EXPLANATORY MEMORANDUM TO

THE CLIMATE CHANGE ACT 2008 (2020 TARGET, CREDIT LIMIT AND DEFINITIONS) ORDER 2009

2009 No. 1258

THE CARBON BUDGETS ORDER 2009

2009 No. 1259

1. This explanatory memorandum has been prepared by the Department of Energy and Climate Change (DECC) and is laid before Parliament by Command of Her Majesty.

2. Purpose of the instruments

2.1 These Orders form part of an implementation package for the Climate Change Act 2008 ("the Act").

2.2 The Climate Change Act 2008 (2020 Target, Credit Limit and Definitions) Order 2009 ("the 2020 Target Order") amends the level of the 2020 target in section 5(1)(a) of the Act, sets a limit on the use of carbon credits that may be used to meet the first carbon budget and, finally, defines "international aviation" and "international shipping" for the purposes of section 30 of the Act.

2.3 The Carbon Budgets Order 2009 ("the Budgets Order") sets the first three carbon budgets.

3. Matters of special interest to the Joint Committee on Statutory Instruments

None.

4. Legislative Context

4.1 The Act requires the Secretary of State to reduce the "net UK carbon account" – the amount of net UK emissions after taking account of carbon units which have been credited and debited in accordance with regulations – to 80% below the level of net UK emissions in 1990, by 2050 (section 1).

4.2 With a view to meeting that target, the Secretary of State must set five-year "carbon budgets" representing the maximum level of the net UK carbon account for budgetary periods. The first three carbon budgets, covering the 2008-2012, 2013-2017 and 2018-2022 budgetary periods, must be set before 1st June 2009 (sections 4 and 8).

4.3 The carbon budget which includes the year 2020 must not exceed an amount in section 5(1)(a) – currently this requires a reduction in net carbon

dioxide emissions of at least 26% below 1990 levels. The Secretary of State has the power to amend this target in certain circumstances (section 6) and, during the passage of the Climate Change Bill, the Minister promised to exercise the power after taking advice from the Committee on Climate Change (established under Part 2 of the Act).

4.4 The Secretary of State has a duty to set a limit on the net amount of carbon units that can be credited to the net UK carbon account for each budgetary period. The limit for the first budgetary period (2008-2012) must be set no later than 1st June 2009 (section 11).

4.5 The targets and budgets in the Act do not include emissions from "international aviation" and "international shipping" (section 30(1)). The Secretary of State has a power to define by order what is to be regarded as international aviation and international shipping for that purpose (section 30(2)).

4.6 These Orders have been laid before Parliament alongside the Carbon Accounting Regulations 2009[1]. Those Regulations set out what the "carbon units" are for the purposes of Part 1 of the Act, and the circumstances in which they are to be debited from and credited to the net UK carbon account. A separate explanatory memorandum has been prepared in relation to them.

5. Territorial Extent and Application

5.1 This instrument extends to the whole of the United Kingdom.

6. European Convention on Human Rights

6.1 The Parliamentary Under-Secretary of State for Energy and Climate Change, Joan Ruddock, has made the following statement regarding Human Rights:

> "In my view the provisions of the Climate Change Act 2008 (2020 Target, Credit Limit and Definitions) Order 2009 and the Carbon Budgets Order 2009 are compatible with the Convention rights."

7. Policy background

Amendment of the target for 2020

7.1 During the final stages of the passage of the Climate Change Bill, the percentage target for 2050 in section 1 was amended from 60% to 80% following advice from the shadow Committee on Climate Change. At the same time, on the Committee's advice, the default gas coverage of the targets and budgets in the Bill was changed to include all greenhouse gases rather than just carbon dioxide.

[1] SI 2009/1257

7.2 The level of the 2020 target was not amended, so provision was added – in what is now section 5(4) – to ensure that compliance is calculated by reference only to carbon dioxide emissions. The purpose of that amendment was to ensure that the 2020 target did not become less stringent simply because the default gas coverage had changed.

7.3 In moving that the House of Lords should agree to the amendments, the Minister, Lord Hunt of Kings Heath said:

> "As noble Lords will know, on 1 December the committee will provide its formal advice on the implications for the 2020 target of their advice on the 2050 target. We do not think that a change should be made to the 2020 target before we receive this advice, especially as we closely linked the committee's advice to the first three carbon budgets. We want to ensure that we get the 2020 target right. ...
>
> ... We accept that we will have to amend the target soon to account for the inclusion of the other greenhouse gases. As I have said, we simply do not consider it appropriate to make a change to the 2020 target until we have received the committee's advice on this issue."
>
> (Lords Hansard, 17th November 2008, Col 960)

7.4 The Committee on Climate Change advised on the level of the 2020 target on 1st December 2008 together with its advice on the first three carbon budgets. The Committee recommended that an 'interim' 2020 target – the appropriate target in the absence of a further global agreement – should be set at a level equivalent to a 29% reduction in carbon dioxide emissions. The Committee considers that an equivalent target covering all greenhouse gases would be 34%. That level is consistent with the United Kingdom's share of the overall European Union targets under the Climate and Energy package agreed in December 2008.

7.5 The Government accepts and agrees with the Committee's advice, which was also supported by the devolved administrations, so Article 2 of the 2020 Target Order amends the 2020 target in section 5(1)(a) to 34%. The repeal of section 5(4) means that the new target covers emissions of all targeted greenhouse gases.

The first three carbon budgets

7.6 Carbon budgets are the total permissible level of the net UK carbon account for each five year period, beginning with 2008–2012. Article 2 of the Budgets Order sets the first three carbon budgets, following the advice of the Committee on Climate Change of 1st December 2008. The carbon budget for 2018–2022 complies with the 2020 target already in the Act (26% carbon dioxide) and with the target as amended by the 2020 Target Order (34% greenhouse gas).

7.7 The carbon budgets have been set at a level broadly at the "interim" level recommended by the Committee on Climate Change, but adjusted to take into account the final outcome of the EU package agreed in December. That has led to a slight decrease in the level of the budgets below those recommended by the Committee. This approach has been supported by the devolved administrations.

7.8 The Government has set out its response to the Committee's advice in more detail in a document published alongside the Orders, with an explanation of how the factors in section 10 of the Act have been taken into account and an overview of how the budgets will be met. The document can be found here: www.hm-treasury.gov.uk/bud_bud09_index.htm

7.9 The Government is required by section 14 of the Act to publish a full report of its proposals and policies for meeting the carbon budgets as soon as is reasonably practicable after setting the carbon budgets. That report will be published later in 2009.

The limit on the net use of credits for the first carbon budget

7.10 "Carbon credits" (or, in the language of the Act, carbon units credited to the net UK carbon account) are units representing reductions in emissions. The carbon units for the purposes of the Act are set out in the Carbon Accounting Regulations 2009, the sister instrument to the Orders covered by this memorandum. The Explanatory Memorandum for those regulations gives more background on the policy in that area.

7.11 The use of carbon credits in meeting carbon budgets was controversial during the passage of the Climate Change Bill, and this is reflected in the Act by a requirement placed on the Secretary of State to set a limit on the net amount of carbon units that can be credited to the net UK carbon account during each budgetary period.

7.12 Article 3 of the 2020 Target Order sets the limit on the net use of carbon units for the first budgetary period (2008–2012) at zero units, but that limit excludes any net use of credits which results from the operation of the European Union Emissions Trading System ("the EU ETS"), and EU ETS units acquired as part of the proposed Carbon Reduction Commitment trading scheme.

7.13 Under the EU ETS, participants have their emissions capped and must surrender a sufficient number of European Union Allowances ("EUAs") to cover their emissions in each scheme period. Participants may also purchase other types of carbon units representing the same amount of carbon dioxide (or equivalent) to cover their emissions, including Certified Emissions Reductions (CERs) generated under the Clean Development Mechanism in developing countries. However, the use of these units is limited under the UK's National Allocation Plan for the current phase of the EU ETS (2008–2012).

7.14 The scheme operates at European level, and it is theoretically possible for United Kingdom's emissions covered by the scheme to increase; that is acceptable under the EU ETS because any such increase would be offset by emissions reductions elsewhere and the overall EU ETS cap would still be met.

7.15 It is difficult to predict exactly how many carbon units will enter and leave the United Kingdom each year under the EU ETS; if UK emissions covered by the scheme increased and the use of credits arising from the scheme rose above the level of a cap set for the purposes of the Act, the only way to offset the increase in emissions would be to reduce emissions in the other sectors of the economy at very short notice, which would almost certainly be economically inefficient.

7.16 For that reason, the Government considers any crediting and debiting of carbon units which results from the EU ETS should be ignored in determining whether the limit has been reached, and that this is justified because the EU ETS sets a fixed cap at European level on the emissions it covers, and limits the use of carbon units representing emissions reductions outside the EU to contribute to that cap, leading to overall reductions in emissions. This approach is permitted under section 11(5) of the Act.

7.17 The limit on the net use of credits also excludes EUAs which are acquired through a trading scheme made under Part 3 of the Act. The proposed Carbon Reduction Commitment trading scheme, which is currently under consultation, will include a "safety valve" mechanism which will allow participants to ask the scheme administrator to purchase EUAs to offset emissions in excess of their cap under the scheme. Because that mechanism will contribute to a reduction in the number of EUAs available to EU ETS participants, the Government considers it appropriate to exclude those units from the credit limit. This safety valve mechanism has been designed as an option of last resort for participants and the Government therefore expects no more than 5 million tonnes of carbon dioxide (or equivalent) per annum will be purchased through the mechanism in the last two years of the 2008-2012 budgetary period.

The definitions of "international aviation" and "international shipping"

7.18 Emissions from international aviation and international shipping are not included in the targets and budgets in the Act, although there is provision in section 10(2)(i) requiring them to be taken into account in relation to carbon budgets. The Secretary of State may make regulations to provide for their inclusion (and must do so, or explain to Parliament why these regulations have not been made, by 31st December 2012); no regulations have yet been made.

