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CLIMATE CHANGE ACT 2008

IMPACT ASSESSMENT

March 2009

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Summary: Intervention & Options

Department /Agency: Department of Energy and Climate Change	Title: Impact Assessment of the Climate Change Act	
Stage: Final – Royal Assent.	Version: Final	Date: 9 March 2009
Related Publications: MARKAL Macro analysis of long run costs of climate change mitigation targets available from http://www.defra.gov.uk/environment/climatechange/research/pdf/markal-analysis-cc-targets.pdf		

Available to view or download at:

http://www.decc.gov.uk/en/content/cms/legislation/cc_act_08/cc_act_08.aspx

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What is the problem under consideration? Why is government intervention necessary?

Climate change is caused by the emission of greenhouse gases into the atmosphere. An externality exists as 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 Act creates 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 also sets 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 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.

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

There was also no previous requirement for Government to regularly assess all the impacts from climate change holistically or to draw up a single programme to address them. The Act 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 Act also creates a number of powers, for which impact assessments are included in the annexes. The impact assessments are final for the powers themselves but are interim assessments with regard to specific policies implementing the powers. Any detailed policy proposal relating to these powers will be subject to a separate and final impact assessment. The powers are: A power that allows the Government to ask for adaptation reports from public authorities and statutory undertakers, information gathering powers for the Carbon Reduction Commitment, powers to pilot local authority incentives for household waste minimisation, powers to require charges for single use carrier bags and powers to oblige electricity generators and energy suppliers to deliver carbon emission reduction targets.

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 adaptation programme will also be conducted.

Ministerial Sign-off For final Impact Assessment:

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: 9 March 2009

Summary: Analysis & Evidence

Policy Option:	Description: Statutory targets and carbon budgets for emissions reductions. Formation of the Committee on Climate Change to advise on budgets.
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COSTS	ANNUAL COSTS		Description and scale of key monetised costs by 'main affected groups' Figures presented are a partial measure of the long run costs of tackling climate change and are based on estimates of the reduction in GDP over the period to 2050. Long-term modelling suggests that the costs will be in the range estimated by the Stern Review of 1% +/- 3% of GDP.
	One-off (Transition)	Yrs	
	£ 0	43	
	Average Annual Cost (excluding one-off)		
	£14.7 to 18.3 billion		Total Cost (PV) £324 – 404 billion
Other key non-monetised costs by 'main affected groups' Figures above do not include the full range of costs, in particular the short-term transition costs. Therefore, overall costs could be higher than those estimated by the long-term modelling. Overall the costs will depend on the specific policies put in place to implement the carbon budgets. Costs of non-CO2 GHG abatement are not included.			

BENEFITS	ANNUAL BENEFITS		Description and scale of key monetised benefits by 'main affected groups' The monetised benefits include avoided damages from reduced GHG emissions (£404 to 964 billion) and improved air quality benefits (£32 billion).
	One-off	Yrs	
	£ 0	43	
	£20.7 – 46.2 billion		
			Total Benefit (PV) £ 457¹ – 1020 billion
Other key non-monetised benefits by 'main affected groups' The contribution of action now to reducing abatement costs after 2050 is not quantified. The framework will provide greater predictability for households and firms to plan for and invest in a low-carbon economy. Improved energy security for the UK and the benefits of non-CO2 GHG abatement are not included.			

Key Assumptions/Sensitivities/Risks Figures presented are indicative estimates of 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 multi-lateral action; choice of policies; and, when abatement occurs. There are significant uncertainties over the avoided damage costs associated with reduced greenhouse gas emissions.

Price Base Year 2008	Time Period Years 43	Net Benefit Range (NPV) £ 53 – 696 billion	NET BENEFIT (NPV Best estimate) £ 641 billion
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What is the geographic coverage of the policy/option?		United Kingdom	
On what date will the policy be implemented?		2008 onwards	
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?		£988billion	
Will the proposal have a significant impact on competition?		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 - Decrease)

¹ Lower value reflects the scenario where the UK takes action but the rest of the world does not. In this case the benefits would be distributed across the globe, whereas all the costs would be borne by the UK and the UK would not receive any benefits from reciprocal action by other nations.

Increase of £ N/A

Decrease of £ N/A

Net Impact £ N/A

Key:

Annual costs and benefits: Constant Prices

(Net) Present Value

Summary of Costs and Benefits of the Climate Change Act

S1. Section 2 sets out a high level discussion of the costs and benefits of the long-term target created by the Climate Change Act. This section provides a summary table, with details of the scenarios that have been used to provide an illustrative range for the costs and benefits of action.

Costs					
Scenario				NPV system costs (£billion)	NPV total costs (£billion)
2020 reduction	2050 reduction	Other factors	Part of Range		
33%	80%	International trading allowed	Best Estimate	237	379
33%	80%	High High Fossil Fuel prices	Lower bound	206	324
33%	80%	No international trading allowed	High	254	404
Benefits					
Scenario	Other factors	Part of Range	Air Quality benefits (£billion)	Reductions in GHG emissions (£billion)	Total Benefits (£billion)
2020/2050 reduction					
33%/80%	UK acts and the world acts	Upper bound	32	988425	1020457
33%/80%	UK acts alone	Lower bound	32	425988	4571020
Estimated Net Present Value of the Climate Change Act					
Part of range	Cost (£billion)		Benefit (£billion)	Net Present Value (£billion)	
Central	379		1020	641	
Upper	324		1020	696	
Lower	404		457	53	

S2. It should be noted that the benefits of reduced carbon emissions have been valued using the social cost of carbon which estimates the avoided global damages from reduced UK emissions. The benefits of UK action will be distributed across the globe. In the case where the UK acts in concert with other countries then the UK will benefit from other nations reduced emissions and would be expected to experience a large net benefit. Where the UK acts alone, though there would be a net benefit for the world as a whole the UK would bear all the cost of the action and would not experience any benefit from reciprocal reductions elsewhere. The economic case for the UK continuing to act alone where global action cannot be achieved would be weak.

S3. Other factors not included in the range:

- uncertainty over projected costs of action;
- uncertainty over the 'social cost of carbon';
- rate of innovation in low carbon technology;

- degree of international effort;
- transition costs in the short and medium term;
- costs and benefits of including all Greenhouse Gases;
- degree of international effort; and
- pathways to the long-term target.

1. Purpose and intended effect

1.0.1 This is an Impact Assessment of the measures in the Climate Change Act. 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 in the Act.

1.1 Objectives

- 1.1.1 The Climate Change Act 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 to the UK from climate change and draw up a programme to address them; and
 - creating a power for the Government to require a range of public authorities or statutory undertakers to assess and address the impacts of climate change.
- 1.1.2 In addition, the Act 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 Act also contains supplementary provisions to enable some specific policies and powers that will contribute to tackling climate change. For example, information gathering powers for the Carbon Reduction Commitment (see Annex B), a legislative framework to drive UK action on adapting to climate change (see Annex C), powers for local authorities to pilot local authority incentives for household waste minimisation and recycling (see Annex D), powers to require retailers to charge for single use carrier bags (Annex E), provisions to reduce the administrative and compliance costs of the Renewable Transport Fuel Obligation (Annex F), and powers to place energy efficiency obligations on generators and to specify energy efficiency obligations by area (Annex G). Any detailed policy proposal relating to these provisions will be subject to a separate impact assessment.
- 1.1.4 The Act 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.

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 (GHGs²) as a result of human activities such as the combustion of fossil fuels and changing patterns of

² A glossary of terms is provided in Annex A.

land use. The most recent Intergovernmental Panel on Climate Change (IPCC) report, in 2007, 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.³

- 1.2.2 The international community has already begun a coordinated response to the challenge. The 1992 UN Framework Convention on Climate Change (UNFCCC) has as its ultimate objective the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system".⁴
- 1.2.3 The 1997 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, the Russian Federation, Canada, Australia, and Japan), was agreed in December 1997. Under the Protocol, Annex I Parties agreed to reduce their collective greenhouse gas emissions to 5.2% below base-year levels between 2008 and 2012.⁵
- 1.2.4 However, as work such as the IPCC report and the 2006 Stern Review has amply demonstrated, it is now clear that international cooperation must go much further to stabilise greenhouse gas concentrations at levels which will avoid dangerous climate change. At the 2008 Hokkaido summit, the G8 endorsed the target of reducing global greenhouse gas emissions by 50% by 2050.⁶
- 1.2.5 Our next key objective at the international level is to secure in 2009 a global and comprehensive 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 'common but differentiated responsibilities and respective capabilities'.
- 1.2.6 In the light of the EU's goal of keeping global average temperature rise below 2°C, a point beyond which the risk of serious impacts may increase, Heads of Government agreed at the March 2007 EU Spring Council 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 is 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. At the October 2008 Council, EU Heads of Government also agreed the long-term objective of developed countries collectively reducing emissions by between 80% and 95% by 2050 compared to 1990.
- 1.2.7 At the December 2008 European Council meeting, agreement was reached on a package of legislation to achieve the unilateral 20% reduction in emissions by 2020. The package includes a strengthening of the EU Emissions Trading Scheme (EU ETS), national emissions reduction targets for those sectors not covered by the ETS, national targets for the proportion of energy supplied by renewable sources (to ensure that 20% of the EU's energy is supplied by renewables in 2020), and provisions to construct demonstration plants for carbon capture and storage (CCS) technology. These measures have received final agreement from the European Parliament on the 17th December 2008.

³ Working Group I Contribution to the Fourth Assessment Report: *Climate Change 2007: The Physical Science Basis*. All Fourth Assessment Report documents are available from : www.ipcc.ch.

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 (the fluorinated gases) the base year is 1995

⁶ The G8 statement did not specify a base year for the 50% reduction.

- 1.2.8 If the G8 and EU long-term goals are to be achieved, leadership must come from the major developed economies such as the UK, which have been responsible for the majority of the historical rise in greenhouse gas concentrations, generally have higher per-capita emissions, and have the income levels and technological capacity to lead the necessary investment. A wide variety of different methods exist for dividing the global effort between countries according to their differing circumstances. The international community has not agreed on any one method, but considering the different approaches together provides a useful indicator of the appropriate effort for different countries to undertake. Under all of these methods, the UK's share of a global effort consistent with the G8 and EU goals equates to at least an 80% reduction in UK emissions from 1990 levels by 2050.
- 1.2.9 Other developed countries are responding to the threat of climate change by adopting similarly ambitious long-term targets. For example: France aims to reduce its emissions by 75% between 1990 and 2050, Japan by up to 80%, Sweden by up to 90%, and Norway by 100%. The US President Barack Obama has long advocated a cut in US emissions of 80% from 1990 levels by 2050.
- 1.2.10 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 at the 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 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;
 - strongly supporting the development of the package of legislation to achieve the EU's 2020 aims, now agreed at the European Council;
 - accepting relatively high burden-sharing commitments within the EU under the Kyoto Protocol, in Phase I and Phase II national allocation plans under the EU ETS, and in the 2020 package;
 - encouraging the 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

- 1.2.11 Currently, there is significant uncertainty surrounding the degree of climate change mitigation that will be undertaken globally in the future. This is, in part, because of the continuing negotiations on a global and comprehensive international climate change agreement within the framework of the UNFCCC and Kyoto Protocol. 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.

- 1.2.12 The Act enshrines 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 80% demonstrate the Government's ambition to equip the UK with the conditions necessary for a successful transition to a low carbon economy.
- 1.2.13 The mitigation framework provided by the Act 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.
- 1.2.14 The Act 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 Act 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

- 1.2.15 Climate change is caused by the emission of greenhouse gases to the atmosphere. There is an externality as 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.
- 1.2.16 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 Climate Change Act.
- 1.2.17 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 450-550ppm 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.

1.2.18 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

1.2.19 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 Act. However, the provisions contained within the Act do not pre-judge the trajectory and specific policies required to achieve these goals.

1.2.20 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.

1.2.21 Equally, this Impact Assessment does not contain an assessment of the costs and benefits for the adaptation programme. The specific policies and objectives which constitute the programme will be costed as part of standard policy development practices and further impact assessments provided. Annex C sets out the impact assessment of the adaptation measures in the Climate Change Act. The document focuses on information on the costs and benefits that result from the adaptation reporting power. A further detailed Impact Assessment will be made on this issue.

2. Illustrative Costs and Benefits of reducing UK emissions

2.0.1 This section sets out a high level discussion of the:

- illustrative costs and benefits of action to deliver the proposed statutory Greenhouse Gas emissions reduction of at least 80% by 2050 with a reduction of at least 26% in CO₂ emissions 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 Act 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 and carrying the UK's share of the burden of a global deal. The impacts of the Act'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.

Box 1: Uncertainty and carbon valuation

Government is currently assessing the case for changing to an approach that values carbon in a 'target-consistent' way, in appraisals of individual policies and projects. However, it would not be appropriate to assess emission reduction targets using such a target-consistent figure, as this is inevitably circular (a target's desirability cannot be assessed using a carbon valuation derived from that target). As such, overall targets still require assessment using empirical and modelling evidence - including the social cost of carbon (essentially estimates the marginal damage caused by incremental GHG emissions) - to value the benefits of emission reductions, and comparing these to costs of action.

However, it should be noted that whilst social cost estimates are currently the estimates we have to calculate the benefits avoided by taking action to mitigate climate change, there is a huge amount of uncertainty surrounding estimates. This uncertainty is a key reason for moving to a target-consistent based approach for valuing emissions in policy and project appraisal.

The uncertainty was demonstrated by Downing (2005)⁷ in a study for Defra which showed social cost estimates from different modelling exercises ranging from £1/tC to £1000/tC. Uncertainty is inevitable given the difficulty of estimating impacts occurring far in the future. For example, there is little certainty on catastrophic impacts – when they occur, what the economic impacts will be and how quickly these accrue. Further, some commentators (see Watkiss, 2007)⁸ note that estimates fail to capture the full range of impacts of emissions increases, for example, socially contingent impacts. There is also disagreement about ethical considerations – such as the appropriate discount rate that should be used. Given that the greatest impacts occur far in the future, the choice of

⁷ Downing, T. E., D. Anthoff, B. Butterfield, M. Ceronsky, M. Grubb, J. Guo, C. Hepburn, C. Hope, A. Hunt, A. Li, A. Markandya, S. Moss, A. Nyong, R. S. J. Tol and P. Watkiss (2005). Scoping Uncertainty in the Social Cost of Carbon. London, DEFRA.

⁸ Peer Review of the Social Cost of Carbon and the Shadow Price of carbon: what they are, and how to use them in Economic Appraisal in the UK
Paul Watkiss¹ September, 2007.
(<http://www.defra.gov.uk/environment/climatechange/research/carboncost/pdf/paul-watkiss.pdf>)

discount rate is a key parameter in determining the magnitude of social cost estimates.

Nonetheless, an illustration of the potential magnitude of the benefits of action can be obtained by valuing emission reductions targets at the social cost of carbon, using the estimates from the Stern Review which we regard as being the most robust current evidence. Clearly, given the uncertainties, this should not be the only informational input into decision-making processes. Consideration of risks, and the potential danger of exceeding certain temperature thresholds will play a very important role.

2.1 The level of the Long-term target

2.1.1 The level of the long-term target in 2050 is the most important factor in determining the scale of the environmental, social and economic impacts of the Act. The Act placed a duty on the Committee on Climate Change (CCC) to advise on the target by 1 December 2008.⁹

2.1.2 The CCC provided interim advice on the long term target in September 2008. Following this advice the Climate Change Bill was amended during its parliamentary passage to include a target of a reduction of at least 80% in all Kyoto gases. The more detailed advice from the CCC on the 1 December confirmed their view that the long term target should be a reduction in UK net GHG emissions of at least 80% by 2050 and the Government has accepted it. Box 2 outlines the approach adopted by the CCC and the evidence which informed their advice:

Box 2: CCC advice on the long term target

The government adopted a long term target of a reduction in UK net GHG emissions of at least 80% following advice from the Committee on Climate Change. The full advice published on December 1 2008 outlined the approach that the Committee had taken to producing this advice and the evidence upon which it was based. The Committee has concluded:

“that ideally global policy should seek to avoid a mean global temperature rise of more than 2°C. Given emissions and concentration increases which have already occurred, and given the uncertain relationship between emission levels and temperature increases, however, it is not now possible to ensure with high likelihood that a temperature rise of more than 2°C is avoided. There is a significant probability that the world will enter the danger zone of increasing human welfare impact. We therefore recommend that the objective should be to limit our central expectation of temperature rise to 2°C, or as close as possible. In addition we propose an additional rule which is to reduce the risk of extremely dangerous climate change to very low levels (e.g. less than 1%). We have made the judgement that 4°C this century would be this ‘extreme danger’ threshold.”¹⁰

The long-term target is then derived from the atmospheric concentrations of GHG that will deliver a good chance of delivering the objectives of limiting temperature rises. To travel from the concentration of greenhouse gases in the atmosphere towards a UK target the CCC explored a variety of global burden sharing methodologies that might underpin a global deal on climate change action. The advice concludes:

“Given the range of reduction required under the different burden-sharing methodologies the Committee therefore recommends that the UK’s 2050 objective should be to reduce its

⁹ <http://www.theccc.org.uk/reports>

¹⁰ <http://hmccc.s3.amazonaws.com/pdf/TSO-ClimateChange.pdf>

emissions of GHGs at least 80% below the 1990 baseline.”

The implication of the CCC approach is that the science indicates that the costs of failing to limit temperature rises to below 2°C are very significant, and the costs of inaction leading to temperature rises beyond 4°C are catastrophically high and that there would be large net benefits to global action.

In theory the marginal cost of abatement can be compared to the marginal benefit of (or avoided damages from) the reduced emissions to find the optimal level of the UK’s abatement target. The CCC have not focussed on this approach owing to the uncertainties inherent in the estimates of the damage costs associated with GHG emissions (see box 1). However the CCC did commission work using the PAGE2002 model run by Chris Hope and published a technical paper¹¹ detailing their work¹².

The CCC concluded that:

“Our analysis shows that:

- There are substantial damage costs from climate change under the baseline and that our estimates are broadly in line with the Stern Review.
- The mitigation costs are small compared to the damage costs of climate change, even for relatively large emissions reductions.
- There are net benefits from taking action to reduce emissions for a range of discount rates and the case for large emissions reduction holds for a range of discount rates, including those used in Government appraisals.”

The government will engage further with the evidence provided by the CCC Integrated Assessment Modelling.

2.1.3 The 2050 target must be set mindful of a global stabilisation target and an equitable burden share of that, and the chances that this stabilisation goal will avert dangerous climate change. Equally importantly, the 80% target demonstrates the UK’s commitment to tackling climate change and taking responsibility for emissions, which will help to maintain our leadership and influence in the international climate change negotiating process.

Moving to a greenhouse gas target

2.1.4 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), the waste sector (e.g. from landfill) and industrial process emissions, for example in the cement and paper industries.

¹¹ <http://hmccc.s3.amazonaws.com/pdfs/Tech%20Appendix%20Final.pdf>

¹² Page 2002 is an integrated assessment model combining evidence on the costs of delivering abatement targets with modelling of damage costs. It was used to underpin the estimates of the damage costs associated with GHG emissions in the Stern Review.

- 2.1.5 Collectively, non-CO₂ emissions accounted for approximately 15% of the UK's overall impact on climate change in 2006. In addition, the UK's obligations internationally (under the UNFCCC and the Kyoto Protocol and within the EU) require the UK to achieve emissions reductions in the basket of gases collectively. It is therefore important that the UK's emissions reduction framework should include these other greenhouse gases, both as these gases also cause climate change, and to bring our domestic commitments into line with what is required internationally.
- 2.1.6 Therefore, the Climate Change Act proposes that the system of 5-year budgets together with the statutory targets for emissions reductions in 2020 and 2050 will apply to the basket of GHGs, rather than just CO₂.
- 2.1.7 There are strong scientific and economic arguments in favour of defining the UK's long term goal in terms of the basket of greenhouse gases. A multi greenhouse gas target incentivises the least cost abatement across the basket of greenhouse gases, ensuring that potentially greater reductions can be achieved for a given cost; Chapter 10 of the Stern Review identified this as a desirable feature of emissions reduction frameworks.
- 2.1.8 Extending the coverage to the basket of GHGs also removes 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. Indeed, excluding the non-CO₂ 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 and Benefits of the Climate Change Act beyond 2050

- 2.1.9 The following sections on the costs and benefits of the long term target consider the costs and benefits of UK action up to 2050.
- 2.1.10 The IA uses MARKAL to provide illustrative costs and benefits of action. The counterfactual scenario is a baseline case where the energy system and emissions are calibrated to the current UK situation, and then the model is run with no carbon constraints. The emissions in this case continue downwards to 2020 and then begin to rise, reaching 537MtCO₂ by 2050. So this case does include the impact of current policies to the extent that they have already altered the UK energy system, and the impact plays out over the next decade. Comparative scenarios include carbon constraints such as the scenario which includes carbon constraints that deliver reductions by 2050 of 80% and 33% by 2020.
- 2.1.11 The Social Cost of Carbon used to estimate the damages associated with UK emissions up to 2050 uses estimates of the damages that GHG emissions will have over their lifetime in the atmosphere. In this way the estimates of avoided damage costs include the avoided damages beyond the year 2050 from emissions reductions before 2050.
- 2.1.12 UK action on climate change would not cease in 2050, but costs and benefits of UK action beyond the period covered by the long-term target are not quantified in this impact assessment. Evidence on costs of action indicate that the costs of action remain significant in 2050. The UK continuing as a low carbon economy would deliver an ongoing stream of benefits from reduced emissions. UK action between now and 2050 could reduce the costs of abatement after 2050 through induced technological change and contribute to a one-off structural shift in the economy. Such a benefit from the Act is not quantified in this impact assessment.

