>Corporate identity***</td>
<td>-</td>
<td>£150,000</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>£1,624,000</strong></td>
<td><strong>£2,730,000</strong></td>
</tr>
</tbody>
</table>

**Notes**

*Ongoing costs are only estimates at this stage.

** To enable the Committee to provide its advice on the first three carbon budgets before 1st December 2008 as required by the Bill, the Committee is being set up in shadow form ahead of Royal Assent.

2007/08 costs reflect that the shadow Committee secretariat and members will only be in place part way through the year.

***Corporate identity costs will only be incurred in 2008/09, when the Committee becomes a statutory body after Royal Assent.

3.2.24 There will also be similar costs associated with the adaptation sub-committee. Overall these costs are estimated to be in the region of £580,000 annually once the sub-committee is established.
Table 2: Outline of estimated Ongoing Costs of an Adaptation Sub-Committee on Climate Change

<table>
<thead>
<tr>
<th>Function</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Sub-Secretariat</td>
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<tr>
<td>Sub-Committee</td>
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<tr>
<td>Research</td>
<td>£150,000</td>
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<tr>
<td>Running costs</td>
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<tr>
<td>Total**</td>
<td>£578,000</td>
</tr>
</tbody>
</table>

Notes
* Ongoing costs are only estimates at this stage.
** An estimate for accommodation is not included, as it is likely that this can be absorbed within the existing provision for the Sub-Committee and main Secretariat. It is possible that the Secretariat accommodation costs may need to increase to take account of the additional staff.

**Issue 3: Review of statutory targets and/or interim budgets**

3.2.25 It is important to consider whether, and in what circumstances the proposed system of unilateral statutory targets and budgets could be amended in the context of managing environmental risk, economic cost and wider policy objectives effectively.

3.2.26 Following the statutory review of the 2050 target, which will take place by 1 December 2008, the Bill proposes the Government would have the ability to review the 2050 and 2020 statutory targets in the light of significant developments in climate science or in international law or policy. For example, a review might be exercised in the event that a new multilateral agreement requires the UK to adopt more stringent emissions reduction targets. Alternatively, changes in our understanding of climate science might imply the need for higher or lower degrees of emissions reductions internationally, which would need to be reflected in the domestic framework.

3.2.27 There would be some flexibility to amend statutory carbon budgets as a result of significant changes affecting the basis upon which the Secretary of State originally set, or last amended, the budgets. So, for example, the Government could seek agreement from Parliament to re-profile (i.e. amend) the carbon budgets, so that emissions reductions could be spread over a longer timeframe, if it became clear that the emissions forecasts used when a budget had initially been set proved to be significantly inaccurate. This could result from large changes in the price of gas on international markets, or the pace of development in a new technology such as carbon capture and storage, such that the only policy options available to meet a budget would result in unacceptable economic costs. However, to ensure credibility and minimize the impact on expectations, the same Parliamentary process would be used for amending budgets as was used to set them in the first place.

Benefits:

3.2.28 The capacity to review budgets or targets would enable policy makers to:
- minimise economic and social costs and competitiveness risks arising from significant changes to key drivers of mitigation costs; and,
- continue to demonstrate international leadership in the light of revised assessments surrounding environmental risk.
3.2.29 The Government’s decision as to whether to exercise a review for either the statutory targets or budgets would be subject to Parliamentary approval under the affirmative resolution procedure. In the case of amending carbon budgets, the Government would also be required to seek advice from the Committee. Overall, given the political and Parliamentary risks and constraints surrounding the execution of any review clause, it is likely that the adverse impact of such a mechanism on certainty would be limited.

Costs:

3.2.30 Having no facility to amend targets would provide households and firms with the greatest degree of certainty surrounding the intention of Government to manage policies designed to deliver a defined level of emissions reductions in a particular time period. However, the understanding of the level of environmental, economic and social risk for given concentration levels of greenhouse gases is still developing. Tightly restricting the capacity of the Government to amend either the long run or interim target might result in exposure to undesirable economic costs or competitiveness risks, and raise the costs of tackling climate change. This may potentially reduce the credibility in the framework as a whole.

3.2.31 A facility to review targets reduces the predictability for households and firms about the long run scale and timing of the Government’s objectives to reduce emissions. This may increase the overall cost of reaching a given mitigation goal as households and firms may delay the decision to invest in low-carbon technologies.

Issue 4: Retaining the flexibility to move to a greenhouse gas target.

3.2.32 Climate change is caused by various greenhouse gases. The Kyoto Protocol applies to emissions of a basket of six greenhouse gases: Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur Hexafluoride (SF₆). Non-CO₂ greenhouse gas emissions arise from a number of sources including agriculture and land use change (largely methane from livestock), and industrial process emissions, for example in the cement and paper industries.

3.2.33 Collectively, non-CO₂ emissions accounted for approximately 15% of the UK’s overall impact on climate change in 2005. It is therefore important to consider whether the UK’s emissions reduction framework should include these other greenhouse gases.

3.2.34 The Bill proposes that the system of 5-year budgets together with statutory targets for emissions reductions in 2020 and 2050 would for now apply only to CO₂. However, the Bill provides a review clause, with the option of allowing the long-term targets to be revised to apply to a wider set of greenhouse gases.

Benefits:

3.2.35 There are potentially strong scientific and economic arguments in favour of defining the UK’s long term goal in terms of greenhouse gases. A multi greenhouse gas target would incentivise the least cost abatement across the basket of greenhouse gases, ensuring that greater reductions can be achieved for a given cost; Chapter 10 of the recent Stern Review identified this as a desirable feature of emissions reduction frameworks. It would remove a perverse economic incentive to focus on CO₂ reductions only even if it were economically or scientifically rational to take firmer action on other gases.

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41 The statutory targets could be changed by the Government only after seeking the advice of the Committee on Climate Change.
42 Hydrofluorocarbons (HFCs) are haloalkanes – alkanes where some hydrogen atoms are replaced by fluorine. Perfluorocarbons (PFCs) are compounds containing just fluorine and carbon.
3.2.36 A decision to exclude non-CO$_2$ gases would mean that approximately 15% of the UK’s impact on climate change would not be covered by the proposed carbon management framework.

Costs:

3.2.37 There is a lack of detailed analysis to support the decision on setting a long-term greenhouse gas target. While there is an extensive body of analysis supporting the current targets for CO$_2$ there is currently insufficient understanding of the potential economic and environmental impacts of moving to a greenhouse gas target. This risks setting a target for greenhouse gas emissions before understanding the full costs of mitigation, resulting in additional costs of tackling climate change.

3.2.38 Additional domestic non-CO2 abatement is expected to become difficult and costly$^{43}$. A range of international and domestic policies have already delivered substantial reductions in non-CO$_2$ emissions in recent years: there has been a 44% reduction in non-CO$_2$ emissions between 1990 and 2005, expected to reach 50% by 2020. Box 3 outlines some of these policies in more detail.

Conclusions

3.2.39 There are potentially strong grounds to include other greenhouse gases in the emissions reduction targets. However, given the existing level of analysis, a full consideration of the potential economic, social and environmental impacts is necessary before a decision can be made. Retaining the ability to include other greenhouse gases at a later stage will increase the flexibility of the framework to respond when further analysis of the impacts has been conducted.

3.2.40 The Government has specifically asked the Committee on Climate Change, as part of its review of the 2050 target, to provide advice on whether other greenhouse gases should be included; and has committed to their inclusion unless the Committee advises otherwise.

Box 3: Tackling Non- CO$_2$ Emissions

There are a wide range of policies, implemented domestically and through the EU and other forums for international cooperation, designed to tackle non-CO$_2$ emissions, for example:

- **Methane** is the second most important GHG in the UK after CO$_2$, contributing 12 per cent of the UK’s total emissions of GHGs in 1990. Methane emissions fell by approximately 60% between 1990 and 2005, driven in part by the EU Landfill Directive which imposes strict engineering requirements on landfills, a major source of methane emissions. UK implementation of the Directive aims to reduce the amount of biodegradable municipal waste landfilled to 75%, 50% and 35% of the total amount of waste produced in 1995 by 2010, 2013 and 2020 respectively.

- Emissions of **fluorinated or industrial gases** are small in absolute terms (14MtCO2e or 8% of UK total greenhouse gas emissions in 1990), but generally have high global warming potentials, so it is important to control the emissions of these gases. The UK was instrumental in fostering agreements at EU level for a new Regulation on certain fluorinated greenhouse gases and a Directive relating to emissions from Mobile Air Conditioning systems in 2006 which ensure a two-step phase out of Mobile Air Conditioning that use fluorinated -gases with a GWP greater than 150, and the introduction of maximum annual leakage limits to cover the interim period before the phase out; as well as controls on refilling the retrofitting for these systems.

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$^{43}$ See for example, a recent AEAT study on reducing Methane and HFC emissions from four selected sectors - http://www.defra.gov.uk/environment/climatechange/trading/uk/pdf/aeat-reducing-emissions-report.pdf

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Furthermore the Government is considering new policies to address key sources of non-CO\textsubscript{2} emissions including, for example:

- A market based mechanism to facilitate trading of greenhouse gas reductions from agriculture, forestry and other land management sectors. These sectors accounted for around 8\% of greenhouse gas emissions in 2004 (weighted by global warming potential);\textsuperscript{44} and
- A competitive grant scheme, administered by the Coal Authority, to support projects aimed at controlling emissions arising from electricity production from coal mine methane (CMM), exempted from the Climate Change Levy in November 2003.

**Issue 5: Emissions from international aviation and shipping**

3.2.41 Emissions of greenhouse gases from international aviation and shipping represent an increasing proportion of total global greenhouse gas emissions. Emissions from aviation in particular are increasing at a faster rate than emissions from other sectors.

3.2.42 However, emissions from international aviation and shipping are currently excluded from the targets as there is not yet an agreed methodology on how to assign these emissions to the relevant countries. We therefore need to give careful consideration to how it is most appropriate to handle international aviation and shipping in the context of a unilateral UK target. The Bill requires that emissions from international passenger travel and imports or exports of goods must be included in the targets within 5 years of the Bill becoming law, or that the Government report on the reasons why these emissions have not been included. If these emissions were to be included, the Government may wish to revisit the level of the targets to ensure they remain both ambitious and achievable, balancing the need to reduce emissions with the need to avoid excessive economic or social cost, and consistent with international progress. Therefore, it is not possible to identify at present what the effect would be of including these emissions on the Bill’s targets, without first making an assessment of what appropriate targets would be. The assessment below considers two potential outcomes for illustration, firstly, the inclusion of international aviation and shipping emissions with a proportionate reduction in the level of the target and secondly, inclusion with no changes to the targets.

**Benefits:**

3.2.43 Including international aviation and shipping in the Bill's targets would ensure all ‘UK’ emissions were within the targets, thus providing greater environmental certainty over future ‘UK’ emissions. Not adjusting the target to reflect the inclusion of emissions from aviation and shipping would result in a higher overall level of emission reductions compared to reducing the target. However, because of the relative cost of reducing emissions in these sectors, not adjusting the target would require other sectors of the economy to undertake a greater level of emission reductions, with an associated increase in overall costs (see section on costs below).

**Costs:**

3.2.44 In order to include international aviation and shipping, one must first create a methodology to define the UK’s share of these emissions along with the UK’s share of emission credits purchased by these sectors. There is a risk that by unilaterally adopting a particular methodology, the UK could compromise negotiations on developing an internationally agreed methodology and delay international action on tackling these emissions.

\textsuperscript{44} Source: UK Climate Change Programme 2006, http://www.defra.gov.uk/environment/climatechange/uk/ukccp/index.htm
3.2.45 It would be possible, when including international aviation and shipping emissions, to reduce the Bill targets proportionally, so as to avoid imposing any additional cost to the economy.

3.2.46 Alternatively, it would be possible to include these emissions and leave the Bill targets unchanged. On that basis, some analysis using the MARKAL-Macro model has been conducted to show the possible impacts of including international aviation emissions in a long-term emissions reduction target. These results suggest that the reduction in GDP related to a 60% reduction in greenhouse gases against a 2000 baseline (including those from aviation) are 50% higher in 2050, or around 1.2% in 2050, compared with 0.8% excluding aviation. Including aviation therefore has a similar economic cost in terms of GDP as setting a 70% reduction target excluding aviation.

3.2.47 The analysis reflects that there are currently assumed to be very limited abatement opportunities in the aviation sector, now and in the future. Including aviation in the target would therefore require other sectors to reduce emissions further in order that the UK as a whole can meet its long-term target (assuming the target remained unchanged).

3.2.48 The above analysis assumed that it will be possible for the UK to take unilateral action to reduce aviation emissions. In reality, due to the international nature of the industry, such ‘emission reductions’ may simply result in increases elsewhere. Thus global emissions could remain unchanged, although there would be a significant impact on the competitiveness of the UK’s aviation industry.

3.2.49 Analysis by Department for Transport (DfT) suggests that against a 1990 baseline the emissions reductions required by other sectors of the economy would be between 69-76% if the 60% emissions target included aviation and shipping, assuming that current aviation and shipping forecasts are correct.

3.2.50 The terms of aviation's inclusion in the EU-ETS are still subject to negotiation, but we expect that flights arriving and departing Europe to enter the scheme in 2012 and that aviation operators would only be allocated allowances equivalent to its emissions at average 2004-6 levels (216 million tonnes CO₂), with any further emissions needing to be met through the purchase of emission reductions elsewhere within the EU-ETS. Thus, in the presence of aviation's inclusion in EU-ETS there will be no growth in net aviation emissions from 2004-6 onwards. On this basis, DfT analysis suggests the inclusion of international aviation emissions into the Bill’s targets would require the rest of the sectors of the economy to reduce emissions by 64% in order to meet an overall reduction of 60%.

Conclusion:

3.2.51 The Bill requires that emissions from international passenger travel and imports or exports of goods must be included in the targets within 5 years of becoming law, or that the Government report on the reasons why these emissions should continue to be excluded. In reviewing whether to change the targets as a result - and if so, how to do so – the Government would need to take into account a range of factors, including advice from the Committee, the broader international context and the potential economic cost.

3.3 Provisions to allow flexibility in the Government’s response to climate change

Issue 6: Allowing the use of ‘traded effort’ to meet UK statutory targets
3.3.1 As greenhouse gas emissions are a global externality; the location of emissions reductions does not change their environmental value. However, it may be cheaper to abate in some sectors than others due to greater availability of mature technological or process substitutes. Alternatively, investment in less developed countries may deliver relatively greater emissions reductions due to the existence of less efficient capital stock. Flexibility to choose where to invest to reduce greenhouse gas emissions is a key pillar of existing multilateral frameworks.

3.3.2 The Kyoto Protocol establishes a system of tradable emissions reductions credits, (the Clean Development Mechanism (CDM) and Joint Implementation mechanisms(JI)), which allow “Annex 1” countries (developed countries with direct emissions reductions obligations) to invest in mitigation projects in other countries in order to meet their own greenhouse gas reduction targets. This may also be consistent with wider policy objectives on international development, as it can result in the transfer of finance and technology to developing countries. However, the Kyoto Protocol also supports the “principle of supplementarity”, which asserts that (Annex I) countries should use the project mechanisms in a way which is supplemental to domestic emissions reductions meaning they should therefore achieve a significant part of their emissions reductions obligations through domestic effort.

3.3.3 The Bill proposes that the Government has the power to introduce policies which allow for flexibility in terms of where emissions reductions are realised, across the entire economy (including those sectors not currently covered by the EU-ETS). It might also be possible to meet budgets through the purchase of EU allowances (EUAs), or JI or CDM emissions reductions credits, with the restriction that at least 70% of the reduction in the net UK carbon account to meet a budget, compared with actual UK emissions over the previous budgetary period, must come from domestic abatement.  

3.3.4 The Committee would advise on the appropriate balance of domestic emissions reductions versus financed emissions reductions overseas. In providing this advice, the Committee would be likely to consider:
- the marginal and dynamic costs of domestic abatement in sectors outside the EU-ETS in relation to the expected international carbon price. This would need to factor in assessments of potential ancillary effects, such as improved public health, increased energy security, and reduced fuel poverty, which are likely to reduce the net cost of domestic mitigation policies; and,
- the potential impact of purchasing emissions reductions overseas on the capacity of the UK to demonstrate international leadership (resulting in slower transformation in the carbon intensity of domestic markets).

Benefits:

3.3.5 Allowing sufficient purchases of effort to realise emissions savings internationally increases the flexibility of the framework, thereby potentially reducing mitigation costs of reaching a given level of emissions reductions. However, the level of benefits will depend on a number of factors such as the cost of abatement, both domestic and overseas, the level of the emissions reductions undertaken in the UK and abroad and any limits to the use of credits. Analysis suggests that there is significant potential for the use of project credits to reduce the direct costs of the EU ETS. The benefits to the UK will depend on the extent to which it will be a net buyer of credits in the EU ETS.