7.19 The Secretary of State has the power to define, by order, what is to be regarded as "international aviation" or "international shipping". If the power is not exercised, the terms will be given their natural and ordinary meaning in the context of the Act. That would give rise to the possibility that definitions

might be adopted that are different from those used for international reporting purposes.

7.20 In order to avoid that possibility, which would then require the preparation of two sets of emissions figures, article 4 of the 2020 Target Order provides definitions which reflect international reporting practice. The definitions put beyond doubt possible ambiguities, such as how to treat flights into or out of the United Kingdom which have interim stops.

7.21 The definitions are only intended to set out which emissions are not included in the targets and budgets in the Act. They cannot be used as universal definitions of international aviation and international shipping, and they do not state how emissions from international aviation and international shipping are to be allocated to different countries.

8. Consultation outcome

8.1 The Act does not require public consultation on any of the issues covered by the orders to which this Explanatory Memorandum relates. However, there are specific consultation requirements:

- the 2020 target: the Secretary of State must obtain and take into account the Committee on Climate Change's advice and any views expressed by the devolved administrations;

- carbon budgets: the Secretary of State must take into account the Committee on Climate Change's advice under section 34 and any views expressed by the devolved administrations;

- credit limit: the Secretary of State must take into account the Committee on Climate Change's advice under section 34(1)(b) in relation to the budgetary period, and must consult the devolved administrations;

- definitions of "international aviation" and "international shipping": no consultation requirements, but the Secretary of State has consulted the devolved administrations.

8.2 The Secretary of State is also required to publish certain statements setting out how the views of the devolved administrations have been taken into account. If any new targets or the carbon budgets are set at levels which differ from the Committee on Climate Change's advice, the Secretary of State must publish statements setting out the reasons for those decisions. Those statements have been published, and can be found at the link in paragraph 7.8.

9. Guidance

9.1 No guidance has been published in relation to the matters contained in the orders, because none is considered to be required. This memorandum provides a full explanation of the background and the Government has,

alongside this order, published a document setting out more information about the matters contained in the Orders. It can be found at the link in paragraph 7.8.

10. Impact

10.1 An Impact Assessment (IA) of the EU Climate and Energy package, the revised EU Emissions Trading System Directive and meeting the UK non-traded target through UK carbon budgets has been published. Owing to the close links between the levels of the carbon budgets and the UK's obligations under the EU Climate and Energy package their impacts have been considered together in the same IA. The IA has been attached as an Annex to this memorandum, and can also be obtained from the website of the Department of Energy and Climate Change: www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/carbon_budgets/carbon_budgets.aspx

10.2 The net benefits of the UK's mitigation action set out by carbon budgets is subject to considerable uncertainty. The avoided damages from UK greenhouse gas emissions is a function of the level of global action. The best estimate of the net benefits, in a world where the UK acts to reduce emissions in concert with the rest of the world, is a net benefit of £223.5 billion. Should the UK's mitigation action be unilateral, and not lead to any future co-ordinated global action, then carbon budgets are estimated to carry a net cost of £10.5 billion. This underlines the importance of achieving a global deal.

11. Regulating small business

11.1 The legislation does not apply to small business.

12. Monitoring & review

12.1 The Committee on Climate Change recommended two sets of budgets – an "intended" level to be set following an international agreement to reduce greenhouse gas emissions in the period after 2012, and an "interim" level to be set before an agreement is reached. In accordance with this, this Order sets the levels of the 2020 target and the first three carbon budgets at the "interim" level (with a small adjustment to reflect developments at EU level since the Committee reported).

12.2 A new international agreement is being negotiated and will be the focus of the UN climate change conference in Copenhagen in December 2009. As the Committee recommends, both the level of the budgets and the 2020 target will need to be reconsidered in the light of an agreement, and of subsequent negotiations at EU level to determine the burden share for each Member State of a new target adopted by the EU.

12.3 It is unlikely that the limit on the net use of credits for the first budget period will need to be reconsidered following an international agreement, because any agreement will only come into effect after the first budget period

has ended. The level of the net UK carbon account will be kept under review through annual statements of emissions as required under Section16 of the Act, and monitored to ensure that the first carbon budget is being met.

12.3 The definitions of international aviation and international shipping will be kept under review to ensure that they continue to reflect international reporting practice, and will be amended as necessary.

13. Contact

Paul van Heyningen at DECC Tel: 020 7238 4272 or email: paul.vanheyningen@decc.gsi.gov.uk can answer any question regarding these instruments.

Summary: Intervention & Options

Department /Agency:	Title:	
Department of Energy and Climate Change	Impact Assessment of EU Climate and Energy package, the revised EU Emissions Trading System Directive and meeting the UK non-traded target through UK carbon budgets.	
Stage: Final Proposal	**Version: Final**	**Date: 22 April 2009**
Related Publications: The Committee on Climate Change report: Building a low-carbon economy. Government response to the Committee's report. Climate Change Act IA.		

Available to view or download at:

http://

Contact for enquiries: Tom Corcut **Telephone: 0207 238 1186**

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

The EU, along with the rest of the world, needs to take action to reduce greenhouse gas (GHG) emissions to avoid the risk of dangerous climate change. If left unchecked, climate change would impose considerable costs on the EU. The EU made a commitment at the 2007 Spring European Council to reduce GHG emissions by 20% in 2020 compared to 1990 levels, and by 30% if an international agreement is reached. The European Commission proposed a package of measures to deliver the 20% GHG reduction, which was agreed by the European Council and European Parliament in December 2008.

What are the policy objectives and the intended effects?

The principal aim of the Climate and Energy package is to reduce emissions in the EU in a cost effective manner, while fairly distributing the costs between Member States. In order to do this the Commission have devised a burden sharing methodology for the effort each Member State must undertake to reach the GHG and renewable energy targets.

The secondary objective of the package is to enhance the chances of a securing an international agreement to reduce emissions, through the EU showing leadership.

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

The Commission proposed a Climate and Energy package in January 2008 that set out how the EU will meet the 20% reduction in GHG emissions. The package includes reforms to the EU Emissions Trading System, a target to meet 20% of energy use from renewable sources, and to reduce emissions in the non-traded sectors. The package will require the UK to reduce emissions to 34.9% below 1990 levels.

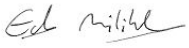
The counterfactual against which policy scenarios are assessed is the continuation of current UK policies and targets as set out in the 2007 Energy White Paper, including a continuation of the UK's Phase II EU ETS cap to 2020.

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects? The Climate Change Act sets out a statutory annual reporting process which will evaluate the UK's progress in meeting its targets and carbon budgets.

Ministerial Sign-off For final proposal Impact Assessments:

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

Signed by the responsible Minister:



Date: 21st April 2009

Summary: Analysis & Evidence

Policy Option: A	Description: Set UK carbon budgets to enable the UK to meet commitments made to reach the goals of the EU Climate and Energy Package.

COSTS

ANNUAL COSTS		Description and scale of **key monetised costs** by 'main affected groups' Cost to installations covered by EU Emissions Trading Scheme (£1.9bn). Cost of Renewable Energy Strategy = (19.9bn). Cost savings (through negative cost abatement opportunities) of meeting remaining GHG reductions in the non-traded sector (-£1.2bn).	
One-off	Yrs		
£ 0	0		
Average Annual Cost (excluding one-off)		Total Cost (PV)	**£ 20.6 billion**
£ 3.0 billion			

Other **key non-monetised costs** by 'main affected groups' Possible local air quality costs from some renewable sources not included. Policy costs in non-traded sector. Possible hidden costs in non-traded sector such as hassle and time costs associated with energy efficiency measures.

BENEFITS

ANNUAL BENEFITS		Description and scale of **key monetised benefits** by 'main affected groups' Benefits of GHG emissions reductions to meet UK commitments to a 20% reduction in GHG emissions. Benefits will depend on other's actions and the emissions concentration trajectory the world is on. High end of range reflects world where EU action is pivotal in achieving a global deal.	
One-off	Yrs		
£ 0	0		
Average Annual Benefit (excluding one-off)		Total Benefit (PV)	**£ 9.2 to 242.1 billion**
£ 1.3to 35.2 billion			

Other **key non-monetised benefits** by 'main affected groups'. Innovation benefits from the Renewable Energy Strategy to bring down future mitigation costs. Possible air quality benefits in the non traded sector.

Key Assumptions/Sensitivities/Risks There are significant uncertainties over the avoided damage costs associated with reduced greenhouse gas emissions; benefits depend on the emissions trajectory assumed to measure the social costs of carbon. Costs of the policies are sensitive to the fossil fuel prices assumed. Estimation, by the DECC Energy Model, of the effort required to meet the non-traded target is subject to large confidence intervals.

Price Base Year 2008	Time Period Years 8	Net Benefit Range (NPV) **£ -11.4 to + 221.5 billion**	NET BENEFIT (NPV Best estimate) **£ 221.5 billion**

What is the geographic coverage of the policy/option?	UK
On what date will the policy be implemented?	January 2013

Which organisation(s) will enforce the policy?			Environment	
What is the total annual cost of enforcement for these			£ -	
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			£ N/A	
What is the value of changes in greenhouse gas emissions?			£ 9.0 to 241.9	
Will the proposal have a significant impact on competition?			No	
Annual cost (£-£) per organisation (excluding one-off)	Micro -	Small -	Mediu m	Large -
Are any of these organisations exempt?	No	No	N/A	N/A

Impact on Admin Burdens Baseline (2005 Prices)				(Increase -
Increase	£ -	Decreas	£ -	Net **£** -

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

Evidence Base

Contents

PART A IMPACTS TO THE UK OF THE EU CLIMATE CHANGE AND ENERGY PACKAGE

Section 1 Introduction

1. This Impact Assessment sets out the costs and benefits of the UK meeting its intermediate climate change goals in a manner that is consistent with the recently agreed EU Climate and Energy (C&E) package of targets and policies.