2.2 Outlining the costs of UK action to reduce climate change

2.2.1 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). In addition, the CCC have provided new evidence from MARKAL modelling they commissioned to support their work on the level of the long-term target. The UK government's GLOCAF (global carbon finance) model provides estimates of the reduction in the costs arising from emissions trading. The Blake Computational General Equilibrium (CGE) model has been used to provide some evidence on the macro implications of the emissions reduction targets. Technical issues surrounding the use of these and wider generic approaches to modelling mitigation costs are outlined in Box 3 below.

2.2.2 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 3: 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).¹³
- 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 MARKAL-Macro models are particularly useful in exploring the energy system in the long-term. As a UK only model, the MM model cannot capture competitiveness impacts, it is also limited in its capability to capture the potential for international carbon trading to reduce costs. 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 be expected to produce lower-bound estimates of the costs of carbon abatement in 2050.

Runs of the MARKAL model commissioned for the Energy White Paper (2007) and in the Autumn 2007 did not include the option of using international carbon units to meet the target. The CCC commissioned runs of the MARKAL model which included an exogenously determined carbon price for the purchase of international carbon units, providing a partial insight into the impact of trade on the costs of the long-term target. The CCC MARKAL modelling also used the new MARKAL elastic demand (MED) model which allows the level of individual energy service demands to respond to the costs of meeting them, whereas the MARKAL-Macro model has a much more general mechanism whereby increased costs feed through into a GDP effect which has a consequent impact on all demands of energy services. The MED model allows a greater demand response in those sectors in which technological abatement is especially difficult and expensive.

¹³ More detailed papers on the development of the MARKAL and MARKAL-Macro model available from the UKERC website www.ukerc.ac.uk/content/view/142/112/

The GLOCAF (Global Carbon Finance) model combines bottom up abatement costs curves from all regions of the world. Due to differences in infrastructure stock, geographical endowment, and specialisation in production, differences in regional abatement cost curves will persist indefinitely. Emissions trading can reduce the overall cost of achieving a given environmental outcome by allowing countries with relatively expensive domestic abatement options at the margin to shoulder their share of global effort by funding abatement abroad. The GLOCAF model provides figures for global finance flows that result from global deals and varying limitations on the international carbon market.

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.¹⁴

A macro-economic model that does have a detailed treatment of abatement technologies is the Blake CGE model. This model is a dynamic multi-sectoral model of the UK economy. It uses equations derived from micro-economic relationships which maximize consumer welfare and firm profits and ensure that (after the economy has adjusted, which is subject to a significant amount of structural rigidity in the form of factor employment, adjustment costs and time lags) the supply and demand of all factors and products are balanced.

An environmental extension of the model has been specifically developed to allow analysis of changes in economic variables and emissions in response to explicit environmental policy changes (including carbon pricing and a range of emissions trading and abatement measures). The model describes the behavioural adjustments of the economy back towards a general equilibrium through feedback loops between agents after the policies are introduced, incorporating and direct, indirect and induced impacts of relative price changes on the economy.

Linkages in the economy between sectors, the government and households are explicitly defined. The model has a relatively simple representation of the energy system, but a relatively detailed treatment of the policy framework. It distinguishes between industry sectors supplying electricity, oil, gas, coal, nuclear and renewable energy while the capacity of the energy sectors is constrained using Marginal Abatement Cost curves. The model is unique in that it captures the link between the purchase of abatement measures and their corresponding energy impact. This makes the model suitable for assessing the longer term impact of such policy changes once adjustments back to equilibrium have occurred.

When considering the results of 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 tend to lower abatement costs over time. The latter class of models, which treat technological change exogenously, 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 2030.¹⁵

COSTS: Illustrating long run cost impacts up to 2050

2.2.3 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 CO₂e 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. 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.¹⁶

¹⁴ The full report by Oxford Economics is published at www.berr.gov.uk/files/file38978.pdf

¹⁵ Barker T. *et al.*, A report prepared for the HM Treasury Stern Review on "The economics of climate change" The Costs of Greenhouse Gas Mitigation with Induced Technological Change: A Meta-Analysis of Estimates in the Literature www.hm-treasury.gov.uk/media/8A7/01/ster_review_supporting_technical_material_terry_barker_231006.pdf

¹⁶ The cost assessments outlined by the Stern Review are expressed in terms of a balanced growth equivalent. This measures 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.

MARKAL modelling

- 2.2.4 The ‘bottom up’ UK MARKAL model has been used to estimate long run mitigation costs. The model only provides a partial answer to the costs of the 2050 target. The model covers only CO₂, not all Kyoto gases. Furthermore the model runs carried out in 2003 and 2007 did not include the flexibility for the UK to meet some of its long term target through international trading.
- 2.2.5 The 80% long term reduction target was adopted on the advice of the CCC. The costs estimates produced by the CCC commissioned runs of the MARKAL MED model will be used to provide the illustrative costs of the long-term target for this impact assessment¹⁷. Older MARKAL modelling is provided as context and supporting evidence. The CCC MARKAL MED modelling uses fossil fuel prices that are consistent with the latest government fossil fuel price scenarios, has updated technology costs, includes a proxy for international trading and uses more a more sophisticated modelling approach to demand elasticities. The CCC modelling also considered a greater variety of sensitivity analysis around an 80% long term target. The baseline GDP growth in the CCC modelling differed from that used in previous MARKAL modelling, preventing direct comparison of the costs.
- 2.2.6 The central case is taken to be one where the UK reduces net GHG emissions by 33% in 2020 and by 80% in 2050. This trajectory is chosen as the central case for a number of reasons. Firstly it matches the long term target and represents an almost straight line trajectory of emissions reductions from 2008 to 2050. It is the modelled trajectory that most closely resembles the interim budgets outlined by the CCC advice on December 1, and it was used as the central scenario for the CCC analysis and as a result has the greatest amount of sensitivity analysis of all the trajectories modelled.
- 2.2.7 An estimated range is provided for the costs of action through consideration of two further scenarios. There are lower costs to deliver the same trajectory of emissions reductions under a scenario in which there are higher (‘high high’) fossil fuel prices (see paragraph 2.4.28). There are higher costs where the same reduction trajectory is delivered but without the flexibility to meet some of the reductions through the purchase of international carbon units (see paragraph 2.3.6).

Table 1: Estimated costs of Climate Change Act

Scenario				NPV system costs (£billion)	NPV total costs (£billion)
2020 reduction	2050 reduction	Other factors	Scenario		
33%	80%	-	Central	237	379
33%	80%	High High Fossil Fuel prices	Low	206	324
33%	80%	No international trading	High	254	404

As such, this is a slightly different measure from the GDP indicator used in relation to the UK long run and transition cost modelling.

¹⁷ A report on the CCC MARKAL modelling will be published shortly on the CCC website. <http://www.theccc.org.uk/>

- 2.2.8 Under a range of scenarios the CCC found that the costs of the 2050 target were equal to a permanent reduction of 1-2% of GDP in 2050. Key sensitivities related to technology cost, emissions pathway and fossil fuel prices. These sensitivities are discussed below.
- 2.2.9 For a scenario requiring a 33% reduction in CO₂ emissions in 2020 and an 80% reduction in 2050 (both compared to 1990 levels), access to international credits allowed, the net present value of the energy system costs over the period 2008 – 2050 were £237 billion (2008 prices). Including consumer welfare impacts arising from the constraints on energy use, the costs rise to £379 billion¹⁸.
- 2.2.10 An identical scenario but with the additional constraint of achieving 32% renewable electricity in 2020 would carry system costs of £238 billion and total costs including welfare losses of £367 billion.¹⁹

Results of previous modelling exercises

- 2.2.11 The 2003 Energy White Paper runs of the MARKAL model were based on a wide range of sensitivity analyses. The conclusion was reached that the expected costs of reducing carbon emissions by 60% by 2050 were equal to between 0.5% and 2% permanent reduction in GDP in 2050 depending on the scenario considered. The modelling at that time did not consider the implications of an 80% target.²⁰ 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 3 for details on both models).
- 2.2.12 Analysis using the 2007 MARKAL-Macro model indicates that the long run costs of reducing carbon dioxide emissions by 80% by 2050 are around 1.6% of GDP by 2050 in the central fossil fuel price scenario.
- 2.2.13 From the 2007 MARKAL modelling the present value of the cumulative cost of reducing emissions by 80% by 2050. Expressed in terms of NPV, the reduction in GDP in the central case would be £172billion.
- 2.2.14 The Blake CGE modelling results find that the introduction of policies and measures that deliver the Climate Change targets will reduce GDP by 0.96% in 2050 compared to a baseline without Climate Change action. The net present value of the cumulative cost of action up to 2050 is £366 billion. This result is consistent with the MARKAL results, however the baseline GDP growth differs to those used in the MARKAL so direct comparison between the costs cannot be made.
- 2.2.15 Figure 1 illustrates the impact on UK GDP, compared to the baseline, of the UK's action. The graph indicates that action is clearly consistent with continued economic growth and prosperity, on this scale the growth in UK GDP where action is taken is almost indistinguishable from the baseline case. It is important to note that the baseline GDP

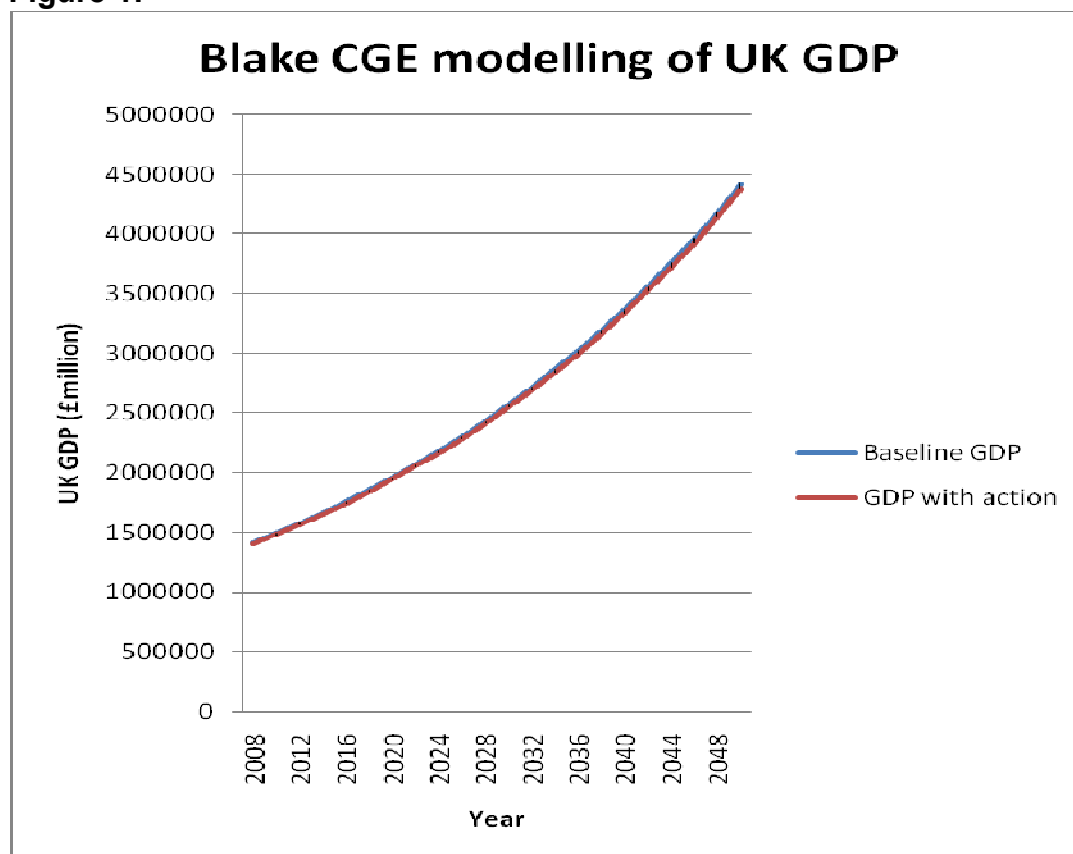
¹⁸ The MARKAL model produces annual costs at five yearly intervals. (2010, 2015....2050). Costs for intervening years have been interpolated and the costs discounted to provide an estimate of the NPV of costs. The MARKAL model also produces its own estimate of the NPV of each scenario, which would be expected to be similar to the NPV of costs calculated through the annual costs method. At present there remains a significant discrepancy, with the NPV produced by MARKAL showing a cost that is 3 to 4 times SMALLER than that produced from using the annual figures. The CCC are continuing to explore the reasons for this discrepancy. All figures in this IA are based on the annual cost figures.

¹⁹ Adding a constraint would be expected to result in the same or higher costs as a scenario without the constraint, so it is surprising that the overall cost is lower WITH a constraint to deliver a required level of renewables in 2020.

²⁰ In the 2003 analysis, GDP impacts were estimated 'off model' and are not directly comparable with the MARKAL-MACRO estimates (see Box 1).

does not include the damage costs that would be experienced in a world where no action is taken.

Figure 1:



2.3 Outlining the Key Cost Uncertainties and Sensitivities

2.3.1 This section outlines analysis surrounding the sensitivity of the cost assessments outlined in the previous section to a number of key uncertainties including:

- international trading;
- costs of including all GHG;
- transition costs;
- choice of emissions reductions pathway;
- credibility of the long-term target;
- 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; and
- cost of fossil fuels.

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

International trading

2.3.3 The long term target can be met in part through the purchase of international carbon units. International carbon trading has the potential to significantly reduce the global cost of achieving a stabilisation goal – reducing costs both for developed countries and developing countries. A carbon constrained world will require the UK to take significant

domestic action, exploiting cost-effective abatement options. However at the margin, where the cost of domestic abatement is steepest, the UK will have a choice of funding abatement abroad in countries which have greater quantities of cost-effective abatement opportunities (such as forestry) or have been allocated less onerous emissions reductions obligations.

- 2.3.4 The MARKAL modelling carried out in 2003 and 2007 required the emissions reductions to all be achieved domestically and took no account of the potential for international trading to reduce the costs. The costs arising from these model runs should therefore overstate the costs to the UK of the long-term target.
- 2.3.5 The MARKAL modelling commissioned by the CCC did include an exogenously determined carbon price as a proxy for international credits. The report on their modelling concluded:
“In assessing the role of international carbon credits, it is clear that these have a significant [role] to play (based on the assumed carbon prices from the GLOCAF model) alongside domestic abatement efforts. However, the model analysis also suggest that in most cases credits do not contribute more than 10% of total reduction requirements, reflecting the relatively cost-effective nature of domestic abatement options. “
- 2.3.6 The CCC MARKAL modelling found that a scenario of a 33% reduction in 2020, and a 80% reduction in 2050 with a 32% renewable electricity target in 2020 but WITHOUT the flexibility to use international credits increases the energy system costs to £266 billion and the total costs including welfare impacts to £408 billion. Without the renewables targets and again with no flexibility to trade the system costs are £254billion with total costs of £404billion.
- 2.3.7 Comparing these costs to scenarios that are identical other than that international trading is permitted indicates that the total costs of meeting the long term target are reduced by approximately 10% through international trading.
- 2.3.8 There are reasons to believe that the CCC modelling understates the role that international trading might play in meeting the UK’s long term target. The domestic abatement costs come from MARKAL which exclude transition costs. The international carbon price is determined from GLOCAF which in comparison to MARKAL has higher abatement costs. This means that the CCC modelling is comparing the costs of domestic abatement to international abatement where the relative costs come from different models. The relatively lower estimates for domestic abatement costs downplays the role of carbon trading in meeting the target.
- 2.3.9 GLOCAF modelling only carries regional abatement costs. Modelling was carried out of two scenarios where the EU is required to meet an 80% reduction in GHG compared to 1990 while the rest of the world takes on a burden share consistent with a stabilisation target of 450ppm but where atmospheric GHG concentrations temporarily overshoot to 500ppm. In one of the scenarios the EU must meet all of its 80% reduction within the EU, while in the other scenario there is unrestricted carbon trading with the rest of the world. Using GLOCAF to model this carries the advantage that both domestic abatement costs (within the EU) and international costs are from the same model and have the same underlying methodology.
- 2.3.10 If it is assumed that the UK is typical of the EU as a whole, then the GLOCAF modelling can provide an insight into the extent to which the UK would achieve its target domestically under a global least cost approach to avoiding dangerous climate change.
- 2.3.11 Where there is unrestricted carbon trading in the GLOCAF model, the EU imports **20%** of its reduction target, reducing emissions within the EU to 64% below the level in 1990.

Insufficient abatement is identified in the EU MAC curves for delivering all the abatement within the EU. In the scenario where all the abatement must be delivered within the EU a backstop technology must be assumed. This makes estimates for the cost savings for the EU much more uncertain. However the model does indicate that restricted trading **DOUBLES** the costs for non-Annex 1 countries who are unable to benefit from finance flows from Europe and other developed nations.

- 2.3.12 The CCC MARKAL modelling does find an increase in costs for the UK where the flexibility to trade internationally is removed of approximately 10%. However this could be a significant understatement. GLOCAF modelling does not show sufficient potential for the EU to achieve an 80% reduction domestically and suggests that the EU would import a larger proportion of their abatement than indicated by the CCC modelling. This would suggest that the increase in costs for the UK where there is no international trading would be significantly greater than 10%.
- 2.3.13 In conclusion, in a global carbon trading system the evidence suggests that the UK would be an importer of international carbon units and that this would be expected to significantly reduce both the costs to the UK of its long-term target and the global costs of meeting a given stabilisation goal.

Costs of including all GHG

- 2.3.14 As the largest sources of non-CO₂ emissions, we expect – and initial work has indicated – that there may be cost effective abatement potential in the Agriculture and Waste sectors. However, it is uncertain the extent to which these reductions will be picked up by the UK's GHG inventory. This potentially means that certain inventory methodologies may need to be changed in order for these additional savings to contribute to our targets. Work is ongoing to address this issue.
- 2.3.15 Furthermore additional domestic non-CO₂ abatement in certain sectors is expected to become difficult and costly given the amount of progress that has already been made to date. A range of international and domestic policies have already delivered substantial reductions in non-CO₂ emissions. For example, between 1990 and 2006 there was a 45% reduction in non-CO₂ GHGs, and this is expected to reach around 50% by 2020. Further projections post 2020 are not currently available. Box 4 outlines progress to date in more detail.
- 2.3.16 Moving to targeting the basket of GHGs should not result in an increase in CO₂ abatement costs relative to targeting CO₂ only, provided that CO₂ and GHG targets are equivalent in terms of the level of additional effort required above baseline projections in reducing environmental damage and that there is the potential over the longer term to achieve an 80% reduction in non-CO₂ emissions.
- 2.3.17 Moving to a GHG target involves a greater level of effort in terms of additional abatement required above baseline projections than a CO₂ target.
- 2.3.18 The costs incurred for CO₂ abatement may prove to be greater if it turns out to be the case that there is limited non-CO₂ abatement potential or this potential is more costly than CO₂ abatement. Conversely, the costs incurred for CO₂ abatement may prove to be lower if it turns out to be the case that there is the cost-effective potential to go further than an 80% reduction in non-CO₂ gases.
- 2.3.19 Initial analysis suggest that the reduction in CO₂ emissions required under an 80% all-GHG target will be between 74% (if non-CO₂ emissions were reduced to zero) and 90% (if non-CO₂ emissions were to reduce no further from today's levels). Each of these

extreme scenarios is unlikely, hence in reality the required CO₂ reduction would lie somewhere between these two extremes.