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45 Although it is important to recognise that the existence of project credit markets beyond 2012 is subject to a subsequent international agreement
3.3.6 Failure of the UK to participate in international emissions reduction markets could
discourage the level of ambition of other countries who followed suit, and deny the UK
potential links to emissions trading schemes being developed and proposed in a
number of countries (e.g. Norway, Switzerland, Japan and Australia, New Zealand, and
state-level schemes in the US). Furthermore, it would limit ability to transfer finance and
technology to developing countries through the use of project credit mechanisms.

3.3.7 The carbon market itself also brings benefits to the UK. London is at the centre of the
global carbon market, and UK companies are providing valuable emissions trading
services (such as brokerage and verification). The World Bank State of the Market report
for 2006 valued the project market at $5.4 billion, with the UK having a 50% interest in
those credits. In addition, the EU ETS market was worth approximately $20 billion, with
an estimated 80% of that trading involving the UK. This would put the combined value to
the UK at $18 billion. Given a successful resolution of the post-2012 negotiations, the
market is expected to grow by a factor of 20 by 2030. If the UK share was 25%, the direct
value to the UK would be $125 billion.

Costs:

3.3.7 The principal disadvantage of purchasing emissions reductions credits is that it would
encourage Government and firms to use overseas credits as a cheaper short-term option
to reduce emissions. This may restrict the pace of decarbonisation of the UK economy
and lead to higher mitigation costs in the long run.

3.3.8 In addition, preliminary analysis by the Office of Climate Change looked at the impact on
Annex 1 countries of a range of supplementarity restrictions given an assumed set of
emissions reduction targets. Results from scenarios which impose no supplementarity
restrictions suggest that this would minimise the global cost of meeting a global target.

3.3.9 Applying supplementarity restrictions on all regions is expected to increase the costs.
The effect on regions which would be net buyers from a trading scheme (as the UK may
be expected to be) relative to a scenario with no supplementarity restrictions, however, is
ambiguous. While supplementarity limits would force more abatement to take place
domestically, which may increase costs, this would be offset by a lower global price for
carbon as a result of supplementarity limits reducing the demand for international credits
(e.g. CDM). Applying supplementarity limits would disadvantage developing countries as
it would restrict their market and the extent of financial flows.

3.3.10 Scenarios where a supplementarity restriction was applied to only the UK would be likely
to result in higher costs to the UK to meet a particular target. Not only would this result in
more expensive domestic abatement, but the UK would also not benefit from a lower
global carbon price since it is unlikely the UK alone could materially affect the global
carbon price. However, these results provide only a partial analysis of the impacts. The
modelling is unable to identify the impact of supplementarity limits in signalling the long-
run intentions of the UK to reduce emissions, for example.

3.3.11 Analysis published by the European Commission on meeting Kyoto Protocol targets also
found that the costs of reducing emissions could be reduced by a third through emissions
trading. The resources at the disposal of the UK economy are finite, so imposing higher
costs than necessary means reduced resources for other priorities and/or less economic
growth than would otherwise have taken place.

3.3.12 In addition, the relationship with the EU Emissions Trading Scheme is also important
here, as the EU ETS already covers around 50% of the UK’s CO₂ emissions. We cannot
predict the extent to which companies are going to reduce their emissions in the UK and
the extent to which they are going to buy in allowances from abroad. This depends upon
the level of the carbon price and on many individual commercial decisions.

3.3.13 Limiting the number of units from within the EU ETS that we can count towards the net
UK carbon account risks the fact that in some years UK companies will decide to buy
more than this limit. We cannot and would not want to interfere with their freedom to do
so, under the EU ETS rules. However, this would mean that we could not count all of
these units towards meeting the overall UK budget.

3.3.14 This would mean that, in order to comply with the overall UK budget, the Government
would need to find additional emissions reductions by either (a) introducing additional
policies to reduce emissions in those sectors covered by the EU ETS, or (b) reducing
emissions further within those sectors of the economy not covered by the EU ETS.

3.3.15 Under the first option, the practical effect could increase costs, as it could be more cost-
effective for a company to buy the allowances from elsewhere. It could also lead to
double-regulation, as the company would be subject to both the EU ETS and the
additional Government policies. It could also raise difficulties of compatibility with EU law.

3.3.16 Under the second option, the practical effect would be to transfer effort from the sectors
within emissions trading to the sectors of the economy outside the EU ETS. For every
UK company which chose to meet its EU ETS obligations by buying allowances, the
Government would need to find equivalent emissions savings from other sectors to make
up the difference. This could create uncertainty and instability for other sectors of the
economy, as the level of emissions reductions they were required to make would depend
on the purchasing decisions of companies within the EU ETS, which the Government
cannot control.

**Issue 7: Provisions for ‘banking’ and ‘borrowing’ between carbon budget periods**

3.3.17 As outlined in Sections 2.1 and 2.2, the overall cost of reducing the UK’s impact on
climate change is likely to be affected by the choice of emissions reduction pathway as
well other factors such as future technology and fossil fuels costs. As such, a system of
five year carbon budgets, established three periods ahead, would require the formation
of detailed expectations surrounding these factors over a period of around 15 years.
However, factors affecting emissions or the cost of mitigation may be subject to short
term shocks or periods of volatility, potentially leading to sharp increases in the costs of
meeting budgets.

3.3.18 Banking and borrowing allows households and firms to minimise costs or
competitiveness risks in response to short run factors, or to smooth incentives across
commitment periods when managing the timing of emissions reductions. Banking is the
ability to carry over unused quotas from one budget period to a future period and is an
accepted principle of the Kyoto Protocol. ‘Borrowing’ would allow a Government to bring
forward emissions allocations from future budget periods.

3.3.19 The Bill proposes that the Government would be allowed to bank unused emissions
rights for use in a successive period. The Government, under certain circumstances and
to a limited extent, would also be allowed to borrow budget allocations from the following
period. It is proposed that the maximum permitted level of borrowing would be equivalent
to 1% of the following carbon budget. It is envisaged that borrowing might be utilised to
dampen the impact of a short run shock.
3.3.20 It is envisaged that banking and borrowing provisions would not require Parliamentary approval, but would only be used once the government had first received the advice of the Committee, in order to maximise the transparency of its decision.

Benefits:

3.3.21 Banking provides an incentive for ‘over-performance’ in a given period by allowing additional emissions reductions to count against future targets. Banking can therefore provide for improved environmental outcomes as emissions are reduced sooner. In the case of policies designed to establish a carbon price, banking reduces the risk of price spikes or crashes at the end of budget periods. This may reduce the costs of mitigation, particularly where abatement could become more expensive over time. For example, the heavy use of banking in the US Acid Rain Program has been seen by some as a success in terms of delivering early reductions and improving efficiency.\(^{47}\) In addition, the potential flexibility of banking to bring forward the profile of emissions reductions may send out important signals surrounding the capacity of the UK to demonstrate leadership in achieving early emissions reductions.

3.3.22 The absence of banking might weaken the incentives of policy makers to realise larger-than-needed cost-effective abatement, arising for example from earlier-than-expected availability of new technologies or a change in the underlying preferences of households and firms towards placing greater value on the need for energy conservation. This might result in a missed opportunity for the UK to demonstrate additional leadership in emissions reductions or increased short and medium run mitigation costs, as policy makers may need to institute a step change in policy once a new budget period begins (especially if it is perceived to be substantially more constraining).

3.3.23 The capacity to borrow would help to:

- reduce the costs of mitigation arising from the need to manage policy in response to short run shocks or volatility in emissions or the cost of abatement; and deal with “accounting errors” due to time lags in data availability;
- promote credibility in the overall framework by increasing the capacity of the Government to manage the delivery of the budget constraints in the event such events; and,
- do so within a tight limit (1%) which would substantially reduce the risk of undermining the certainty provided by the carbon budgeting framework.

3.3.24 Without the availability of a small borrowing facility to make the necessary accounting adjustment, the Government may be forced to purchase credits on the international markets at short notice in the event of a sudden short run shock in emissions, which may increase the cost of meeting a given target. In addition, the absence of either banking or borrowing may marginally increase the likelihood of needing to review the budget profile.

Costs:

3.3.25 Banking may increase the uncertainty surrounding the precise profile of emissions reductions. Unrestricted, banking could potentially lead to emissions being concentrated in time. Overall the impact on certainty can be limited through the establishment of clear rules surrounding the operations of this element of the framework as well as transparent advice and analysis by and for Government.

\(^{47}\) Research (Tietenberg, T. (1998): 'Tradable Permits and the Control of Air Pollution in the United States' Colby College, Department of Economics, Working Paper) found that 30% of allowances were banked between 1995-99 (Phase One of the programme). Firms made efficient decisions to make earlier reductions and banked allowances forward, due to the expectation of tighter caps in future phases. As a result, in total, emissions reduced in Phase One were twice that required to meet the cap in Phase Two.
3.3.26 Borrowing may impose a cost by reducing predictability surrounding the precise profile of emissions reductions, reducing the certainty provided by the framework. Furthermore, it might limit the potential of Government to deliver the following carbon budget, thereby reducing credibility in the overall framework. Box 4 outlines these indicative impacts in the first two budget periods. As noted, these risks provide a strong argument for limiting the extent of the possible use of this mechanism. There may also be presentational costs associated with allowing borrowing, since this facility is not currently allowed under the Kyoto Protocol or EU-ETS. Under both frameworks, there is a legal obligation to deliver reductions in emissions irrespective of prevailing economic, technology and weather conditions (which the UK has always supported).

3.3.27 However, these costs are likely to be limited due to the fact that:
- the Bill proposes unilateral long term targets, which could put additional risks on UK competitiveness, so additional flexibility is desirable;
- borrowing would not be permitted in relation to emissions reductions obligations under multilateral agreements; and,
- the Bill proposes a series of carbon budgets (agreed unilaterally three periods ahead); as such, unlike in the multilateral context, the level of the subsequent budget from which we would be borrowing is clearly defined.

Box 4: Considering the Impact of Borrowing on Chances of Meeting Carbon Budgets

As outlined in Section 2.2, there are a number of uncertainties that affect the UK’s ability to stay within a given carbon budget. Based on the Government’s own assessment of market uncertainties (although not those affecting the effectiveness of mitigation policies directly), it is useful to consider the potential impact of introducing a borrowing limit of up to 1% of a successive budget period on the likelihood of meeting:
- an illustrative carbon budget in 2008-12 (assuming no additional policy or purchase of overseas emissions reduction credits); and,
- an illustrative carbon budget in 2013-17 (assuming no further borrowing).

Table 3 below shows that introducing a borrowing limit of up to 1% would increase the likelihood of the Government meeting an illustrative carbon budget in 2008-12 (which it currently considers it would have a 75% likelihood chance of meeting, given existing policies and expectations of market uncertainties) by approximately 9%.

<table>
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<th>Borrowing Rate</th>
<th>Probability of meeting 2008-12 budget</th>
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<tr>
<td>None</td>
<td>75%</td>
</tr>
<tr>
<td>0.50%</td>
<td>80%</td>
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<td>0.75%</td>
<td>82%</td>
</tr>
<tr>
<td>1.00%</td>
<td>84%</td>
</tr>
</tbody>
</table>

However, borrowing in one period (particularly higher borrowing limits), reduces the potential of Government to meet subsequent budgets. For example, borrowing 1% in the 2008-12 budget period from the 2013-17 carbon budget (also set so that there is a 75% chance of meeting this budget) might reduce the likelihood of meeting this later budget by 9%, whereas a 2% borrowing limit might reduce this probability by 19% (given existing policies and expectations of market uncertainties). However, the probabilities outlined above do not account for uncertainty around the delivery of policy measures.

Policy uncertainty can vary substantially depending on the particular policy (or mix of policies), with policies designed to influence behaviour at a given carbon price often being subject to more uncertainty than fiscal measures or cap and trade schemes (which fix emissions quantities).48 However, the overall uncertainty range roughly equivalent to around 100% of the central expectation of emissions reductions abatement by 2010. This represents 15% of the entire uncertainty surrounding CO2 emissions for this period.

48 Analysis conducted for the National Audit Office (http://www.nao.org.uk/publications/nao_reports/06-07/climate_change_projections.pdf) showed that the Climate Change Programme measures had an uncertainty range roughly equivalent to around 100% of the central expectation of emissions reductions abatement by 2010. This represents 15% of the entire uncertainty surrounding CO2 emissions for this period.
level of uncertainty is likely to reduce as a result of, for example: the expected increased importance of the EU-ETS in the overall mix of mitigation policies; and a reduced capacity to fuel-switch between gas and coal in the generation sector, which would lead to higher emissions if coal was chosen over gas.

**Issue 8 - Enabling powers to introduce trading schemes through secondary legislation**

3.3.28 The Bill includes provisions to introduce new powers to enable a broader range of trading schemes to be implemented through secondary legislation. Once a sector is covered by a trading scheme, the level of its total emissions is guaranteed. The enabling power would not remove the requirements for a full assessment, following the principles of better regulation, of the impacts of any potential scheme.

3.3.29 The Stern Review outlined three broad mechanisms for establishing a carbon price (a key element of the recommended overall mitigation strategy), either: explicitly through direct taxation or the establishment of cap and trade schemes or implicitly, through regulations such as energy performance standards. The choice of intervention is influenced by the particular market which a policy targets: each generic policy instrument (sometimes in combination) is appropriate in certain circumstances. The taking of powers to introduce a particular instrument does not prejudge future policy decisions surrounding the most appropriate instrument in each particular market and time period.

3.3.30 The ease and legal foundations with which these interventions can be made by Government, in seeking to manage carbon emissions, differs for each mechanism. Changes in fiscal policy are already ‘enabled’ in the sense that they can be made annually as part of the Finance Act. Similarly the Government is enabled to regulate building markets while the EU institutions largely regulate product markets. The Pollution Prevention and Control Act (1999) enables the Government to introduce trading schemes for large industrial sources of emissions within Great Britain. However, it cannot be applied to establish schemes which:

- cover numerous small consumers, for example within heat and transport markets; or
- target sources of emissions at other points in the energy chain (e.g. fuel suppliers, end users of electricity).

**Benefits:**

3.3.31 Currently, to introduce trading schemes in markets not covered by the EU-ETS, the Government would be required to introduce further primary legislation to establish the necessary powers. Failing to take the opportunity to lift constraints to allow for the introduction of trading schemes in secondary legislation could increase:

- the volume of emissions reductions financed internationally (rather than achieved domestically potentially at lower cost); and / or,
- the risk of Government needing to implement more expensive policy options (due to time constraints).

3.3.32 Allowing the introduction of trading schemes across the economy through secondary legislation would reduce the lead-time for implementing these policies, which will add an important element to the policy mix for meeting the targets and budgets in the framework. The provision increases the ability of Government to develop and strengthen the policy framework to better ensure budgets can be met. In the absence of such powers, the Government would be required to introduce further primary legislation

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49 The IPPC Act does not extend to Northern Ireland. These powers have not been used for climate change measures to date as the UK emissions trading scheme was introduced as a voluntary mechanism and the EU-ETS was introduced using the European Communities Act. They will however be used in combination with powers in the European Community Act to introduce the proposed SO₂, NOₓ, and particulate trading scheme.

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to establish the necessary powers requiring Government time and resources to prepare as well as Parliamentary time to approve.

3.3.33 Taking powers now would reduce future pressures on the legislative programme by allowing the core building blocks of any scheme to be developed and scrutinised once rather than repeatedly in primary legislation.

Costs:

3.3.34 As outlined earlier, there are a range of mechanisms with which to establish a carbon price which also include the use of direct taxation and regulations such as energy performance standards. Taking such enabling powers could be perceived as prejudging future policy decisions surrounding the most appropriate instrument in each particular market and time period, although Government could mitigate this risk by clearly outlining its approach to using these powers and the principles it intends to be guided by.

3.3.35 The Bill provides for the introduction of regulations that could create offences relating to trading schemes and to specify the penalties for such offences. The cost of these measures, and the cost of court time will be considered as part of the Impact Assessment of any scheme brought in.

3.4 Provisions to enhance the reporting framework

**Issue 9: Reporting of the UK’s progress towards its carbon management objectives.**

3.4.1 The Bill contains provisions to require the Committee to produce an independent assessment of the UK’s progress to achieving its targets and budgets, in an annual report to Parliament. The Government should produce a response to the Committee’s report each year, also to Parliament. In addition, every five years, following the release of the final, validated data to show emissions in the last year of a budget period, the Committee report should include a comprehensive assessment report on whether the budget was actually met, and the implications of this for current and future actions to stay on track to meet the legislated targets.

Benefits:

3.4.2 Involving the Committee in the annual reporting process would increase the independence and credibility of the reporting framework because:

- the Committee would publish independent advice and analysis on progress towards budgets and targets; and,
- the Government would be required to respond explaining, where necessary, why the advice of the Committee has not been adopted.

3.4.3 This would provide an independent assessment to Parliament of the progress the government has made in meeting the statutory emissions reduction targets. This transparency will give additional credibility to the framework and may therefore help households and firms form expectations regarding future emissions reductions requirements. The reporting requirements will also provide for a consistent approach to reporting of progress against the long run target.