2. In December 2008 the European Council and the European Parliament agreed the EU's 2020 C&E package, which represents the implementation phase of the EU's political commitment to move to a low carbon future. Together the various elements of the Climate and Energy Package implement the decisions agreed by EU Heads of State and Government at the March 2007 Spring European Council. The C&E package is composed of three main elements:

- **EU Emissions Trading System[2] (EU ETS) Directive** – this Directive improves the function of the EU ETS from the start of Phase III in 2013, and scales up the effort required to meet EU reduction commitments. The Directive provides for a central EU-wide cap.
- **GHG Effort Sharing Decision** – this Decision sets Member State targets for reductions in the sectors of Member States' economies not covered by the EU ETS[3].
- **Renewables Directive** – this Directive sets a target for the EU of 20% renewable energy by 2020.

3. The Climate Change Act (2008) requires the Government to set Carbon Budgets for 3 five-year periods, which determine the UK's level of GHG emissions. Government has decided to set carbon budgets at the interim level suggested by the Committee on Climate Change – i.e. at a level consistent with the UK's non traded sector targets and the share of the EU ETS cap assigned to the UK. Therefore, this Impact Assessment also considers the costs and benefits of setting the UK's Carbon Budgets in line with the UK's commitments under the EU C&E package.

1.1 Rationale for Intervention

4. The science on the negative impacts of climate change is clear: man-made climate change is a serious threat to our way of life and the continued prosperity of people in the UK, Europe and the rest of the world. As highlighted in the Stern review, climate change is the result of several complex market failures.

- The principal market failure associated with climate change is the absence of a price for carbon (GHG) emissions, meaning that firms and individuals do not account for the cost of carbon (GHG) emissions when making their production and consumption choices. Without Government intervention to price carbon (GHG) emissions there is little incentive for firms or individuals to alter their behaviour and carbon (GHG) emissions will remain unchecked.

[2] The revised directive changes the name from EU Emissions Trading Scheme to EU Emissions Trading System.
[3] Emissions not covered by the EU ETS are referred to as the non-traded sector.

- Another market failure, associated with taking action on climate change, relates to the positive spill-over effects from innovation, meaning that, even with an appropriate carbon pricing mechanism in place, firms are not able to fully benefit from the research, development and demonstration that they undertake. This is largely because other firms will be able to replicate the technology over time. If further Government intervention can help bring forward emerging low carbon technologies, and help reduce the cost of deploying these technologies, then there could be significant benefits because the resultant carbon price will be lower and overall mitigation costs would be reduced.
- A third area where Government can intervene is on the demand side, where a mixture of market failures, information failures and behavioural issues, e.g. consumer / business inertia and high private discount rates, will lead to a socially suboptimal outcome in the absence of Government intervention.
- As Climate Change is a global problem that requires a global solution, the UK or the EU acting alone cannot solve the Climate change mitigation problem. The unilateral commitment by the EU, and the offer to move to a tougher 30% reduction if there is an international deal, is an attempt to induce other countries to sign-up to an ambitious agreement. By acting first, the EU is attempting to overcome the current coordination failure between governments across the globe by signalling a clear commitment to climate change mitigation.

5. The principal focus of this IA is to explore how the UK's targets and policies, that must comply with the legal requirements of the C&E package, overcome the market failures associated with an absence of a price for carbon and the lower than optimal level of innovation in low carbon technologies. The IA notes the importance of the proposal in overcoming the coordination failure between governments across the world and this is reflected in the scenarios considered in the carbon valuation section (Section 2.1).

1.2 Approach to analysis and structure of this impact assessment

6. The aim of this impact assessment is threefold:

- to provide an overarching assessment of the cost and benefits as a whole;
- to provide a link between the UK's targets from the Climate and Energy package and the domestic policy framework as set by the Climate Change Act; and,
- to update the partial impact assessment on the revised EU ETS Directive in order to reflect the outcome of the final negotiations.

7. This analysis is intended to complement other impact assessments relating to the C&E package and other EU policies, namely those on carbon capture and storage, the renewable energy target and aviation.

Establishing a baseline for analysis

8. The C&E package builds on EU policies that are already in place, namely the EU's commitments under the Kyoto Protocol. Therefore the costs and benefits of the UK's targets, derived from the EU's collective target have been compared to the counterfactual of the policies and emissions projections

aimed at meeting our previous commitments, as set out in the 2007 Energy White Paper (consistent with the Kyoto Protocol).

9. The costs and benefits of the C&E package are looked at cumulatively; that is the cost and benefits are the combined costs and benefits of the EU ETS, renewable energy target and non-traded sector targets/policies. This approach is necessary because there are numerous interdependencies between the targets and policies, such that it is difficult to consider the costs and benefits of single elements of the package in isolation. This issue is most pertinent for considering the costs and benefits of the approach taken in the EU ETS and the target in the non-traded sector. For example, for a given GHG target the benefits of tougher EU ETS caps are that less effort has to be undertaken in the non-traded sector. The benefit of tougher traded sector targets can only be assessed after looking at the costs of the alternative way of meeting the GHG target through more abatement in the non-traded sector.

10. This IA presents the costs and benefits of the C&E package from 2008 to 2020. There will be further impacts as a result of the package that will occur after 2020. This include the additional costs and benefits of investments made before 2020 that will continue after the C&E targets have been met. These have not been included as part of this impact assessment as they cannot be presented on a consistent basis for all elements of the package. Individual IAs of the policies that the Government is implementing to meet its targets, including the IA for the RES[4], do present full lifetime costs and benefits. The impact of the UK's climate change targets to reduce emission by 80% in 2050 is set out in the impact assessment to the Climate Change Act[5].

EU targets following Copenhagen

11. The C&E Package represents the EU's offer to the world in the run up to the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) at Copenhagen in December this year. This clear commitment to a 30% EU emissions reduction target in the event of a global deal on climate change, made by Heads at Spring European Council in 2007, and reiterated in 2008, still stands. This sends a clear signal of the EU's environmental ambition and puts us in the best position to reach an ambitious international deal at Copenhagen. This remains the UK and EU's ultimate objective.

12. While there is a commitment from the EU to move to a 30% emissions reduction target in the event of an international agreement, this will require the agreement of both the European Council and European Parliament and the details of such a target have yet to be finalised. This Impact Assessment therefore only considers the costs and benefits of the UK meeting its commitments under the EU 20% reduction targets.

Sources of data and assumptions

13. This impact assessment makes use of the Department of Energy and Climate Change (DECC) energy model to estimate GHG savings in both the counterfactual scenario and with package scenario. The DECC energy model produces a range of estimates depending on the fossil fuel price assumptions

[4] http://www.berr.gov.uk/consultations/page46797.html
[5] http://www.decc.gov.uk/Media/viewfile.ashx?FilePath=85_20090310164124_e_@@_**climatechangeact**ia.pdf&filetype=4

and also on the effectiveness of policies, with high, central and low policy effectiveness scenarios. To aid clarity, this impact assessment presents costs and benefits of the C&E package for one scenario, which assumes a central fossil fuel price and is based on central estimates of the emissions savings from policies.

14. The analysis in this impact assessment considers only the time period 2013-2020, uses standard Government 'Green Book' accounting, including the use of a discount rate of 3.5%. Costs and benefits are presented in 2008 prices.

Structure of this Impact Assessment

15. The Impact assessment is divided into two parts. Part A explores the costs and benefits of the package of as a whole and part B provides a qualitative exploration of the revised ETS directive. In more detail:

- Section 2 explores the cost and benefits of the package;
- Sections 2.1-2.3 look at the GHG benefits of the C&E package and other ancillary benefits;
- Sections 3.1-3.4 explore the direct resource costs of the package, looking at the ETS, non traded and renewable energy target elements of the package in turn;
- Section 3.5 brings the costs and benefits together with an NPV calculation;
- Section 4 explores the interim budgets and the additional costs of the suggested approach;
- Section 5 provides estimates of the electricity price and fuel poverty impacts of the combined package; and,
- Section 6 presents estimates of the macroeconomic costs of the C&E package.

16. Part B of this impact assessment looks at the impacts of the revised ETS Directive

- Section 1 sets out the experience of Phase I of the ETS and the background to the review of the ETS Directive;
- Section 2 sets out the changes in scope of emissions covered by the System under the revised Directive;
- Section 3 discusses the outcomes of the cap setting approach;
- Section 4 looks at the allocation methodology;
- Section 5 discusses the impact of decisions on the use of project credits ;
- Section 6 discusses the reforms to the monitoring, reporting and verification (MRV) requirements of the scheme.

1.3 Policies in the EU Climate and Energy Package

The EU Emissions Trading System

17. The EU Emissions Trading System (EU ETS) has been revised to be more environmentally ambitious, with a cap-setting mechanism that is consistent with the EU reducing emissions by between 60-80% by 2050. The

combination of a tighter cap with a set declining trajectory; auctioning as the primary means of allocation; and reduced access to project credits from outside the EU will result in more predictable market conditions with a more stable price and improved certainty for industry.

18. Central to this is a far more rigorous approach to setting the cap on emissions. A central EU cap will guarantee that the EU ETS will deliver its share of emission reductions in order to meet the EU's overall climate change targets. The central EU cap is set at a much more ambitious level and for the first time there is an annually declining trajectory for the cap. This will deliver a year on year reduction of 1.74% of 2005 emissions up to 2020 and beyond. By 2020, the EU ETS will have delivered an emission reduction of 21% below 2005 levels for those emissions covered by the EU ETS cap.

19. Other key elements of the revised Directive include:

- access to international carbon credits limited to ensure that at least half of the required emission reductions take place within the EU, whilst also providing finance to developing countries to invest in low carbon projects;
- a large increase in auctioning. At least 60% of EU ETS allowances will be auctioned by 2020. In Phase II only around 3% of allowances are being auctioned across the EU. This will provide a more economically efficient way of allocating allowances, and help to address the issue of windfall profits; and
- use of up to 300 million EU ETS allowances, worth billions of pounds, to part-fund up to 12 Carbon Capture and Storage (CCS) demonstration plants. This provides a credible financing mechanism for this technology that has huge potential to reduce emissions across the globe.

20. These elements of a revised EU ETS demonstrate the EU's leadership in tackling global climate change. They provide a solid foundation by which the EU ETS can link to other capped systems with the ultimate objective of achieving a global carbon market.