Box 4: Non-CO₂ emissions reductions to date

- **Methane** is the second largest contributor to total GHGs in the UK after CO₂, contributing 13% (103.5MtCO₂e) of the UK's total emissions of GHGs in 1990. Emissions fell by more than 50%, to 49.1MtCO₂e, between 1990 and 2006, contributing around 7% of total UK GHG emissions in that year. The main sources of methane are landfill sites and agriculture (mainly from livestock and manure), representing 40% and 38% of the total, respectively. The abatement achieved was 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 land-filled to 75%, 50% and 35% of the total amount of waste produced in 1995 by 2010, 2013 and 2020 respectively.

2.4 Illustrating transition costs in the short and medium term

- 2.4.1 The estimated monetary costs from MARKAL 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. MARKAL modelling assumes perfect foresight about the future availability of technologies. Transition costs are discussed in paragraph 2.4.4 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 MARKAL costs presented above must be treated with caution. The actual cost of mitigation will depend on the policies implemented to reach the emissions reduction targets.
- 2.4.2 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.
- 2.4.3 As outlined in Box 3, macroeconomic models which focus on the short-run dynamics are better suited to capturing these transitional costs than 'bottom up' models such as those referred to in the previous section.
- 2.4.4 Macroeconomic analysis conducted by Oxford Economics as part of the 2007 Energy White Paper²¹ 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

²¹ Available at www.berr.gov.uk/files/file38978.pdf

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 2020.²²

- 2.4.5 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 countries²³) 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.
- 2.4.6 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 2020.²⁴ 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 estimated that the US would face a cost of meeting Kyoto which was more than the global total for the other Annex I countries²⁵. This high cost of the Kyoto Protocol to the US arose because CO₂ emissions were projected to grow much more rapidly in the US than in other regions, so containing emissions would prove much more expensive.
- 2.4.7 The Blake CGE model accounts for capital adjustment costs. Turning these costs off provides an insight into the proportion of total costs identified in the model which result from adjustment costs. The costs are reduced to 0.55% (rather than 0.96%) of GDP in 2050, and the present value of costs over the whole period is £190billion (rather than £366billion).
- 2.4.8 However, transitional costs will depend on a number of factors, including the pathway to the 2050 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 sections.

Pathways to transition

- 2.4.9 The timing and pathway of emissions reductions towards the long term target are likely to impact on costs. The Climate Change Act does not specify the trajectory for UK emissions reductions but does establish a criteria which the CCC must consider when providing advice and which the government must take into account when setting budgets. The criteria include requirements that the level of the budgets must be consistent with the long term target and the overall objectives of the Climate Change Act – ensuring the UK is making a full contribution to global action on climate change mitigation. The first three carbon budgets will be set by 1 June 2009 covering the period

²² These costs show that GDP in 2020 would be 1% to 2% lower than under the baseline.

²³ The group of countries included in Annex B of the Kyoto Protocol that have agreed to a target for their greenhouse gas emissions. The only difference between Annex I and Annex B countries is that Turkey and Belarus are not Annex B.

²⁴ Energy Information Administration (1998)

²⁵ "Requiem for Kyoto, an economic analysis of the Kyoto protocol", Nordhaus and Boyer (1999)

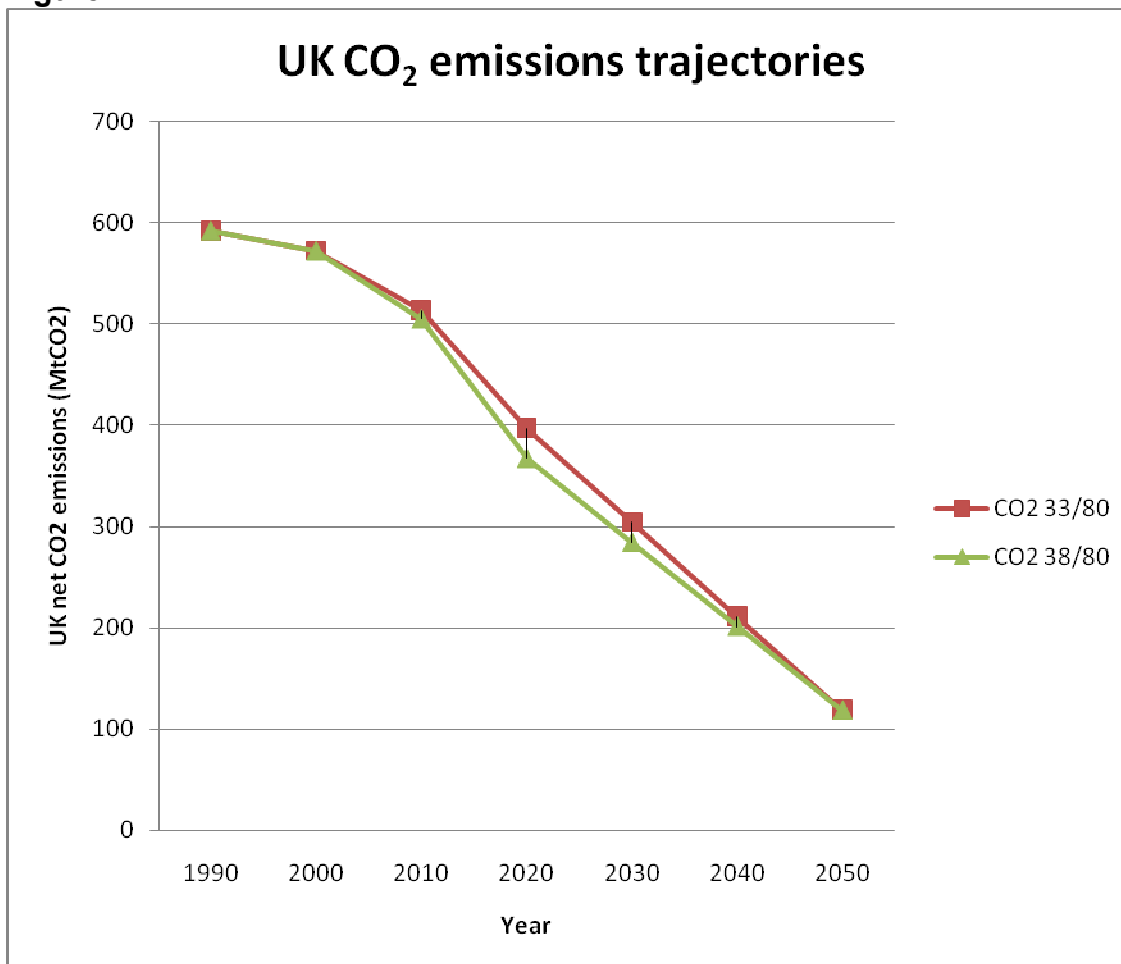
http://www.econ.unideb.hu/rendezvenyek/programsorozatok/szeminariumsorozat/nordhaus_boyer_Kyoto.pdf

2008 – 2022, with a fourth budget being set in 2011 to cover 2023 – 2027. The budgets will provide a clear medium term signal for the trajectory of UK emissions.

2.4.10 The actual level of the budgets will have to consider the international context – they must be at least as stringent as any international obligations that the UK has. They must also consider the possibility of technology lock-in and the policy feasibility of delivering further and faster reductions in the near term. A faster reduction in the near term will reduce UK emissions, increasing the carbon benefits of UK action. However faster reductions would be expected to increase costs in the short term. Early retirement or ‘stranding’ of carbon intensive capital equipment would raise costs. However to the extent that earlier action brings forward investment that would have been required anyway it would not significantly impact on UK costs over the whole period to 2050.

2.4.11 The CCC performed MARKAL runs which placed constraints on emissions reductions in 2020 and 2050. An approximately straight line trajectory between now and 2050 is captured by a 33% reduction in CO₂ emissions in 2020 (on 1990 levels) leading to the 80% reduction in 2050. This trajectory is roughly consistent with the ‘interim’ budgets that have been recommended. The CCC analysis also considered a scenario where the reduction in 2020 was 38% compared to 1990 levels, leading to the same long term target of an 80% reduction. Figure 2 illustrates these trajectories.

Figure 2:



2.4.12 The energy system cost of a 38% 2020 target leading to an 80% 2050 target are estimated at £460 billion – almost exactly double the costs of a 33% reduction in 2020 followed by an 80% reduction in 2050. The total costs including welfare costs are £693 billion, over £300 billion more than the 33%/80% scenario. In 2020 the marginal

abatement cost is more than twice as high, at £78/tCO₂, when a 38% reduction in emissions is required compared to a 33% reduction (£36/tCO₂).

- 2.4.13 The difference in the costs in these two scenarios result from a sharp spike in the costs of abatement between 2015 and 2020. Though a price spike would be expected, the CCC believe that the spike is exaggerated and is in part a product of incomplete modelling of abatement potential in the period 2015 to 2020. Another issue which will clearly have to be considered in greater detail is the degree to which, when adopting such a steep trajectory, we could rely on international credits to reduce the spike in costs. This will be particularly relevant when assessing the UK's burden share should the EU move to a 30% target by 2020, which would be triggered by an ambitious global deal.
- 2.4.14 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 CO₂ 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.
- 2.4.15 The CCC analysis also provides evidence of the potential costs savings that can be achieved by an immediate adoption of a long-term target compared to a scenario where the same long-term target is adopted later - in 2020.
- 2.4.16 The constraints in the MARKAL model are assumed to be perfectly credible. In the case where an 80% target is adopted immediately, the costs to the UK of achieving the long term 80% target are significantly lower (£30billion less than in the case where we start out with a 60% target, revising this to an 80% target in 2020. This is despite the fact that the cumulative emissions reductions in the 26%/60% →80% scenario are lower than the reductions in the 33%/80% scenario. The 33%/80% scenario delivers more abatement at a lower cost. The energy system costs of starting out with a 60% target are £251billion with total costs including welfare losses of £410billion. This total cost is approximately £30billion higher than the scenario where the long term target is adopted immediately.
- 2.4.17 The increased costs arise in part from a stranding of capital investments which were made between 2008 and 2020. These capital investments were compatible with a less carbon constrained world but were not viable following the adoption of a more stringent target in 2020. A credible long-term target avoids the stranded investments being made in the first place.
- 2.4.18 The comparative benefits of adopting the long-term target early will only arise where it is credible enough to dissuade investment in potentially stranded assets. The more credible the long-term signal created by the 2050 target the greater the avoided costs of stranded investments are likely to be.
- 2.4.19 The two scenarios tested illustrate the importance of getting the trajectory to the 2050 target right – that is, at a level that allows the UK to meet its overall emissions reductions targets at least cost. The first scenario illustrates the costs of making stringent emissions reductions too early and the second scenario the costs of taking action too late. It is precisely because of the importance of the trajectory that the Climate Change Act has set up a flexible system of five yearly carbon budgets, which Government will set on a fifteen year rolling basis, informed by advice from the CCC. This process will ensure that the evidence on costs is reassessed periodically and should mitigate the risk of cost spikes

illustrated above. Neither of the costs of these scenarios are reported in the cover sheet of this Impact Assessment; they are included for illustrative purposes and decisions on the trajectory will be made when more extensive evidence is available at the time of setting carbon budgets.

Degree of international effort

2.4.20 The Act sets unilateral targets in statute for the UK to take responsibility for a share of the global mitigation effort. 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.

2.4.21 Work for the Australian government²⁶ 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'.²⁷ It is likely that different approaches to modelling technological change account for some of these differences (outlined in Box 3).

2.4.22 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

2.4.23 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 for 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 2030.²⁸

2.4.24 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.²⁹

²⁶ Energy Futures forum www.csiro.au/files/files/pbd1.pdf

²⁷ 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 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.

²⁸ Barker T. *et al.* (2006)

²⁹ 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.

- 2.4.25 Analysis in 2007 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 GDP impact (to 2050) could be significantly higher in a scenario where there were no developments in technological innovation beyond 2010. For an 80% 2050 target the GDP impact rises to £371 billion compared to £171 billion with unrestricted innovation. These numbers are based on different GDP growth assumptions to other modelling so should not be directly compared. The figures are useful to show the sensitivity of the results to the degree of innovation that is assumed – the costs can more than double if the very pessimistic assumption is made that there is no innovation.
- 2.4.26 CCC MARKAL modelling considered the impact of Carbon Capture and Storage (CCS) not being developed. This technology has the potential to make a significant contribution to de-carbonising the power sector, but as yet is unproven at the scale required for large power stations. CCC modelling also considered a scenario where there was no use of nuclear as well as no development of CCS. Access to international credits was not allowed in either case.
- 2.4.27 In the scenario without CCS, system costs were £274 billion, with total costs of £433 billion. With neither nuclear nor CCS system costs rose to £403 billion with total costs of £663 billion. CCC analysis concluded that the long term targets would be extremely challenging without at least two of the three key low or zero carbon power generation options being developed (nuclear, CCS or renewables).

The cost of fossil fuels

- 2.4.28 The long run levels of, and 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.
- 2.4.29 CCC MARKAL modelling has compared the costs of meeting a 33% 2020 and 80% 2050 reduction target where fossil fuel prices are in line with the DECC central fossil fuel price scenario and the DECC high high fossil fuel price scenario³⁰. With high high prices, for a MARKAL scenario with no imposed 32% renewable electricity target in 2020 the energy system costs reduce to £206 billion compared to the non-carbon constrained world. (With central fossil fuel prices the cost was £237 billion) and the total costs reduce to £324 billion (compared to £379 billion with central fossil fuel prices). For equivalent reductions but with a renewable electricity target of 32% in 2020 with high high fossil fuel prices the costs are reduced to £206 billion (compared to £238 billion with central fossil fuel prices) and total costs reduce to £324 billion (compared to £367 billion with central fossil fuel prices).
- 2.4.30 These results indicate that fossil fuel prices represent a significant sensitivity when calculating the relative costs of delivering carbon reductions. The total relative costs are approximately 15% lower where fossil fuel prices are 'high high'.

CONCLUSIONS

- 2.4.31 Analysis for the UK indicates that the long run costs of achieving the long-term target of an 80% reduction in GHG will be consistent with the range of costs**

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<http://www.berr.gov.uk/files/file46071.pdf>

identified by the Stern Review (which estimated that the long run costs of global action to stabilise atmospheric greenhouse gas concentrations at 550ppm CO₂e are likely to be around 1% of GDP by 2050, within a range of +/- 3%).

2.4.32 The range of costs presented on the summary sheet are all derived from the latest CCC MARKAL MED modelling.

Table 2: Estimated costs for the Climate Change Act

Scenario				NPV system costs (£billion)	NPV total costs (£billion)
2020 reduction	2050 reduction	Other factors	Scenario		
33%	80%	-	Central	237	379
33%	80%	High High Fossil Fuel prices	Low	206	324
33%	80%	No international trading	High	254	404

2.4.33 There are strong grounds for including the full basket of greenhouse gases in our emissions reduction targets: the science shows that each GHG causes climate change, and the economics shows that least-cost abatement can be achieved across the basket of GHGs as this provides us with the widest range of levers by which to reduce emissions. In addition, this approach ensures the UK's domestic framework mirrors the international framework.

2.4.34 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 2.4).

Uncertainty and policy design

2.4.35 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.

2.4.36 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.

2.5 BENEFITS

Potential size of benefits from reducing CO₂ emissions

- 2.5.1 Delivering the GHG emissions reductions required by the Climate Change Act will represent a full contribution from the UK towards global action to avoid serious climate change. The 80% reduction in UK net emissions is consistent with a global stabilisation of atmospheric CO₂e concentration at 450-475ppm with an overshoot to 500ppm³¹. The precise outcome will depend on the final burden sharing agreement.
- 2.5.2 The precise reduction in UK emissions will depend on the trajectory that is taken towards the long-term target.
- 2.5.3 Box 5 explains the methodology for valuing the emissions reductions resulting from UK action and explains why a particular approach is needed in the context of the Climate Change Act Impact Assessment, where the comparison under consideration is between the UK taking no action on the one hand and reducing emissions to 80% below 1990 levels on the other. Damage costs from UK emissions are calculated for the year the emissions are released by multiplying the level of emissions by the social cost of carbon in that year. The benefits of action are the avoided damages – the reduction in damage in the case where the UK takes action compared to the scenario where the UK does not act.
- 2.5.4 According to the evidence of the Stern Review, the social cost of carbon will depend on the stabilisation level of global emissions – it is higher at higher stabilisation levels. Crucially, it is assumed here that global stabilisation levels will be higher – at business as usual levels – if the UK takes no action to reduce its own emissions, since a global agreement on climate change would not be negotiable. In contrast, if UK action to reduce emissions spurs global action, then both UK emissions will be lower, *and* the social cost of carbon will be lower, the combined effect resulting in lower overall damages from UK emissions.³²

Box 5: The Social Cost of Carbon (SCC) and the Climate Change Act IA: using the SCC to Assess Non Marginal Changes in Emissions Reductions Targets

Technical rationale

The government's current Shadow Price of Carbon (SPC) is the estimate of the social cost of carbon assuming the world is on a 550ppm stabilisation path. Results from the Stern review indicated that the social cost of carbon varied by atmospheric concentration, with the Business as Usual social cost of carbon being approximately three times higher. In 2008 the SPC is £26/tCO₂ and the BAU SCC is £73.60 (in 2007 prices). The Government's approach to carbon valuation is currently being reviewed; a methodology paper has been peer reviewed by Simon Dietz (see Simon's comments on carbon valuation in the context of this IA in Annex I) and the review itself is expected to be published later this year.

The current SPC is the appropriate value to use for actions/measures that induce marginal

³¹ <http://hmccc.s3.amazonaws.com/pdf/TSO-ClimateChange.pdf>

³² In practice, there is a risk that UK action, while certainly a necessary condition for global action, may not be sufficient. The assumption that UK action will bring about global action is relaxed in the sensitivity tested in section 2.5.12.

changes in emissions relative to the 550 ppm stabilisation path, and this was the basis for deciding, as part of the previous review of the SPC, that it should be used in policy appraisals. However, for a commitment such as the 80% target in the Climate Change Act the change in emissions reflects the UK's contribution to global action on climate change. Such global action is non-marginal – without it there is a compelling argument for assuming that the global trajectory of emissions would be on a business as usual path. This is because UK action is a necessary part of co-ordinated global action: a global deal with sufficiently ambitious cuts in emissions is highly unlikely to be negotiable without action from developed countries such as the UK.

There is, in any case, a moral case for the UK to contribute to any global action. Should it prove possible to negotiate a global deal in the absence of UK action, then the UK would be free-riding on the effort of other nations. This would be entirely inconsistent with the UK's leadership position.

The counterfactual for the Climate Change Act IA is a world where the UK makes no commitment to reduce greenhouse gas emissions. For the arguments above, absence of UK action is only compatible with the world being on a business as usual trajectory of emissions. Action to reduce UK net emissions by 80% in 2050 is consistent with an equitable global deal which would stabilize atmospheric concentrations of GHG at approximately 450-475ppm³³. The correct comparison is therefore one of:

- the UK reducing emissions by 80% by 2050, and the world being on a 450-475ppm stabilisation target ; and
- the UK not reducing emissions relative to business and usual and the world also being on a business as usual trajectory of emissions.