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50 Due to the international reporting framework there is a 15 month time lag on the publication of this final, validated data. Hence for the 2008-12 budget period the comprehensive assessment report final data would be published in spring 2014.
Costs:

3.4.4 The Government is already legally required to produce an annual assessment of its progress on greenhouse gas emissions reductions, under Article 2 of the Climate Change and Sustainable Energy Act 2006. However, the cost of the Committee monitoring the Government’s progress would be marginal given that the Committee would necessarily have a Secretariat tasked with doing analysis and assisting the Government in various matters.

Issue 10: Requirement for the Government to report on adaptation.

3.4.5 There are currently no legal requirements on the Government to report on or monitor the risks of climate change and the progress the Government is making in adapting to these risks, but there is growing recognition of the need for a more coherent approach. A statutory duty to report on adaptation makes more certain of this and future Government’s intentions to acknowledge the risks imposed by climate change for the UK, and address these risks through a coherent strategy.

3.4.6 The Bill requires the UK Government to take two main steps in relation to adapting to the impacts of climate change:

- Publication of a UK risk report at least every 5 years; and
- Publication of an adaptation programme covering England and reserved matters, based on the principles of sustainable development.

Benefits:

3.4.7 The benefits of a risk assessment are wide-ranging, depending on its interpretation and application through work programmes put in place by the UK Government and devolved administrations. Programmes which take the identified risks into account and are then implemented fully could have significant long-term benefits, minimising environmental, social and economic impacts related to climate change.

Costs:

3.4.8 The costs and benefits of these requirements are difficult to quantify. Broadly speaking, there would be a marginal cost to Government of carrying out the risk assessment. The requirement to publish a programme essentially sets in statute work which is already under way, so the additional costs involved would be negligible. There could be costs associated with implementing measures set out in the programme; as with mitigation measures, these would be assessed individually.

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52 The overwhelming response to a Government consultation in 2005 on the development of an adaptation policy framework was that this would be useful in helping to coordinate adaptation action, both at local level and across Government. It was also felt that the time was right for a national framework to provide strategic direction, outline priority areas for action and develop methods for trying to avoid cross-sectoral inconsistencies.
4. Small Firms Impact Test

4.1 The Government recognises that small business account for significant quantities of emissions. For example, the Carbon Trust identified that small and medium-sized enterprises (SMEs) with less than 50 employees in manufacturing sectors or 250 employees in service sectors accounted for approximately 37MtCO$_2$ of emissions in 2002. In addition, it identified a total cost effective abatement potential of approximately 7.9% (based on a 15% discount rate).\textsuperscript{53}

4.2 In delivering the proposed statutory objectives, it is likely that SMEs will be affected potentially by both specifically targeted measures as well as wider policies, such as the Renewables Obligation, designed to reduce the carbon intensity of key energy services. These are likely to raise the costs of energy, with subsequent risks to output and employment. However, these risks are likely to be very limited in the case of service sector SMEs, which typically incur a low ratio of energy to total costs, and reduced more generally through the promotion of greater resource efficiency.

4.3 The Government recognises that, in designing and implementing policies designed to tackle SME emissions directly (or more general polices affecting this sector), it needs to take account of their often limited capacity to meet detailed or complex compliance requirements. For example, it has taken care to ensure the exemption of small emitters from current emission trading schemes. The development of any future policies will be the subject of detailed impact assessments which will include analysis of impacts on small firms.

4.4 The Small Business Service was provided with a copy of these proposals prior to public consultation, and acknowledged our approach and findings.

5. Competition Assessment

5.1 This impact assessment does not include a Competition Assessment. This is because the proposals contained within this Bill do not provide for the specific policies and, therefore, the specific impacts on competition within individual markets cannot be considered. However, a discussion of generic distributional issues is included in Section 2.3. Detailed Competition Assessments will be undertaken as part of the Impact Assessment for any policies which are put in place to meet the requirements of the Bill.

6. Administrative Burdens

6.1 This Impact Assessment does not include any analysis of the potential additional administration burdens of the policies that may be implemented to reach the objectives of the Bill. Any change in administrative burdens will be considered as part of the Impact Assessments for any proposals brought forward to meet the objectives of the Bill.

7. Enforcement, sanctions and monitoring

7.1 The Bill includes a number of checks and balances surrounding the proposed flexibility mechanisms in the framework, in order to ensure transparency and accountability.

\textsuperscript{53} The Carbon Trust: “The UK Climate Change Programme: Potential evolution for business and the public sector”. 

There is a requirement for the Government to report annually to Parliament on the level of emissions.

7.2 Minor adjustments to the timing of emissions reductions, in the form of banking and limited borrowing proposed under Issue 8 (Section 3.4), would be subject to advice from the proposed Committee. Any use of the wider review clauses enabling the Government of the day to revise the statutory targets or budgets in the event of significant developments in relevant circumstances, would be subject to Parliamentary approval under an affirmative resolution procedure.

7.3 Responding to climate change is an increasingly high priority of households, firms and elected representatives. The Bill therefore requires that if emissions exceed the target set, the Government set out its proposals and policies for making up for the excess. In addition, the Government would be exposed to the possibility of Judicial Review. In such instance, the Government could be required to take remedial action by order of court.

7.4 These proposals give the Committee a primary function in reporting on progress towards meeting the budgets and targets, maintaining a consistent approach regardless of the Government of the day. Requiring the Government to respond to the Committee’s annual report ensures that Parliament and the public are able to monitor policy in this area and that the Government can be held to account annually in Parliament.

7.5 The Government is also required to report to Parliament on its adaptation work – the risk assessment, the programme, a mid-term review of the programme and its strategy for use of the adaptation reporting power. In addition, the adaptation sub-committee will report to Parliament, through the Committee on Climate Change, on the adequacy of the Government’s adaptation programme.

8. Implementation and delivery plan

8.1 It is expected that the Climate Change Bill will be enacted in Summer 2008. The following milestones are then envisaged:
- the Committee on Climate Change will lay a report before Parliament, recommending to the Government the level of the first three carbon budgets by 1 December 2008;
- the Committee will also advise on whether the target for 2050 should be tightened up to 80%;
- the Government will set the level of these carbon budgets in secondary legislation, following a Parliamentary process (Order requiring affirmative resolution); it must set these budgets by 1 June 2009;
- the Government must, as soon as reasonably practicable, publish a strategy explaining its policies and proposals for keeping within the budgets that it has set;
- the Government will be required to set the next budget, for the fourth budgetary period, in secondary legislation following further advice from the Committee, again publishing a strategy outlining how it intends to keep within the budget;
- subsequent budgets will be set in the same way.
- the Government will report to Parliament on its strategy for use of the adaptation reporting power within 12 months of Royal Assent;
- the Government will report to Parliament on the first risk assessment by 2011 and each subsequent risk assessment no later than every 5 years; and
- the Government will report its adaptation programme to Parliament as soon as reasonably possible after each risk assessment, and will provide a mid-term review of each programme after 30 months.
9. Post-implementation review

9.1 The post-implementation review will focus on the UK’s performance towards meeting its legislated carbon budgets and targets, and will be ongoing, as detailed in the reporting requirements of the Bill. Specifically this means that the following reviews will be required:

- an annual report by the Committee, laid before Parliament, assessing the UK’s performance and progress towards achieving its legislated targets and budgets. The first report will be due by 30th September 2009;
- a Government response to the Committee’s annual report, laid before Parliament by 15th January 2010;
- a repetition of this process by 30th June and 15th October in subsequent years; and,
- in the Committee’s annual report for 2014 (when all of the relevant data for the first budget period becomes available) a statement of its views on the manner in which the Government carried out its functions in relation to meeting its legislated budget for the period 2008-12; this statement will then be repeated after each budget period, when all data for that budget becomes available – in 2019, 2024, 2029 etc.
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Annex A : Impact Assessment for RTFO Provisions in the Climate Change Bill

A1. The Renewable Transport Fuel Obligation (RTFO) will be introduced in April 2008 under the Renewable Transport Fuel Obligations Order 2007 which was made on 25 October to bring the scheme into effect. An Impact Assessment accompanied the Explanatory Memorandum for the order and can be viewed at:


A2. Broadly speaking, the implementation of the RTFO provisions in Schedule [5] to the Climate Change Bill would result in a net saving for transport fuel suppliers and for the Administrator of the scheme.

A3. Schedule [5] enables the appointment of a new Administrator of the RTFO scheme to replace the Renewable Fuels Agency as appointed under the order. The new Administrator could be the Secretary of State and this would reduce the cost to the Exchequer as the role would be performed by one of the Department for Transport’s existing Executive Agencies or a branch within the Department. This means that the Administrator could more easily share the resources of the Agency or Department including HR, finance staff and systems, and IT infrastructure. Also there would not be a requirement for a separate Board. This could result in total cost savings in a range between £100,000 to £300,000 per annum depending on the exact arrangements for the existing Administrator and the new Administrator (and allowance would need to be given for the costs associated with transferring the functions, which again would depend upon the exact arrangements).

A4. The provision for an information sharing gateway with Her Majesty's Revenue and Customs (HMRC) would reduce the need for the Administrator to require evidence of fuel sales or for independent auditing and thereby reduce the administrative burden both on transport fuel suppliers and on the Administrator. The provision would also reduce the amount of compliance and inspection work that the Administrator would need to carry out. It is estimated that this might result in an annual saving of around £135,000 per year to transport fuel suppliers (as an industry), and up to £300,000 per annum to the Administrator. Such a provision could also benefit small businesses as the administrative burden of complying with the scheme would reduce. It would have a negligible impact on competition.

A5. Under the RTFO an obligated supplier can discharge the obligation by making a buy-out payment instead of producing certificates showing that renewable transport fuel has been supplied. The Energy Act 2004 requires that these buy-out payments are redistributed (or ‘recycled’) among transport fuel suppliers. Under the order the payments will be recycled to transport fuel suppliers who redeem or surrender certificates. The Bill provides that the RTF order may instead require that the buy-out payments be paid by the Administrator to the Secretary of State (or kept by the Administrator if the Administrator is the Secretary of State) for payment into the consolidated fund. If implemented this could have a positive impact on public finances (up to a theoretical maximum of £170 million per annum if the market was very short on biofuels). However, it is intended that the option for buy-out payments to be paid into the consolidated fund will only be exercised in the unlikely event that recycling proves to have a negative effect on the Government’s policy objective of encouraging the supply of renewable fuels. For example, if only a relatively small number
of biofuel producers were able to claim a disproportionately large amount of money through the fund. If this happened the RTFO might provide a lot of support to a small number of companies rather than achieving the policy objective of encouraging all transport fuel suppliers to supply renewable fuel. This overcompensation could also raise state aid issues.

A6. It is likely that at least for the first few years of the scheme, the value of the buy-out fund will be very small as there is a strong incentive for obligated suppliers to sell renewable fuel rather than making a buy out payment (given the total package of support measures which comprise the duty incentive for biofuels as well as the buy out payment). This makes it unlikely that the option not to recycle buy-out payments would have to be exercised in the short term and means that, if it were exercised, the positive impact on public finances would be much more limited.

A7. The Bill imposes a new duty on the Administrator to promote the supply of renewable transport fuel which reduces carbon emissions and contributes to sustainable development. This might, for example, include publishing information about the environmental effects of biofuels, undertaking research into how to promote good biofuels or providing training or guidance about the benefits or detrimental effects of certain biofuels. It is not expected that this will result in significant cost implications.

A8. The Bill contains a new power for the Secretary of State to give written directions to the Administrator concerning the exercise of the Administrator’s power to require information from transport fuel suppliers. This power of direction is unlikely to impose additional administrative costs on suppliers or the Administrator. The Administrator will under the order require transport fuel suppliers applying for certificates to provide information about the carbon and sustainability of their biofuels in a certain form or using a particular methodology for measuring carbon savings and assessing sustainability. The power of direction is required to ensure that the Secretary of State could remedy the position in the unlikely event that the requirements imposed by the Administrator did not contribute effectively to government policy or were otherwise unsuitable, for example if they imposed too great a burden on transport fuel suppliers. In exercising the power the Secretary of State would endeavour not to do so in a way which imposed additional administrative costs.

A9. The Bill also provides a new power for the Secretary of State to give written directions in relation to how the Administrator counts amounts of biofuel for the purpose of issuing certificates. This power of direction is unlikely to impose additional administrative costs on suppliers or the Administrator. Under the Energy Act it is possible for the RTF order to link the issue of certificates with the carbon savings or sustainability of the biofuels concerned. Because the calculation of carbon saving and sustainability is complex and technical it is likely that the order would require the Administrator to determine and publish the methodology to be applied. The power of direction is required to ensure that the Secretary of State could remedy the position in the unlikely event that the methodology adopted by the Administrator did not contribute effectively to government policy or was otherwise unsuitable, for example if it imposed too great a burden on transport fuel suppliers. In exercising the power the Secretary of State would endeavour not to do so in a way which imposed additional administrative costs.

A10. The Bill also allows the RTF order to make references to documents as revised or re-issued from time to time when making provision for counting amounts of biofuel. This will enable the order to refer to international standards relating to carbon saving and sustainability without the need to amend the order every time a change is made to the international standard. It will therefore save the costs of making a new order in these circumstances.
Annex B: Carbon Reduction Commitment Information Gathering
Powers in the Climate Change Bill

B1. The Carbon Reduction Commitment is a new mandatory cap and trade emissions trading scheme covering all energy use emissions from up to 5,000 organisations with electricity consumption in excess of 6,000MWH per year from mandatory half-hourly meters. In the Energy White Paper, Government announced that it would implement the scheme, starting in 2010.

B2. The information gathering power is necessary to begin identifying organisations covered by the scheme. Government is consulting on an identification process which requires energy suppliers to provide a list of all mandatory half-hourly meters in the UK and their electricity consumption for 2008. The process also requires electricity users to collate their organisation’s total electricity consumption from mandatory half-hourly meters and confirm to Government whether it meets the inclusion threshold. This process may take up to 12 months to administer.

B3. Government is keen to begin the exercise as early as possible in 2009 in order to give potential participants sufficient time to assess whether they are covered by the scheme, and to begin preparing for the new regulation. Without an information gathering power Government will not be able to begin this process until CRC regulations come into force, which depending on parliamentary process may be April or October 2009. Relying on secondary legislation may, therefore, restrict Government’s ability to identify participants in time for the scheme to start in 2010, and could place undue administrative burdens on potential participants because of reduced timescales to respond to information requests, as well as reducing the time available for participants to prepare for the scheme.

B4. The costs associated with the use of these powers have already been included in the updated version of the Partial RIA which was published in June 2007. The costs which were included in this Partial RIA are those identified by Hedra in their 2007 report, “How is the successful qualification of EPC (now CRC) organisations ensured”. Note the figures presented below have been updated since the Partial RIA was published, and will be included in the final Impact Assessment for the policy.

B5. The total costs relate to those upon Government (producing guidance, building the database and populating the database), electricity suppliers (sending information to customers and producing an electronic file extract) and the organisations themselves (determining whether or not they are included in the CRC). The total cost of the above is estimated to total approximately £5.5 million every four years.