The Greenhouse Gas (GHG) Effort Sharing Decision

21. The GHG Effort Sharing Decision sets Member State targets for emission reductions in the sectors of their economies not covered by the EU ETS, in the most part residential and transport. In total these targets will deliver a 9 per cent reduction in GHG emissions from 2005 levels by 2020. Responsibility for meeting this target has been distributed between Member States on the basis of relative GDP per capita. In summary, the Decision includes:

- a percentage reduction target for each MS to reach by 2020;
- a binding annual trajectory from 2013 to 2020 to keep the EU on track to make the emissions reductions required over the 8 year period;
- provisions to change Member State targets in the event of an international agreement;
- flexibility mechanisms to help Member States to meet their targets cost-effectively (the ability to bank and borrow against the annual trajectory, use of project credits such as the Clean Development Mechanism, the ability to trade Member State emissions allocation allowances);
- a compliance factor against the annual trajectory (set at 1.08) puts a price on any failure by Member States to meet their targets; and
- monitoring and evaluation provisions.

The Renewable Energy Target

22. The Renewables Directive sets a target for the EU to produce 20% of its energy supply from renewable sources by 2020. The Directive includes sustainability criteria for biofuels, including a requirement on the Commission to develop a methodology for taking Indirect Land Use Change into account in the sustainability criteria and also a 2014 Review of Biofuels. Other key elements include:

- a trading/flexibility mechanism based on Member State to Member State transfers of renewable energy achievement and joint projects (which would allow for agreements to be forged between Member States);
- a Commission review in 2021 that will assess a) the workings of the Directive in enabling Member States to meet their targets cost-effectively; and b) the influence of external factors beyond a Member State's control; and
- non-binding interim targets that strike a balance between allowing Member States to determine their own best trajectory and providing an effective means to monitor progress.

UK targets under the EU Climate and Energy Package

23. The UK led calls for an ambitious package to tackle climate change and deliver a low carbon economy in Europe. The C&E package reinforces the UK's own ambitious targets under the Climate Change Act to reduce emissions and put Europe at the forefront of international action.

24. By establishing an EU-wide central cap on emissions covered by the EU ETS to 2020 and beyond, ensuring both scarcity and certainty, the UK will no longer have responsibility for setting a separate EU ETS emission cap for the UK economy. This means that the UK is tied into delivering its share of the total EU ETS reduction (21% by 2020, compared to 2005). The precise allocation of EUAs to UK installations will be determined only once industry benchmarks have been agreed. In this impact assessment a de facto UK cap has been estimated by combining the UK's allocation of auctioning rights with estimates of the of the number free allowances that UK installations will receive between 2013-2020.

25. In the non-traded sector the UK has committed, through the Effort Sharing Decision, to reducing its GHG emissions by 16 per cent by 2020 from 2005 levels. It is left to the UK to set out the policy measures to be used to meet its target and these will be governed by the Climate Change Act, the Energy Act and the Renewable Energy Strategy.

26. The Renewables Directive calls for 15% of the energy consumed in the UK to come from renewable sources by 2020; and 10% of road transport fuels to come from renewable sources, subject to them being produced in sustainable way. As well as meeting legal targets, increasing the UK's use of renewable energy is a key part of the UK's strategy to tackle climate change and ensure a secure supply from diverse energy sources. The 15% UK target is very challenging, but achievable; we consulted last year on measures which have the potential to meet the target and will publish our Renewable Energy (RE) strategy in Spring 2009.

1.4 The Climate Change Act (2008) and Carbon Budgets

The Climate Change Act 2008

27. The Climate Change Act 2008, which became law on 26 November 2008, creates a new approach to managing and responding to climate change in the UK through: setting ambitious targets, taking powers to help achieve them, strengthening the institutional framework, enhancing the UK's ability to adapt to climate change, and establishing clear and regular accountability to the UK Parliament and devolved legislatures. An Impact Assessment for the Climate Change Act was published in March 2009.

28. The Act sets an ambitious and legally binding target of at least an 80% reduction in greenhouse gas emissions by 2050. To set the trajectory towards this target, the Act introduces a system of "carbon budgets". Carbon budgets limit greenhouse gas emissions over consecutive five-year periods, with three budgets set at any one time; they define the emissions reduction pathway out to achieving the 2050 target. The first three carbon budgets will run from 2008-12, 2013-17, and 2018-22, and the Act requires us to set them by 1 June 2009.

The Advice of the Committee on Climate Change

29. The Act established an independent, expert body, the 'Committee on Climate Change' (CCC), to advise the Government on setting carbon budgets and to report to Parliament on the progress made in reducing greenhouse gas emissions. The Committee published its first report on 1 December 2008.

30. The Committee has recommended that the appropriate carbon budgets for the UK should reflect the outcome of the Conference of the Parties to the UNFCCC in Copenhagen in December 2009, and any subsequent negotiations on an international agreement, and should be in the line with the EU approach. The Committee has therefore proposed two sets of budgets, one to apply once a global deal has been reached ('Intended' budgets), and the other to apply for the period before a global deal is reached ('Interim' budgets). The Committee's recommended Intended and Interim budgets are summarised in the table 1 below:

Table 1 Levels of the first three carbon budgets recommended by the Committee on Climate Change

	Budget 1 (2008-2012)	**Budget 2 (2013-2017)**	**Budget 3 (2018-2022)**
Interim budget (MtCO2e)	3018	2819	2570
Intended budget (MtCO2e)	3018	2679	2245

31. The Government agrees with the Committee that an appropriate approach is to set the carbon budgets in line with the UK's commitments under the C&E package.

32. In producing its advice, which was published on 1 December 2009, the Committee inevitably had to make certain assumptions about the shape of the final EU package. The package that was agreed on 12 December differed in some important respects from the European Commission's

original proposals. The UK's share of the EU ETS cap is more stringent than the CCC assumed.

33. As a result of this, while we agree with the Committee's approach, the carbon budgets proposed by Government differ slightly from those it recommended. They are in fact tighter and therefore more challenging to achieve. The budgets in Table 2 below are set at the level given by the CCC in the non-traded sector, but are adjusted in the traded sector to take account of the revisions to the EU ETS directive agreed after the CCC published its report.

Table 2: Government's proposed carbon budgets ($MtCO_2e$)

	Budget 1 (2008-2012)	**Budget 2 (2013-2017)**	**Budget 3 (2018-2022)**
Traded sector	1233	1078	985
Non-Traded Sector	1785	1704	1559
Total	3018	2782	2544

Achieving the proposed budgets

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

35. As described below, we are aiming to ensure that all effort to meet carbon budgets outside the EU Emissions Trading System is achieved through domestic emissions reductions. As required by the Act, the Government will publish a report that will set out our proposals and policies for meeting the budgets in this way. This will form part of an Energy and Climate Change Strategy to be published in summer 2009.

Use of international credits

36. The CCC recommended that we should not plan to purchase offset credits (e.g. from Clean Development Mechanism projects) to meet the "Interim" budgets. Use of offset credits, however, would be appropriate in making the transition from the "Interim" to the "Intended" budgets. If the "Intended" budget is adopted after an international deal, the additional effort needed in the non-traded sector could be achieved by purchasing credits up to the limit proposed in the EU's Effort Sharing Decision. The CCC recommended that no limit be set on the use of allowances under the EU Emissions Trading System (EUAs) to meet UK emissions reductions targets, and also said that it considered the limits on the use of offset credits within the EU ETS to be appropriate.

37. The Government agrees with the CCC and will therefore aim to ensure that all effort in the non-traded sector to meet the carbon budgets is achieved though domestic emissions reductions without any planned purchase of offset credits. The EU framework sets the minimum emission reductions that the carbon budgets must achieve. But achieving the 'Interim' budgets through domestic emissions reductions alone in the non-traded sector would take the UK further than its EU obligations (see below).

The level of the 2020 target

38. Section 5 of the Climate Change Act requires that emissions of carbon dioxide in 2020 must be at least 26 per cent below 1990 levels. This target is expressed in terms of carbon dioxide only – rather than covering the basket of greenhouse gases – as a result of the timing of the amendment to the Climate Change Bill increasing the 2050 target to an 80 per cent reduction in greenhouse gas emissions.

39. The move to an 80 per cent reduction target was made in response to interim advice from the Committee on Climate Change, published on 7 October 2008. Parliamentary time did not allow for further consideration of what an appropriate target for 2020 would be in the context of this change. Instead, both Houses of Parliament agreed that the target should remain in terms of carbon dioxide only, pending the Committee on Climate Change's formal advice on the level of the first three carbon budgets contained in their report published on 1 December, after the Climate Change Act had received Royal Assent.

40. Having received and considered this advice, and considering the views of the Devolved Administrations[6], we now propose that the target in section 5 should be amended to require the third carbon budget to be set at a level that is equivalent to a reduction in greenhouse gas emissions of at least 34 per cent below 1990 levels. . This is consistent with our proposed carbon budget for the period 2018-2022.

Consistency with 2050 target

41. Section 8 of the Act requires us to set the carbon budgets with a view to meeting the 2020 and 2050 targets. The level of domestic effort required to meet the "Interim" budgets with no planned use of international credits will prepare the UK for the move to a tougher 2020 target, which will be set in line with any future EU commitment to increase its target to as much as a 30 per cent reduction under a new international agreement and when other developed countries make comparable efforts, and put us on a pathway to achieving our 2050 target.

42. The UK negotiates internationally on climate change as part of the EU. We expect, as we did for the Kyoto Protocol, to agree our emissions reduction target under any future international agreement at European level as part of arrangements to share out the EU's target among Member States. We will therefore ask the Committee on Climate Change to review the carbon budgets once the European Commission has

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

brought forward its proposal to share out the EU target, probably through proposals to revise the EU ETS Directive and the Effort Sharing Decision. We will amend the carbon budgets in the light of its advice.

Limit on credit use in the first budget period:

43. The Climate Change Act requires a limit to be set on the use of international credits for each budget period, and the limit for the first period (2008-2012) only must be set by 1 June 2009. The limit proposed for the period is zero, to apply only in respect of the non-traded sector.