If, as the Stern Review found, the social cost of carbon differs for different atmospheric concentrations, then the valuation of UK emissions should reflect this. In figure 1, the benefits of action are represented by boxes A, B and C. The damage costs of the emissions in the counterfactual case should be valued at the BAU SCC and the damage costs of the emissions in the case of taking action should be valued at the 450 ppm SCC. The avoided damage costs are equal to:

Equation 1:

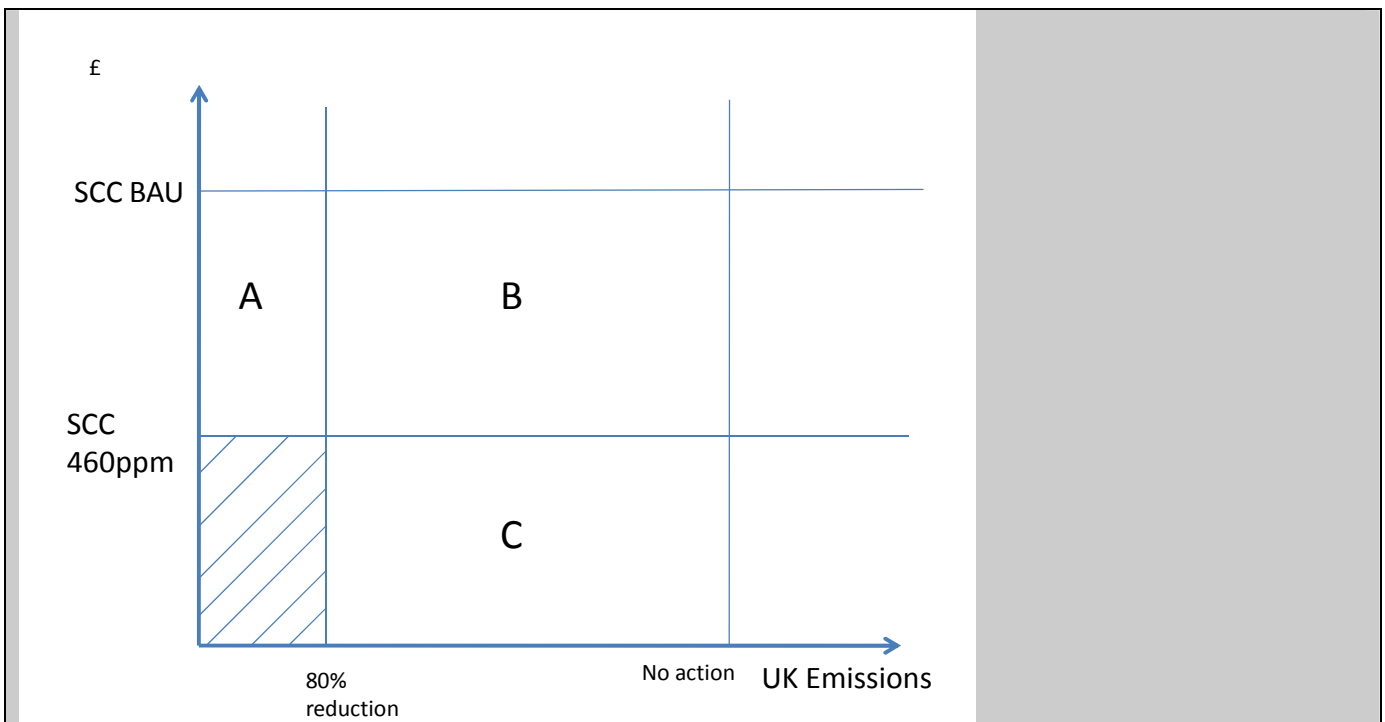
$$\text{Avoided damages} = \text{UK emissions no action} * \text{BAU SCC} - \text{UK emissions 80\% target} * \text{450ppm SCC}$$

Using a social cost of carbon that assumes that a low stabilisation target would be reached with or without action would be equivalent to only capturing the benefit of box C, and would be based on an assumption that the UK can successfully free ride on the efforts of other countries to tackle climate change³⁴.

Figure 1: Illustration of the avoided damages from the Climate Change Act

³³ <http://hmccc.s3.amazonaws.com/pdf/TSO-ClimateChange.pdf>

³⁴ The valuation of carbon in the previous partial IA implicitly made this assumption, which, as argued here, is not a realistic one.



For the central estimates of the benefits of the Climate Change Act are valued using equation 1.

As a sensitivity the benefits of action are also calculated for a world where the UK takes action but the rest of the world does not. The UK action would not significantly change the global emissions trajectory from the BAU path (the UK share of global emissions is only 2%). This means that the BAU SCC should be used to value the carbon in both the case where the UK takes action and where it does not.

$$\text{Avoided damages} = \text{UK emissions no action} * \text{BAU SCC} - \text{UK emissions 80\% target} * \text{BAU SCC}$$

It is important to note that where the UK takes action that is not reciprocated the avoided damages will be distributed across the globe, while the UK will pay **all** the costs of action. While the action may show a net benefit at the global level, the UK continuing to act while the rest of the world does not, would result in a large net cost for the UK. Where there is international co-operation and co-ordinated action the benefits of UK action will still be distributed across the globe. However, in contrast, the UK will derive benefits from action from all other countries' reciprocal action. In this case there would be a net benefit for the world from action AND a net benefit for the UK.

Estimates of the Social Cost of Carbon, derived from the Stern Review are included in Annex H.

2.5.10 MARKAL modelling provides annual CO₂ emissions figures for the UK for both a baseline scenario and for where the UK takes action. These can be used, along with estimates of the social cost of carbon from the Stern Review to value the benefits of UK CO₂ emissions reductions. This will not value the benefits of reductions in the other GHG gases. This is consistent with the costs of UK action where costs are only calculated for delivering the required reductions in CO₂ emissions. Just as the costs will be larger due to the required reductions in non-CO₂ GHG gases, so will the benefits of action be larger. Using figures for CO₂ only allows a comparison of the costs and benefits of action on the level of CO₂ emissions.

2.5.11 A straight line trajectory towards an 80% reduction in CO₂ emissions reduces UK net emissions by approximately 9GtCO₂. The net present value of the avoided damages is **£988billion** when the green book discount rates are used (See box 6). If the avoided damages are discounted at a rate consistent with the Stern Review, using a 2.1% discount rate, then the avoided damages rise to £1,287 billion (not reported in the cover sheet, to comply with Treasury Green Book recommendations).

Box 6: Discounting and the Climate Change Act IA

Monetary costs and benefits that are expected to accrue in the future are discounted in appraisal to reflect the fact that people value future costs and benefits less than those occurring today. Partly this reflects the fact that society is anticipated to be wealthier in the future, partly

The central estimate of the benefits of reduced emissions delivered by the Climate Change Act uses a standard Treasury Green Book discount rate. A reduction in GHG emissions of 1 tonne of CO₂e is valued in the year that the reduction took place. To find the net present value of the avoided damage this valuation is then discounted back to the present using a 3.5% discount rate for the first thirty years, and then a 3% discount rate thereafter.

The discount factor used by the Stern Review was different to the standard Green Book discount rate for several reasons.

The Stern Review set out to assess, from a global perspective, the effects on the welfare of current and future generations of very large and for all practical purposes, irreversible changes to the environment, resulting from pollution induced climate change. The standard Green Book assessment of the economic costs and benefits of expenditure proposals, is rarely concerned with such major changes to the wealth and welfare of future generations. Discount rates are, however, made up of several elements and the implications of each for the Stern Review was examined.

While starting from the overall standard Green Book approach to discounting, the Stern Review, because of its particular frame of reference, had to consider some fundamental ethical issues concerning the responsibility of the current generation to future generations. This led the review to conclude that it was not ethically defensible for a pure rate of social time preference to be applied to future cost benefit calculations where these involved significant non-marginal and for all practical purposes irreversible wealth transfers from the future to the present. This consideration applied to the 0.5% pure social time preference element of the standard Green Book discount rate.

Further, Stern did not apply a single fixed discount rate, but rather varied it according to the prosperity of future generations. This is because we should attach a greater value to the welfare of future generations that are relatively poor, compared to those who are relatively rich. And, unlike other policy decisions, climate change has the potential to have a significant impact on future growth prospects.

The Stern Review also had to take account of the effects on wellbeing of a large number of possible alternative growth projections, analyzing the probability of these outcomes through a Monte Carlo simulation. To allow for the effects of these various consumption projections the Review used the standard Green Book parameter of 1 for the marginal elasticity of the utility of consumption applying this to each growth projection endogenously. This follows Green Book guidance and enabled the Stern Review to properly allow for the differing wealth effects of each growth projection.

Last but not least, the Stern Review included an allowance in the discount for the possibility of future events resulting in the human extinction. The 0.1% level used in the review is an estimate, it being the lowest possible at the one decimal place level, and the review argued that

it is a generous allowance for such a possibility. On the other hand the component of the standard Green Book discount allowing for this exogenous catastrophic risk is 1%. This lies within the range suggested by academic investigation and allows a larger set of possible risk factors than simple species extinction. These factors relate to typical public expenditure projects and include unforeseen changes in social and political objectives and priorities and to possible wider changes in the economy society and technology which are not part of endogenous project specific risk assessment. These factors were largely irrelevant to the Review's assessment of climate change that could also be said to allow for exogenous variation through the Monte Carlo calculations.

Due to the endogenous discounting used in the Stern Review there is no single figure for the discount rate used – the discount rate depended on the different scenarios analyzed. However all the discount rates were in the range of 1.4% – 2.1 % with a lower discount rate being used in the scenarios where future generations were relatively poorer.

For the Climate Change Act IA a sensitivity has been run, where the benefits of action have been discounted using a Stern consistent discount factor of 2.1%. This has the effect of increasing the benefits of action.

Benefits when the UK acts but the world does not

2.5.12 If the UK were to deliver an 80% reduction in UK emissions while the rest of the world did not act then the global emissions trajectory would still be largely consistent with the Business as Usual scenario. **The benefits of UK action would be significantly lower at £425 billion and this benefit would be distributed across the all nations while the UK would carry all of the cost of action.** Unlike the case where the UK acts in concert with the rest of the world, the UK would not receive any benefit from reciprocal action by other nations. The long-term target under such a scenario would show a small net benefit for the world as a whole, but would show a very large net cost for the UK – close to all of the costs of the UK's action. **This highlights the central importance of co-operative and co-ordinated international action on climate change.**

Benefits of a steeper trajectory for UK emissions to 2020

2.5.13 If the UK were to adopt carbon budgets requiring a further and faster reduction in UK emissions the avoided damages would increase. A trajectory requiring a 38% reduction in emissions in 2020, with a reduction of 80% in 2050, would avoid damages of £1010 billion – assuming that the further and faster action does not significantly alter the global stabilisation trajectory.

Benefits of greater predictability to households and firms

2.5.14 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.

Co-benefits of Climate Change mitigation

2.5.15 Many measures or policies that are introduced to reduce Greenhouse Gas (GHG) emissions also act to reduce air pollutant emissions, and the associated externalities. This is primarily because of the emissions of both types of pollution from the combustion of fossil fuels. Some measures increase air pollutants – for instance the use of residential

bio-mass. The importance of estimating these ancillary costs or benefits (or co-benefits) is to understand the full impacts on society from climate policy. Whilst the full benefit of GHG reductions from climate policy will mostly be experienced by future generations, the ancillary co-benefits of climate policy occur now.

2.5.16 Defra commissioned an extension to the MARKAL modelling to quantify the air quality impacts of changes to the UK energy system driven by climate change policy. A final report was delivered in November 2008. In 2050 the annual undiscounted reduction in damage costs exceeds £3billion.

2.5.17 The net present value of the avoided damages from improved air quality are £32billion.

CONCLUSION

2.5.18 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 benefits from reducing emissions will depend on the trajectory of emissions reductions and the mix of policies chosen to reduce climate change. For a central scenario with a reduction in CO₂ emissions of 33% in 2020 and 80% in 2050 the benefits of action are estimated at £1020 billion, where the UK acts as part of co-ordinated global action. The benefits of action are estimated at £457billion when the UK acts but the rest of the world does not. Ancillary air quality benefits of £32billion are included in both cases.

Table 3: Estimated Benefits of the Climate Change Act:

Scenario	Reductions in CO ₂ (£billion)	Air Quality benefits (£billion)	Total Benefits (£billion)
Low	425	32	457
High	988	32	1020

2.5.19 Further benefits from reduction in non-CO₂ GHG emissions are not valued in this range of benefits.

2.5.20 The illustrative range for the net cost of the Climate Change Act is presented below in table 4.

Table 4: Estimated Net cost of the Climate Change Act:

Net cost of Climate Change Act			
	Cost	Benefit	NPV net cost
Central	379	1020	-641
Lower bound	404	457	-53
Upper bound	324	1020	-696

2.6 Estimating Distributional Effects

2.6.1 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 in the Act.

Energy intensive industries

2.6.2 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 £19/tCO_{2e} on the UK economy using input output tables.³⁵ It found that energy intensive sectors are most likely to be adversely affected by mitigation policies. However, it also found that only six 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.³⁶ 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 to substantially reduce the risk of competitiveness impacts.

2.6.3 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

2.6.4 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%).³⁷ 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).

2.6.5 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.

³⁵ Stern Review, Chapter 11.

³⁶ Sectors identified were gas supply and distribution; electricity production and distribution; refined petroleum; cement; fertilisers; and fishing.

³⁷ 2005 estimate in Annual Business Inquiry (see www.statistics.gov.uk/abi/)

Consumers and energy prices

- 2.6.6 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.
- 2.6.7 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 particularly large for households. The input output analysis identified a 0.9% long run increase in consumer prices arising from a £19/tCO₂ carbon price.³⁸ 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.

Encouraging innovation and resource efficiency

- 2.6.8 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 2005-10.³⁹ 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 Commitment⁴⁰ 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.
- 2.6.9 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.⁴¹ 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

³⁸ Stern Review Chapter 11.

³⁹ Barker et al., The Macro-Economic Rebound Effect and the UK Economy, A report to DEFRA May 2006. www.defra.gov.uk/science/Project_Data/DocumentLibrary/EE01015/EE01015_3554_FRP.pdf

⁴⁰ 'Energy Efficiency and Trading Part II: Options for the implementation of New Mandatory UK Emissions Trading'. NERA consulting 2006.

⁴¹ M. E. Porter, C. van der Linde, (1995), "Toward a New Conception of the Environment-Competitiveness Relationship", *Journal of Economic Perspectives*, Fall 1995, pp. 97-118.

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.⁴²

The choice of policy mix

- 2.6.10 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 markedly different sectoral impacts. For example, the allocation methodology used by an emissions trading scheme will have large distributional impacts. When allowances are grandfathered⁴³ 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.
- 2.6.11 **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 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.**
- 2.6.12 **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.**
- 2.6.13 **Ensuring an efficient and fair distribution of the costs of action to tackle climate change across UK society will be a key goal of climate change policy development going forward.**

⁴² See, for example, Palmer, K., W.E. Oates and P.R. Portney (1995): 'Tightening environmental standards: The benefit-cost or the no-cost paradigm?' *Journal of Economic Perspectives* 9:119–132

⁴³ 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.

3. Detailed Analysis of Measures

- 3.0.1 This section sets out a detailed assessment of the impacts from the provisions contained in the Act to establish a framework for the management of climate change policies. Detailed analysis of the impacts of the Government's preferred solutions are presented.
- 3.0.2 Further details on the impacts of the Renewable Transport Fuels Obligation⁴⁴, provisions on Climate Change Adaptation, Corporate Reporting, Powers to place obligations on generators and by area and the Waste Incentives for Local Authorities can be found in their respective Impact Assessments.

3.1 Provisions for the Management of Climate Change policy

- 3.1.1 This section provides a qualitative description of the impacts of the package of measures in the Act. 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 on Climate Change and the 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.

- 3.1.2 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.
- 3.1.3 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.
- 3.1.4 The Act includes a statutory target to reduce GHG emissions by at least 80%, 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" places a limit on the aggregate quantity of GHG emissions permitted over a five year period.
- 3.1.5 Carbon budgets will 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 will be set consistent with the 2020 target in the Act, which is currently at least a 26% cut in CO₂ emissions by 2020 (but we will need to take on board the Committee's views on the appropriate level of the 2020 target), providing a firm legislative boundary for the trajectory to 2050.
- 3.1.6 The Government of the day is directly accountable to Parliament for the delivery of both the 2050 target and the achievement of the five-year budgets. In the event that budgets are exceeded or the target not met, the Government will be required to lay before

⁴⁴ Details of the impacts of the RTFO provisions contained in the bill are set out in Annex F.

Parliament a report setting out proposals and policies to compensate in future periods for the excess emissions. Parliamentary approval is required in order to amend the targets and budgets. More detailed analysis of the circumstances in which these targets and budgets might be amended is provided in Issue 3 below.

- 3.1.7 The Act 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 7 below discusses annual targets in more detail.

Benefits:

- 3.1.8 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 GHG emissions. This system will 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 negotiations on a global and comprehensive agreement have not yet been concluded and it is therefore not yet clear what the contents of the second commitment period of the Kyoto Protocol (starting 1 January 2013) will entail.
- 3.1.9 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 CO₂e 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).
- 3.1.10 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:

- 3.1.11 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 7: 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

- 3.1.12 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.
- 3.1.13 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.
- 3.1.14 The Committee on Climate Change has therefore been set up to advise Government on the level of the carbon budgets and thus 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.
- 3.1.15 In forming its advice, the Committee is required to consider a broad set of factors (which the Government itself will also 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 is 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.
- 3.1.16 As well as advising the Government on the optimal trajectory, the Committee is 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.

3.1.17 The Government is also 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.

3.1.18 The Committee, through the work of a dedicated sub-committee, must 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:

3.1.19 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.⁴⁵

3.1.20 The role of the Adaptation Sub-Committee is to provide independent scrutiny to Government through the Committee, in relation to:

- the preparation of the UK risk assessment in particular its methodology and conclusions;
- the implementation of the Government's Adaptation Programme (for England and reserved matters), highlighting areas where the Government is doing well, and areas where it is falling short on delivering changes; and
- any relevant topic suggested by the Government and the Devolved Administrations.

⁴⁵ The Committee will 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.

3.1.21 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:

3.1.22 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 5 below provides a short breakdown of these expected costs.

Table 5: Outline of Estimated First Year and Ongoing Costs of Committee on Climate Change

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

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.

3.1.23 There will also be similar costs associated with the adaptation sub-committee. Overall these costs are estimated to be in the region of £774,000 annually once the sub-committee is established.

Table 6: Outline of estimated Ongoing Costs of an Adaptation Sub-Committee on Climate Change

Function	Ongoing costs *
Sub-Secretariat	£340,000
Sub-Committee	£240,000
Research	£150,000
Running costs	£136,000
Total**	£866,000

Notes

* Ongoing costs are only estimates at this stage.

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

- 3.1.24 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.
- 3.1.25 The Government has 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.
- 3.1.26 There is 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 amend the level of the carbon budgets if it became clear that the emissions forecasts used when a budget had initially been set proved to be significantly inaccurate. (Similarly the Government can also seek agreement from Parliament to amend the length of the budgets.) 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:

- 3.1.27 The capacity to review budgets or targets will 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.
- 3.1.28 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.⁴⁶ 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:

- 3.1.29 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

⁴⁶ The statutory targets could be changed by the Government only after seeking the advice of the Committee on Climate Change.

tackling climate change. This may potentially reduce the credibility in the framework as a whole.

3.1.30 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 5: Emissions from international aviation and shipping

3.1.31 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.

3.1.32 However, given the international nature of the industries, 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 individual countries. Careful consideration therefore needs to be given as to how it is most appropriate to handle international aviation and shipping in the context of a unilateral UK target.

3.1.33 Reflecting these current uncertainties, the Act requires that emissions from international aviation and shipping must be included in the targets by 31st December 2012 or that the Government must report to Parliament on the reasons why these emissions have not been included. If these emissions were to be included, the Government might at that point wish to revisit the level of the targets.

3.1.34 The assessment below considers the impact of including international aviation and shipping emissions within the UK's targets. No assessment has yet been made about the appropriate level of the targets following inclusion.

Benefits:

3.1.35 Including international aviation and shipping in the Act's targets would mean that a proportion (depending on the allocation methodology used) of these emissions would be assigned to the UK. Assuming that the levels of the targets and budgets were kept the same, this would increase the amount of emissions covered by the targets and therefore the level of action needed to meet them.

3.1.36 It is worth noting the possibility that greater regulation of international aviation and shipping emissions allocated to the UK might not result in reduced emissions, if aviation and shipping journeys were displaced to other countries. There may also be a risk of emissions increasing as the displacement effect distorts journey patterns.

Costs:

3.1.37 In order to include international aviation and shipping within the UK's targets, a methodology must be created 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.

3.1.38 As aviation and shipping are international industries, the UK is continuing to push for action to be taken at an international level. As a first step towards a global solution for aviation, it is to be included in the EU Emissions Trading Scheme (EU ETS) from 2012. From 2012, emissions from all flights arriving in and departing from European airports will

be capped at 97% of average 2004-06 emissions; from 2013, the cap will reduce to 95% of average 2004-06 emissions. Any emissions above this level would therefore either need to be abated by the aviation sector itself, or met through the purchase of emission reductions elsewhere within the EU ETS. Thus, in the presence of aviation's inclusion in the EU ETS there will be no growth in aviation emissions from 2004-6 onwards that would not be met with compensating reductions elsewhere in the EU emissions trading scheme.

3.1.39 Given the currently limited amount of cost-effective abatement potential in the aviation and shipping sectors, it may be less costly overall to achieve the additional reductions in other sectors of the economy, and for the aviation and shipping sectors to purchase allowances generated by these reductions. With aviation in the EU ETS from 2012, inclusion in parallel of aviation in the UK's targets could reduce the efficiency of the EU system, by restricting the ability of UK operators to trade. It is possible that inclusion of these emissions in the UK's targets would therefore only have the effect of requiring the UK to make further reductions in other sectors, as unused aviation allowances would merely be sold on for use elsewhere within Europe and overall emissions levels would remain the same.