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55 This was not included in the updated version of the CRC Partial RIA.
56 This figure has been re-calculated and is now slightly higher than the figures included in the updated version of the CRC Partial RIA.
### Annex C: Glossary of Terms and Abbreviations

<table>
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<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td><strong>Annex I Countries</strong></td>
<td>Definition for Kyoto Protocol. Industrialized countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT Parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States.</td>
</tr>
<tr>
<td><strong>BERR</strong></td>
<td>Department for Business, Enterprise &amp; Regulatory Reform (formally the Department of Trade &amp; Industry)</td>
</tr>
<tr>
<td><strong>CCPR</strong></td>
<td>UK Climate Change Programme Review</td>
</tr>
<tr>
<td><strong>Clean Development Mechanism (CDM)</strong></td>
<td>The project mechanism provided for under Article 12 of the Kyoto Protocol. These are projects in developing countries which reduce emissions of greenhouse gases or enhance sinks.</td>
</tr>
<tr>
<td><strong>CO₂</strong></td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td><strong>CO₂e</strong></td>
<td>Carbon Dioxide equivalent: an internationally accepted measure of Global Warming Potential (GWP) of greenhouse gases (GHGs). The CO₂e of represents the amount carbon dioxide with the same global warming potential (GWP), as a single ton of the GHG.</td>
</tr>
<tr>
<td><strong>CRC</strong></td>
<td>Carbon Reduction Commitment is a new mandatory cap and trade emissions trading scheme covering all energy use emissions from up to 5,000 organisations with electricity consumption in excess of 6,000MWH per year.</td>
</tr>
<tr>
<td><strong>EU</strong></td>
<td>European Union</td>
</tr>
<tr>
<td><strong>EU-ETS</strong></td>
<td>European Union Emissions Trading Scheme</td>
</tr>
<tr>
<td><strong>EWP</strong></td>
<td>Energy White Paper</td>
</tr>
<tr>
<td><strong>G8</strong></td>
<td>Group of 8 of the world’s major industrialised economies (Canada, France, Germany, Italy, Japan, Russia, UK, USA), with the European Commission also represented at meetings.</td>
</tr>
<tr>
<td><strong>GDP</strong></td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td><strong>Gleneagles Dialogue</strong></td>
<td>Forum for participating countries to work together on the shared challenges of addressing climate change, energy security and access to energy. The Dialogue also oversees implementation of the Gleneagles Plan of Action, which aims to increase the speed with which we reduce greenhouse gas emissions.</td>
</tr>
<tr>
<td><strong>Global Warming Potential (GWP)</strong></td>
<td>A measure of how much a given mass of a greenhouse gas is estimated to contribute to global warming. It is a relative scale which compares the gas in question to that of the same mass of carbon dioxide (whose GWP is by definition 1). GWP figures are provided and reviewed by the IPCC.</td>
</tr>
<tr>
<td><strong>IEA</strong></td>
<td>International Energy Authority</td>
</tr>
<tr>
<td><strong>IPCC</strong></td>
<td>Intergovernmental Panel on Climate Change: A UN body set up to “assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation.” For further details please see: <a href="http://www.ipcc.ch/">http://www.ipcc.ch/</a></td>
</tr>
<tr>
<td><strong>IETA</strong></td>
<td>International Emissions Trading Association</td>
</tr>
<tr>
<td><strong>Joint Implementation (JI)</strong></td>
<td>The project mechanism provided for under Article 6 of the Kyoto Protocol. These are projects undertaken in developed countries with targets which reduce emissions of greenhouse gases or enhance sinks.</td>
</tr>
<tr>
<td><strong>Kyoto Protocol</strong></td>
<td>The Kyoto Protocol to the UNFCCC. Negotiated in Japan in 1997, it came into force in February 2005. Among other things, the Protocol sets binding targets for the reduction of greenhouse gas emissions by industrialized countries.</td>
</tr>
</tbody>
</table>
MARKAL-Macro  A model of the UK energy system which incorporates a ‘top down’ macroeconomic component to facilitate the explicit calculation of macroeconomic variables (such as GDP). The model can also capture changes in the demand for energy in response to changes in the price.

Marrakech Accords  Agreements reached in 2001 which set out the detailed provisions building on provisions of the Kyoto Protocol, including those relating to supplementarity, CDM and JI.

ppm  Parts per million: measurement of atmospheric concentration of greenhouse gas.

Stern Review  A recent review lead by Sir Nicholas Stern on the economics of climate change. See the Treasury’s website - http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm

Supplementarity  The principle that the use of the project mechanisms should be supplemental to domestic action to reduce greenhouse gas emissions.

UNFCCC  United Nations Framework Convention on Climate Change. 189 countries around the world have joined this international treaty that sets general goals and rules for confronting climate change. The Convention sets an ultimate objective of stabilizing greenhouse gas emissions “at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system.” As a "framework" document it is something to be amended or augmented over time. Further information is available from: http://unfccc.int
## Annex D

**Summary: Intervention & Options**

<table>
<thead>
<tr>
<th>Department /Agency:</th>
<th>Title:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defra</td>
<td>Impact Assessment of Adaptation measures in the Climate Change Bill</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage:</th>
<th>Version:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final</td>
<td>1</td>
<td>6 November 2007</td>
</tr>
</tbody>
</table>

**Related Publications:** The Climate Change Bill

**Available to view or download at:**
http://www.

**Contact for enquiries:** Philip Earl  
**Telephone:** 020 7238 3263

### What is the problem under consideration? Why is government intervention necessary?
A wide range of public services will be impacted by climate change including, for example, health care, transport, education and resilience to flooding. Currently there is no standard for organisations to work to with regards efforts to address adaptation. Government intervention is necessary due to the presence of a large number of market failures preventing optimal uptake of adaptation measures. Those addressed by this proposal include moral hazard, misaligned incentives and behavioural barriers.

### What are the policy objectives and the intended effects?
The objective of this proposal is to provide a clear legislative framework for the UK to drive action on adapting to climate change by placing a duty on all public bodies to have regard to the need to adapt to climate change. This would be supported by guidance, which together would augment existing provisions in the Climate Change Bill to further strengthen the co-ordinating framework for adaptation. The intended effect is a substantial increase in the level of cost-effective adaptation action being taken forward.

### What policy options have been considered? Please justify any preferred option.
Two approaches have been considered - one using the provisions of the climate change Bill, the alternative being to do nothing now but leave the option open for action in the future outside of the Bill framework. The prefered option was chosen because of the need for urgent action on adaptation, and its expected high levels of effectiveness in terms of leveraging more action from public bodies.

### When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?
The impact of the duty will be reviewed in line with, and as part of, the adaptation programme to be set up under the Climate Change Bill.

**Ministerial Sign-off** For final proposal/implementation stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that (a) it represents a fair and reasonable view of the expected costs, benefits and impact of the policy, and (b) the benefits justify the costs.

Signed by the responsible Minister:

.............................................................................................................Date:
### Summary: Analysis & Evidence

<table>
<thead>
<tr>
<th>Policy Option: Option 2</th>
<th>Description: Placing a duty on public bodies to have regard for climate change adaptation</th>
</tr>
</thead>
</table>

#### ANNUAL COSTS

| Description and scale of key monetised costs by ‘main affected groups’ | Lower-bound costs of £1000-£3800 per organisation, associated with the admin costs of conducting a risk assessment. Annual costs of £200-£760 (again, per organisation) represent this one-off cost amortised over 5 years to represent ongoing risk assessment activity. Additional one-off cost to government of £50k of developing statutory guidance. |
|---------------------------------------------------------------|

<table>
<thead>
<tr>
<th>One-off (Transition)</th>
<th>Yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>£ 50k</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average Annual Cost (excluding one-off)</th>
<th>£ n/a</th>
</tr>
</thead>
</table>

| Total Cost (PV) | £ n/a |

Other key non-monetised costs by ‘main affected groups’ Costs of appraising options are assumed to be negligible, as they will incorporated into mainstream appraisal processes.

#### ANNUAL BENEFITS

<table>
<thead>
<tr>
<th>Description and scale of key monetised benefits by ‘main affected groups’</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>One-off</th>
<th>Yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>£ n/a</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average Annual Benefit (excluding one-off)</th>
<th>£ n/a</th>
</tr>
</thead>
</table>

| Total Benefit (PV) | £ n/a |

Other key non-monetised benefits by ‘main affected groups’ Net benefit to organisations and society in the long run of improved resilience to climate change impacts as a result of additional / more appropriate / more urgent adaptation measures adopted as a result of the duty. The value of this net benefit is unknown, but is definitely positive and could be substantial. Each measure will be the subject of its own investment appraisal or impact assessment to ensure positive NPV.

#### Key Assumptions/Sensitivities/Risks

Assumption that appraisal costs are negligible. Sensitivities around extent to which bodies already have regard, and possibility of higher costs to conduct more complex risk assessments. Risk that duty not strong enough without enforcement mechanism.

#### Price Base

<table>
<thead>
<tr>
<th>Price Base Year</th>
<th>Time Period Years</th>
<th>Net Benefit Range (NPV) £</th>
<th>NET BENEFIT (NPV Best estimate) £</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

**What is the geographic coverage of the policy/option?**

England

**On what date will the policy be implemented?**

May 2008

**Which organisation(s) will enforce the policy?**

n/a

**What is the total annual cost of enforcement for these organisations?**

£ n/a

**Does enforcement comply with Hampton principles?**

n/a

**Will implementation go beyond minimum EU requirements?**

n/a

**What is the value of the proposed offsetting measure per year?**

£ n/a

**What is the value of changes in greenhouse gas emissions?**

£ n/a

**Will the proposal have a significant impact on competition?**

No

**Annual cost (£-£) per organisation (excluding one-off)**

<table>
<thead>
<tr>
<th>Micro</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>£200</td>
<td>£200</td>
<td>£760</td>
<td></td>
</tr>
</tbody>
</table>

**Are any of these organisations exempt?**

Yes

No

N/A

N/A

**Impact on Admin Burdens Baseline (2005 Prices)**

<table>
<thead>
<tr>
<th>Increase of</th>
<th>Decrease of</th>
<th>Net Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>unclear</td>
<td>£ 0</td>
<td>unclear</td>
</tr>
</tbody>
</table>

Key: Annual costs and benefits: Constant Prices (Net) Present Value
**Policy Option: Option 3**

**Description:** As Option 2, plus a power for the Secretary of State to require specific public bodies to provide information to show that they have regard for the impacts.

### ANNUAL COSTS

<table>
<thead>
<tr>
<th>Description and scale of key monetised costs by ‘main affected groups’</th>
<th>Costs for risk assessments (£1000-3800, £200-£760 p.a.) and guidance (£50k) are the same as under Option 2. However, there would be an additional cost to specific bodies of £840-£1550 per request associated with providing information to the Secretary of State, and a cost to government of £1550 per request of analysing this information.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>One-off</strong> (Transition) Yrs</td>
<td>£ 50k</td>
</tr>
<tr>
<td><strong>Average Annual Cost</strong> (excluding one-off)</td>
<td>£ n/a</td>
</tr>
<tr>
<td><strong>Total Cost (PV)</strong></td>
<td>£ n/a</td>
</tr>
</tbody>
</table>

**Other key non-monetised costs** by ‘main affected groups’

As in Option 2, costs of appraising options are assumed to be negligible, as they will incorporated into mainstream appraisal processes.

### ANNUAL BENEFITS

<table>
<thead>
<tr>
<th>Description and scale of key monetised benefits by ‘main affected groups’</th>
<th>As in Option 2, net benefit from improved resilience to climate change impacts as a result of additional adaptation measures adopted. In addition, the power to request information from specific bodies will allow this to be effectively targeted and rigorously enforced where it matters most. Each measure will be the subject of its own investment appraisal or impact assessment to ensure positive NPV.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>One-off</strong></td>
<td>£ n/a</td>
</tr>
<tr>
<td><strong>Average Annual Benefit</strong> (excluding one-off)</td>
<td>£ n/a</td>
</tr>
<tr>
<td><strong>Total Benefit (PV)</strong></td>
<td>£ n/a</td>
</tr>
</tbody>
</table>

**Other key non-monetised benefits** by ‘main affected groups’

As in Option 2, net benefit from improved resilience to climate change impacts as a result of additional adaptation measures adopted. In addition, the power to request information from specific bodies will allow this to be effectively targeted and rigorously enforced where it matters most. Each measure will be the subject of its own investment appraisal or impact assessment to ensure positive NPV.

### Key Assumptions/Sensitivities/Risks

As in Option 2, assumption that appraisal costs are negligible. Sensitivities around extent to which bodies already have regard, and possibility of higher costs to conduct more complicated risk assessments, or to respond to SoS requests for information in complex cases.

### Price Base

<table>
<thead>
<tr>
<th>Price Base Year</th>
<th>Time Period Years</th>
<th>Net Benefit Range (NPV) £ n/a</th>
<th>NET BENEFIT (NPV Best estimate) £ n/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>n/a</td>
<td>£ n/a</td>
<td>£ n/a</td>
</tr>
</tbody>
</table>

### Impact on Admin Burdens Baseline (2005 Prices)

<table>
<thead>
<tr>
<th>Increase of £-£ per organisation</th>
<th>Decrease of £</th>
<th>Net Impact £-£ per body</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increase of £ 200-760 per body</strong></td>
<td>£ 0</td>
<td><strong>Net Impact £ 200-760 per body</strong></td>
</tr>
</tbody>
</table>

**Key:**

- Annual costs and benefits: Constant Prices
- (Net) Present Value
Evidence Base (for summary sheets)

[Use this space (with a recommended maximum of 30 pages) to set out the evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Ensure that the information is organised in such a way as to explain clearly the summary information on the preceding pages of this form.]

Introduction

This Impact Assessment appraises the proposed measures in the Climate Change Bill aimed at ensuring all public bodies take appropriate action to adapt to the future impacts of climate change.

Objectives

The objective is to provide a clear legislative framework for the UK to drive action on adapting to climate change by placing a duty on all public bodies to have regard to the adaptation by adding to existing provisions in the Climate Change Bill to further strengthen the co-ordinating framework for adaptation.

Background

The Need for adaptation

Even if climate change mitigation policies were completely successful, significant impacts will arise in the next 30-40 years – or 100 years for sea level rise – due to the lags in the system. According to the Stern Review, even if all emissions stop tomorrow, the Earth will warm by a further 0.5 - 1°C over coming decades. Thus, even in the presence of extremely successful global mitigation, some adaptation will be necessary. If global mitigation is less successful, on current trends, global temperatures could rise by 2 - 3°C within the next fifty years or so.

We are already experiencing an increasing number of extreme weather events, some of which may be the result in changes to our climate, and these events can have disastrous consequences – Europe’s extreme summer heat wave in 2003 claimed around 20,000 lives. Whilst mitigation can hopefully reduce the risk of these events occurring in the future, adaptation is required to reduce the impacts of both these extreme events, and the more gradual rise in temperature which will be experienced in the coming decades.

In a general sense, it has been shown that adaptation to extreme events (some of which may be caused by climate change) can be very cost effective. The World Bank and US Geological Survey calculate that economic losses world-wide from natural disasters in the 1990s could have been reduced by $280 billion if $40 billion had been spent on preparedness, mitigation and prevention strategies.57

Specific evidence on the costs and benefits to the UK of undertaking climate change adaptation measures is more limited, since the future benefits of actions taken today depend on many factors, including on technological progress, and population and economic growth. However, where studies have been undertaken in individual sectors, adaptation measures have been shown to yield substantial cost savings. For example a study undertaken by Defra found that even under very conservative assumptions, there was a strong economic case for undertaking

measures to safeguard households against climate change induced shortfalls in water availability\textsuperscript{58}.

While information is not available on the scale of the costs and benefits involved, it could be expected that the early consideration of the need for adaptation will allow the most cost-effective adaptation to be undertaken, because it will allow organisations the flexibility to choose the most cost-effective measures, rather than being forced to act urgently and reactively. Early action will also avoid lock-in to long lived assets such as buildings and infrastructure not resilient to the changing climate.

\textit{Adaptation already in the Climate Change Bill}

The Climate Change Bill, to be laid before the House in November, contained initial proposals for a new legislative reporting framework on adaptation:

- Publication of a UK risk report at least every 5 years; and
- Publication of an adaptation programme covering England and reserved matters, contributing to sustainable development.

The Bill places a duty on the Government to regularly report on the risks of the impacts of climate change for the UK, and on the Government’s proposals and policies for adapting to climate change. This will provide a framework for making clear the actions to tackle the now unavoidable effects of climate change, providing greater predictability for UK households and firms.

\textit{Rationale for further Government intervention}

A wide range of public services will be impacted by climate change including for example, health care, transport, education, resilience to flooding. Currently there is no standard for organisations to work to with regards efforts to address adaptation.

In the absence of government intervention, many organisations would undertake adaptation measures anyway, as it in their direct interest to do so. However, there are a number of market failures which may mean the level of adaptation undertaken in the absence of government intervention is less than optimal. These reasons and current policy responses are set out in Table 1.

<table>
<thead>
<tr>
<th>Market failure</th>
<th>Description</th>
<th>Current policy response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncertainty and imperfect information</td>
<td>A lack of information on the impacts of future climate change at the local scale may result in suboptimal choices being made i.e. if decision makers are badly informed, they are unlikely to invest in the most efficient adaptation measures. Uncertainty also makes the case for investment in adaptation less strong. In the presence of many competing demands for funds, it may be difficult to justify the certain costs of investing now in adaptation measures, when they can only be weighed against highly uncertain future benefits.</td>
<td>Currently UKCIP publish regional information on the likely impacts of climate change. Climate change Bill will require a five yearly review of the risks posed by the impacts of climate change to the UK. No requirement for public bodies to have regard to this information</td>
</tr>
<tr>
<td>Externalities and public goods</td>
<td>Some adaptation measures provide spillover benefits to society over and above the benefits they provide to the individual organisations. When this is the case, investment in these measures is likely to be lower than the socially desirable level, as the organisations will not take into account the benefits to society in their decision making. Adaptation responses can be public goods (i.e. non-excludable and non-rival). For example, it is not possible to exclude organisations in a given location from the benefits of coastal flood defence; neither does one organisation benefiting from the flood defence impede any other organisation from benefiting from it.</td>
<td>Range of policies address adaptation issues but weaknesses exist (see below). Climate Change Bill will require Government to publish an adaptation programme at least every 5 years.</td>
</tr>
<tr>
<td>Moral Hazard</td>
<td>Individuals and organisations will not take sufficient adaptation action if they think they will be bailed out by the Government in the event of disaster. For example, the duty on utilities to ensure continuity of supply as far as is ‘reasonably practicable’ may be interpreted as providing a ‘get-out clause’ in the event of a climate induced disaster and thus may disincentivise appropriate investment in adaptation measures.</td>
<td>Lack of specific duty to take account of the impacts of climate change. Lack of clarity/guidelines about responsibilities.</td>
</tr>
<tr>
<td>Misaligned incentives</td>
<td>Decision makers may have short planning horizons and many of the actions required for efficient adaptation, such as making buildings more resilience to climate change impacts, or land use decisions, will only yield benefits in the long run. This, combined with the uncertainty over future impacts, and imperfect information in the market, may lead to less than optimal adaptation. For example, a resilient office block may be worth no more in the market currently than one with no climate proofing, as those wishing to purchase it are not informed about the future risks of climate change impacts.</td>
<td>The Green Book requires public sector investors to adapt long-term planning horizons and makes reference to climate change adaptation, but not clear that there is a policy mechanism to ensure that the impacts of climate change are factored into investments and the maintenance of assets.</td>
</tr>
<tr>
<td>Behavioural</td>
<td>Climate change impacts are likely to be just one of</td>
<td>No requirement for</td>
</tr>
</tbody>
</table>
Table 1 shows that because of a wide range of market failures, Government intervention is likely to be required in order to bring the undertaking of adaptation policies by organisations, including public bodies closer to optimal levels for society. In particular, the problems of moral hazard, misaligned incentives, behavioural barriers and financial constraints are not currently covered by policy.