44. This is consistent with our aim to ensure that all effort in the non-traded sector is achieved through domestic emissions reductions. It also follows the advice of the CCC. The CCC noted that in the traded sector, both EU allowances (EUAs) and project credits (CERs and ERUs) can be purchased but limits on the use of project credits already exist and are fixed for 2008-2012 as part of the UK's national allocation plan for the second phase of the EU ETS[7]. The CCC felt that the use of offset credits in the traded sector up to the limit allowed in the EU ETS was acceptable. Given this, the Government has concluded that the limit on credits set under the Act should only apply to their use in the non-traded sector. This is allowed by the Act, which says that the Order may provide that carbon units of a description specified in the Order do not count towards the limit.

[7] http://www.defra.gov.uk/ENVIRONMENT/climatechange/trading/eu/operators/phase-2.htm

Section 2 The benefits of the GHG emissions reduction.

45. The principal quantified benefits resulting from the climate and energy package are the reduced damage costs associated with the carbon savings relative to the counterfactual, of a continuation of the Phase II cap and Energy White Paper policies[8]. See Section 2.1 below for more details.

46. The renewables target should also offer benefits in terms of generating more innovation in lower carbon technologies and helping to bring down abatement costs over time. The package will also have an effect on air quality in the UK.

2.1 Valuing the Carbon Savings from the Climate and Energy package

47. The carbon savings associated with the package are valued using the shadow price of carbon. This is based on estimates of the social cost of carbon (SCC) – the marginal damage cost of incremental emissions - summed over their lifetime and discounted back to the year of emission. Estimating the SCC is a very complex and difficult exercise involving the use of integrated assessment models to estimate and quantify the damages caused by different emissions profiles (see Box 1 below). The Government is currently reviewing the overall approach to the valuation of carbon in policy appraisal.

48. For this Impact Assessment, we use the results of the Stern Review[9]. Stern found that the social cost of carbon varied by final atmospheric concentration (parts per million (ppm)) of GHGs in the atmosphere, with the social cost of carbon being approximately three times higher under business as usual (BAU) than under a trajectory leading to stabilisation at 550ppm. For policies that have a marginal impact on emissions, it is reasonable to assume that the final stabilisation level is invariant to the policy under consideration and for this reason, when appraising the impacts of marginal policy decisions, the 550ppm social cost is currently used . But this is not appropriate when assessing the impact of the EU high level emissions reductions targets under consideration – indeed the premise of these commitments is that they are needed to induce action from the rest of the world, thereby changing the final global stabilisation level[10]. Because there is a question over whether or not this premise holds, different scenarios are needed, one in which the 20% package is pivotal in securing an international deal, and another in which it is not. The International deal is assumed to move global emissions onto a path to avoid serious climate change, consistent with a global stabilisation of atmospheric CO_2e concentration at 450-475ppm with an overshoot to 500ppm[11].

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[8] There are also carbon benefits (and costs) associated with the possibility that the EU moves to a 30% world following an international deal before 2012. This would mean the negotiation a new set of EU targets, caps, credit limits and burden shares which are as yet unspecified. If this situation arises, a new Impact Assessment will be prepared.

[9] http://www.hm-treasury.gov.uk/sternreview_index.htm

[10] A similar argument was made in the Climate Change Act Impact Assessment for the 2050 target of an 80% reduction in UK emissions relative to 1990.

[11] http://hmccc.s3.amazonaws.com/pdf/TSO-ClimateChange.pdf

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 a comparison of these to the 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 et al (2005)* 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)** 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 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.

* 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.

** Watkiss, P., (2007), 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. (http://www.defra.gov.uk/environment/climatechange/research/carboncost/pdf/paul-watkiss.pdf)

The different scenarios

49. Two scenarios are quantified, accounting for the uncertainty over whether the EU's unilateral commitment to a 20% reduction in GHG emissions will be pivotal in achieving a global deal.

Scenario 1 (Climate and Energy Package is pivotal):

- The EU unilateral commitment to a 20% EU climate and energy package is followed by a global deal, consistent with delivering a 450ppm stabilisation of GHG atmospheric concentrations.
- In the counterfactual, where the EU does not adopt a package, no deal is reached. In this case the global emissions trajectory is on a business as usual path.
- The package is pivotal in a move to a less damaging stabilisation path.

Avoided damages = UK emissions under no action * BAU SCC – UK emissions under EU 20% target * 450ppm SCC

Scenario 2 (Climate and Energy Package is not pivotal):

- The EU unilateral commitment to a 20% EU climate and energy package is followed by a global deal, consistent with delivering a 450ppm stabilisation of GHG atmospheric concentrations (i.e. the same as in Scenario 1).
- In the counterfactual where the EU does not adopt a package a deal is still reached. In this case the global emissions trajectory is also on a 450ppm path.
- The package makes no difference to the stabilisation path.

Avoided damages = UK emissions no action * 450ppm SCC – UK emissions under EU 20% target * 450ppm SCC

50. It should be noted that in practice, were the EU's commitment successful in delivering a global deal, this would result in the adoption by the EU of a 30% emissions reduction target by 2020. As noted, the details of such a target, and the way in which it would be allocated to different Member States, have yet to be finalised. Were such a target to be adopted, its costs and benefits would be assessed in a separate impact assessment.

51. A final scenario should also be considered in which, despite the action undertaken by the EU, no global deal is secured and the world reverts to a business as usual path. In this case the world would be on a course for dangerous and unchecked climate change. This outcome has not been quantified because, using the approach set out above, it would be extremely difficult to capture the impacts of unilateral action when the rest of the world does not act. Indeed, the benefits of unreciprocated unilateral action could actually appear to be higher than under Scenario 2 (non-pivotal action in a world in which there is a global deal) because of the higher marginal damage costs assumed at higher concentrations of GHGs. Maintaining unreciprocated unilateral action indefinitely is highly unlikely to be sustainable in practice, since carbon-intensive industries would be more prone to relocation outside the EU (carbon leakage) and, in any case, the benefits of the UK's share of the EU's unilateral action would be spread thinly across all nations, whereas all the costs would be borne exclusively by the UK. This shows the limits of the marginal approach to valuation in this field, but it is clear that such an outcome is the worst case scenario, which would seriously question the benefits of

ongoing unilateral action, while also highlighting the central importance of co-operative and co-ordinated international action on climate change.

52. Estimates of the Social Cost of Carbon, derived from the Stern Review are included in the Impact Assessment for the Climate Change Act.

2.2 GHG Savings from the Climate and Energy package.

53. This impact assessment considers the benefits of the UK's traded and non-traded sector targets and policies relative to the counterfactual of the UK continuing with the policies in the 2007 Energy White Paper. This includes an assumption that the UK's ETS cap would remain at the Phase II level. The GHG savings associated with the C&E package stem from the tighter UK ETS cap from 2013-2020 and from the non-traded sector target for the UK as stipulated by the package. While the RES target on its own would result in emissions savings, in the context of the C&E package, it is seen as a means to achieve the UK's emissions reduction targets in the traded and non-traded sectors. Therefore in this Impact Assessment, no emissions savings have been assigned to the RES, as emissions reductions resulting from the use of renewable energy are considered as part of the emissions savings in the traded and non-traded sectors. This approach avoids double-counting the emissions reductions, but differs from that taken in the impact assessments that accompanied the renewable energy strategy consultation in which the GHG savings from the RE target in the non-traded sector are valued as additional. While this is the right approach when looking at individual elements of the package this impact assessment considers the impacts of the package as a whole, in which case including the GHG savings stemming from the RES target would imply double counting the savings from the rest of the package. The GHG savings from the RES target play an important role in achieving the UK's GHG targets, in both the traded and the non-traded sectors, although they significantly increase the costs of meeting these targets,

54. It is also important to note that carbon savings associated with Aviation entering the EU ETS in 2012 are not considered in this assessment, this is because Aviation was not part of the package and has a separate Directive. The costs and benefits of aviation entering the EU ETS will be considered in a forthcoming IA.

55. Table 3 below captures the GHG emissions projected under EWP policies. The carbon emission projections are generated by DECC's energy model and is based on the central estimate of policy savings and central fossil fuel price scenario[12]. The non-CO_2 GHG emissions are projections estimated by AEA technology[13]. These savings assume that the UK faces the same traded sector cap as in Phase II of EU ETS, which is a flat limit of emissions in the traded sector of 246 $MtCO_2$ for the years 2013-2020, and from estimated savings from EWP policies for the non-traded sector in the years 2013-2020.

[12] The EWP paper results presented a range of emissions savings scenarios based on high, central and low policy saving estimates and with a range of fossil fuel price assumptions. This IA is only considering the emissions from the central scenario because having a range of potential Carbon savings in the counterfactual would present a range of carbon benefits that is unnecessary given that this is a stylised illustration the package.

[13] The projection run shown is Updated Energy projections (UEP) 37

56. This package scenario assumes that the UK meets the targets set out in the EU C&E package. As such the table sets out the GHG emissions that would occur when the UK achieves its non-traded sector targets and for the savings associated with new, tougher, ETS targets and the implied de facto UK ETS cap. Comparing the savings from the counterfactual scenario with the package scenario suggests that the UK's targets from the package will result in significant additional GHG emission savings compared to the counterfactual.

Table 3: Carbon savings in the counterfactual and C&E package scenarios

Carbon emissions ($MtCO_2e$)	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
UEP37 (central fossil fuel prices, central policy impacts)								
Traded	246	246	246	246	246	246	246	246
Non-traded (carbon)	261	260	259	257	256	255	253	252
Non-traded (non-carbon)	95	95	94	94	93	93	92	92
TOTAL	600	598	596	594	592	591	589	588
C&E package target								
Traded	222	218	214	209	205	201	197	193
Non-traded (carbon & non-carbon)	347	342	337	332	326	321	316	310
TOTAL	569	560	550	541	532	522	513	504
Annual GHG savings from package compared to counterfactual	**31**	**38**	**46**	**53**	**61**	**69**	**76**	**84**

58. Having identified the GHG emissions in the counterfactual case and from the C&E package these benefits need to be quantified. The approach taken in this IA mirrors that taken in the Climate Change Act IA, which takes a scenario approach to value the benefits of the reduction in carbon (GHG) emissions, as discussed in Section 2.1. Table 4 below shows the valuation of carbon savings from the Counterfactual case and the C&E package case under the two carbon valuation scenarios[14]. The total carbon (GHG) benefit is then the sum of each year's savings, discounted back to today. The large divergence in benefits from the two scenarios highlights the importance of achieving an international deal on mitigation targets and the difference between the two outcomes could be interpreted as reflecting the benefits of leadership, should an international deal be achieved.