Conclusion:

3.1.40 The Act requires that emissions from international aviation and shipping must be included in the targets by 31st December 2012 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 will need to take into account a range of factors, including advice from the Committee, the broader international context and the potential economic cost.

3.2 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

3.2.3 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.

3.2.4 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 complementarity", 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.

3.2.5 The Act provides the Government with powers 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.⁴⁷

3.2.6 The Committee advised on the appropriate balance of domestic emissions reductions versus financed emissions reductions overseas. In providing this advice, the Committee considered:

- 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;⁴⁸ 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:

3.2.7 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.

3.2.8 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.

3.2.9 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 negotiations on a global and comprehensive climate change deal, 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:

3.2.10 The principal disadvantage of purchasing emissions reductions credits is that it might encourage Government and firms to use overseas credits as a cheaper short-term option

⁴⁷ Although it is important to recognise that the existence of project credit markets beyond 2012 is subject to a subsequent international agreement

⁴⁸ Section 9.2 of the Synthesis of Analysis of the Energy White Paper 2007 www.berr.gov.uk/files/file39198.pdf

to reduce emissions. This may restrict the pace of decarbonisation of the UK economy and lead to higher mitigation costs in the long run.

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

3.2.12 Applying complementarity restrictions on all regions is expected to increase 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 complementarity restrictions, however, is ambiguous. While complementarity 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 complementarity limits reducing the demand for international credits (e.g. CDM). Applying complementarity limits would disadvantage developing countries as it would restrict their market and the extent of financial flows.

3.2.13 Scenarios where a complementarity 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 complementarity limits in signalling the long-run intentions of the UK to reduce emissions, for example.

3.2.14 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.

3.2.15 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.

3.2.16 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.

3.2.17 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.

3.2.18 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.

3.2.19 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

3.2.20 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, requires 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.

3.2.21 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.

3.2.22 The Act allows the Government to bank unused emissions rights for use in a successive period. The Government, under certain circumstances and to a limited extent, is also allowed to borrow budget allocations from the following period. The maximum permitted level of borrowing is 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.

3.2.23 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:

3.2.24 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.⁴⁹ 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.

3.2.25 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

⁴⁹ 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.

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).

3.2.26 The capacity to borrow helps 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;
- do so within a tight limit (1%) which would substantially reduce the risk of undermining the certainty provided by the carbon budgeting framework.

3.2.27 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:

3.2.28 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.

3.2.29 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 8 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).

3.2.30 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 8: 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 7 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 7: Impact of Borrowing on Probability of Meeting Illustrative Carbon Budget, 2008-12

Borrowing Rate	Probability of meeting 2008-12 budget
None	75%
0.50%	80%
0.75%	82%
1.00%	84%

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).⁵⁰ However, the overall 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

3.2.31 The Act 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.

3.2.32 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 prejudice future policy decisions surrounding the most appropriate instrument in each particular market and time period.

⁵⁰ Analysis conducted for the National Audit Office (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.

3.2.33 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.⁵¹ 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:

3.2.34 Previously, to introduce trading schemes in markets not covered by the EU-ETS, the Government would have been 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 have increased:

- 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).

3.2.35 Allowing the introduction of trading schemes across the economy through secondary legislation reduces the lead-time for implementing these policies, and 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 to establish the necessary powers requiring Government time and resources to prepare as well as Parliamentary time to approve.

3.2.36 Taking powers now reduces 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:

3.2.37 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.

3.2.38 The Act 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.

⁵¹The 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, NO_x and particulate trading scheme.

3.3 Provisions to enhance the reporting framework

Issue 9: Reporting of the UK's progress towards its carbon management objectives

3.3.1 The Act 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,⁵² 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:

3.3.2 Involving the Committee in the annual reporting process increases the independence and credibility of the reporting framework because:

- the Committee will 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.

3.3.3 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.

Costs:

3.3.4 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 2006.⁵³ 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.

3.3.5 There were previously no legal requirements on the Government to report on or monitor the risks of climate change and the progress the Government was making in adapting to these risks.⁵⁴ 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.

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

⁵² 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.

⁵³ Available from: www.opsi.gov.uk/ACTS/acts2006/20060019.htm

⁵⁴ 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.

- 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:

3.3.7 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:

3.3.8 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.

Issue 11 – Corporate Reporting of Greenhouse Gas Emissions

3.3.9 The Act places a number of requirements on the UK Government:

- Under Section 83, to publish guidance on the measurement or calculation of greenhouse gas emissions to assist reporting of such emissions by 1 October 2009;
- Under Section 84, to review the contribution that reporting on greenhouse gas emissions may make to achieving the Government's objectives on climate change and lay a report before Parliament by 1 December 2010 (the results of that review will be available ahead of a decision by the Secretary of State under section 85); and,
- Under Section 85, either to make regulations under the Companies Act 2006 for directors' report of a company to contain information on emissions as may be specified in the regulations, or to report to Parliament why no such regulations have been made.

Benefits:

3.3.10 The guidance on the measurement or calculation of greenhouse gas emissions will be developed through discussions with key stakeholders and will be the subject of public consultation in 2009. The aim will be that once the guidance is published it will represent best practice, and be practicable for businesses, whilst also driving environmental benefits, and as such will be adopted by companies on a voluntary basis.

3.3.11 The benefits of mandatory reporting are difficult to quantify, and there are none that can be monetised at present. Mandatory reporting requirements would force companies to measure their emissions, but the case that mandatory reporting helps companies reduce their emissions is currently not proven. The Government review by 1 December 2010, of the contribution that corporate reporting makes to the UK achieving its climate change objectives, will ensure that the benefits and costs of mandatory reporting are thoroughly examined prior to the introduction of any requirement.

Costs:

3.3.12 The specific requirements in the Climate Change Act do not introduce any new administrative costs on business/industry.

- 3.3.13 An impact assessment will be produced during the consultation stage for the guidance on the measurement or calculation of greenhouse gases in 2009. A further impact assessment, and a robust cost benefit analysis, will be produced prior to any introduction of regulations requiring mandatory reporting under section 416 (4) of the Companies Act.
- 3.3.14 The cost to the UK Government of producing the guidance is difficult to estimate and would depend on a number of factors: the scope of the guidance, the level of expert resource and stakeholder involvement necessary to develop workable guidance, and the level of agreement between parties. However, we would expect it to be in the region of £100,000 to in excess of £200,000. The administrative costs for this would be incorporated within existing Departmental budgets. Likewise, the cost of Government reviewing and reporting on the contribution that company reports make to the achievement of Government climate change objectives will be met within the Department's budget.
- 3.3.15 It has been assumed that there would be no additional costs to Government or to the Financial Reporting Council (the regulatory body) of monitoring voluntary reporting requirements.
- 3.3.16 The report on the Civil Estate Section will not result in additional costs to Departments. Departments are already required to provide information on properties they occupy to OGC through OGC's Electronic Property Information Mapping Service (EPIMS). The only additional costs to Government will fall on the Office of Government Commerce, which will be required to produce the State of the Estate Report. These costs are expected to be minimal.

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 37MtCO₂ of emissions in 2002. In addition, it identified a total cost effective abatement potential of approximately 7.9% (based on a 15% discount rate).⁵⁵
- 4.2 In delivering the statutory objectives of the Act, 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 enabling provisions of the Act do not place any costs on small businesses.
- 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 core elements of the Act do not provide for specific policies, so 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 Act.

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 Act.

7. Enforcement, sanctions and monitoring

- 7.1 The Act includes a number of checks and balances surrounding the proposed flexibility mechanisms in the framework, in order to ensure transparency and accountability. There is a requirement for the Government to report annually to Parliament on the level of UK 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), are subject to advice from the 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

⁵⁵ The Carbon Trust: "The UK Climate Change Programme: Potential evolution for business and the public sector". <http://www.carbontrust.co.uk/publications/publicationdetail.htm?productid=CTC518>

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 Act 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 The key milestones are as follows:
- the Committee on Climate Change laid a report before Parliament, recommending to the Government the level of the first three carbon budgets on the 1 December 2008;
 - 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 Act. 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.

Specific Impact Tests: Checklist

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

Annex A: Glossary of Terms and Abbreviations

Annex I Countries	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
BERR	Department for Business, Enterprise & Regulatory Reform (formally the Department of Trade & Industry)
CCPR	UK Climate Change Programme Review
Clean Development Mechanism (CDM)	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.
CO₂	Carbon Dioxide
CO₂e	Carbon Dioxide equivalent: an internationally accepted measure of Global Warming Potential (GWP) of greenhouse gases (GHGs). The CO ₂ e represents the amount of carbon dioxide with the same global warming potential (GWP), as a single ton of the GHG.
CRC	Carbon Reduction Commitment is a new mandatory cap and trade emissions trading scheme covering all energy use emissions from approximately 5,000 large non-energy intensive organisations with electricity consumption in excess of 6,000MWH per year through half-hourly meters.
EU	European Union
EU-ETS	European Union Emissions Trading Scheme
EWP	Energy White Paper
G8	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 and the EU Presidency if not one of the above.
GDP	Gross Domestic Product
Gleneagles Dialogue	Forum for participating countries (G8 plus Brazil, China, India, Mexico and South Africa) 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.
Global Warming Potential (GWP)	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.
IEA	International Energy Authority
IPCC	Intergovernmental Panel on Climate Change: A UN body set up to “ <i>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.</i> ” For further details please see: http://www.ipcc.ch/
IETA	International Emissions Trading Association
Joint Implementation	The project mechanism provided for under Article 6 of the Kyoto Protocol. These are projects undertaken in developed countries with targets which

(JI)	reduce emissions of greenhouse gases or enhance sinks.
Kyoto Protocol	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.
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 complementarity, CDM and JI.
ppm	Parts per million: measurement of atmospheric concentration of greenhouse gas.
Stern Review	A 2006 review led by Sir Nicholas Stern on the economics of climate change. See the Treasury's website - 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 B: Carbon Reduction Commitment Information Gathering Powers in the Climate Change Act

- B1. The Carbon Reduction Commitment is a new mandatory cap and trade emissions trading scheme covering all energy use emissions from approximately 5,000 large non-energy intensive organisations with electricity consumption in excess of 6,000MWH per year from half-hourly meters. In the Energy White Paper, Government announced that it would implement the scheme, starting in 2010.
- B2. The information gathering power (detailed in Schedule 4 of the Act) is necessary to begin identifying organisations covered by the scheme. Government has consulted on an identification process which requires energy suppliers to provide a list of all half-hourly meters settled on the half hourly market in the UK and their electricity consumption for 2008. The process also requires electricity users to collate their organisation's total electricity consumption from all 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 in late 2009. Relying on secondary legislation may, therefore, restrict Government's ability to identify participants in time for the scheme to start in April 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. Details of the CRC's associated costs and benefits were included in the updated Partial RIA, published in June 2007⁵⁶, and will be reviewed in March 2009.

⁵⁶ <http://www.defra.gov.uk/environment/climatechange/uk/business/crc/pdf/crc-partial-ria.pdf>

Annex C

Summary: Intervention & Options

Department /Agency: Defra	Title: Impact Assessment of Adaptation measures in the Climate Change Act	
Stage: Final	Version: 2	Date: December 2008
Related Publications: The Climate Change Act http://defraweb/environment/climatechange/adapt/index.htm		

Contact for enquiries: Defra helpline

Telephone: 020 7238 6000

What is the problem under consideration? Why is government intervention necessary?

A wide range of public services will be affected by climate change including, for example, health care, transport, education and resilience to flooding. Currently there is no overarching plan to ensure climate change risks are addressed in the UK and no standard for organisations to work to with regards efforts to address adaptation. Government intervention is necessary due to the presence of a 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 creating a National Risk Assessment, a national adaptation strategy, an Adaptation Sub Committee of the new Committee on Climate Change, and devising a strategy for directing public bodies and statutory undertakers to have regard to the need to adapt to climate change. This strategy will be supported by guidance. The intended effect is a substantial increase in the level of cost-effective adaptation action being taken forward.

The majority of measures listed above do not involve increased regulatory burden. The strategy for the reporting power and the statutory guidance may lead to regulatory burdens for public bodies and statutory undertakers and for this reason this impact assessment focuses on these measures.

What policy options have been considered? Please justify any preferred option.

Two approaches to the reporting power strategy have been considered - one using the provisions of the Climate Change Act, the alternative being the do nothing at this stage. The preferred 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 and statutory undertakers.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?

The impact of the reporting power will be reviewed in line with, and as part of, the adaptation programme to be set up under the Climate Change Act.

COSTS	ANNUAL COSTS		Description and scale of key monetised costs by 'main affected groups' Producing a risk assessment would entail costs of £1000-£3800 per organisation. There will be an additional burden 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. Producing the initial guidance will cost the government £50k.
	One-off (Transition)	Yrs	
	£ 50k		
	Average Annual Cost (excluding one-off)		
	£ n/a		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 may be incorporated into mainstream appraisal processes.			

BENEFITS	ANNUAL BENEFITS		Description and scale of key monetised benefits by 'main affected groups'
	One-off	Yrs	
	£ n/a		
	Average Annual Benefit (excluding one-off)		
	£ n/a		Total Benefit (PV) £ n/a
Other key non-monetised benefits by 'main affected groups': The power to request information from specific bodies will allow this to be effectively targeted and rigorously enforced where it matters most. The guidance for this power will be made publicly available. It is hoped it will become best practice and adopted more widely than just those organisations directed to adapt.			

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 complicated risk assessments, or to respond to SoS requests for information in complex cases.

Price Base Year 2005	Time Period Years n/a	Net Benefit Range (NPV) £ n/a	NET BENEFIT (NPV Best estimate) £ n/a
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What is the geographic coverage of the policy/option?	England			
On what date will the policy be implemented?	Nov 2009			
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)	Micro n/a	Small £200	Medium £200	Large £760
Are any of these organisations exempt?	Yes	No	No	No

Impact on Admin Burdens Baseline (2005 Prices)		(Increase - Decrease)	
Increase of	£ 368-1070 per body	Decrease of	£ 0 Net Impact £ 368-1070 per body

Key: Annual costs and benefits: Constant Prices (Net) Present Value

Evidence Base

Introduction

This Impact Assessment appraises the proposed measures in the Climate Change Act aimed at ensuring all public bodies and statutory undertakers 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. This includes directing certain public bodies and statutory undertakers to have regard to and produce reports on the measures they are considering for adaptation, in line with statutory guidance.

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. On current trends, global temperatures could rise by 2 - 3°C or more 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 of 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 technological progress, population increase 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.⁵⁸

⁵⁷ Cabinet Office (2005) Full Regulatory Impact Assessment for Part 1 of the Civil Contingencies Bill

⁵⁸ Defra (2004) Climate change impacts and adaptation: Cross Regional Research Programme - Climate change and water resources, <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=13232&FromSearch=Y&Publisher=1&SearchText=GA01076&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description>

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.

Rationale for 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 is 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 1: Rationale for intervention

Market failure	Description	Current policy response
Uncertainty and imperfect information	<p>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.</p> <p>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.</p>	<p>Currently UKCIP publish regional information on the likely impacts of climate change.</p> <p>Climate Change Act will require a five yearly review of the risks posed by the impacts of climate change to the UK.</p> <p>Option 2 will require public bodies and statutory undertakers to take into account this information.</p>
Externalities and public goods	<p>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.</p> <p>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.</p>	<p>Range of policies address adaptation issues but weaknesses exist (see below). Climate Change Act will require Government to publish an adaptation programme every 5 years.</p>
Moral Hazard	<p>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.</p>	<p>Lack of specific duty to take account of the impacts of climate change. Lack of clarity/guidelines about responsibilities.</p>
Misaligned incentives	<p>Decision makers may have short planning horizons and many of the actions required for efficient adaptation, such as making buildings more resilient 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.</p>	<p>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.</p>

Behavioural barriers	Climate change impacts are likely to be just one of many competing considerations for decision makers.	No requirement for decision makers to give adaptation the priority it needs.
Financial constraints	Many adaptation responses will require upfront investment and not all organisations may be able to access the required capital	No specific policies to address financial mechanism for funding adaptation measures.

Table 1 shows that because of a wide range of market failures, Government intervention is 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

This would not completely close off the options of taking action, as intervention could be pursued in the future outside of the Climate Change Act, 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: 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 the body in question to submit a risk assessment or similar and outline any policies/proposals to address the risks identified. The Government will produce guidance for public bodies and statutory undertakers to help them produce these risk assessments.

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 Act 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 development of the reporting power 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 and statutory undertakers 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 term of effectiveness, i.e. how much additional adaptation activity takes place as a result of the proposal.

Costs

Costs of developing statutory guidance

The development of the reporting power will be accompanied by statutory guidance, which will explain what is required under the reporting power, 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 reporting power 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 UKCIP's tools.

The UK Climate Impacts Programme (UKCIP) provide tools and information to help organisations to assess their need to adapt to Climate Change. UKCIP⁵⁹ suggest that the initial process of reviewing an organisation's vulnerability to current climatic variability, and identifying key risks posed by future climate change, can be done effectively in a half day workshop with relevant individuals from the organisation. 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.

⁵⁹ Personal communication

Table 2: Costs of undertaking an initial risk assessment

	Assumed number of person hours	Average hourly rate	Total cost per organisation
Small/Medium – e.g. local authority	8hrs x 6 people = 48	£21.01 (Senior officials in local government)	£1008.48
Large – e.g. Large Non-Departmental Public Body	8hrs x 12 people = 96	£38.77 (Senior officials in national government)	£3721.92

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 administrative 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.

However, these costs are expected to represent a low 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 or statutory undertaker.

Further work is being taken forward to assess the likely costs of complying with the reporting power for a selection of public bodies and statutory undertakers of various sizes and types. It should be emphasised, though, that the costs of undertaking the risk assessment are expected to 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, will be nil as they will not be asked to report.

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 and statutory undertakers 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

Under Option 2, the Secretary of State will have the power to request information from specific bodies under the reporting power. The cost of this work will be neutral as cost benefit analysis should ensure costs are counter balanced by savings made through avoiding or reducing climate change impacts. The extra costs imposed on the body of actually producing the report 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. This cost could rise considerably if there was significant further work required,

similarly if the body has already considered the risks presented by climate change the cost could be less than that predicted here. 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. 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 and statutory undertakers 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 and statutory undertakers 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 doing 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 reporting power strategy is taken seriously.

Additional benefits of a targeted response

Under Option 2, it is expected that the power will allow Government to focus on specific public bodies and statutory undertakers 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 and statutory undertakers that would undertake risk assessments in the absence of a direction to report - 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, there are over 28,000 public bodies and statutory undertakers to which it could apply, but it is expected that only a small proportion of these will be asked to report. **Further work on which, and how many, bodies are covered by the reporting power in this proposal is being undertaken through the work being done drawing up the strategy for use of the power, required under the Act within one year of Royal Assent.**

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

Table 3: Illustrative costs and benefits of the options relative to the do-nothing scenario

	Costs	Benefits
<i>Option 2</i>	<p>Costs of risk assessments (per organisation): £1000 – £3800 up front cost, which is equivalent to an annual cost of £200 – £760, assuming the process is repeated every year.</p> <p>In addition to this, there would be an additional burden in the region of £840-£1550 to the organisation and approximately £1550 to government for processing each request.</p> <p>Cost to government of approximately £50k to develop statutory guidance.</p>	<p>Raising awareness.</p> <p>Improving consistency. BY using the statutory guidance, reporting authorities will adopt a consistent approach to assessing risks.</p> <p>Government will be better informed about the risks of climate change, and the level of readiness of different reporting authorities.</p> <p>Net benefit of additional adaptation measures adopted: unknown, but definitely positive and could be substantial</p>

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 costs presented are likely to represent a lower bound, and could be substantially higher. However, the statutory guidance which accompanies the reporting power strategy 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 risk 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 reporting power strategy will make clear what is required to comply with that direction to

report, including an explanation of the risk assessment procedure. This should minimise the risk that bodies spend considerably longer than expected on meeting their direction to report.

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-effective⁶⁰.

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

Table 4: Risk Register

Risk	Mitigating actions
Costs could rise considerably if adaptation considerations are not factored into standard appraisal frameworks	Bodies need to ensure that the consideration of climate change adaptation is embedded into mainstream decision making to minimise the likelihood of this risk occurring.
The reporting obligation becomes a box-ticking exercise and risk assessments are not properly undertaken, hence benefits will not be realised	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.

Small Firms Impact Test

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

Competition Assessment

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

Enforcement, sanctions and monitoring

Under Option 2, the Government will have the option of requesting information from specific bodies to ensure compliance with the reporting power. 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.