**Options**

**Option 1: Do nothing - No further adaptation provisions to be added to the Climate Change Bill**

For the purposes of this impact assessment it is assumed that doing nothing means taking no action at present, but not ruling out further action in the future when more information is available.

Failing to amend the Climate Change Bill does not completely close off the options of taking action, as intervention could be pursued in the future outside of the Climate Change Bill, including by:

- Issuing guidance to ensure consistency and provide clarity about how public bodies can take account of climate change impacts.
- An outreach programme to educate and communicate how existing requirements, such as duties to ensure supply of energy/water or to protect biodiversity should include thinking about, planning for and acting in a way that accounts for climate change impacts.
- Using corporate planning, strategies, procurement, Gateway Reviews and auditing to integrate and monitor regard for adaptation.

However, given the uncertainty about potential alternative actions, for the purposes of measuring costs and benefits in the IA, the do-nothing is interpreted as a continuation of the current situation.

**Option 2: Amend the Climate Change Bill to further strengthen the co-ordinating framework for adaptation by placing obligations on public bodies to take account of the likely impacts of climate change**

This would involve placing a ‘General duty on public bodies’, in the exercise of their functions to ‘have regard to the need to adapt to the impacts of climate change’, so far as is compatible with the proper exercise of the public body’s functions.

In relation to the duty, “the impacts of climate change” would be understood as set out in the Secretary of State’s report under clause 47 (the UK risks report). In meeting their duty, public authorities must also have regard to:

(i) the Secretary of State’s adaptation programme under clause 48;

AND

(ii) any guidance issued by the Secretary of State in relation to the duty.

**Option 3: As Option 2, plus an additional power for the SoS to require specific public bodies to provide information to show that they have regard for the impacts**
In practice, this would require (over and above everything in Option 2) the body in question to submit a risk assessment or similar and outline any policies/proposals to address the risks identified.

**Illustrative Costs and Benefits**

In general terms, it is important to reiterate the overall economic case for effective adaptation policies as set out in the Stern report (Chapters 18-20). While evidence on the costs and benefits to the UK of undertaking adaptation measures is limited, studies in individual sectors have shown that adaptation measures can yield substantial cost savings. Not all of these measures will be taken in the absence of government intervention. Effective adaptation policies have the potential to address a range of market failures that tend to make autonomous (or market driven) adaptation sub-optimal. In other words, without an adequate framework of public policy, the potential benefits of a changing climate will not be maximised, and the potential costs will not be minimised. The options for additional legislative measures need to be assessed with this in mind.

This Impact Assessment presents an indicative discussion of the costs and benefits of the proposed measures. However, the proposed amendments to the Bill do not pre-judge the exact actions required to achieve these goals. Hence it is not possible to put an exact figure on the costs and benefits. However, some illustrative costs are presented for the admin burden associated with complying with the duty set out in the proposal.

In addition, the evidence of the costs and benefits associated with adaptation measures are very limited. However, for each possible intervention, public bodies will only undertake action after an investment appraisal or impact assessment has taken place, to ensure a positive net present value is delivered. Thus the benefits of the adaptation actions driven by these policies will outweigh the costs. The benefits of the proposal can therefore be thought of in terms of effectiveness, i.e. how much additional adaptation activity takes place as a result of the proposal.
Costs

Costs of developing statutory guidance

The duty will be accompanied by statutory guidance, which will explain what is required under the duty, and outline the things that a body should consider in having regard to the impacts of climate change. This guidance would be prepared by Defra, which would incur a one-off administrative cost. While this cost cannot be known with certainty, similar work undertaken for guidance to accompany a duty relating to biodiversity cost in the region of £50,000 to produce.

Costs of undertaking a risk assessment

It is difficult to determine the likely costs involved with undertaking a risk assessment as this will vary by organisation. However, a reasonable approximation might be the costs associated with using UKCIPs’s tools.

The UK Climate Impacts Programme (UKCIP) provide tools and information to help organisations to assess their need to adapt to Climate Change. UKCIP suggest that the initial process of reviewing an organisations' vulnerability to current climatic variability, and identifying key risks posed by future climate change, can be done effectively in half day workshop with relevant individuals from the organisations. For a medium sized organisation like a Local Authority, UKCIP have found that identifying and prioritising key climate risks has been possible in a half-day workshop with about half a dozen participants. It is assumed that for a large organisation (such as a central government department), the resource requirements might be approximately double this.

Table 2 sets out the possible one-off costs of undertaking a risk assessment to small, medium and large organisations, based on UKCIP’s estimates of the time taken to run a workshop, and assuming that participants are managers within their respective organisations, and do (on average) around a further half day of associated work in connection with the workshop. These costs are illustrative only.

Table 2: Costs of undertaking an initial risk assessment

<table>
<thead>
<tr>
<th>Assumed number of person hours</th>
<th>Average hourly rate</th>
<th>Total cost per organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small/Medium — e.g. local authority</td>
<td>8hrs x 6 people = 48</td>
<td>£21.01 (Senior officials in local government)</td>
</tr>
<tr>
<td>Large — e.g. Central Government Department</td>
<td>8hrs x 12 people = 96</td>
<td>£38.77 (Senior officials in national government)</td>
</tr>
</tbody>
</table>

NB. Hourly rates are based on the Standard Cost Model. The assumed job title in brackets refers to the classifications in the model.

After an initial cost, it is assumed that organisations might repeat this exercise on average every 5 years – hence this cost is amortised across 5 years to represent the annual admin cost of complying with this proposal.

UKCIP do not charge for use of the tools (Defra funds them to develop tools for use by our stakeholders); and the tools are set up so that organisations should be able to use them themselves. This measure would therefore not impose any additional costs on UKCIP. However, the more organisations that use these tools, the less one-to-one ad hoc support in using the tools UKCIP will be able to provide to them.

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59 Personal communication
However, these costs are expected to represent a lower estimate of the costs of conducting a risk assessment. In cases where the body in question is large, and/or a risk assessment is likely to involve analysis of a number of complex relationships between climate and the effective operation of that body, then the costs could be significantly higher. Anecdotal evidence suggests a comprehensive risk assessment conducted by consultants could cost in the region of £20,000 for a large public body.

**Further work is being taken forward to assess the likely costs of complying with the duty for a selection of public bodies of various sizes and types.** It should be emphasised, though, that the costs of undertaking the risk assessment are expected be proportional to the vulnerability and importance of the body in question – so costs for a body which is not particularly vulnerable, or that does not perform a critical function, should be lower than those for bodies whose work is fundamentally interrelated with, and affected by, changes in the climate.

**Costs of appraising the alternative options for action**

In many cases, the best response to climate change risks will be to factor them into existing appraisal processes, and the additional appraisal costs should then be relatively low. It is assumed that this will be the usual method by which organisations fulfil their duty under the proposal, and so the costs are assumed to be negligible.

However, the costs of identifying and appraising options to tackle the identified risks could be much greater, and therefore it is important to bring consideration of climate change adaptation into mainstream decision processes to minimise the risk of such costs being incurred. This risk is identified in the risk register below.

**Costs of taking action**

There will also be costs associated with actually undertaking the adaptation measures. However, these will be upfront costs which deliver a stream of cost savings in the future - public bodies will not respond to the risks uncovered by their risk assessment unless the future benefits outweigh the costs. Consequently, these are represented as net benefits below.

**Costs of providing information to the Secretary of State (Option 3 only)**

Under Option 3, the Secretary of State will have the power to request information from specific bodies to ensure their compliance with the duty. This information will consist of the risk assessment and evidence of any resulting work which should already have taken place as a result of the duty. Therefore the extra costs imposed on the body supplying the information should be relatively small. However, assuming that a body allocates 5 days (40 hours) of management time to collating, presenting and supplying the information, including responding to any follow-up questions, then using the same hourly rates as before, this represents an additional one-off cost of between £840 and £1550 per organisation. If this is amortised over 5 years as for the risk assessment costs, this is equivalent to £170-£310 p.a. for the affected organisation. Again, though, this cost could rise considerably if there was significant further work required. The total cost will obviously vary according to the number of requests made.

There will also be a cost to government in terms of the time taken to analyse the information provided by the body. Based on similar procedures, such as those associated with the Civil Contingencies Act, it is estimated that this might take in the region of 5 days time by a senior official. Using the Standard Cost Model, this would give a cost of £1550 (based on 40 hours work at an hourly rate of £38.77).

**Benefits**
Net benefits of adaptation action

As described above, the benefits of this proposal are the additional cost-effective adaptation measures adopted as a result of undertaking the risk assessments required under this proposal. These benefits may result from purely additional activity, or may be realised through investments/action which are more appropriate or carried out sooner than they would have been otherwise. These will all have positive net benefits, as all interventions, investments and policies by public bodies will be subject to impact assessments or investments appraisals in the usual manner (and subject to the guidance set out in the Green Book). Public bodies will therefore only pursue action where the discounted future benefits outweigh the up-front costs.

The actual net benefit from these actions is not possible to estimate, but relative to the do-nothing, this proposal has the potential to achieve significant leverage in stimulating action by removing or reducing some of the key market failures, particularly those relating to moral hazard, misaligned incentives and behavioural barriers as outlined above. – Given the scale of the possible climate change damage costs avoided by the likely resulting increase in adaptation-related action, these net benefits could be substantial.

Crucially, though, these benefits are dependent on a robust enforcement mechanism to ensure the duty is taken seriously. While there is likely to be some monitoring under Option 2 (see below), Option 3 provides the additional opportunity to request information from specific bodies to ensure their compliance.

Additional benefits of a targeted response (Option 3 only)

Under Option 3, it is expected that the power will allow Government to focus on specific public bodies which it thinks are crucial to our ability to adapt to climate change. This will facilitate a targeted response in the light of the UK risk assessment, meaning that adaptation will be taken account of where it is most important, thus maximising the benefits of this proposal.

Summary of costs and benefits

The illustrative costs and benefits presented above are generally presented on a per-organisation basis. Any attempt to aggregate these figures into an annual, national total of costs and benefits would be subject to a number of key uncertainties, including:

- The proportion of public bodies that would undertake risk assessments in the absence of a duty - in other words, the additional impact of the proposal in relation to risk assessments and hence adaptation action;
- The proportion of risk assessments that find there are no risks that need addressing;

For this reason, aggregated figures are not presented here. However, to give an idea of the scale of this proposal, it is possible to compare it to a duty on public authorities in the Race Relations (Amendment) Act 2000, for which it was calculated there were 70 Central Government bodies and 410 Local Authorities to which the duty applies. Further work on which, and how many, bodies are covered by the duty in this proposal will be undertaken in the course of developing the adaptation programme.

Table 3 below qualitatively presents the costs and benefits of the options relative to the do-nothing scenario.

<p>| Option 2 | Costs of risk assessments (per) | Benefits | Net benefit of additional adaptation |</p>
<table>
<thead>
<tr>
<th>Organisation</th>
<th>£1000 – £3800 up front cost, followed by an average of £200 – £760 annual cost.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measures</td>
<td>unknown, but definitely positive and could be substantial</td>
</tr>
<tr>
<td>Cost of appraising options assumed to be negligible.</td>
<td></td>
</tr>
<tr>
<td>Cost to government of approximately £50k to develop statutory guidance.</td>
<td></td>
</tr>
</tbody>
</table>

**Option 3**

- As Option 2, plus costs of providing information to the SoS.
- These additional costs could be in the region of £840–£1550 to the organisation and approximately £1550 to government for each information request, although these will vary according to the complexity of the issues.
- As Option 2, although net benefits leveraged by the duty may be greater due to more robust monitoring and enforcement as a result of the power.
- Also, some additional benefits from more targeted approach.

**Sensitivities, uncertainties and risks**

Some uncertainties are identified above in relation to aggregation of the cost figures. However, there are also some key sensitivities which could mean the costs presented might either be higher or lower than those presented:

- As identified above, the risk assessment cost presented are likely to represent a lower bound, and could be substantially higher. However, the statutory guidance which accompanies the duty will explain what bodies should be considering in having regard to the impacts of climate change, and will encourage a proportional response.

- Further research undertaken to follow up the findings of the risk assessment could substantially increase the costs. However, it is assumed that this research will not be undertaken unless the risk assessment indicates that there is a strong possibility of the resulting investment being cost-effective – in other words, instances where extensive research is conducted but no mitigation action is taken should be minimised.

- As identified above, it is unclear what proportion of organisations already do, or plan to, have regard for the need to adapt to climate change, but it is unlikely to be zero. With this in mind, if the 'per organisation' costs above are considered as an average, then they are likely to be overestimated to some degree.

- There also a possibility that the risk assessment procedure could take longer than the estimates provided above. However, the statutory guidance which accompanies the duty will make clear what is required to comply with that duty, including an explanation of the risk assessment procedure. This should minimise the risk that bodies spend considerably longer than expected on meeting their duty.

It should also be noted that the key assumption here is that for any adaptation measures adopted, the benefits will outweigh the costs. Whilst the evidence on this is limited, this assumption is relatively robust since (a) any public body wishing to introduce a policy or make an investment must subject their intervention to an impact assessment or investment appraisal...
in the normal manner, and (b) evidence from other sectors suggests that adaptation measures are usually cost-effective\(^60\).

The risk register below shows the main risks associated with this proposal.

<table>
<thead>
<tr>
<th>Risk</th>
<th>Mitigating actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs could rise considerably if adaptation considerations are not factored into standard appraisal frameworks</td>
<td>Bodies need to ensure that this duty is embedded into mainstream decision making to minimise the likelihood of this risk occurring.</td>
</tr>
<tr>
<td>The duty becomes a box-ticking exercise and risk assessments are not properly undertaken, hence benefits will not be realised</td>
<td>Government needs to support efforts to have regard by providing appropriate guidance, and ensure progress is made. Option 3 significantly reduces this risk by giving the SoS power to request information from specific bodies to ensure compliance. See also ‘monitoring’ below.</td>
</tr>
</tbody>
</table>

**Small Firms Impact Test**

This measure will only affect public bodies and will not have an impact on small firms.

**Competition Assessment**

This measure will only affect public bodies and will not have a significant impact on competition. However, there could be a slight impact in cases where a public body is in direct competition with a private company which is not bound by this duty.

**Enforcement, sanctions and monitoring**

Under Option 2, it is considered too burdensome to require every body to demonstrate its compliance with the duty by submitting its risk assessment, but there are three ways in which the duty could potentially be monitored:

- When designing and delivering the adaptation programme, Defra will require input from public bodies and will therefore be engaging with them to determine what they are currently doing, and to gain support for the programme. Through this process, it should be feasible to assess which organisations are currently having regard to adaptation, and which are not.

- Defra will be laying the UK risks report and adaptation programme before Parliament. This will be an opportunity to identify any gaps in the report as a result of an organisation not having regard to adaptation, and Parliament could then take appropriate action (e.g. ‘naming and shaming’).

- The NAO or similar may be asked to play an ad hoc role in scrutinising the work of Government in adapting to climate change, of which this proposal and the associated duty forms a part.

\(^{60}\) Defra (2006) Climate Change Impacts and Adaptation: Cross Regional Research Programme - Quantifying the Costs of Impacts and Adaptation
Under Option 3, the Government will have the additional possibility of requesting information from specific bodies to ensure compliance with the duty. This allows monitoring and enforcement to be focussed where it is most important (thus reducing the associated costs), and significantly reduces the risk of the duty not being taken seriously.
Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

<table>
<thead>
<tr>
<th>Type of testing undertaken</th>
<th>Results in Evidence Base?</th>
<th>Results annexed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competition Assessment</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Small Firms Impact Test</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Legal Aid</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Sustainable Development</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Carbon Assessment</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Other Environment</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Health Impact Assessment</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Race Equality</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Disability Equality</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Gender Equality</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Human Rights</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Rural Proofing</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Specific Impact Tests

*Legal aid* – there will be no impact on legal aid as a result of the proposal, since it affects public sector bodies rather than individuals.