Table 4 Value of Carbon savings of C&E package relative to EWP savings.

£ billion	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
Scenario 1	31.6	31.2	30.8	30.4	30.0	29.6	29.3	29.0	241.9
Scenario 2	0.6	0.8	0.9	1.1	1.2	1.3	1.5	1.6	9.0

[14] Note for scenario 1, the benefits include the reduction in damage costs for all UK emissions as a result of moving from the BAU trajectory to a 450ppm trajectory, not just for the emissions reductions which take place as a result of the C&E package. This benefit, applied to all UK emissions, is far larger than the benefits from the emission reductions in the package alone (measured in scenario 2).

2.3 Air quality impacts

59. Air quality and climate change are inexorably linked. At a systematic level this relationship is clear from the broad definition of air pollution as, "the human introduction of, chemicals, particulates, or biological materials that cause harm or discomfort to humans or other living organisms, or damage the environment, into the atmosphere".

60. Recent developments have meant that air quality and climate change policy have been pursued separately. The key distinction being that climate change policy is primarily focused on the climate change potential of air pollutants while air quality has the somewhat broader remit of reflecting impacts on human health and the natural and man-made environment.

61. Recent evidence has shown the importance of analysis to reflect both the climate change and air quality impacts of policies. Recent work to bring together climate change and air quality has looked to integrate the two impacts by extending the UK MARKAL Elasticity Demand model (MARKAL ED) used to model reactions to different long-term targets. This analysis estimated that by internalising air quality impacts, the air quality benefits are increased from around £15 billion to £40 billion, between 2010 and 2050[15].

62. For some policy interventions the relationship between air quality and climate change impacts is relatively straightforward. For measures to promote efficiency, leading to less combustion, there can be notable synergies. However, the relationship in other areas is complicated by factors such as fuel switching, generally there are synergies but some low carbon fuels may have particularly damaging to air quality; geographical issues, air quality is highly sensitive to the location of emissions whereas climate change is not; switching between pollutants or compounds, for example nitrous oxide (N_2O) is a potent greenhouse gas but other oxides of nitrogen (NOx) have an impact on human health and the environment; and technology trade-offs, some exhaust cleaning equipment on industrial or road transport may actually reduce fuel efficiency and thereby increase carbon emissions. A comprehensive systematic consideration of the synergies and trade-offs between these objectives is provided in the 2007 Air Quality Expert Group third report, Air quality and climate change: a UK perspective.[16]

63. The analysis in this paper suggests that the likely measures undertaken to achieve the EU ETS targets will also deliver significant air quality benefits. The level of benefit depends on the target set and the mechanisms used to deliver them but on aggregate we expect an air quality benefit valued at around £25 million per annum. This benefit is largely delivered by a move in the power sector away from coal which results in high emissions of both CO_2 and other air pollutants. Table 5 shows the expected air quality benefits from the EU ETS targets.

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[15] Optimising delivery of Carbon reduction targets: integrating air quality benefits using the UK MARKAL model (2008) available from http://www.defra.gov.uk/environment/airquality/panels/igcb/publications.htm

[16] Available from www.defra.gov.uk/environment/airquality/publications/airqual-climatechange/index.htm

Table 5: Value of air quality benefits from EU ETS (discounted)

£ million	2013	2014	2015	2016	2017	2018	2019	2020	Total
Benefits from moving from counterfactual to C&E package	16.4	4.8	8.8	22.7	29.8	32.9	50.3	46.1	211.8

64. These benefits have been estimated based on damage costs developed by the Interdepartmental Group on Costs and Benefits (IGCB). This valuation approach applies the impact-pathway approach to move from emissions of air pollutants to ambient concentrations, exposures and ultimately a range of quantifiable end-points that are valued. The most significant impact in this process is the mortality effect of chronic exposure to particulate matter (PM10). However, a number of other impacts are included such as morbidity impacts and impacts on the natural environment[17].

65. It is, however, important to note that there are a range of uncertainties around this valuation. Two key considerations are:

- Firstly, it does not value the associated benefits to the natural environment, for example through reduced acidification and eutrophication of natural habitats. Therefore these benefits must be considered to be a conservative estimate of the true benefits.
- Secondly, uncertainties surrounding each stage of the methodology mean that the outcome is variable. A key example is that the Clean Air For Europe (CAFE) methodology uses a similar approach yet finds substantially different monetised values for a given change in emissions.

66. It is also likely that there will be air quality impacts associated with measures taken in the non-traded sector and also because of the renewable target. It has not been possible to fully assess the potential impacts on air quality resulting from the targets in the non-traded sector and from the RES target. However, greater use of small-scale biomass to meet the renewable energy target may have substantial negative air quality implications. These may outweigh the benefits above from fuel switching in the traded sector. The bioenergy ambitions for the renewable heat sector (which tends to consist of small installations) in the RES have been worked up with consideration of the possible air quality impacts. However, further analysis of the air quality implications of the C&E package is being undertaken to ascertain the overall impact. This will be presented in forthcoming analysis on RES and for the full policy mix given for the non-traded sector.

2.4 Innovation and security of supply benefits from the RES target.

67. The rationale underlying the EU's RE target is to induce increased innovation and deployment in renewable technologies, such that the cost of using these technologies decreases and supply from these sources increases. Rapidly increasing development and use of renewable energy over a short period of time, and the prospect of a significant market

[17] Further information on the IGCB air quality methodology can is available from www.defra.gov.uk/environment/airquality/panels/igcb/.

demand for renewable energy technologies, will provide a market for all renewable technologies. This is expected to significantly enhance the drive to innovate in the electricity, heat and transport sectors. This innovation is likely to include both the refinement and improvement of existing energy technologies (e.g., reducing costs, improving efficiency, lowering maintenance requirements) and the development of new technologies (such as wave and tidal stream energy), which may be important in achieving our stabilisation targets. This could potentially bring benefits in the form of reduced abatement costs and a lower carbon price as the policy takes effect to long in the future.

68. As stated earlier it is not possible to accurately estimate these benefits because of the uncertainties regarding future technology costs. However, it is possible to consider how large the benefits must be for the target to have a beneficial effect. For the RE target to have beneficial effect, the benefits, in the form of decreased mitigation costs, have to be larger than the resource cost of developing the technologies up to 2020 less the costs it would have taken to reduce the emissions in ETS and non-traded sectors in the absence of the RE. Analysis suggests that achieving the emissions reductions without the RE target would reduce the costs of the package by £15.8 billion. However, this ignores the potential and unquantifiable benefits from innovation in renewable technologies. Given that the benefits of the RE target should be felt for many years after the RE target, up to 2050 and beyond, and may be global in their reach, even though the RES costs appear substantial, it is plausible that, over time, the RE target will have a net benefit.

69. Meeting the renewable energy target is also likely to have a positive impact on security of energy supply. The UK market has sought to address security of supply concerns, resulting from increased dependency on imports, through greater diversification. A higher level of renewable energy in the energy mix should have a positive impact on security of supply, in that it is likely to reduce the amount of fossil fuels consumed in the UK, and hence the UK's dependency on fossil fuel imports. The precise extent to which it will do so will depend on the extent to which different forms of energy supply – gas or coal-powered electricity generation, nuclear electricity, gas for heating, petrol for transport, etc. – are displaced by renewable energy. However, this needs to be balanced against the risk that with increased amounts of electricity produced from renewable resources there is a greater chance of hour-by-hour intermittency problems because of the dependency of some renewable technologies on meteorological factors.

Section 3 Costs estimates of the 'Climate and Energy Package'

70. The following section explores the direct resource costs of the Climate and Energy package to the UK. This refers to the first order costs of abatement required to meet the targets, which is the resource cost of the abatement activity. These costs do not include second order costs that result from higher electricity prices, which will be felt at a macroeconomic level. These are considered in Section 6.

71. As noted in the introduction the cost of the new ETS cap needs to be explored in the context of the overall abatement effort an economy makes and the split of abatement effort between the traded and non-traded sectors. Comparing the costs of the ETS cap without placing them in the context of the package as a whole would give a misleading picture of the benefits of the new cap setting approach. The Commission's approach to cap setting is discussed in more detail in Box 2 below.

3.1 Costs of the EU ETS

72. The direct costs to UK firms of the EU ETS will be principally determined by the overall level of the cap, the way that cap is allocated among Member States, the carbon price and the extent to which UK firms can undertake low-cost carbon abatement.

73. Table 6 shows the estimated carbon prices and direct costs associated with the EU ETS in the counterfactual and package scenarios. The EUA price estimates are made using the DECC carbon price model - further details on modelling methodology and assumptions can be found in Annex A1. Implementation of the C&E package is expected to result in an increase in the EUA price – the estimates suggest a €5/tCO_2 increase in the average carbon price in the period to 2020. The main driver of the increase is due to the revised ETS Directive, which will result in a significantly tighter ETS cap.

74. The direct cost estimates capture how much UK firms would have to spend on abatement and on purchasing EU allowances. The costs are based on estimating the difference between projected UK emissions in the traded sector[18] (taking account of the impact of the Energy White Paper policies and the estimated impact of meeting the 15% renewable energy target) and the UK share of the ETS cap. This difference represents the 'effort' that UK firms will be required to make under the system, which they will meet either through undertaking domestic abatement or through the purchase of credits (from installations in other Member States or through the Kyoto Flexible Mechanisms). This effort is valued at the estimated EUA price.