There are two ways in which the reports could potentially be monitored:

- Defra will be laying the UK reporting strategy and adaptation programme before Parliament and these documents will be made publicly available. Reports produced by bodies asked to report will also be made publicly available. 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').

⁶⁰ Defra (2006) Climate Change Impacts and Adaptation: Cross Regional Research Programme - Quantifying the Costs of Impacts and Adaptation
<http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=13231#RelatedDocuments>

The NAO or other body 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 direction forms a part.

Specific Impact Tests: Checklist

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.

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

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.

Annex D

Summary: Intervention & Options

Department /Agency:	Title: Impact Assessment of powers to pilot local authority incentives for household waste minimisation and recycling	
Stage: Final	Version: 2	Date: December 2008
Related Publications: “Modelling the Impact of Household Charging for Waste in England” report for Defra by Eunomia Research and Consulting (December 2006)		

Available to view or download at:

www.defra.gov.uk/environment/waste/strategy/incentives/pdf/wasteince

Contact for enquiries: Samuel Thomas

Telephone: 0207 238 1036

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.

Summary: Analysis & Evidence

Policy Option:	Description:
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COSTS	ANNUAL COSTS	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).
	One-off (Transition) Yrs	
	£ 70m - 135m 7	
	Average Annual Cost (excluding one-off)	
	£ 50m - 60m	Total Cost (PV) £ 420m - 480m
Other key non-monetised costs by 'main affected groups' Across wider society more recycling could lead to significant additional time costs of householders sorting waste which would outweigh other net benefits. This will be revealed if householders do not respond to incentives as expected as at the household level incentives should compensate for incremental recycling effort.		

BENEFITS	ANNUAL BENEFITS	Description and scale of key monetised benefits by 'main affected groups': 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.
	One-off Yrs	
	£ none 7	
	Average Annual Benefit (excluding one-off)	
	£ 80m - £200m	Total Benefit (PV) £ 440m - £1.2bn
Other key non-monetised benefits by 'main affected groups'; There may also be amenity benefits associated with less waste treatment and movements, these will depend on the type and location of waste facilities.		

Key Assumptions/Sensitivities/Risks There may be distributional 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 Eonomia study and ranges in annex 2.

Price Base Year 2006	Time Period Years 7	Net Benefit Range (NPV) £ 0 - £750m	NET BENEFIT (NPV Best estimate) £ 285m
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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)	Micro None	Small None	Medium None	Large None
Are any of these organisations exempt?	No	No	N/A	N/A

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

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.
5. 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.
6. 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.
7. 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.
8. 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

9. 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.
10. 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.
11. 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

12. 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

13. 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

14. 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.
15. 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).
16. 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

17. 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.
18. 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

19. 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).
20. 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

21. Comparison of Options Bi, Bii, and C

22. 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

23. 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.
24. 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

25. 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.
26. The impact of incentives has been investigated through:
- 1) a Defra-funded research project⁶¹ 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:

27. 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.
28. 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

29. This proposal will affect local authorities that decide to pilot incentive schemes. Government will not compel any authority to pilot an incentive scheme.
30. 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.
31. 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.
32. 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

⁶¹ www.defra.gov.uk/corporate/consult/waste-incentives/index.htm

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.

33. 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.
34. 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.
35. 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).
36. 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.
37. 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.
38. 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.
39. 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.
40. 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 estimated financial costs and benefits to a representative local authority for a financial incentives scheme covering 50,000 households

One off cost increases	
<i>Included in Eunomia Report</i>	
Fleet management software	£0 - £5,000
Scanners	£0 - £3,000
Delivery and scanning of bins	£0 - £65,000
Start up call centre	£30000
Start up information provision (incl fly tipping)	£100000
Bin changes	£0 - £85,000
<i>Additional costs identified by Defra</i>	
Fly-tipping strategy/training/data analysis	£0 - £85,000
Annual operating cost increases	
Additional staff for implementation / queries	£24,000
Additional monitoring of fly-tips	£50,000
Billing costs	£16,000 - £280,000
Range of annual cost savings from reduced waste collection, disposal and treatment	
	£290,000 - £1.4m

41. 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

42. 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

43. 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).

44. 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.

45. 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:

- households 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.

46. 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 the 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 give 40 free pre-paid sacks to use over time.
47. 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.
48. 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.⁶² 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.⁶³ 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.⁶⁴
49. A study of waste arising in an English local authority area shows that a small number of households create a disproportionately large amount of residual waste.⁶⁵ 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.
50. Research shows no link between income and levels of waste generated⁶⁶. 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.
51. There is some evidence that levels of waste 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.

⁶² Open University (2005) The Open University Household Study, Factsheet No. 2: Working Out the Factors that Affect Household Waste Generation, www.defra.gov.uk/environment/statistics/waste/research/download/ou-fct02-20060621.pdf

⁶³ Welsh Assembly Government (2003) The composition of municipal solid waste in Wales. Report by AEA Technology, December 2003.

⁶⁴ Add reference to Flanders data

⁶⁵ Dresner and Ekins

⁶⁶ Newcastle 2004. SWAT: a tool to enhance the precision and compatibility of solid waste analysis data. Warner Bulletins, Issue 94, March 2004; Welsh Assembly Government (2003) The composition of municipal solid waste in Wales. Report by AEA Technology, December 2003; Parfitt J. R. Flowerdew and R. Pocock (1997) A review of the United Kingdom Household Waste Arisings and Compositional Data. Report produced for the Department of the Environment, May 1997

Time cost to society as a whole

52. 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

53. Greenhouse gases

54. 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.

55. The level at which the local authority sets 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.

56. Incentives have the potential to increase levels of recycling and home composting. Modelling in the Defra commissioned research project predicts that 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%.

57. 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.

58. 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 CO₂ 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

59. 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 with 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.

60. Fly-tipping

61. 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

62. 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 all 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

63. 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)

64. 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

65. 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 weighing technology required to facilitate these schemes would favour larger, incumbent providers.

Enforcement, Sanctions and Monitoring

Enforcement

66. 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.

67. 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

68. 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

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 or imprisonment. For more information see www.defra.gov.uk/environment/localenv/legislation/cnea/fixedenforcementnotices.pdf

behind in its waste payments. However in England authorities are under a statutory duty to collect waste. Government does not propose to change the law to allow any authorities to leave waste uncollected for long periods of time where householders have not paid or complied with a scheme.

Monitoring

69. The Government would fund a monitoring project to assess the progress of the pilots, especially any increase 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

70. 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 authority 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.

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

	Option C (relative to do nothing)
Annual net benefit to local authorities	£0.3m-£1.4m per authority
Annual net benefit to business	Not identified
Environmental impact	CO2 savings of £80k-340k per authority that takes up scheme Reduced disamenity value
Net benefit to households	Neutral
Net benefit to society	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

72. 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

73. 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.

Specific Impact Tests: Checklist

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.

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

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 ENCAMS 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 household 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 are likely to 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 prices⁶⁸. Initial set up costs are annualised and spread over the lifetime of the scheme throughout this analysis.
4. The greenhouse gas emissions analysis is based on the behavioural responses modelled in the same report and on the emissions factors presented in the impact assessment for the Waste Strategy for England 2007⁶⁹. Where increases in recycling are predicted it is assumed that the material collected will be in similar

⁶⁸ www.defra.gov.uk/environment/waste/strategy/incentives/pdf/wasteincentives-research-0507.pdf

⁶⁹ www.defra.gov.uk/environment/waste/strategy/strategy07/pdf/waste07-annex-a.pdf (see table A.28 for emissions)

proportion to those currently reported in municipal waste statistics⁷⁰. In the absence of better information and given an expectation that incentives could be associated with greater home composting of garden waste, it is 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 cannot 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 is 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 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, but 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 but 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).
9. The conservatively calculated social cost benefit analysis showed a net benefit to society of introducing household charging in all but 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

⁷⁰ www.defra.gov.uk/environment/statistics/waste/kf/wrkf16.htm

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.

2006/7 prices £m (except italics)	Sack-based				Bin Volume-based				Frequency-based				Weight-based				Weight and Frequency			
	a**	a	b	b	a	b	b	b	a	b	b	b	c	c	c	c	d	d	d	d
Estimated annualised impacts 2009/10																				
Financial costs of running scheme	£0.24	£0.40	£0.41	£0.38	£0.43	£0.50	£0.49	£0.44	£0.46	£0.53	£0.53	£0.49	£0.53	£0.53	£0.49	£0.53	£0.49	£0.53	£0.49	£0.49
Savings from lower collection, disposal and treatment costs (incl. landfill tax)	£0.57	£0.48	£0.29	£0.30	£0.90	£1.12	£0.65	£0.64	£0.74	£1.02	£0.53	£1.18	£0.53	£1.42	£1.38	£1.42	£1.38	£1.42	£1.38	£1.38
Savings from lower collection, disposal and treatment costs (excl. landfill tax)	£0.43	£0.34	£0.18	£0.19	£0.78	£0.96	£0.52	£0.51	£0.42	£0.60	£0.25	£1.15	£0.60	£0.98	£1.35	£0.98	£1.35	£0.98	£1.35	£1.35
Net annual financial savings to local authority as a result of scheme introduction (incl. landfill tax)	£0.34	£0.08	-£0.12	-£0.08	£0.47	£0.62	£0.15	£0.20	£0.29	£0.49	£0.01	£0.69	£0.49	£0.88	£0.89	£0.88	£0.89	£0.88	£0.89	£0.89
CO2 equivalent savings from increased recycling and composting (tonnes)*	2,656	3,510	2,332	2,683	2,396	2,750	1,357	1,600	7,145	8,790	4,183	-6,126	9,234	-6,301	9,234	9,234	-6,301	9,234	-6,301	-6,301
CO2 equivalent savings from waste prevention (tonnes)*	2,814	1,443	1,164	1,084	2,405	3,694	3,136	3,025	3,125	4,439	4,759	9,497	4,461	9,724	9,724	4,461	9,724	4,461	9,724	9,724
Annual value of carbon equivalent savings 2009/10*	£0.14	£0.12	£0.09	£0.09	£0.12	£0.16	£0.11	£0.11	£0.25	£0.33	£0.22	£0.08	£0.34	£0.08	£0.08	£0.34	£0.08	£0.34	£0.08	£0.08
Estimated discounted impacts 2009/10 to 2015/16																				
Present value cost of running scheme over 7 years [i]	£1.39	£2.39	£2.44	£2.25	£2.53	£2.93	£2.91	£2.58	£2.69	£3.15	£3.12	£2.88	£3.15	£3.15	£2.88	£3.15	£2.88	£3.15	£2.88	£2.88
Present value savings from reduced waste collection and treatment cost (incl. landfill tax) [ii]	£3.39	£2.84	£1.71	£1.78	£5.33	£6.62	£3.82	£3.76	£4.39	£6.01	£3.15	£6.98	£6.01	£8.37	£8.16	£8.37	£6.98	£8.37	£6.98	£8.16
Present value savings from reduced waste collection and treatment cost (excl. landfill tax) [iii]	£2.40	£1.85	£0.97	£1.03	£4.46	£5.50	£2.96	£2.89	£2.15	£3.16	£1.17	£6.73	£3.16	£5.38	£7.91	£5.38	£6.73	£5.38	£6.73	£7.91
Present value cost carbon savings expected over 7 years [iv]	£0.82	£0.75	£0.53	£0.57	£0.72	£0.97	£0.68	£0.70	£1.55	£1.99	£1.35	£2.06	£1.99	£2.06	£0.52	£2.06	£2.06	£2.06	£2.06	£0.52
Total net present value to society [iii - i + iv]	£1.83	£0.20	-£0.95	-£0.65	£2.65	£3.54	£0.72	£1.01	£1.01	£2.00	-£0.60	£4.36	£1.01	£4.30	£5.55	£4.30	£4.36	£4.30	£5.55	£5.55
Range of financial savings to local authority [ii - i] ***	£2.00	-£0.73 - £0.45	-£0.91 - £3.69	-£0.04 - £4.1	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69	£0.91 - £3.69
Financial savings as a proportion of expenditure on waste	5%	-1.9% - 1.1%	2.5% - 10.1%	0.1% - 12.4%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%	15% - 16.6%

* 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. The following section considers a distributional analysis as described in the Treasury Green Book guidance on policy and project appraisal⁷¹. 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 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 Ekins⁷², 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 weight receiving more than £50 back, and those households producing waste above the mean 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.
5. Distributional weights were derived using net equivalised income data from the Family Resources Survey 2005-06⁷³ and applied to the net impacts associated with the weight based charging structure. The results show that,

⁷¹ <http://greenbook.treasury.gov.uk/annex05.htm>

⁷² www.psi.org.uk/docs/rdp/rdp20-dresner-ekins-waste.pdf

⁷³

www.dwp.gov.uk/asd/hbai/hbai2006/excel_files/chapters/chapter_2_excel_hbai07.xls#'2.3!A1

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.

Table 2.2 Net equivalised disposable income (£) per week

£per week equivalent 2005/06 prices including the self-employed, before housing costs										Source: FRS 2005/06		
	Mean	Median	50% mean	60% median	Bottom quintile	Second quintile	Middle quintile	Fourth quintile	Top quintile			
1	297	242	148	145	< 152	152-210	211-279	280-384	385+			
2	443	362	222	217	< 226	226-313	314-416	417-573	574+			
3	532	434	266	260	< 272	272-375	376-499	500-688	689+			
4	678	554	339	332	< 346	346-479	480-637	638-877	878+			

Table 2.3 Distributional weights using net equivalised income

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

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

Household size	Bottom quintile	Second quintile	Middle quintile	Fourth quintile	Top quintile	Average	Net impact for 50,000 household authority
1 Single with no children	-£89.66	-£37.65	-£27.81	-£20.52	-£17.70	-£43.91	-£13.55
2 Couple with no children	-£18.77	-£7.87	-£5.81	-£4.29	-£3.70	-£9.19	-£3.52
3 Single with two children aged 5 and 14	£61.54	£25.87	£19.13	£14.09	£12.15	£30.16	£4.81
4 Couple with two children aged 5 and 14	£72.31	£30.33	£22.40	£16.51	£14.25	£35.39	£4.89
							-£7.36
							-£367,953.13

Annex E

Summary: Intervention & Options

Department /Agency: Defra	Title: Partial Impact Assessment of powers to require charges for single-use carrier bags	
Stage: 1	Version: 2.4	Date: December 2008
Related Publications:		

Contact for enquiries: Daniel Dipper

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What is the problem under consideration? Why is government intervention necessary?

The number of single-use carrier bags (13 billion in 2006) distributed every year. Single-use carrier bag use is indicative of consumers' behaviour towards the environment; action on this issue may act as a catalyst for wider changes in preferences for environmental goods. Waste minimisation of carrier bags will also address a number of negative environmental externalities. Plastic bags contain embodied carbon and biodegrade slowly, leading to disamenity impacts through poor local environmental quality and dangers to marine life when littered. Paper and other biodegradable bags produce the greenhouse gas methane when landfilled.

The Government is committed (Waste Strategy 2007, Prime Minister's November 2007 speech) to phasing out (free) single-use carrier bags. Yet the Government has been unable to orchestrate a sufficient response to public demand for a huge reduction in carrier bag usage. Government intervention is needed because retailers are unlikely to be able to achieve this themselves without resorting to charging for bags – and their ability to do this collectively is impeded by competition law. Responding to public demand in this way will build trust in the Government's other environmental programmes as well as leading to beneficial behaviour change by consumers.

What are the policy objectives and the intended effects?

To be able to force retailers to take sufficient action if they cannot do so on a voluntary basis.

The intended effects are a drop of at least 70% in the numbers of bags distributed, accompanied by behaviour change to favour reusable bags. As well as the direct environmental effects (less litter, less harm to marine life, fewer emissions from transport and waste management), the measure is also expected to catalyse other environmental benefits including increased participation in recycling by consumers.

What policy options have been considered? Please justify any preferred option.

- (i) No further action on bags once the existing voluntary agreement with retailers expires at the end of 2008;
- (ii) To try and negotiate a stronger successor agreement without taking reserve powers to force retailers to charge;
- (iii) To take powers to charge and use their existence to motivate stronger voluntary action by retailers, with compulsory charging as a fallback if this does not work (our preferred option);
- (iv) To take powers to charge and introduce these immediately without trying for a further voluntary agreement;
- (v) A mandatory ban on all carrier bag distribution. As well as being disproportionate, this would almost certainly be illegal under EU law.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? Six months after Royal Assent, we will review whether these new powers are having the desired effect. Any regulations introduced as a result of that review will themselves be subjected to further impact assessment.

Summary: Analysis & Evidence

Policy Option: 3 **Description: Govt taking powers to force retailers to charge for single-use carrier bags**

COSTS	ANNUAL COSTS		Description and scale of key monetised costs by 'main affected groups' – the costs will depend upon the nature of any legislation and estimates will be set out more fully in the IA accompanying any consultation, which would be carried out before any regulation. A charging scheme would lead to some retailer transition costs – though to be in the region of £20m (one-off). Under such a scheme, a lower net demand for bags (having taken into account switching to bin liners and multiple use bags) will lead to a reallocation of resources away from the UK bag industry with attendant impacts on revenue and jobs in the sector. Retailers would reduce their costs through the supply of fewer bags. Enforcement costs would be borne by Trading Standards (thought to be in the region of £0.1m p.a.). A media campaign (perhaps costing £2m) would be needed to maximise the desired behaviour change and avoid some of the unintended consequences
	One-off (Transition)	Yrs	
	£ 22m (if powers taken up)	1	
	Average Annual Cost (excluding one-off)		
	£ £0.1m	30	Total Cost (PV) £ 23.9m (if powers taken up)
Other key non-monetised costs by 'main affected groups' – hassle costs to consumers (to remember to carry multiple-use bags), which may dissipate over time, and time costs, which will not. With a charging scheme there would be some distributional effects, with a monetary transfer from consumers to producers (and perhaps from producers to environmental charities) equivalent to the size of the charge multiplied by the number of bags sold.			

BENEFITS	ANNUAL BENEFITS		Description and scale of key monetised benefits by 'main affected groups' - the benefits will depend upon the nature of any legislation and estimates will be set out more fully in the IA accompanying any consultation. A charging scheme would lead to carbon benefits from waste minimisation owing to the reduction in the number of plastic bags: a first guess range of estimates of these has been identified here, assuming a 70% reduction in bags offset by increases in sales of bin liners and bags for life (reducing the carbon savings to perhaps between 10% and 50% - the range used here). Further carbon benefits could be realised through reductions in methane from landfilled paper bags. Lower net demand for bags will reduce costs to retailers.
	One-off	Yrs	
	£ n/a		
	Average Annual Benefit (excluding one-off)		
	£ 10m	30	Total Benefit (PV) £ 85m - £239m (if powers taken up)
Other key non-monetised benefits by 'main affected groups' - increase in waste awareness; potential catalytic effect on environmental preferences of society; improved local environmental quality through less litter; reduction in the risk of environmental damage to marine life.			

Key Assumptions/Sensitivities/Risks The key risk is that of inaction. Taking powers is much less risky than failing to do so and proving unable to implement a policy to which the Prime Minister, the Chancellor and other senior Ministers have pledged strong personal support. The assumptions on substitution of bin liners and "bags for life" for single-use carrier bags needs to be investigated further for the consultation IA since it provides the large range of benefits presented here.

Price Base Year 2007	Time Period Years 30	Net Benefit Range (NPV) £ 61m - £237m	NET BENEFIT (NPV Best estimate) £ 138m (if powers taken up and assuming midpoint of carbon benefits)
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What is the geographic coverage of the policy/option?		England, Wales and N Ireland	
On what date will the policy be implemented?		Royal Assent CC Act	
Which organisation(s) will enforce the policy?		Trading Standards	
What is the total annual cost of enforcement for these organisations?		£ 100,000	
Does enforcement comply with Hampton principles?		Yes	
Will implementation go beyond minimum EU requirements?		Yes	
What is the value of the proposed offsetting measure per year?		£ 0	
What is the value of changes in greenhouse gas emissions?		£85m to £239m	
Will the proposal have a significant impact on competition?		No	
Annual cost (£-£) per organisation (excluding one-off)	Micro	Small	Medium
Are any of these organisations exempt?	N/A	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)		(Increase - Decrease)	
Increase of	£ Small	Decrease of	£ 0
Net Impact		£	Small

Key: Annual costs and benefits: (Net) Present Value

Background

There is good evidence for the direct environmental benefits of reducing bag use, and this is summarised below. Evidence is also available – from Ireland, and from the trials of bag charging by Marks and Spencer – as to the sensitivity of the public to the level of any bag charge, and from work undertaken by AEA Technology Ltd for the Scottish Executive on the impacts on retailers and industry.