*Sustainable development* – this proposal is fundamentally about sustainable development, hence no specific impact test is required.

*Carbon, health and other environmental impacts* – this proposal will not have any direct implications for the environment or health, although could lead to decisions being made which have an indirect impact on the environment (e.g. decisions regarding where to locate new infrastructure as result of having regard for climate change adaptation).

*Race, disability and gender equality and human rights* – this proposal will have no impact on race, disability and gender equality or human rights.

*Rural proofing* – the policy is not expected to have adverse impacts on rural communities.
What is the problem under consideration? Why is government intervention necessary?
The UK needs to radically reduce the amount of waste it sends to landfill, to reduce the climate change impact of our production and consumption and to comply with the EU Landfill Directive. Encouraging householders to minimise, compost and recycle their waste as far as possible is an important part of this. The UK is currently the only EU15 country to prohibit local authorities from placing financial incentives upon householders to minimise and recycle waste. Government wishes to provide a power to pilot local authority incentives for household waste minimisation and recycling.

What are the policy objectives and the intended effects?
The objective is to give local authorities a power to pilot incentives, as a potential additional tool to change waste behaviour in order to boost recycling, reduce waste levels and reduce waste to landfill.

What policy options have been considered? Please justify any preferred option.
Government has considered the following alternatives:
Do nothing;
Introduction of a local waste charge (as seen elsewhere in Europe)
Introduction of revenue neutral financial incentives

A power to pilot local authority incentives for household waste minimisation and recycling
In addition, a number of other options are already available to authorities to encourage recycling and waste minimisation by households. These include reward schemes, compulsory recycling and Alternate Weekly Collection.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?
Defra will carry out monitoring and evaluation of the first pilots to gather evidence on the costs and benefits with a view to a review during 2010/11.

Ministerial Sign-off For final proposal/implementation stage Impact Assessments:
I have read the Impact Assessment and I am satisfied that (a) it represents a fair and reasonable view of the expected costs, benefits and impact of the policy, and (b) the benefits justify the costs.

Signed by the responsible Minister:

.............................................................................................................Date:
<table>
<thead>
<tr>
<th>Policy Option:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ANNUAL COSTS</strong></td>
<td><strong>ANNUAL BENEFITS</strong></td>
</tr>
<tr>
<td>One-off (Transition) Yrs</td>
<td>Description and scale of key monetised costs by ‘main affected groups’ Costs to the UK as a whole will depend on whether powers are made more widely available following the initial pilots, and, if so, how many local authorities take up the option to introduce incentives. Start-up costs for a 50,000 household scheme are estimated at £100k - £200k, annual running costs at £200k to £500k (costs borne by local authorities).</td>
</tr>
<tr>
<td>£ 70m - 135m</td>
<td><strong>Total Cost (PV)</strong></td>
</tr>
<tr>
<td><strong>Average Annual Cost (excluding one-off)</strong></td>
<td>£ 420m - 480m</td>
</tr>
<tr>
<td>£ 50m - 60m</td>
<td><strong>Total Benefit (PV)</strong></td>
</tr>
<tr>
<td><strong>Average Annual Benefit (excluding one-off)</strong></td>
<td>£ 440m - £1.2bn</td>
</tr>
<tr>
<td><strong>Description and scale of key monetised benefits by ‘main affected groups’</strong> Financial savings can be made through lower waste treatment due to waste prevention, estimate for a 50,000 household scheme suggest £290k and £1.4m savings accruing to local authorities (£180k to £1.35m savings excluding tax to society as a whole). CO2 equivalent savings valued at £80k to £340k p.a. are also predicted.</td>
<td></td>
</tr>
<tr>
<td><strong>Other key non-monetised benefits by ‘main affected groups’</strong> There may also be amenity benefits associated with less waste treatment and movements, these will depend on the type and location of waste facilities.</td>
<td></td>
</tr>
<tr>
<td><strong>Key Assumptions/Sensitivities/Risks</strong> There may be distibutional impacts depending on the type of incentives the authority pilots, the relative income of households producing larger than average amount of waste or who are not easily able to change their behaviour. Nb. Aggregate estimates are based on potential coverage rates of households and schemes in the Eunomia study and ranges in annex 2.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Price Base</th>
<th>Time Period</th>
<th>Net Benefit Range (NPV)</th>
<th>NET BENEFIT (NPV Best estimate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 2006</td>
<td>Years 7</td>
<td>£ 0 - £750m</td>
<td>£ 285m</td>
</tr>
</tbody>
</table>

| What is the geographic coverage of the policy/option? | England |
| On what date will the policy be implemented? | 2009/10 |
| Which organisation(s) will enforce the policy? | Local Authorities |
| What is the total annual cost of enforcement for these organisations? | £ N/A |
| Does enforcement comply with Hampton principles? | Yes |
| Will implementation go beyond minimum EU requirements? | No |
| What is the value of the proposed offsetting measure per year? | £ N/A |
| What is the value of changes in greenhouse gas emissions? | £ 17m - 38m |
| Will the proposal have a significant impact on competition? | No |
| Annual cost (£-£) per organisation (excluding one-off) | None |
| Are any of these organisations exempt? | No |

**Impact on Admin Burdens Baseline (2005 Prices)**

<table>
<thead>
<tr>
<th>Increase of</th>
<th>Decrease of</th>
<th>Net Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>£ N/A</td>
<td>£ N/A</td>
<td>£ N/A</td>
</tr>
</tbody>
</table>

Key: Annual costs and benefits: Constant Prices (Net) Present Value
Draft Impact Assessment – Evidence Base

Introduction

1. This Impact Assessment looks at options to introduce a new tool to enable local authorities to boost recycling, reduce waste levels and reduce waste to landfill of their populations.

Background

2. The Government’s Waste Strategy 2007 aims to help England achieve increasing annual net reductions in global greenhouse gas emissions from waste management. Challenging targets for waste minimisation and recycling in the Strategy, alongside EU targets for a reduction of biodegradable municipal waste sent to landfill, mean that local authorities need residents to take steps to reduce their waste, home compost and recycle waste. The European Landfill Directive states that:
   - by 2010 biodegradable municipal waste landfilled must be reduced to 75% of the total amount produced in 1995;
   - by 2013 biodegradable municipal waste landfilled must be reduced to 50% of the total amount produced in 1995; and
   - by 2020 biodegradable municipal waste landfilled must be reduced to 35% of the total amount produced in 1995.

3. If these challenging targets are not met, the UK will be liable to substantial financial penalties from the EU. The government has the power to pass these penalties on to individual local authorities that contribute to any UK breach of these targets. This would further drive up the costs of waste management, putting pressure on the local government funding system.

4. In this context, the Government believes that local authorities need to be given sufficient power to choose the tools necessary to be able to achieve key priorities, namely:
   - boost recycling/composting;
   - encourage waste minimisation; and
   - reduce waste going to landfill.

6. Householders’ behaviour is vital towards meeting these national targets in a cost effective way. Authorities need residents to take steps to reduce their waste, home compost more, where appropriate, and recycle more. If residents do not change their behaviour, authorities may need to invest in more expensive waste technologies or purchase additional allowances to landfill biodegradable municipal waste. They may also face substantial penalties. Failing to minimise, home compost and separate waste also increases greenhouse gas emissions, mainly from the demand for new products made from virgin materials.

7. Variable charging for waste, or “pay as you throw”, is common elsewhere in Europe. The principle behind it is that householders pay according to the amount of waste they throw away. In Flanders for example, 98% of municipalities have waste charging in place. In most cases, waste bills have fallen as a result of introducing charging. Flanders households recycle 70% of their waste, compared to 27% in England.

8. The Local Government Association (LGA) has called for local authorities to be given the power, not the duty, to incentivise householders in this way. Its 2007 publication, War on Waste, calls for: “save-as-you-throw’ powers to help encourage people to take more responsibility for the way they throw their rubbish away... it's also fairer because if you throw out less you pay less.” Sir Michael Lyons
has recommended that Government give authorities the freedom to implement such schemes, developed in close consultation with local residents and other stakeholders.

9. The Local Government White Paper published in October 2006 sets out the Government's intention to empower local communities by giving them greater freedoms and powers to improve public services. Granting local authorities new powers to meet their waste management challenges is an important part of increasing local flexibility as part of the Government's devolutionary agenda.

**Rationale for intervention**

10. There is currently no way to distinguish between those who produce the most waste and those who produce the least, in terms of the overall amount they pay to the local authority. This means that there is little or no incentive for householders to reduce or sort their waste. As a direct result there is likely to be an inefficiently large amount of waste entering the municipal waste stream and - due to its mixed nature – it may be difficult to treat in an efficient manner.

11. There are wider impacts of waste disposal and treatment beyond the market price, most notably the climate change impacts of landfilling waste and the climate change and natural resource protection benefits of avoiding primary production through waste prevention and recycling. As well as producing too much waste, accounting for these impacts suggests that we have over relied on landfill and other disposal technologies, which in turn are associated with single mixed waste collections. To allow more efficient levels of treatments like recycling, waste needs to be better sorted. Incentivising the reduction of mixed residual waste (and not waste sorted for treatment) gives an incentive for both sorting and reducing waste.

12. From a wider UK perspective the EU Landfill Directive places legally binding limits on the amount of biodegradable municipal waste that can be landfilled. This obligation has been devolved to local authorities. Providing the ability to pilot incentives gives local authorities an additional potential instrument to reduce waste landfilled and hence it should help the UK as a whole to meet its targets at lowest cost.

**Options**

13. Three options were identified in the public consultation:

1) Do nothing
2) Allow authorities to levy a separate charge upon householders for waste collection
3) Introduce a new power to allow local authorities in England to introduce revenue-neutral financial incentives with the purpose of encouraging recycling and minimisation of waste.

**Option A – Do nothing**

14. The Government could leave legislation unchanged, meaning that authorities would not be able to introduce financial incentives schemes. They would still be able to offer rewards and to charge for collection of certain wastes (such as garden waste and bulky waste).

**Option B (i) – Allow authorities to levy a separate charge upon householders for waste collection**

15. In the public consultation, some stakeholders wanted to see waste funded through a separate local waste charge, as happens in many European countries. This would mean moving to a local waste charge for all local authorities. Individual authorities could then choose whether they wished to implement a variable waste charge, or whether should charge all households at a flat rate.

16. In England, waste is funded through a combination of Council Tax, redistributed business rates and central government grant. In order to change to a European system without increasing the amount of tax paid overall, the charge would have to replace revenues raised through Council Tax and central government funding to local authorities (which comes from business rates and general taxation).
17. Funding waste entirely through a local charge would have distributional impacts. The tax burden on individuals and lower income households would increase, because the cost of waste services would no longer be met to a significant degree from the national tax pot, but would be met solely by charges on individuals. Thus, though the aggregate tax bill to society as a whole would not change, moving from general taxation to a local waste charge would be regressive.

**Option B(ii) – Charge for waste through Council tax**

18. A further option for a local waste charge would involve turning the proportion of householders’ Council Tax bills that funds waste services into a variable charge. Central Government funding would be unchanged. Council Tax funds only a proportion of local authority waste services, meaning that the level of the incentive to householders could be limited under such a system.

19. The incentive effect of this option would be smaller than fully funding waste through local taxation, however it would not have the regressive impact of removing the national element of funding.

**Option C – Introduce a new power to allow local authorities in England to introduce revenue-neutral financial incentives with the purpose of encouraging recycling and minimisation of waste**

20. This was the Government’s preferred option set out in the public consultation. It would involve a rebate being paid to households producing the least waste, with households producing most waste paying to do so. As such, all the revenue raised by the local authority would be returned to residents in a transparent way and would not increase the amount that residents as a whole pay to their authority. (This is the concept of revenue neutrality).

21. In order to avoid unfair impacts on certain groups or unintended impacts such as flytipping, the following conditions would also have to be met prior to introduction of any financial incentive scheme:
   - Any household covered by an incentives pilot would have to be served by a good free kerbside recycling service
   - The authority would have to have a fly-tipping prevention strategy in place
   - The authority would have to take account of any potential disadvantage caused to particular social groups

**Costs and Benefits**

22. **Comparison of Options Bi, Bii, and C**

23. Options Bi, Bii and C would all grant local authorities the power to incentivise waste reduction, and thus help to reduce waste more cost-effectively than could be done under option A. However Option Bi results in a shift from general taxation to taxation on individuals regardless of income, and would therefore be regressive. Option Bii could constrain the level of incentive possible, since Council Tax funds only a proportion of local authority waste services. Option Bi could have a regressive impact (meaning that those on low incomes could end up paying relatively more) but Options Bii and C would not.

**Option D – a power to pilot local authority incentives for household waste minimisation and recycling**

24. The Government proposes to provide a power to pilot local authority incentives. Incentives could take several forms, as put forward by local authorities, potentially including pure rebates for householders; a combination of charges and rebates (with all revenue raised by the authority being returned to residents) and the ability to link incentives to Council Tax. This would allow, for instance, the piloting of options similar to Bii and C, with the benefits set out above. The conditions set out in paragraphs 20 and 21 above would also apply to option D.

25. The following discussion is based on research on incentives as a whole as opposed to specific options set out. Hence it should be viewed as a comparison of a system with and without incentives. The Government would prefer to allow incentives to be put in place through option D based on the arguments presented above.
Impact of incentives

26. Option D would mean that local authorities could pilot incentives for minimising and recycling household waste. Granting local authorities this power will not necessarily mean that they will wish to pilot these schemes. The costs and benefits of doing so will vary depending on the characteristics of the local authorities. There should therefore only be a net gain to society of providing powers to pilot incentives since pilots should only be put in place where there are net benefits of doing so. For illustrative purposes and to show the range and magnitude of potential costs and benefits associated with introducing financial incentives the following section presents estimates of the range of impacts that could be associated with the introduction of a scheme covering 50,000 households.

27. The impact of incentives has been investigated through:
   1) a Defra-funded research project which analysed the impact of household waste charging in England, including by surveying existing literature on international waste charging schemes and by carrying out modelling work;
   2) a partial Regulatory Impact Assessment carried out prior to consultation;
   3) further work by Defra to analyse the likely costs and benefits of schemes.

Sectors and groups affected

The public sector

Costs to central Government:

28. Government has allocated up to £1.5 million a year for three years to help implement and monitor the pilots, and to research the impacts, for example on waste behaviour, fly-tipping and attitudes. If in the future powers became more widely available, we would expect further authorities to fund set up of incentive schemes from within existing budgets.

29. There will also be a small reduction in revenue from landfill tax to the Exchequer, depending on whether pilots are replicated more widely in the future and the associated reduction in waste to landfill.

Local authorities

30. This proposal will affect local authorities that decide to pilot incentive schemes. Government will not compel any authority to pilot an incentive scheme.

31. In all options local authorities will incur additional costs relating to the introduction, administration and monitoring of pilots, and the increased attention required to prevent increases in fly-tipping. However, the behaviour change created by the incentives can generate cost savings for authorities (see below for more detail), benefiting all residents by reducing pressure on authorities’ waste management costs and hence on Council Tax bills. The net impact for the UK as a whole should be to reduce the cost of compliance with the Landfill Directive.

32. Defra has funded a research project, which examined evidence from international household charging schemes and modelled the potential future effect of such schemes in England.

33. By increasing recycling and encouraging waste minimisation, incentive schemes can reduce the amount of waste that has to be disposed of. This can lead to cost savings and help reduce pressure on Council Tax bills. First, it can reduce authorities’ waste management costs. Modelling in the Defra-funded research project predicts cost savings to local authorities of up to £18 per household per year as a result. This figure however is highly dependent on the type of authority and scheme in place, and the marginal avoided disposal costs in these authorities. Where the avoided disposal is landfill, although costs savings to the local authority may be this high, the net saving for

the UK as a whole will be lower as part of financial saving is savings in the tax Local Authorities are liable for and is thus simply a transfer from local to central government. The extent to which tax makes up a portion of this saving will also depend on the share of waste that is disposed of rather than recycled or composted. An attempt has been made to adjust savings to account for the landfill tax across different schemes in the costs and benefits annex, annex 2. It could be argued that a charging scheme might have a stronger incentive effect than an incentive scheme, because the threat of penalties would be more likely to generate behavioural change than the chance to gain a financial benefit. Government believes however that the broad costs and benefits as identified in this report could apply equally to a charging scheme or an incentive scheme.

34. The level at which the local authority set the incentive will affect the results – a high average level should, all other things remaining equal, encourage a more pronounced change to household waste behaviour than a lower one, and thus more cost savings. The Defra commissioned research report looked at evidence on the relationship between level of charge and impact on behaviour. It found that there was little data which compared different levels of charge within similar schemes, and therefore robust conclusions could not be drawn. This is an area where further research is needed.

35. It should be noted that the costs of waste disposal may also vary from authority to authority depending on contract type as well as alternative treatment. For example, if the authority’s waste disposal contract committed it to a minimum level of charges even if waste volumes fell, the marginal benefit of avoided disposal could be very low or potentially zero for a particular authority, this would therefore reduce expected savings. Individual authorities would need to assess carefully the likely costs, savings and benefits for their locality before putting forward proposals to pilot incentives.