75. The counterfactual scenario assumed that the UK maintains the ETS cap at the same level as in Phase II. The combination of this cap and the impact of the Energy White Paper policies implies that the 'effort' required by UK installations is falling over the course of Phase III. The estimate of costs in the 'with package' scenario increases due mainly to the tighter ETS cap – the UK's estimated share of the overall cap is significantly lower than the UK cap in Phase II.

[18] Emissions projections from DECC energy model. See: http://www.berr.gov.uk/files/file48514.pdf

76. The direct costs of ETS are offset somewhat by the fact that meeting the renewables target will result in a significant amount of abatement in the traded sector, reducing the amount of effort that is required from UK ETS installations. It is important to note, however, that while the renewables target will reduce the overall costs imposed by EU ETS from £6.7 billion to £1.9 billion, it significantly increases the overall costs of meeting the EU's 20% GHG reduction from £3.9 billion to £18.7 billion, as some abatement through renewables displaces lower-cost abatement through the EU ETS and in the non-traded sector.

77. The estimates suggest that moving from the counterfactual to the EU Package results in an increase in the direct costs from EU ETS of around £1.9 billion over the period 2013-2020.

Table 6 – direct costs of EU ETS (2013-2020)

	EUA price (€/tCO$_2$)	**Discounted direct costs 2013-2020 (£ billion)**
Counterfactual	27	0.44
C&E Package	32	2.37
Additional cost of C&E Package	5	1.93

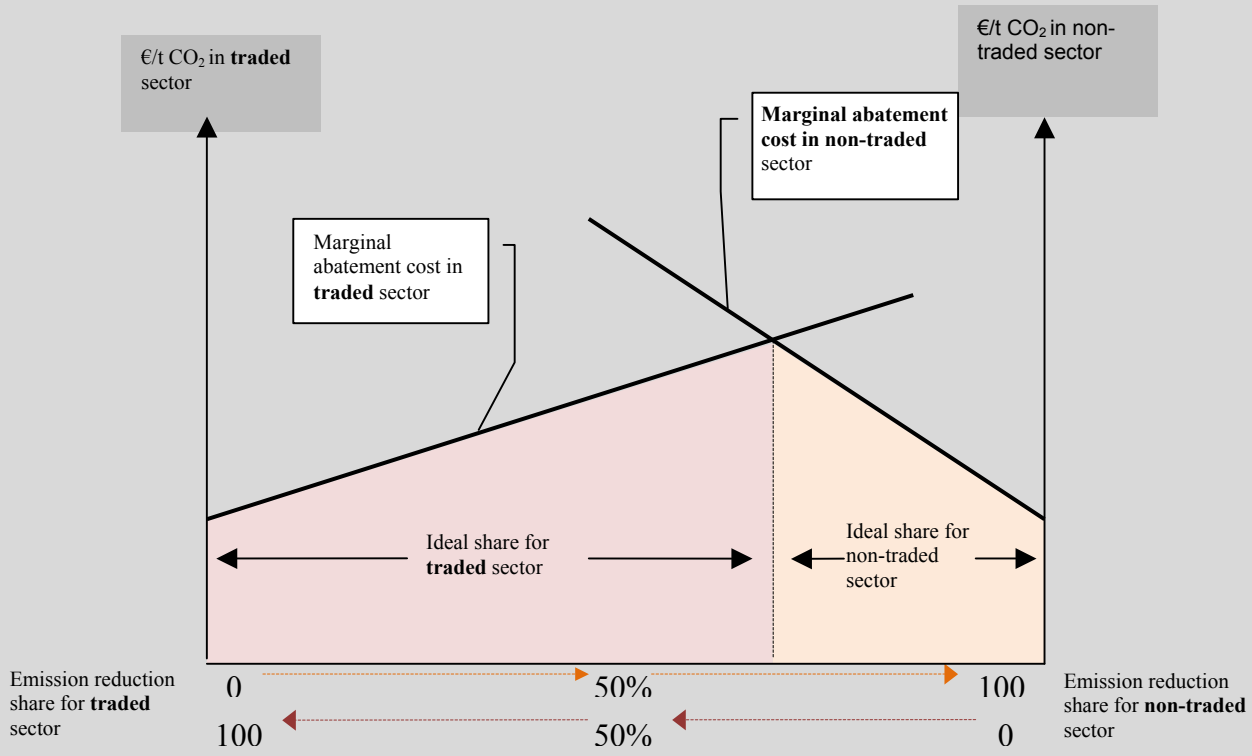
78. It is important to note that these estimates represent only the direct costs to UK firms of complying with the EU ETS. There will be other macroeconomic costs associated with the ETS, relating principally to the competitiveness effects of the EU taking unilateral action on climate change. These macroeconomic effects are discussed further in Section 6.

Box 2: Minimising the costs of taking action between the traded and non-traded sectors.

Equalising the marginal cost of abatement (MAC) between the traded (EU ETS) and non-traded sectors i a necessary condition of meeting a given GHG reduction target at least costs. Figure 1 below shows th marginal cost of reducing emissions in the two sectors. If the marginal costs between the two sector differ, it would be more efficient to meet the emissions reduction target by reducing more in the secto with lower cost, and reducing less in the sector with higher costs.

Figure 1: determining the efficient split of effort between the traded and non-traded sectors.

Figure 1: determining the efficient split between the traded and non-traded sectors



In order to estimate the efficient split the Commission have used the PRIMES model to determine th marginal abatement cost curves for the two sectors. As the EU ETS creates a single price across th EU27 in the traded sector (determined by the marginal cost of abatement in the EU), the Commissio conducted the analysis at an EU wide level. This may mean that for some Member States, the margina cost of abatement in the non-traded sector could be above or below the traded price. However undertaking the analysis at the EU level is the only way to find the efficient split given a central EU cap.

3.2 Costs in the non-traded Sector

79. The Climate and Energy Package presents a significant change in the approach at the EU level for GHG emissions abatement. Under the Kyoto EU burden share, Member States were not allocated specific non-traded targets, nor were rules placed on the level of CDM credits that could be used for compliance with the overall targets. Thus, the binding targets in the package offer a new approach to the non-traded sector across the EU. For the UK, the Package requires:

- A 16% reduction in UK GHG emissions in the non-traded sector in 2020 relative to 2005 (which is estimated to result in a target of 310.4MtCO_2e in 2020[19]).
- Implied annual targets from 2013 verified emissions to the 2020 target.
- An annual limit on the use of project credits equal to 3% of 2005 emissions (which is estimated to equal a project credit allowance of ~11 MtCO_2e per year). This limit does not vary by year.
- Unlimited banking of CDM allowance between years is permitted.
- The ability to transfer any shortfall of up to 5% of 2005 emissions (equal to 18.5 MtCO_2e per year) to the following year therefore making the following year's target more stringent.
- CDM access and over-compliance can be traded amongst MSs (effectively intra-EU trading of non-traded sector targets).

80. This section presents the estimated cost of meeting the non-traded sector target beyond planned policies captured in the 2007 EWP. The approach taken is to assume that our Energy White Paper and Renewable Energy targets are delivered, and then to assess the level of additional effort that is required to meet the non-traded sector target. The cost of undertaking this residual effort is estimated based on a view of potential abatement technologies and costs across the non-traded sector, from marginal abatement cost (MAC) curves, and also on the availability and expected price of project credits.

81. Estimates of the effort required in order to meet the non-traded sector target are made by taking the difference between a projection of emissions in the non-traded sector (based on the current policy package as set out in the EWP and adjusted to account for the renewable energy target) and the UK's emissions target in the non-traded sector.

82. The emission projections used in this analysis are derived from the latest run of the DECC energy model (UEP37)[20]. These projections are then adjusted to reflect delivery of the renewables target[21]. This adjustment is consistent with the carbon savings reported for renewables in the impact assessments that accompanied last year's renewable target consultation. The savings from meeting the 15% renewable target assume that the target is met entirely through domestic action and through action across electricity (32% share by 2020), heat (14% share by 2020) and transport (10% share by 2020). Table 7 shows the central estimate of the residual effort, i.e. the distance between the emissions projections and the non-traded sector targets required in order for the UK to meet the target in the non-traded sector from 2013-2020. The estimates suggest that there would be a small shortfall in most years from 2013-2020, with the shortfall reducing a little in the final two years as delivery of the RE target is projected to take effect. It is important to note that these estimates are

[19] Not including emissions from land-use change

[20] http://www.berr.gov.uk/files/file48514.pdf

[21] The biofuel savings included in this analysis incorporate meeting 10% biofuel by energy by 2020. This does not incorporate the slowdown in the RTFO that is currently being consulted upon as a result of the recommendations from the recent Gallagher review (http://www.renewablefuelsagency.org/_db/_documents/Report_of_the_Gallagher_review.pdf). Clearly if the slowdown is agreed, additional abatement will be required from other sources to ensure that our non-traded targets are met.

based on long-run emission projections, which are inherently uncertain. The estimated gaps are sensitive to assumptions on economic growth, demographics, fossil fuel prices and on the effectiveness of the EWP and RES policy packages, with this latter uncertainty being particularly important given the potential barriers to the ramp-up of delivery of some renewable technologies. Ideally, the analysis would look at a number of scenarios with different emissions pathways. However, to aid clarity, the analysis in this Impact Assessment focuses on one illustrative scenario.