The primary driver for measures to limit bag distribution, however, is the importance this has in public opinion as a measure of the Government's seriousness about this and other environmental issues. Quantifying this trust effect in an impact assessment is not straightforward.

A second important driver is behaviour change. Reducing the supply of bags can increase beneficial behaviours in other closely related areas as, for example, people who start to reuse bags rather than take a fresh set each time they shop also start to recycle more. Work by WRAP has captured this effect.

While the evidence below concentrates on the most measurable impacts – good and bad – of potential intervention on bags, these less tangible but potentially much greater benefits should be born in mind.

Main options

There are a number of possible options that we have considered in tackling the issue of single-use carrier bags. In terms of level of intervention, the hierarchy of options is roughly -

1. No further action on bags once the existing voluntary agreement with retailers expires at the end of 2008 (the current position);
2. To try and negotiate a stronger successor agreement without taking reserve powers to force retailers to charge;
3. To take powers to charge and use their existence to motivate stronger voluntary action by retailers, with compulsory charging as a fallback if this does not work (our preferred option);
4. To take powers to charge and introduce these immediately, without trying for a further voluntary agreement;
5. A mandatory ban on all carrier bag distribution. As well as being disproportionate, this would almost certainly be illegal under EU law.

A summary of our considerations on these options is outlined below.

1. No further action on bags once the existing voluntary agreement with retailers expires at the end of 2008.

A number of major retailers and trade associations⁷⁴ signed a UK-wide voluntary agreement with WRAP and the Government in February 2007, in which the retailers committed to reducing the environmental impact of the single-trip bags they distribute by 25% by the end of 2008.

The voluntary agreement was conceived as a first stage. Its success was measured informally by WRAP at a stocktake meeting at the end of February, and formally at the end of 2008. There has been some significant retailer response - Tesco have told WRAP that they have achieved their target one year early (which demonstrates the scope for more ambition); and Marks & Spencer have rolled a 5p per food bag charge out nationally, following successful pilots in Northern Ireland and the South West.

However, the existing voluntary agreement relates only to the direct environmental impact of carrier bags, whereas the Government now wishes to capture other benefits which are only associated with reducing the numbers of bags. Under the current agreement, it is possible for retailers to meet the 'impact' target with minimal reductions in bag numbers. These benefits are primarily the hard-to-quantify trust and behaviour change ones mentioned above.

2. To try and negotiate a stronger successor agreement without taking reserve powers to force retailers to charge

The Government could try to come to a new voluntary agreement with retailers for a much greater reduction in the numbers of bags than hitherto. In order to deliver benefits on the scale the Government expects, such an agreement would have to be for a reduction of at least 70% from the 2007 baseline, or over 9 billion bags.

However, there is a strong risk that such an approach would not work, for two reasons:

First, retailers are likely to be unwilling to sign up to such an ambitious target without the threat of legislation. Ministers were not able to secure a commitment from them to a 50% reduction in environmental impacts (much easier to achieve than a 50% reduction in bags) when the original agreement was negotiated in early 2006.

Secondly, even if retailers were willing to sign up to such a target, there is a risk that they would be unable to deliver it. This is because the only instrument which has so far been proven to achieve such deep reductions in bag consumption by consumers is charging (eg the Irish tax, or Marks and Spencer's experience with their charge). But retailers would find it extremely difficult to introduce charging en masse, owing to the difficulties of reaching an agreement which did not infringe competition law. Office of Fair Trading have advised that any voluntary action where retailers co-operate to agree how to deal with the price of single-use bags could be interpreted as 'price-fixing' and in breach of competition law.

Any national agreement by retailers to charge a minimum price – even one requested by the Government itself – is likely in principle to be anti-competitive. For such an agreement to be permitted, it would either need to demonstrate exemption from the Competition Act prohibition on cartels by satisfying certain economic criteria, or be specifically exempted by BERR as being in the overriding public interest.

⁷⁴ ASDA, Boots The Chemist Ltd, Co-operative Group, Debenhams, DSG Retail Limited (Dixons, Currys and PC World), Early Learning Centre, E H Booths and Co Ltd, Halfords Plc, Home Retail Group (Argos and Homebase), John Lewis Partnership (John Lewis and Waitrose), Marks & Spencer, The Musgrave Group Plc, Next Group Plc, Primark Stores Ltd, Sainsburys Supermarkets Ltd, Somerfield Group, Spar (UK) Ltd, Tesco, Travis Perkins (Wickes), United Co-operatives Ltd, Wm Morrison Supermarkets Plc, Association of Convenience Stores, British Retail Consortium, Federation of Small Businesses Scotland, NIIRTA (Northern Ireland Independent Retail Trade Association), Packaging and Industrial Films Association, Scottish Grocers Federation

To be statutorily exempt, an agreement would need to fulfil four cumulative criteria. These criteria rely very heavily on economic considerations, and include both the need to prove that the agreement is necessary to achieve its stated ends, and that consumers would receive a fair share of the resulting benefit. Designing a voluntary agreement which meets these criteria may be possible, but will require a great deal of detailed work, including external legal advice, to minimise the risk of successful challenge.

Another potential route for exemption is that the Competition Act provides for the Secretary of State from BERR to make an exclusion from the Act's prohibition of anti-competitive arrangements. Such exclusions can only be made where there are "exceptional and compelling reasons of public policy". It is worth noting that only two such exclusions have been provided to date (both for defence-related matters) and any UK exclusion order would not disapply the prohibition under the EC Treaty of any agreement that might have an effect on inter-state trade.

Without reserve powers to force charging in place, we do not believe that retailers will be able to obtain a 70% (or greater) reduction in the number of single-use bags distributed (which we could expect from introducing a minimum charge) on a voluntary basis. It is even possible that retailers may need to ask the Government to use its proposed powers, if they are to avoid difficulties with Competition law.

For these reasons, we reached the conclusion that the prospects of any voluntary ban would be increased significantly if backed up by a legislative, mandatory contingency.

3. To take powers to charge and use their existence to motivate stronger voluntary action by retailers, with compulsory charging as a fallback if this does not work (our preferred option)

Our preferred option.

The proposal would be to make, by regulations, a requirement for retailers of certain descriptions to charge customers for every bag supplied, subject to certain exceptions. The point of this proposal would be to change consumers' behaviour by ensuring that they have to pay a small – but meaningful - charge every time they accept a single-use bag.

As announced in the Budget, retailers would have the opportunity to pursue a substantial reduction on a voluntary basis, but with the knowledge that we are bringing forward contingency powers if they are not. This is a challenge that was re-stated at the 'forum of the supermarkets' on 7 May 2008.

In this way, we would aim to use the existence of powers as a means of incentivising further and much more radical action by retailers than is currently the case under the present purely voluntary scheme. We would only wish to employ the powers if it was clear that sufficient progress was not going to be made on a voluntary basis.⁷⁵

Scope - bags

The kind of bags included in the charging scheme would be defined in secondary legislation by reference to both the purpose of the bags and their size / thickness. Appropriate exemptions, such as small bags used to contain unpacked food, or sealed bags used for packaging goods before they were offered for sale, would be provided for. Clearly, these decisions – and those

⁷⁵ The Irish levy saw an over 90% reduction in the number of plastic bags of distributed. However, the Irish levy allowed for substitution of plastic for paper bags. As such, we believe that we could achieve around a 70% reduction in the number of single-use bags distributed in England, if a charge was brought in (9.1bn fewer bags distributed).

on scope below – would have a significant impact on costs. As such, they will be subject to a further Impact Assessment.

Scope - retailers

In terms of which retailers would be selected, we are primarily focussed on large supermarkets, who distribute the vast majority of single-use carrier bags. Retailers falling within the scope of the powers would thus be defined (most likely by square footage) in secondary legislation.

We believe that the costs to retailers of adapting to charging in this way would be modest – we have estimated £20m across all supermarkets for such things as adapting tills and accounting for revenue. We will discuss these estimates with retailers before exercising the powers, and refine them if necessary.

Cost

While the option to introduce legislation which requires retailers to charge for single-use carrier *could* be limited to simply a requirement to charge (e.g. they could apply a minimum charge of 1p, or a fraction of a penny), we have concluded that it would be sensible to specify a minimum price (otherwise a negligible amount – a penny or a fraction of a penny – could be set by retailers).

The Irish experience with their levy indicated that the charge is probably best introduced at 10p. We would seek the power to vary the minimum charge by secondary legislation (the Irish raised their environmental levy from 15c to 22c from July 2007, when it was found that plastic bag usage had risen in 2006).

Revenue raised

The revenue raised by the charge will need to be clearly accounted for. While we recognise that the introduction of a charge would have a knock-on effect on retailers, we would want to consult about the case for including the requirement in secondary legislation to ensure that they keep, and make available to the public, records of the number of bags sold and the revenue raised, in order to make it clear where the money was going. We have allowed for the estimated costs of keeping such records.

We are investigating possible further ways of influencing how retailers spend net revenue from a bags charge. This is because public confidence could be damaged if retailers were thought to be profiteering. Possible candidates are a voluntary code of practice. As far as possible, we intend to rely on transparent accounting for net proceeds, and customer pressure on retailers, to ensure a fair result without the need for prescription.

Likely costs and benefits

Although these will be subject to exactly how (following consultation) a charge was brought in, an indication of what these might look like is set out below –

Sectors & Groups affected

The proposed charge would impact on:

- Consumers – who would have to pay the levy, unless they took legitimate steps to avoid it (such as re-using bags), and would also have to purchase alternative products to get their purchases home (e.g. bags for life) and to dispose of their waste (e.g. bin liners). To encourage behaviour change, we would require that the customer pay the levy – it would not be possible for retailers to absorb the cost.
- Retailers – who would have to collect the charge; and keep returns outlining bags provided, amounts collected, and where the money went. Most are likely to see their costs decrease (through buying fewer single-use carrier bags) and even increase as single-use bags are sold, and customers purchase more 'bags for life'.

- Manufacturers of carrier bags – who could expect to see demand for their product decrease. Most carrier bags used in the UK originate in the Far East, but there is a small, domestic manufacturing capability.
- The UK Government – who would run an information campaign and considered what advice would need to be provided. The UK Government would also need to notify the proposed charge to the European Commission under the Technical Standards Directive.
- Trading Standards – responsible for enforcing the charge – this would not be onerous, as we envisage a light tough enforcement regime, but it would create a new burden, which the Government will need to budget for.
- The voluntary sector – the Government would strongly encourage that revenue raised by the charge be passed on to environmental charities. They would therefore benefit from the introduction of the charge.

Benefits and Costs

- A reduction of around 70% in the use of single-use carrier bags – or 9.1 billion fewer bags (A reduction of 90% was achieved in Ireland, but there was some substitution of plastic for paper).
- An increase in waste awareness (including messages about reducing waste).
- There were three reports published in 2008, including the Defra funded report Life Cycle Assessment of Biopolymers for single use Carrier Bags, which suggested that the embodied fossil energy of PRIMARY plastic film that is typically used for the ‘thin vest’ bags converts to 3.1kg of CO₂e. Assuming that single-use plastic bags make up around 0.3% of the municipal/domestic waste stream, and that, in 2006/7 household waste was: 25,855kt and so plastic bags made up 78kt of this and thus by not producing them AT ALL we could save: 241,000 tonnes of CO₂. At the current Shadow Price of Carbon (£26 per tonne of CO₂e, 2007 prices), and assuming that a 70% reduction in single-use carrier bags led to a 10% to 50% reduction in plastic in bags (after accounting for increases in sales of “bags for life” and bin bags), this equates to a potential saving of around £0.6m - 3m per annum. This however assumes that all current bags are made entirely of primary plastic made with fossil energy sources and so it is likely to be an overestimate. More analysis will be needed for a fuller IA for a consultation on any uptake of powers.
- Based on An Australian Study, Friends of the Earth Scotland estimate that the energy embodied and consumed in the manufacturing process of a typical single high density polyethylene bag is 0.48MJ per bag (with 8.7 bags equivalent to driving a car 1km). A reduction of 9.1 billion carrier bags would be the equivalent of around 1.05 billion car kilometres.
- The (relatively small) carrier bag manufacturing industry in the UK would be affected. We have assumed a loss of £3.4m on the basis that – 9.1 billion fewer bags will be bought, 9.1 billion bags costs approximately £68 million, and assuming that 5% of the bags distributed originated in the UK (the vast majority of our bags are from overseas).
- The large food retailers would make a saving from reducing their free supply of carrier bags to customers. 1,000 bags cost £7.47 (average) – this suggests that a reduction of 9.1 billion carrier bags would equate to a saving of nearly £68 million. Increased sales of ‘bags for life’ and bin liners could generate further annual income for retailers, although this is harder to quantify (In Scotland AEA Technology estimated that use of ‘bags for life’ and bin liners in Scotland (estimated at 8 million and 118 million respectively) would increase after the introduction of a levy (to 23 million and 208 million).
- Retailers would have to keep a record of number of bags distributed, revenue raised, and where it went. The first two could be integrated into the check-out tills (simply scanning a bar code off a bag), so we would expect these administrative costs to be negligible, and more than off-set by the money raised by the charge. Similarly, the one-off cost of updating till lines, tills, and security measures to take account of the charge, would be small.
- The charge would not impact on large non-food retailers or SMEs, as we do envisage them being within the scope of the charge (although, obviously, this is subject to consultation).

- Environmental charities would benefit from money raised by the charge – which could equal around £120 million a year if rolled out across the UK (In Ireland, revenue from the levy is around €12 million a year. With a population of 4m, this equates to 80 million bags a year sold. With a population of 60 million, the UK could be expecting to be selling around 1.2 billion single use bags a year. If the charge was set at 10p, this would equate to £120 million a year).
- There would be a small additional burden on Trading Standards Officers. We have attributed £100,000 p.a. to this – on the basis of 20,000 affected premises, on which TSOs must spend 10 minutes a year inspecting each, at a rate of £30 per hour.

Unintended Consequences

A media campaign will be necessary to maximise the desired behaviour change and avoid unintended consequences of a charging policy. These include:

- Excessive buying of “bags for life” to avoid embarrassment of buying single-use bags in public
- Buying of single-use bags because the money is perceived to go to good causes
- Consumers thinking they have “done their bit” for the environment by using multi-use carrier bags

4. To take powers to charge and introduce these immediately, without trying for a further voluntary agreement.

Similar to Option 3, only the powers would be implemented straightaway, without providing retailers with the opportunity to make further progress on a voluntary basis.

This would be a somewhat draconian approach, and would be seen as undermining the progress made on a voluntary basis to date. It would also contradict the announcement made in the Budget, and the messages in support of further voluntary action which were passed on to retailers and retail groups at the supermarkets forum on 7 May 2008.

5. A mandatory ban on all carrier bag distribution. As well as being disproportionate, this would almost certainly be illegal under EU law.

A mandatory ban is highly likely to be illegal under EU law. Carrier bags fall under the Packaging and Packaging Waste Directive. The Directive lays down requirements on the composition of packaging; its reusable, recoverable and recyclable nature; and limits on it containing heavy metal concentrations. Article 18 of the Directive states that Member States shall not impede the placing on the market of packaging that satisfies the Directive requirements. A ban would fall foul of Article 18.

In February 2007, a proposal from France to ban non-biodegradable bags was considered likely to be contrary to the Directive by the European Commission and other Member States, including the former DTI on behalf of the UK (which has lead responsibility for the Directive).

Although the recent London Local Authorities (Shopping Bags) Bill proposed a ban on single-use carrier bags in London, Defra officials have consistently advised them that this is highly likely to be illegal under EU law.

As such, we have concluded that a mandatory ban was not an option worth pursuing. It would, in any event, be a disproportionate measure since it would – by definition – preclude retailers

from providing bags to customers who have forgotten to bring a reusable one, forcing them to buy a more expensive bag in store.

Conclusion

There are difficulties inherent in any of the potential measures to phase out free single-use carrier bags, and the voluntary actions of retailers and the public will continue to play a valuable role. However, these means could be underpinned most usefully by taking forward legislation for reserve powers to require a minimum price per bag.

The impacts of the detail of this proposal will be explored more fully in the context of a consultation on secondary legislation.

Specific Impact Tests: Checklist

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.

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

Annexes

Competition Assessment

Would the regulatory proposal:

- Directly limit the number or range of suppliers? No. The proposal would not prevent any retailers, even those within the scope of the charge, to supply single-use carrier bags – it would simply require a minimum charge to be applied. There is no award of exclusive rights to supply, no procurement from a single supplier or a restricted group of suppliers, no creation of a form of licensing scheme, and no fixed limit on the number of suppliers.
- Indirectly limit the number or range of suppliers? No. We do not believe that the proposal would significantly raise the costs of suppliers who were under the scope of the powers – it is more likely to increase profits (as they would be charging for something previously given away for free) – although the revenue raised would not be significant, and is highly likely to be passed on to good causes. The proposal would not significantly raise the costs of new suppliers relative to existing suppliers (who would either be outside the scope of the charge, or subject to the same charging regime as comparable suppliers in their sector), and it would not significantly raise the costs of entering, or exiting, the affected market. Small businesses are unlikely to be within the scope of the proposed charge, and are unlikely to be impacted on disproportionately.
- Limit the ability of suppliers to compete? No. The proposal *would* control the price certain retailers could charge for a particular product (a single-use carrier bag). However, it does so for a product ordinarily given away free, and in such a way as to create a 'level playing field' across the major grocery retailers. It limits the scope for innovation to introduce new products or supply existing products in new ways only in the sense that any product which is defined as a 'single-use carrier bag' in relation to the secondary legislation will still be subject to the charge. The proposal does not limit the sales channel a supplier can use, or substantially restrict the ability of suppliers to advertise their products.
- Reduce suppliers' incentives to compete vigorously? No. The proposal does not exempt suppliers from general competition law. It does not increase the costs to customers of switching between supplier (the charge is an optional one, and one which will be common across the major retailers). The proposal *would* require the publication of information on how many bags were distributed, how much money was raised, and where it went.

Small Firms Impact Test

The impact the proposal would have on small firms is entirely subject to the way in which it is codified and implemented – which is subject to formal consultation. If we were to take the approach set out in Option 3 of the above Impact Assessment, this proposal would primarily focussed on large supermarkets, who distribute the vast majority of single-use carrier bags. As such, it is unlikely that the proposal would affect significantly small businesses, their customers, or competitors.

Legal aid

We do not consider the proposal to have any legal aid implications, as it would only be creating a criminal sanction (for those supplying single-use carrier bags for under the prescribed amount) that could be committed by firms, who do not receive legal aid.

Sustainable Development

As outlined above, the proposal contributes helpfully to the five principles of sustainable development – in particular, living within environmental limits, by encouraging a less wasteful society.

Health Impact Assessment (HIA)

The proposal would not have any negative effect on health and well-being. Disamenity impacts through poor local environmental quality are likely to be alleviated by the proposal, as there is likely to be reductions in littering.

Race equality

The proposal would not have any impact on race equality.

Disability equality

The proposal would not have any consequences for disability equality. We do not feel that any opportunity for greater positive impact in this area has been missed or could have been better exploited. The proposal would not lead to any actual or potential negative impact for disabled people.

Gender equality

The proposal would not have any impact on gender equality.

Human Rights

The only potential human rights issue connected with this proposal would be if it the Government decided to direct where the revenue raised by the charge needed to go – this could raise issues around expropriation of retailer income. This would need to be explored if the Government pursued the proposal on this basis.

Rural Proofing

We do not consider this policy likely to have a different impact in rural areas, or on particular rural circumstances or needs.

Annex F: Impact Assessment for RTFO Provisions in the Climate Change Act

- F1.** The Renewable Transport Fuel Obligation (RTFO) was introduced in April 2008 under the Renewable Transport Fuel Obligations Order 2007 which was made on 25 October 2007 to bring the scheme into effect. An Impact Assessment accompanied the Explanatory Memorandum for the order and can be viewed at:

www.opsi.gov.uk/si/em2007/uksiem_20073072_en.pdf

- F2.** Broadly speaking, the implementation of the RTFO provisions in Schedule [7] to the Climate Change Act will result in a net saving for transport fuel suppliers and for the Administrator of the scheme.
- F3.** Schedule [7] 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).
- F4.** The provision for an information sharing gateway with Her Majesty's Revenue and Customs (HMRC) reduces 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 will also reduce the amount of compliance and inspection work that the Administrator needs 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 is expected to have a negligible impact on competition.
- F5.** 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, this might occur 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.