36. The figures quoted above are net of set-up and administration costs which are estimated be between £5 to £6 per household (with any one-off costs annualised over a 7 year scheme). They include the cost of:

- containers, vehicles and equipment;
- sorting/treatment/disposal;
- revenues from material sales;
- scheme implementation (including billing, administration and communications); and
- monitoring and clearing up fly-tips (assuming for prudence that these increase).

37. The actual quantum of savings would depend on the type of schemes taken forward, the level of the incentives, and the coverage of the schemes, the numerical examples given relate to an example of a scheme covering 50,000 households.

38. Government legislation would require any local authority piloting incentives to first have in place a fly-tipping prevention strategy. The detail of such strategies would differ according to local priorities. Defra would however like to see all authorities have fly-tipping prevention strategies in place regardless of whether or not they wish to introduce incentives. A fly-tipping prevention strategy would have wider benefits for a local area, not just in relation to dumping of household waste but also as regards dumping of commercial waste.

39. Annex 1 provides a detailed breakdown of the potential costs associated with fly tipping. However, a local authority might expect to incur additional costs of around £130,000 to £180,000 up front plus £50,000 per year thereafter. This is compared to savings of up to £1.4m through waste prevention.

40. Defra will develop detailed best practice guidance for authorities on fly-tipping working with the Local Government Association and the Environment Agency, and will also put in place monitoring of the pilots in order to detect any impacts on fly-tipping and learn lessons regarding mitigation.

41. A summary of the potential costs and benefits to a local authority in this section is provided in table 1 below, along with an estimated range of benefits (assuming a 50,000 household scheme). It should be noted that the financial benefits include savings in landfill tax payments that might accrue to local authorities, and hence the costs to society will be lower. A more in depth analysis of costs and benefits of different scheme types is provided in annex 2. As can be seen the range of costs and benefits is large (due to the range of schemes covered) and hence the net benefit will depend on the particular authority.
Table 1: Summary of estimate financial costs and benefits to representative local authority for a financial incentives scheme covering 50,000 households

<table>
<thead>
<tr>
<th><strong>One off cost increases</strong></th>
<th><strong>Included in Eunomia Report</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fleet management software</td>
<td>£0 - £5,000</td>
</tr>
<tr>
<td>Scanners</td>
<td>£0 - £3,000</td>
</tr>
<tr>
<td>Delivery and scanning of bins</td>
<td>£0 - £65,000</td>
</tr>
<tr>
<td>Start up call centre</td>
<td>£30000</td>
</tr>
<tr>
<td>Start up information provision (incl fly tipping)</td>
<td>£100,000</td>
</tr>
<tr>
<td>Bin changes</td>
<td>£0 - £85,000</td>
</tr>
<tr>
<td><strong>Additional costs identified by Defra</strong></td>
<td></td>
</tr>
<tr>
<td>Fly-tipping strategy/training/data analysis</td>
<td>£0 - £85,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Annual operating cost increases</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional staff for implementation / queries</td>
</tr>
<tr>
<td>Additional monitoring of fly-tips</td>
</tr>
<tr>
<td>Billing costs</td>
</tr>
</tbody>
</table>

| **Range of annual cost savings from reduced waste collection, disposal and treatment** | £290,000 - £1.4m |

42. It should be noted that Table 1 assumes a revenue neutral scheme, if the local authority were to fund incentives out of current expenditure, an average incentive payment of, for example, £35 per household would translate to additional costs of £1.75m per year.

**Businesses**

43. This proposal will not affect businesses, who already pay for collection of their waste, unless it discourages illegal disposal of commercial waste in the household waste stream.

**Households**

44. Since these schemes are likely to reduce costs overall to local authorities, there is likely to be a net cost saving to householders, though within this group some will receive a rebate while others will pay more. Option D will affect householders, as they could potentially receive a rebate or face a payment according to the type of incentives being piloted and the amount of waste they produce. Some householders could potentially pay more to their local authority than at present, whereas others could receive a payment. All householders would have the opportunity to reduce the amount they pay by taking steps to recycle and compost more and throw away less (authorities would not be permitted to introduce an incentive scheme where residents were not served by a good, free kerbside recycling service).

45. Households may spend more time separating waste for recycling and composting, however, the impact in terms of time on householders of this additional recycling is likely to be minimal, as any household covered by an incentive scheme would have to be served by a good, free kerbside recycling service, limiting the need for trips to recycling facilities etc. Households increasing their production of and using compost will also benefit from the use of this bi-product however again the value of this is likely to be minimal.

46. Any local authority choosing to pilot incentives would be required to consider any potential disadvantage caused to particular social groups. Government will work with stakeholders to develop guidance on this point. Groups that may need to be considered include:
- householders receiving Council Tax benefit;
- families with young children (who tend to produce more waste); and
- groups that might have difficulties in separating waste for recycling or adjusting to new waste collection systems, such as the elderly or people with disabilities.

This might affect the number of households that any pilot might be able to cover.
47. In some cases, authorities may choose to exempt certain households from the incentives. However, experience from England and overseas shows that there are a range of options for managing potential impacts on these groups while still incentivising them to reduce and recycle their waste. It should not be assumed that taking account of needs of potentially disadvantaged groups means excluding them altogether. Example measures to mitigate impacts on disadvantaged groups in England and overseas include the following:

- Harrow’s compulsory recycling scheme – residents using disposable nappies are entitled to rent an extra bin at low cost;
- Fingal County, Ireland – disadvantaged residents are offered free tags (to identify their waste for collection in a sack-based system); and
- Leuven, Belgium – households with new born babies are given 40 free pre-paid sacks to use over time.

48. Many authorities in England already offer assistance to those with disabilities, e.g. collecting waste and recycling from the house, and these services will be important in ensuring that all households are able to recycle as much of their waste as possible.

49. Research shows that larger households create more waste, but that they produce less waste per head than smaller households. According to one study, an average one-person household produces 19kg/week of waste, while a five-person household produces 29kg/week. However, there is significant variation in the amount of waste produced by different-sized households. For example, one study from Wales shows many five-person households creating less waste than average one-person households. Data from Flanders shows that the top residual waste-producing households disposed of between 3 and 17 times as much waste as average households of the same size.

50. A study of waste arisings in an English local authority area shows that a small number of households create a disproportionately large amount of residual waste. Data from Flanders shows the same pattern in an area where waste charging schemes operate. This suggests that under an incentives pilot where those who produced more waste than average paid more and those below the average paid less, more households would benefit from a rebate than would pay more. This is because the waste services required by the small number of high-waste producing houses are effectively currently being subsidised by the majority. These patterns could obviously vary from area to area.

51. Research shows no link between income and levels of waste generated. Hence the distributional impacts will depend on whether the larger residual waste producing households (generally those with more people in) tend to be more or less wealthy in the particular area concerned.

52. There is some evidence that waste arisings are linked to age group. Pensioners produce less waste than average, whereas families with young children produce large amounts (e.g. disposable nappies). Some authorities that have introduced alternate week collection allow households with babies to dispose of extra waste at no charge, and this could be replicated in an incentives pilot. Local authorities would be legally required to take account of the needs of particular groups. It would be for local authorities to decide the exact nature of the measures they introduce to do this.

Time cost to society as a whole

---

64 Add reference to Flanders data
65 Dresner and Ekins
53. Whilst incremental recycling efforts should be compensated at the household level by incentive payments, at the society wide level we should examine the cost of additional time invested in the sorting of waste. The value of this time can be estimated by assuming a wage rate and examining the amount of extra time householder might spend working on waste. Using a range of simple assumptions, that time is valued at the minimum wage rate (£5.35/hr), 50% of household change their waste related behaviour and waste sorting takes between 1 minute per day and 1 minute per week per household. This gives an estimates cost of sorting to society of £120k to £810k for a scheme covering 50,000 people. This reveals the need to ensure that recycling services are made readily available and convenient to householders where incentive schemes are established.

Environmental impacts

**Reduction in residual waste and change in treatment patterns**

54. Greenhouse gases

55. in terms of wider benefits of incentives that will accrue to society as a whole, these are the environmental impacts, that predominantly relate to greenhouse gases. The extent to which greenhouse gases associated with waste production and treatment can be reduced are connected, like the financial costs, to the extent to which incentives change behaviour.

56. The level at which the local authority set the incentive will affect the results – a high average level should, all other things remaining equal, encourage a more pronounced change to household waste behaviour than a lower one.

57. Incentives have the potential to increase levels of recycling and home composting. Modelling in the Defra commissioned research project predicts the best types of schemes see local recycling/composting rates rise from 37% to 54%. The least effective schemes see local recycling/composting rates rise from 43% to 44%.

58. Incentives can also help to reduce the total amount of waste that householders dispose of. Modelling in the research project predicts that total bin waste reduces between 4% to 31%, depending on the nature of the authority and the type of scheme used.

59. Defra’s Waste Strategy 2007 for England examined the link between waste treatment patterns, waste prevention and greenhouse gas emissions. It estimated that if incentives could divert 0.7 to 1.2 million tonnes of waste annually from disposal to recycling and genuinely prevent 0.8 to 2.0 million tonnes of waste nationally it could reduce global greenhouse gas emissions by between 2 and 6 million tonnes of CO$_2$ equivalent per year. A more local level assessment is presented in Annex 2, again looking at the relative carbon impacts of a scheme covering 50,000 households.

Local environmental quality

60. **At the authority level there may be a local environmental quality impact. These have not been estimated as although we have evidence on the disamenity impacts associated landfill, these have not been quantified for other waste disposal or treatment options to or from which waste may be diverted. However, as at a scheme level there is expected to be lower waste treatment, disposal and collection, it seems likely that there will be a net benefit in terms of reduced disamenity impacts at a local level and therefore an environmental gain.**

61. **Fly-tipping**

62. It is important that all authorities crack down on fly-tipping, whether or not they wish to introduce an incentive scheme. There is a lack of evidence to draw any firm conclusions on links between incentives and fly-tipping. Research that exists is often based on anecdotal evidence rather than robust studies. The available evidence shows that in some cases fly-tipping has increased following introduction of similar schemes, but in other cases it has decreased or stayed the same. The research suggests that careful scheme design and strong enforcement can prevent rises in fly-tipping. Options Bi, Bii, C and D would include a requirement that any authority piloting incentives
have in place a fly-tipping prevention strategy, including robust enforcement measures as a last resort.

Race equality assessment

63. There is no evidence to suggest that overall quantities of household waste are affected by ethnicity. How much a household pays for waste collection under these proposals would depend on the total quantity of non-recyclable waste set out for collection. Available evidence indicates that ethnic groups would have an equal opportunity to reduce the amount of non-recyclable waste they produced, provided that a good, free kerbside recycling service was available.

Rural considerations

64. The proposal would not have any adverse effects on rural communities. Rural areas face different challenges in operating good waste collection services. As this would be a voluntary power, not a duty, there would be no requirement for a rural authority, or any other authority, to pilot incentives if this was not judged a good option for their local area.

Small Firms Impact Test (SFIT)

65. The proposals would only affect local authorities and householders, so no disproportionate costs or benefits to small firms arising from the power to introduce financial incentive schemes have been identified.

Competition Assessment

66. The proposals would only affect local authorities and householders and so would have no direct effects on business and no implications for competition. Many local authorities currently contract out waste collection services to private contractors. Research suggests that 42% of waste collection contracts are won by the incumbent provider, indicating that there may be some incumbency advantage in the sector. If a local authority were to introduce a weight-based incentives pilot under Government proposals, there would be a risk that the more advanced weigh technology required to facilitate these schemes would favour larger, incumbent providers.

Enforcement, Sanctions and Monitoring

Enforcement

67. Local authorities would be given the power, not the duty, to pilot incentives. Pilots would need to clearly communicate the details of the scheme to householders. These authorities would need to clearly outline how householders will be required to set out their waste for collection under the pilot.

68. Authorities piloting incentives would need to ensure they took steps to mitigate against possible increases in fly-tipping. Paragraphs 36 – 49 outline measures these local authorities would need to take, and Government would also produce more detailed guidance. Evidence from overseas provides examples of measures that can be taken to avoid an increase in fly-tipping (indeed in some cases a decrease has been achieved).

Sanctions

69. Pilot authorities will be able rely largely on existing and similar legal powers to enforce compliance with incentives.67 In some countries, municipalities refuse to collect waste from any household that is behind in its waste payments. However in England authorities are under a statutory duty to collect

67 The Clean Neighbourhoods and Environment Act 2005 (CNEA) added section 47ZA to the EPA and allows the WCA to impose a fixed penalty notice on persons breaching sections 46 or 47 of the Environmental Protection Act. Fixed Penalty Notices (FPN) can be issued by local authority officers and are penalties of £50. Receiving a FPN does not count as a conviction. Recipients have 14 days in which to pay the penalty or request a hearing. Failure to pay the penalty may result in a higher fine imposed by the court of imprisonment. For more information see http://www.defra.gov.uk/environment/localenv/legislation/cnea/fixedpenaltynotices.pdf
waste. Government does not propose to change the law to allow any authorities to leave waste uncollected for long periods of time where householders had not paid or compiled with a scheme.

**Monitoring**

70. The Government would fund a monitoring project to assess the progress of the pilots, especially any increases in incidences of fly-tipping. These costs are not additional to the £1.5 million a year for three years attributed to central government above.

**Summary and conclusion**

71. Annex 2 shows illustrative calculations for a scheme affecting 50,000 households, discounting future savings. This estimates annualised costs of introducing revenue neutral incentives of approximately £236k to £532k. Pure rebate schemes will face an additional cost of payments to households, an average incentive payment of £35 per household translates to £1.75m per year. From a local authorities' perspective in twelve out of fourteen cases investigated for revenue neutral schemes the financial cost of introducing a scheme was more than outweighed by the financial benefits of the scheme in terms of reduced collection, disposal and treatment costs. From a societal perspective looking at the wider costs and benefits, including greenhouse gases and excluding taxes as transfer payments, all schemes bar 3 showed a net benefit for society as a whole.

72. The following table summarises the annual net benefits of a 50,000 household scheme.

<table>
<thead>
<tr>
<th>Option C (relative to do nothing)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual net benefit to local authorities</td>
<td>£0.3m-£1.4m per authority</td>
</tr>
<tr>
<td>Annual net benefit to business</td>
<td>Not identified</td>
</tr>
<tr>
<td>Environmental impact</td>
<td>CO2 savings of £80k-340k per authority that takes up scheme Reduced disamenity value</td>
</tr>
<tr>
<td>Net benefit to households</td>
<td>Neutral</td>
</tr>
<tr>
<td>Net benefit to society</td>
<td>CO2 savings of £80k-340k per authority that takes up scheme £0.2m-£1.35m cost savings per authority that takes up scheme Some reduction in disamenity Increased time spent sorting waste due to incremental recycling</td>
</tr>
</tbody>
</table>

73. **Assuming therefore that local authorities properly design the schemes and appraise the impacts of piloting incentives in their areas, it should be possible for there to be net financial gains to the local authority and net welfare gains to society as a whole.**

**Aggregating benefits to an England level**

74. The summary sheet provides a scaled up estimate of the costs and benefits to society in England that may arise should incentives be replicated more widely in the future. This will of course depend on whether the powers are made more widely available following the pilots, and, in that scenario, how many local authorities decide to introduce incentives. It also depends on the nature of the incentives themselves. However, the Eunomia Research report suggests a proportion of households that may be covered (62.5%), and what types of scheme could be rolled out (see p95 of the report). Using these proportions of households covered and scheme choices, along with DCLG’s estimate of 21,519,000 households in England for 2006, allows the calculation of an aggregate cost benefit analysis for the UK. Ranges were based on the maxima and minima of costs and benefits calculated in Annex 2, with the central estimate using the average impacts for each scheme type.
Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

<table>
<thead>
<tr>
<th>Type of testing undertaken</th>
<th>Results in Evidence Base?</th>
<th>Results annexed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competition Assessment</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Small Firms Impact Test</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Legal Aid</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Sustainable Development</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Carbon Assessment</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Other Environment</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Health Impact Assessment</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Race Equality</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Disability Equality</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Gender Equality</td>
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<td>No</td>
</tr>
<tr>
<td>Human Rights</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Rural Proofing</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Annex 1 – Fly tipping costs

Government has identified the following additional costs that authorities without well developed strategies might incur if they wished to introduce incentives, some of which were included in the research report costings and others that were not:

(a) Formulation of the strategy

A fly-tipping prevention strategy will need to be written in the first instance. Like all enforcement activities, a prevention strategy must not exist in isolation; it must be developed and integrated with a local authority’s wider environmental enforcement strategies and with other strategies being taken forward by the authority and its partners, including any relevant corporate strategies. It is estimated that this process could cost up to £20,000, based on an estimate of the amount of staff time that would be needed to develop and approve such a plan and to have it signed-off by the necessary people or groups. The cost of this initial measure is not included in the research report’s assumptions.