- F6.** 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.
- F7.** The Act 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.
- F8.** The Act 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.
- F9.** The Act 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.

- F10.** The Act 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 G

Summary: Intervention & Options

Department /Agency: DECC	Title: Partial Impact Assessment of powers to oblige electricity generators and energy suppliers to deliver carbon emission reduction targets	
Stage: 1	Version: 2	Date: March 2009
Related Publications: CESP Consultation Document; CERT Uplift Consultation Document; Heat and Energy Saving Consultation Document; Climate Change Bill Amendment Impact Assessment		

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What is the problem under consideration? Why is government intervention necessary?

The Energy White Paper (2007) set out the long-term energy challenges we face, which include reducing carbon emissions, and ensuring affordable energy. These two challenges can be tackled together through energy efficiency improvements to existing homes. Government intervention (e.g. obligations on energy suppliers to reduce domestic carbon emissions) has begun to address this. However, barriers remain in hard to treat homes and in low income areas, contributing to fuel poverty and hindering emissions reductions. In these circumstances, there are barriers to implementing energy efficiency measures for householders (lack of capital, awareness, hidden costs, etc) and energy suppliers (who tend to focus on least costly measures under current obligation).

What are the policy objectives and the intended effects?

The Community Energy Savings Programme has the twin objective of significantly reducing the fuel bills of some of those living in deprived areas (proposed to be defined as Super Output Areas in bottom decile of the income domain of the Indices of Multiple Deprivation); and contributing to the improvement of the energy efficiency of the existing housing stock in order to reduce the UK's carbon emissions.

What policy options have been considered? Please justify any preferred option.

Option 1 – Do nothing Do not introduce any amendments to the Climate Change Bill, leaving only the existing obligation on energy suppliers to be delivered under CERT.

Option 2 – New Obligation (as exercised): Amendments introduced to the Climate Change Bill taking powers to place carbon emissions reduction obligations on electricity generators and energy suppliers, and to specify obligations by area.

More detailed options for the ways in which the powers might be used are considered in the Impact Assessment accompanying the CESP consultation document, published on 12 February.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? The policy will be reviewed at the end of the programme period. Interim reports will be made available during the programme period.

Summary: Analysis & Evidence

Policy Option: 2

Description: New Obligation– preferred option

COSTS	ANNUAL COSTS		<p>Description and scale of key monetised costs by ‘main affected groups’</p> <p>The costs will depend upon the nature of the secondary legislation, and estimates are set out in the IA accompanying the CESP consultation. However as an indication the Government has described the programme as likely to involve targets broadly equating to £350m of expenditure on measures. Costs to the energy companies may be passed on, in whole or part, to their customer base in the form of higher prices.</p>
	One-off (Transition)	Yrs	
	£		
	Average Annual Cost (excluding one-off)		
	£ 130m		Total Cost (PV) £ 363m
<p>Other key non-monetised costs by ‘main affected groups’</p> <p>Individuals may face some household disruption in the installation of some of the measures. Depending on the design of the scheme there could be effects on competition within the energy market, for example potential deterrence of new entrants, unless mitigating steps were taken.</p>			

BENEFITS	ANNUAL BENEFITS		<p>Description and scale of key monetised benefits by ‘main affected groups’</p> <p>The benefits will depend upon the nature of any secondary legislation and estimates are set out more fully in the IA accompanying the CESP consultation. A new carbon emissions reduction obligation should lead to quantifiable carbon benefits from improved energy efficiency within the existing housing stock. Households who receive measures under the programme should also see a reduction in their fuel bills.</p>
	One-off	Yrs	
	£		
	Average Annual Benefit (excluding one-off)		
	£ 34m		Total Benefit (PV) £ 734m
<p>Other key non-monetised benefits by ‘main affected groups’</p> <p>A new carbon emissions reduction obligation might encourage the energy efficiency market to grow in light of presumed greater interest by generators and suppliers. Depending on the design of the scheme, the community focus may also encourage greater collective engagement and action at local level.</p>			

Key Assumptions/Sensitivities/Risks: The key risk is that of inaction.

Taking powers is much less risky than failing to do so and proving unable to implement a policy to which the Prime Minister and other senior ministers have pledged strong personal support. Other risks, such as possible barriers to entry in the generation and supply markets and the impacts on competition, are discussed in more detail within the CESP IA.

The CESP Impact Assessment discusses a range of options for making use of the powers. The cost/benefit figures above represent the mid-range option.

Price Base Year 2009	Time Period Years 3	Net Benefit Range (NPV) £	NET BENEFIT (NPV Best estimate) £ 370m
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What is the geographic coverage of the policy/option?		GB		
On what date will the policy be implemented?		Not yet known		
Which organisation(s) will enforce the policy?		Ofgem		
What is the total annual cost of enforcement for these organisations?		£ Not yet known		
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?		£ Not yet known		
Will the proposal have a significant impact on competition?		No		
Annual cost (£-£) per organisation (excluding one-off)	Micro 0	Small 0	Medium 0	Large 0
Are any of these organisations exempt?	Will consult on a threshold			

Impact on Admin Burdens Baseline (2005 Prices)				(Increase - Decrease)
Increase of	£	Decrease	£	Net £

Key: Annual costs and benefits: Constant Prices (Net) Present Value

Evidence Base (for summary sheets)

Strategic Overview

The proposal by the Government to take powers to impose new carbon emission reduction obligations on energy suppliers and for the first time electricity generators, and to take powers to specify those obligations by area, comes in the context of other new provisions in the Climate Change Act.

Assessments of detailed proposals for the form of an obligation are set out in the Community Energy Savings Programme (CESP) Consultation Document, and the CESP Impact Assessment.

Background

The Climate Change Act 2008 sets out the Government's commitment to tackling Climate Change; this includes a commitment to reduce greenhouse gas emissions by at least 26% from 1990 levels by the year 2020 and 80% by the year 2050. Reducing emissions from the existing housing stock is an important aspect to this commitment.

The recent rises in energy bills have highlighted the need to find a way of delivering affordable energy to the existing UK housing stock.

The challenges of climate change and affordable energy can be addressed together, through improving the energy efficiency of the existing housing stock, to reduce both carbon emissions and fuel bills. Government intervention has begun to address this twin challenge, through the Energy Efficiency Commitment (EEC, EEC2) programmes, and the current Carbon Emissions Reduction Target (CERT) programme, which placed obligations on energy suppliers to promote energy efficiency measures in their customers' homes. These programmes have resulted in carbon and fuel bill savings for affected households.

However, barriers remain to the uptake of energy efficiency measures, especially in hard to treat homes and in low income areas. Households experiencing income deprivation are usually not in a position to financially contribute to the installation of carbon abatement measures, especially the more significant measures that tend to be more expensive. CERT tends to operate so that energy suppliers target households who are able to contribute a proportion to the financial costs of the carbon abatement measures available, and then work with them as a priority.

There is a need therefore to find a way of delivering significant carbon abatement measures, perhaps through a whole house approach, to homes in income deprived areas who may not currently be receiving help under CERT.

Main Options

Two different options were considered:

- No further action - Do not introduce any amendments to the Climate Change Bill or any new obligations on the generators and suppliers. This leaves only an obligation on energy suppliers to be delivered under CERT (the current position).
- New Obligations - Introduce amendments to the Climate Change Bill that take powers to place carbon emissions reduction obligations on electricity generators and energy suppliers, and to allow for the specification of the areas or types of areas where they should take place (the preferred option).

These options are considered further below.

Do nothing

By taking no further action there would be no additional change to reducing carbon emissions from the existing housing stock as a result of Government action. The CERT programme currently operates by delivering the highest CO₂ savings in the most cost effective way. This process means that houses in income deprivation areas that require significant carbon abatement measures are often not reached.

It should also be noted that there is a good deal of existing activity at community or area level, drawing on different sources of funding (for example, Warm Zones in several locations around the country), and this could be expected to continue in the absence of any new scheme. However, one of the policy intentions behind the new scheme is, precisely, to build on activity of this sort.

Impacts

The Government is committed to reducing the carbon emissions from the existing housing stock, and there is a risk that if no obligation is set, homes in income deprivation areas, which are often representative of the worst in terms of energy efficiency of the UK housing stock, may not be improved.

By choosing no further action towards obliging electricity generators and energy suppliers to act on introducing further measures, hard to treat houses in income deprivation areas would be unlikely to receive a comprehensive package of measures, and might not receive any measures unless and until more cost effective options for suppliers have been exhausted. There is thus a risk that those people who are in the greatest need of help, in terms of reducing their fuel bills through the installation of energy efficiency measures, will not receive it.

New Obligations

The legal basis for option 2 comes from the Climate Change Act 2008. The Electricity Act 1989 and the Gas Act 1986, as amended by the Utilities Act 2000 and the Climate Change and Sustainable Energy Act 2006, contain powers for the Secretary of State, by Order, to impose an obligation on electricity and gas suppliers to achieve carbon emissions reduction targets.

The Climate Change Act has now amended the Gas Act 1986 and the Electricity Act 1989 to:

- allow the Secretary of State to place an obligation on energy generators;
- allow the Secretary of State to place more than one obligation on energy suppliers and generators simultaneously; and
- allow the Secretary of State to specify the areas in which these obligations must be met.

These amendments allow the Secretary of State to place a new carbon reduction obligation on suppliers and generators in addition to that already placed on suppliers under CERT. This new obligation has essentially the same legal basis as CERT but would be implemented via separate secondary legislation.

Impacts

The following impacts have been considered in relation to the taking of powers to place an obligation on generators and suppliers, as has been done under the Climate Change Act. Specific impacts of particular policy choices as to how the powers could be exercised are assessed as part of the consultation process going forward.

There are costs to the generators and suppliers in terms of understanding the powers now taken and assessing the potential impacts on them. Since the generators (unlike the suppliers) have no current experience of legislation placing carbon reductions targets on them, they may need to devote more resource, and potentially legal costs, in assisting them to understand what the new obligation would mean for them. There is also some cost for both suppliers and generators in devoting some resource to working with Government in finalising the design of the scheme (as part of the formal and informal consultation arrangements which Government has in place with many different organisations).

There could be a cost to the investment community as a result of an obligation being placed on generators. The powers could create uncertainty about future regulatory interventions and generation might become a less attractive investment. However, any reactions will depend crucially on the precise detail of the secondary legislation and in particular what types of company will be liable. The Government has said that it is likely to apply a threshold to try and ensure that any new obligation does not apply to smaller companies and act as a deterrent to new entrants to the market.

Conceivably there could be an impact on competition between generators based in Great Britain, and those based abroad, due to the fact that an obligation may now be placed on domestic companies. Foreign generators may be in a market advantage in comparison with a generator based in Great Britain. This impact is likely to be very small – Great Britain currently imports less than 2% of its total energy consumption from foreign generators.

The fact that the new powers include an ability to specify areas or types of areas in which activity will need to take place may give an indication that there will be

relatively less flexibility for generators/suppliers in meeting their obligation, compared to the existing CERT scheme. This may lead to some uncertainty in advance of more specific proposals from Government as to how this particular aspect of the powers could be used in the consultation process.

The fact that the powers expressly include the ability to impose more than one obligation on the same company may increase risk for those who are both generators and suppliers, who may be under three obligations as a result.

Those organisations who are both electricity generators and energy suppliers are at a disadvantage to an organisation that is just one or the other, as they will be under at least three obligations when CERT is considered in conjunction with these new obligations. A supplier is at greater risk as they would be under two obligations, this and the CERT obligation. More obligations equate to greater risk.

This may discourage organisations who are looking to enter the supplier market or branch out to incorporate generation and supply. This could impact on competition

A second obligation on energy suppliers may make the energy supply market a less attractive option to potential start-up organisations. If a supplier were to have to take on the burden of two obligations at the same time, this may prove to be too great a burden. Further the obligation placed on generators may make expansion to incorporate a generation aspect to an organisation unattractive. However (as noted above) the Government has said that it is minded to introduce a threshold for liability, with a view to limiting the impact on smaller firms and new entrants to the market.

The Community Energy Savings Programme – Suggested policy option for implementing carbon emissions reduction obligations.

The precise impacts of introducing an obligation will vary according to the implementation approach. The Government has however said that CESP aims to significantly and permanently reduce the fuel bills of those living in areas with low income levels, and to contribute to the improvement of the energy efficiency of the existing housing stock, in order to reduce the UK's carbon emissions. It proposes that these twin aims be delivered in particular through a community approach, under which energy suppliers and electricity generators would work in partnership with community organisations or local authorities in delivering energy efficiency measures. Partnership working should allow programmes such as CESP to be implemented in the way best suited to conditions in individual areas and helps ensure coordination with existing provisions/initiatives, and there are strong arguments for leaving maximum flexibility to allow for different partnership structures and to allow a variety of community bodies to participate. Proposals in this area will be subject to detailed consultation.

Detail on how the CESP may look in delivering on the new obligations is provided in a separate consultation document, published on February 12th 2009. This is accompanied by a detailed Impact Assessment examining the various options. A draft statutory instrument will also be published early in the consultation period.

General sources of evidence

The Climate Change Programme Review 2006 and the Energy Review 2007 looked at programmes targeting households as well as those targeting industry, transport and other sectors relevant to the Government's climate change and energy objectives. Those reviews considered progress towards targets, options for improving performance, and a large body of evidence on the cost-effectiveness of different programmes.

The results suggest that household energy programmes, both as a group and individually, were among the more cost-effective measures available to reduce the UK's carbon emissions. This is largely because financial savings per tonne of carbon saved were found to be greater in the household sector than in others. This view is supported by the National Audit Office in their report on Government programmes to reduce household energy consumption (published in July 2008, http://www.nao.org.uk/publications/0708/household_energy_consumption.aspx).

The Energy Efficiency Commitment (EEC) was in operation from 2002-2008 and was preceded by the Energy Efficiency Standard of Performance. A large amount of evidence has been accumulated over the years, partly based on experience and evaluation, and partly based on a programme of commissioned research carried out to address specific issues. Much of this evidence is available on the Defra website (www.defra.gov.uk/environment/climatechange/uk/household/supplier/eec.htm), and in Ofgem quarterly updates and annual reports on EEC and CERT. Evidence on energy efficiency policies was presented as part of the Energy White Paper 2002, the Energy Efficiency Action Plan 2004, the HMT/Defra Energy Efficiency Innovation Review 2005, the UK Climate Change Programme Review 2006, the Energy Review 2006 and the Energy White Paper 2007. In addition, there are several data sources that are collecting relevant information on an ongoing basis and are published regularly, such as the English House Condition Survey and the Domestic Energy Fact File.

Current and former obligations (CERT, EEC, EEC2) have resulted in carbon savings and lower fuel bills for the households taking advantage of the programmes, although suppliers have been able to focus on the most cost-effective carbon reduction measures.

There is also evidence supporting the delivery of household energy efficiency measures through a community approach. The British Gas 'Green Streets' experiment has helped families cut CO₂ by 20% and energy use by up to 30% in just over five months, through energy saving measures, neighbourhood energy advisers, and introducing elements of competition into energy saving⁷⁶. The final evaluation of the Warm Zones pilots provides further support for a combined whole-house, community approach as a cost effective means of reducing fuel bills in low income homes⁷⁷. Given the likelihood of similar dwelling types within a street or community, a community approach would have the additional benefit of minimising search costs

⁷⁶ <http://www.ippr.org.uk/research/teams/project.asp?id=3027>

⁷⁷ http://www.warmzones.co.uk/c_archived_news.html

which are likely to increase as measures become more expensive or intrusive (such as solid wall insulation), as well as increasing cost-effectiveness through economies of scale. Targeted groups of houses within a locality can usefully act as demonstration projects of community action and community-led solutions. There is also the possibility to tap into existing networks of knowledge, such as local authorities and regional Energy Saving Trust advice centres, and the potential to pool funds from a range of sources to leverage wider financial support from within the community.

The Sixth Annual Progress report, published October 2008, for the UK Fuel Poverty Strategy provides the fuel poverty figures across the UK for 2006. The figures show there were approximately 3.5 million households in fuel poverty across the UK, an increase of 1 million households since 2005. Around 2.75 million of these are vulnerable households, defined as a household which contains children, the elderly, or somebody who is disabled or long-term sick. The rise in the number of households in fuel poverty during 2006 was due to increases in consumer energy prices. The overall cost of energy to domestic consumers rose by 22 per cent in real terms between 2005 and 2006, with gas prices rising by 29 per cent and electricity prices rising by 19 per cent. There have been further energy price rises since then.

Low income households tend to spend significantly less than average income (and higher income) households on energy bills, with average annual bills in the lowest income decile estimated at around £675 in 2008. The Standard Assessment Procedure (SAP) is a means of determining the energy efficiency standard of a dwelling. It uses a scale to measure the heating and insulation characteristics of a property, with higher numbers indicating a better energy efficiency standard. Looking at SAP ratings, the average SAP value is very similar across all income deciles, although it does tend to drop as income rises. The average SAP rating is however slightly misleading. There are more dwellings with SAP > 65 in the lower income deciles (compared with the higher deciles), but the proportion of lower rated dwellings is similar across the income deciles.

Specific Impact Tests: Checklist

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.

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

Annex H: Social Costs of Carbon for different stabilisation trajectories

The values below are derived from Stern Review estimates of the SCC on different emissions paths, using PAGE2002. Three stabilisation scenarios are presented, with the target concentration of greenhouse gases in the atmosphere expressed in parts per million of carbon dioxide equivalent.

	SCC 450ppm	SCC 550ppm	SCC 650ppm	Business as Usual SCC
2008	21.71	28.15	34.96	75.31
2009	22.10	28.70	35.70	76.80
2010	22.58	29.29	36.37	78.36
2011	23.00	29.90	37.10	79.90
2012	23.50	30.50	37.80	81.50
2013	24.00	31.10	38.60	83.20
2014	24.40	31.70	39.40	84.80
2015	24.90	32.30	40.20	86.50
2016	25.40	33.00	41.00	88.20
2017	25.90	33.60	41.80	90.00
2018	26.50	34.30	42.60	91.80
2019	27.00	35.00	43.50	93.60
2020	27.50	35.70	44.30	95.50
2021	28.10	36.40	45.20	97.40
2022	28.60	37.10	46.10	99.40
2023	29	38	47	101
2024	30	39	48	103
2025	30	39	49	105
2026	31	40	50	108
2027	32	41	51	110
2028	32	42	52	112
2029	33	43	53	114
2030	34	44	54	116
2031	34	44	55	119
2032	35	45	56	121
2033	36	46	57	124
2034	36	47	58	126
2035	37	48	60	129
2036	38	49	61	131
2037	39	50	62	134
2038	39	51	63	136
2039	40	52	65	139
2040	41	53	66	142
2041	42	54	67	145
2042	43	55	69	148
2043	43	56	70	151
2044	44	57	71	154
2045	45	59	73	157
2046	46	60	74	160
2047	47	61	76	163
2048	48	62	77	166
2049	49	63	79	170
2050	50	65	80	173

Annex I: Comments on the Carbon Valuation Methodology used in the IA by Simon Dietz (Vivid Economics)

1. Use of the SCC in appraisal of emissions targets is not straightforward. Alongside the numerous modelling issues, the long life of CO₂ in the atmosphere requires the analyst to make a judgement on the future stock of CO₂, for as long as a marginal tonne resides in the atmosphere (in practice for as long as the horizon of the integrated assessment model chosen, since this is invariably shorter than the atmospheric residence time of a tonne of CO₂).
2. Assuming UK emissions reductions are accompanied by proportional reductions in global emissions, the future stock of CO₂ would be lower if an ambitious domestic emissions target were adopted (and of course met) than it would be along a business-as-usual trajectory. Since the SCC estimates made by the Stern Review and adopted by Defra in its 2007 guidance increase as the future stock of CO₂ increases⁷⁸, it follows that a scenario in which the UK reduces emissions significantly (e.g. 80% by 2050) is valued at the SCC along a consistent global stabilisation path (e.g. stabilising at 480 ppm in 2050), while a scenario in which the UK does nothing is valued at the SCC along a global business-as-usual path. The former SCC is lower than the latter.
3. This point appears to have eluded the 2008 Impact Assessment of the Climate Change Bill (Defra, 2008), which evaluated both a with- and without-target scenario using the SCC along a path to stabilisation of the stock of CO₂ at 550 ppm. This is likely to have significantly underestimated the benefits of the Bill. The without-target scenario should have been evaluated at the SCC along a business-as-usual path. The new draft guidance makes this point clearly and articulates the correct approach.

⁷⁸ Although this result has in fact rarely been found in modelling studies. See my comments on the 2007 Defra guidance (Dietz, 2007),