(b) Setting up enforcement teams

Costs will depend on the size of the team and salary costs. The research report assumes a cost of £50,000 for two officers and other associated administration and enforcement costs (based on a 50,000 household authority).

(c) Training

Enforcement staff and local authority lawyers will need to be fully trained before effective and proportionate enforcement against fly-tipping can take place. There are a number of training providers that could supply generic services although Defra has funded the Flycapture enforcement programme which delivers specific fly-tipping enforcement training through EN CAMS and the Chartered Institution of Wastes Management. The full course of training for local authority officers is currently £1,400. Lawyer specific courses are £400. These costs are not included in the research report. The report assumes two officers (at £2,800), while one lawyer (at £400) would be sufficient for a regular authority. A 50,000 authority could therefore expect additional costs of around £3,200. This cost is not included in the research report.

(d) Communications campaign

Residents’ awareness of incentives and effective communication between them and the local authority will be a significant pre-requisite to its success. Local authorities will likely wish to run a communications campaign before incentives pilots are launched and should also ensure that any successful enforcement action is publicised. Actions could include adverts in the local media, poster campaigns, leaflet or newsletter drops, resident events or house to house calls. The research report assumes £100,000 for an initial communications campaign.

(e) Prosecution costs

Visible and active enforcement, including taking action against offenders, will be important to prevent any initial increases in fly-tipping from becoming embedded in the local culture and to support implementation of the pilot. The Environment Agency has calculated the costs of carrying out each stage of the fly-tipping enforcement process. Costs may include:

(i) cost of identifying suspect = £90;
(ii) cost of issuing a formal caution = £87; and
(iii) cost of prosecution = £600.

These costs do not include the cost to the Court of processing a case. These costs are not included in the research report’s assumptions. Incentives would not necessarily lead to more prosecutions for fly-tipping, but if they did, the cost would be an additional £600 per prosecution.

(f) Joint agency working

Local authorities will need to adopt a multi-agency approach, working with neighbouring authorities, local trading standards, housing associations and landowners amongst others to tackle flytipping in neighbouring authority areas or on private land. Dedicated resource to do this (if not done through the enforcement team as above) could cost in the region of £10,000. Any additional costs for joint agency working are not included in the research report’s assumptions.

(g) Data monitoring

Although Flycapture, the national fly-tipping database, records incidences of illegal disposal, this is done at a high level and will not be detailed enough for more in depth spatial and geographical analysis that would allow local authorities to better mitigate fly-tipping in hot spot areas. Further analysis could cost around £50,000 where authorities are not already doing this (Defra will put in place fly-tipping monitoring schemes for the first schemes). These costs are not included in the research report.

Annex 2: Costs and benefits of an example scheme covering 50,000 households

1. The following calculations should only be viewed as illustrative. They provide a range of costs for a range of financial incentive schemes across different authority types with different characteristics in terms of housing stock and current recycling performance (see table 2.1 and Eunomia Report for more detail). However, they are not a substitute for specific analysis of the costs and benefits of such a scheme in a particular area.

2. The figures are aggregated across 50,000 households, and it assumed that a scheme lasts 7 years, starting in 2009/10. Figures are discounted to 2007/8.

3. The financial costs and benefits are based on those presented in “Modelling the Impact of Household Charging for Waste in England” report for Defra by Eunomia Research and Consulting (December 2006) and are in 2006/7 prices. Initial set up costs are annualised and spread over the lifetime of the scheme through out this analysis.


2007\textsuperscript{69}. Where increases in recycling are predicted it is assumed that the material collected will be in similar proportion to those currently reported in municipal waste statistics\textsuperscript{70}. In the absence of better information and given an expectation that incentives could be associated with greater home composting of garden waste, it assumed that material collected for composting is half garden waste and half food waste. The relative balance of recycling and composting is assumed to remain constant.

5. Where waste prevention occurs, it can not be assumed that all reductions in municipal waste arisings will be genuine waste prevention, for example, some waste will be diverted to home composting, some may be diverted into other commercial waste streams and some reductions may reflect an increase in fly tipping. As a result, in line with some of the more conservative estimates in the Eunomia report, it assumed that only 20\% of any reduction in predicted overall waste arisings will be genuine waste prevention. It is assumed that the material saved through waste prevention is saved in proportion to the estimated composition of municipal waste. The carbon savings related to waste prevention represent the carbon embodied in the material that is assumed is to be no longer produced (from primary sources) at the margin.

6. Increases in waste prevention, recycling and composting are assumed to be diverted from a disposal mix of 90\% landfill and 10\% energy from waste.

7. Net financial benefits to the local authority are calculated from the local authority perspective, including any reductions in tax burden through lower landfilling. Net benefits to society are estimated without the landfill tax, but including carbon benefits values at the HMT recommended social cost of carbon. As before it is assumed the 90\% of disposal is landfill and 10\% energy from waste. It should be noted that this may be reasonable on average, at the margin it is likely to be conservative, this is because binding targets on landfill diversion mean the marginal disposal technology is more likely to be a non-landfill treatment. This means that the societal cost benefit analysis presented is also likely to be conservative.

8. The results are presented in full in table 2.1. In all bar two out of fourteen scenarios there is a net financial saving from piloting incentives. This is the result of lower collection and disposal/treatment costs that result from reduced waste collection. For revenue neutral schemes the average saving across all the scheme and authority types examined represents around £2.1m over 7 years, or around 6\% of total expenditure on waste collection, disposal and treatment. We would expect to find larger savings where a scheme was introduced covering a larger number of households as the set up and administration costs would be relatively smaller. Incentives that are funded from local authority expenditure increase costs over 7 years to the local authority by roughly £10.3m (assuming an average incentive payment of £35 per household).

\textsuperscript{69} http://www.defra.gov.uk/environment/waste/strategy/strategy07/pdf/waste07-annex-a.pdf
\textsuperscript{70} http://www.defra.gov.uk/environment/statistics/waste/kf/wrkf16.htm
9. The conservatively calculated social cost benefit analysis showed a net benefit to society of introducing household changing in all bar 3 cases (2 of those also being those which were also not financially profitable for the local authority under revenue neutrality).

10. Appendix 1 provides an example distributional analysis looking at the impact of a changing framework on households with different income levels. By putting a relative weight on richer and poorer households and looking at the impact of a revenue-neutral charge and rebate scheme (based on weight of waste) the analysis shows that in this example there is a net benefit to less well off households. This was because the data set used seemed to show that the larger households - that are on average the larger producers of waste - were also richer on average. As a result, the net flow of funds expected on waste volumes (from larger to smaller households) was progressive in nature. This will obviously vary between localities, and there may also be a variation in how different groups can respond to household incentives hence this analysis should not be seen as comprehensive nor fully representative. It does however estimate a welfare gain from redistribution to add to the net benefits of revenue neutral scheme to be worth approximately £368k per year in current prices. Despite this, there are still some households and household types - notably poorer households with a large number of inhabitants - who could be worse off with these types of incentives.
Table 2.1: Estimated costs and benefits of different scheme and authority types for revenue neutral incentives schemes.

<table>
<thead>
<tr>
<th>Scheme and Authority Types</th>
<th>2006/7 prices £m (except italics)</th>
<th>2009/10</th>
<th>2015/16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sack-based</td>
<td>a**</td>
<td>b</td>
<td>c</td>
</tr>
<tr>
<td>Financial costs of running scheme</td>
<td>£0.24</td>
<td>£0.40</td>
<td>£0.41</td>
</tr>
<tr>
<td>Savings from lower collection, disposal and treatment costs (incl. landfill tax)</td>
<td>£0.57</td>
<td>£0.48</td>
<td>£0.29</td>
</tr>
<tr>
<td>Savings from lower collection, disposal and treatment costs (excl. landfill tax)</td>
<td>£0.43</td>
<td>£0.34</td>
<td>£0.18</td>
</tr>
<tr>
<td>Net annual financial savings to local authority as a result of scheme introduction (incl. landfill tax)</td>
<td>£0.34</td>
<td>£0.08</td>
<td>-£0.12</td>
</tr>
<tr>
<td>CO2 equivalent savings from increased recycling and composting (tonnes)**</td>
<td>2,656</td>
<td>3,510</td>
<td>2,332</td>
</tr>
<tr>
<td>CO2 equivalent savings from waste prevention (tonnes)*</td>
<td>2,814</td>
<td>1,443</td>
<td>1,164</td>
</tr>
<tr>
<td>Annual value of carbon equivalent savings 2009/10*</td>
<td>£0.14</td>
<td>£0.12</td>
<td>£0.09</td>
</tr>
<tr>
<td>Estimated discounted impacts 2009/10 to 20015/16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present value cost of running scheme over 7 years [i]</td>
<td>£1.39</td>
<td>£2.39</td>
<td>£2.44</td>
</tr>
<tr>
<td>Present value savings from reduced waste collection and treatment cost (incl. landfill tax) [ii]</td>
<td>£3.39</td>
<td>£2.84</td>
<td>£1.71</td>
</tr>
<tr>
<td>Present value savings from reduced waste collection and treatment cost (excl. landfill tax) [iii]</td>
<td>£2.40</td>
<td>£1.85</td>
<td>£0.97</td>
</tr>
<tr>
<td>Present value cost carbon savings expected over 7 years [iv]</td>
<td>£0.82</td>
<td>£0.75</td>
<td>£0.53</td>
</tr>
<tr>
<td>Total net present value to society [iii - i + iv]</td>
<td>£1.83</td>
<td>£0.20</td>
<td>-£0.95</td>
</tr>
<tr>
<td>Range of financial savings to local authority [iv - i]**</td>
<td>£2.00</td>
<td>-£0.73</td>
<td>-£0.45</td>
</tr>
<tr>
<td>Financial savings as a proportion of expenditure on waste</td>
<td>5%</td>
<td>-1.9%</td>
<td>-1.1%</td>
</tr>
</tbody>
</table>

* For simplicity avoided methane emissions from landfill avoided are assumed to be emitted in the year in which they are landfilled and valued as such using the social cost of carbon.

** Authority characteristics: Housing: a. high share high rise & multi-occupancy low rise, b. high share multi-occupancy low rise, c. high share detached, d. high share semi-detached; Initial recycling rate: a&b low, c&d high.

*** NB. These savings relate to revenue neutral incentive schemes. If local authorities are to pay incentives from their own expenditure through a pure rebate scheme - assuming an average incentive payment of £35 per household - discounted over 7 years, scheme costs increase by £10.3m. This does not affect the net benefit to society but reduces the value for money of schemes from a local authority perspective.
Annex 2, Appendix 1: Distributional Analysis

1. This following section considers a distributional analysis as described in the Treasury Green Book guidance on policy and project appraisal\(^7\). In this context we examine the impact across different households of introducing a weight based revenue neutral charge and rebate incentives structure, taking into consideration relative prosperity within and across different household sizes. We consider relative prosperity because poorer households tend to value one pound of income or expenditure more highly than richer households, and it is possible to weight financial impacts of new policies to reflect this. Distributional analysis can also be used to assess impacts on other groups in society e.g. gender or race groups, however these are considered of less concern to this proposal.

2. It should be noted that this analysis is not representative of all authorities that introduce a weight based scheme but more an illustrative example as to what the distribution of impacts might be. In practice this is likely to vary depending on residual waste arisings within a given authority, the proportion of different households and their composition, as well as varying income levels.

3. The data available was limited and only enabled analysis to be carried out using household size of up to only four persons, therefore further analysis when considering introducing a scheme may be required in order to look into the impacts on larger households, as well as considering varying compositions of individuals within different household sizes.

4. A hypothetical authority was considered and a charging structure constructed based on that authority piloting a weight based charge and rebate scheme. This had to take into account that any charging structure introduced would have to be revenue neutral overall. It was assumed that there would be an upfront charge of £50 and that the household producing the mean amount of waste in kg would receive a rebate of £50 at the end of the year. Using evidence from a study by Dresner and Ekins\(^2\), the mean weight of the waste produced by households by different household size was calculated, and a charge of 12 pence per kg of waste produced was estimated. The amount received by households varies in proportion to this amount, with households producing waste below the mean kg produced, receiving more than £50 back, and those households producing waste above the mean kg produced, receiving less than £50 back. It would be expected that smaller households are likely to benefit from this type of charging structure as they produce on average, less waste than larger households.

\(^7\) http://greenbook.treasury.gov.uk/annex05.htm
\(^2\) http://www.psi.org.uk/docs/rdp/rdp20-dresner-ekins-waste.pdf
5. Distributional weights were derived using net equivalised income data from the Family Resources Survey 2005-06 and applied to the net impacts associated with the weight based charging structure. The results show that, for this hypothetical authority and charging structure, with an assumed size of 50,000 households, there is a net benefit of approximately £368,000. This reflects a redistribution from larger households to smaller households, and a net welfare benefit to less well off households, suggesting that in this case the incentive structure is progressive in nature. This was because the data set used seemed to show that the larger households, that are on average the larger producers of waste, were also richer on average.

73 http://www.dwp.gov.uk/asd/hbai/hbai2006/excel_files/chapters/chapter_2_excel_hbai07.xls#2_31A1
Table 2.2 Net equivalised disposable income (£) per week

<table>
<thead>
<tr>
<th>Household size</th>
<th>Mean</th>
<th>Median</th>
<th>50% mean</th>
<th>60% median</th>
<th>Bottom quintile</th>
<th>Second quintile</th>
<th>Middle quintile</th>
<th>Fourth quintile</th>
<th>Top quintile</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Single with no children</td>
<td>297</td>
<td>242</td>
<td>148</td>
<td>145</td>
<td>&lt; 152</td>
<td>152-210</td>
<td>211-279</td>
<td>280-384</td>
<td>385+</td>
</tr>
<tr>
<td>2 Couple with no children (equivalised income benchmark)</td>
<td>443</td>
<td>362</td>
<td>222</td>
<td>217</td>
<td>&lt; 226</td>
<td>226-313</td>
<td>314-416</td>
<td>417-573</td>
<td>574+</td>
</tr>
<tr>
<td>3 Single with two children aged 5 and 14</td>
<td>532</td>
<td>434</td>
<td>266</td>
<td>260</td>
<td>&lt; 272</td>
<td>272-375</td>
<td>376-499</td>
<td>500-688</td>
<td>689+</td>
</tr>
<tr>
<td>4 Couple with two children aged 5 and 14</td>
<td>678</td>
<td>554</td>
<td>339</td>
<td>332</td>
<td>&lt; 346</td>
<td>346-479</td>
<td>480-637</td>
<td>638-877</td>
<td>878+</td>
</tr>
</tbody>
</table>

Source: FRS 2005/06

Table 2.3 Distributional weights using net equivalised income

<table>
<thead>
<tr>
<th>Household size</th>
<th>Bottom quintile</th>
<th>Second quintile</th>
<th>Middle quintile</th>
<th>Fourth quintile</th>
<th>Top quintile</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Single with no children</td>
<td>5.79</td>
<td>2.43</td>
<td>1.80</td>
<td>1.33</td>
<td>1.14</td>
</tr>
<tr>
<td>2 Couple with no children</td>
<td>3.89</td>
<td>1.63</td>
<td>1.21</td>
<td>0.89</td>
<td>0.77</td>
</tr>
<tr>
<td>3 Single with two children aged 5 and 14</td>
<td>3.23</td>
<td>1.36</td>
<td>1.01</td>
<td>0.74</td>
<td>0.64</td>
</tr>
<tr>
<td>4 Couple with two children aged 5 and 14</td>
<td>2.54</td>
<td>1.07</td>
<td>0.79</td>
<td>0.58</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Table 2.4 Net impact (£) of charging structure according to household size and income

<table>
<thead>
<tr>
<th>Household size</th>
<th>Bottom quintile</th>
<th>Second quintile</th>
<th>Middle quintile</th>
<th>Fourth quintile</th>
<th>Top quintile</th>
<th>Average</th>
<th>Average accounting for proportion of household size</th>
<th>Net impact for 50,000 household authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Single with no children</td>
<td>-£89.66</td>
<td>-£37.85</td>
<td>-£27.81</td>
<td>-£20.52</td>
<td>-£17.70</td>
<td>-£43.91</td>
<td>-£13.55</td>
<td>-£7.36</td>
</tr>
<tr>
<td>2 Couple with no children</td>
<td>-£18.77</td>
<td>-£7.87</td>
<td>-£5.81</td>
<td>-£4.29</td>
<td>-£3.70</td>
<td>-£9.19</td>
<td>-£3.52</td>
<td>-£367,953.13</td>
</tr>
<tr>
<td>3 Single with two children aged 5 and 14</td>
<td>£61.54</td>
<td>£25.87</td>
<td>£19.13</td>
<td>£14.09</td>
<td>£12.15</td>
<td>£30.16</td>
<td>£4.81</td>
<td></td>
</tr>
<tr>
<td>4 Couple with two children aged 5 and 14</td>
<td>£72.31</td>
<td>£30.33</td>
<td>£22.40</td>
<td>£16.51</td>
<td>£14.25</td>
<td>£35.39</td>
<td>£4.89</td>
<td>-£367,953.13</td>
</tr>
</tbody>
</table>