Table 7 – residual effort to meet the non-traded sector target ($MtCO_2e$)

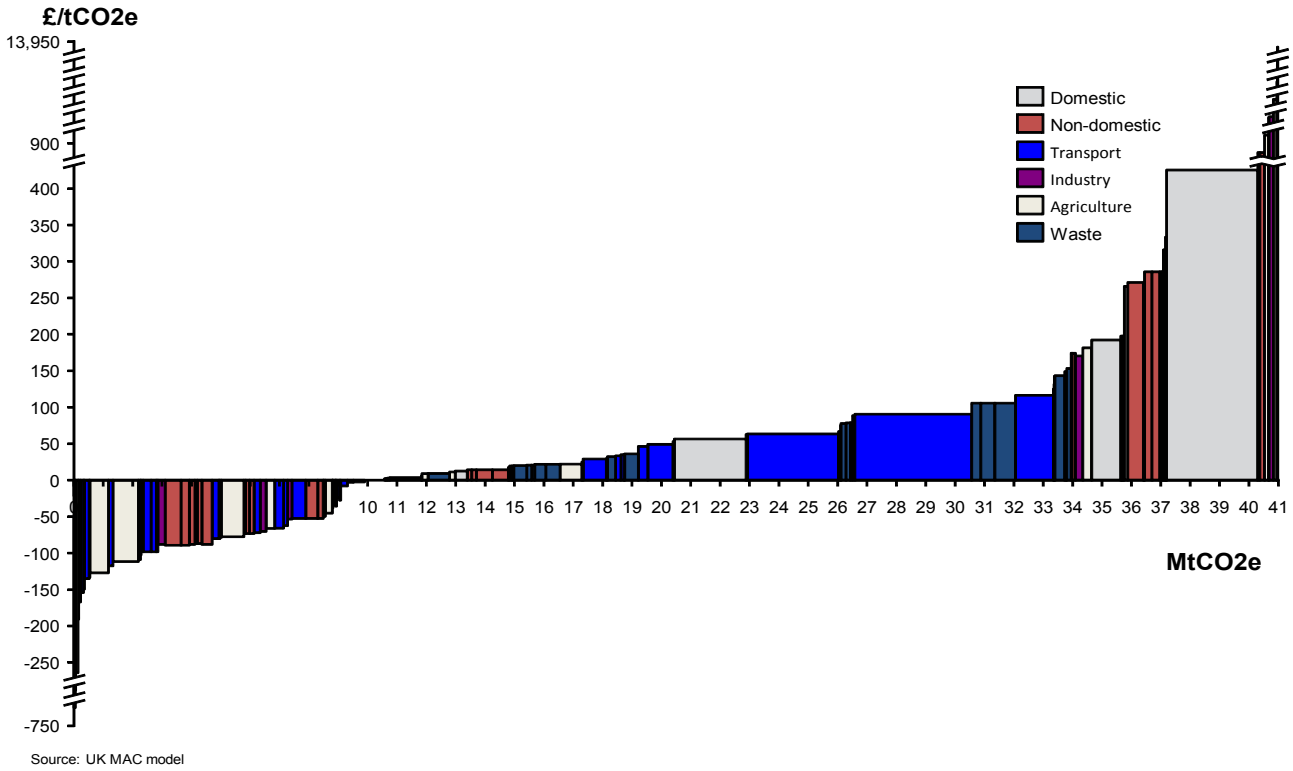
	2013	2014	2015	2016	2017	2018	2019	2020
Residual effort to meet target ($MtCO_2e$)	0.0	1.3	2.1	2.7	3.2	3.5	1.5	-0.5

Notes: negative figures imply a surplus

83. The abatement costs and potentials used in this analysis are taken largely from the Committee on Climate Change's (CCC) marginal abatement cost curves that were developed as a key element of the Committee's evidence base which underpinned their December report22. Figure 2 below gives a graphical depiction of the non-traded MAC curve in the year 2020 relative to UEP37 emission projections. Additional information on the marginal abatement cost curves used in the analysis of the non-traded sector can be found at Annex A2.

Figure 2 shows non-traded MACC in 2020 relative to UEP37, including non-CO_2. This MACC includes renewable measures for CO_2 sectors.

[22] http://www.theccc.org.uk/reports/



Source: UK MAC model

84. The cost estimates are based on the assumption that abatement options will be taken up in ascending order of cost to meet the non-traded sector target. The balance of abatement between domestic options, purchase of project credits and intra-EU trading of compliance will, therefore, be determined by the relative cost and availabilities of abatement options.

85. Table 8 shows the cost estimates for meeting the non-traded sector target to 2020. The results suggest a net saving of around £1.2 billion for meeting the target in the non-traded sector. This result is driven by the level of cost-saving (negative-cost) measures in the non-traded MAC curve. It is important to bear in mind that these results are based solely on the additional resource costs of meeting the target (relative to the counterfactual). Costs would be higher if hidden and policy costs in the cost curves were also considered. The Government will publish a comprehensive report later this year which will set out detailed proposals and policies to meet the carbon budgets in the non-traded sector. It is also important to note that the achievement of the RE target implies a reduced gap between the projections and the UK's non-traded targets, thus the RE target goes some way to help the UK meet its non-traded sector targets.

86. Estimates of the abatement potential in the non-traded sector suggest that there is a significant volume of abatement available at negative cost (i.e. are money saving, for example energy efficiency measures). In theory this abatement should not be available, as firms and individuals

should already have an incentive to abate these emissions to receive the savings in fuel bills. Therefore, it is possible that the estimated savings do not consider the full range of costs, such as time costs, which might be preventing the uptake of these abatement options. Hidden costs of these abatement measures may explain the low uptake of these opportunities. There may be further costs in implementing policies to encourage the uptake of these negative cost measures, which have not been estimated in the non-traded MACC.

Table 8: costs of meeting the non-traded sector targets (£billion PV)

	2013	2014	2015	2016	2017	2018	2019	2020	Total
Costs including all abatement	0.00	-0.13	-0.18	-0.22	-0.25	-0.28	-0.15	0.00	-1.21

Note: A negative present value implies a benefit

3.4 Costs of meeting the renewable energy target

87. The Renewables Directive requires that the EU generates 20% of its energy from renewable sources by 2020. The final Directive agreed a burden sharing methodology for this target that requires the UK to source 15% of its energy from renewable sources by 2020. This is a challenging target as our current level of renewable energy use is less than 2%.

88. The analysis presented in this Impact Assessment assumes that the 15% target is met entirely through domestic action (32% of electricity from renewables; 14% from heat; and 10% from transport). This is an illustrative scenario that is based on analysis of how much renewable energy could be feasible in the heat and electricity sectors using the least-cost technologies. For transport, the EU has a separate target for 10% but it is important to note that this is subject to sustainability issues being addressed.

89. The resource costs associated with this scenario were estimated on a sectoral basis. For electricity, the costs were estimated based on economic modelling by Redpoint et al, with input from other consultants. The resource costs were measured against a 'status quo' scenario that represents the renewable electricity policy following from the Energy Bill proposals, with banding of the Renewable Obligation and upper limit on the obligation size of 20% by 2020.

90. The costs associated with meeting 14% renewable heat were informed through consultancy projects undertaken by Enviros and Nera. They considered the technology costs and potential of using renewable heat rather than conventional heating systems as well as the costs of overcoming supply and demand-side constraints to increased deployment (e.g., the need for supply chain expansion and biogas plant upgrades).

91. Estimates of the cost of meeting 10% renewable energy in transport use the announced Renewable Transport Fuels Obligation (RTFO) as a counterfactual. The resource costs of meeting the 10% target in transport are based on a comparison of the total fuel costs to consumers and businesses for the policy option and the counterfactual. This cost is a function of the pre-tax cost of biofuels relative to fossil fuels and of the extra fuel consumed due to the energy penalty of biofuels.

92. Table 9 shows the cumulative costs to 2020 of meeting the renewables target. The estimates suggest that the costs to 2020 of meeting the 15% target in the UK will be around £19.9 billion.

Table 9 – cumulative resource costs to 2020 of meeting the 15% renewable energy target

Sector	£billion (NPV, 2008 prices)
Electricity	11.5
Heat	6.0
Transport	2.4
TOTAL	19.9

Note: costs in the traded sector exclude the impact of the carbon price as these benefits have already been valued in the ETS costs section.

93. The cost figures presented in Table 9 are provisional estimates based on initial analysis for an illustrative scenario. Cost estimates and scenarios are currently being updated and will be published alongside the forthcoming UK Renewable Energy Strategy. More information on how the renewable energy scenarios were developed is available in the impact assessments that accompanied the Renewable Energy Strategy Consultation[23].

3.5 The combined costs and benefits of the Package

94. The total resource costs arising from the Climate & Energy Package are shown in Table 10. These estimates show the additional costs over the counterfactual scenario. The estimates suggest a cost to the UK of £19.8 billion over the appraisal period. Comparing this with the total present value of the quantified benefits of the package, as shown in Table 10, suggests that the NPV of the package is in the range between £-10.5 billion to £223.5 billion. This large range is the result of the scenario approach to carbon valuation and reflects the uncertainty over whether or not the EU's offer will instigate a global deal. It is also important to note that there are other potential benefits and costs which have not been included in these NPVs. These would include benefits relating to innovation from increased uptake of new technologies to meet the renewables target, and the potential air quality impacts of certain renewable sources (such as biomass). These impacts have not been quantified but should be considered alongside the monetised costs and benefits presented in this impact assessment.

Table 10: resource costs and benefits associated with the three elements of the Climate & Energy Package (2013-2020)

	Discounted direct impacts 2013-2020 (£billion)
Renewable energy target	19.9
Non-traded sector target	-1.2
EU ETS	1.9
Total Costs	20.6
Total Benefits (scenario 1)	242.1
Net Benefits (scenario 1)	242.1 – 20.6 = **221.5**

[23] http://renewableconsultation.berr.gov.uk/related_documents

Total Benefits (scenario 2)	9.2
Net Benefits (scenario 2)	9.3 – 20.6 = **-11.4**

Section 4 Costs and benefits of Carbon Budgets

95. On 1 December 2008 the CCC published its report on building a low carbon economy and recommended what the UK's carbon budgets[24] should be. The report stated that the 'interim budget' should be set equivalent to the targets for UK as set out in the Climate and Energy package. The CCC also recommended that the UK should meet its non-traded sector targets from purely domestic abatement, i.e. without purchasing project credits. The Government has accepted this advice and proposed carbon budget levels on this basis. This section assess the cost and benefits of the CCC's recommend approach by adapting the methodology taken in section three, in which the UK non-traded sector MAC curve was used to estimate the cost of the of non-traded sector target.

4.1 Consistency of analysis with C&E package

96. The CCC stated that the UK's interim carbon budgets should follow the UK's traded sector and non-traded sector targets. This would imply that the costs and benefits of the budgets are the same as the costs and benefits from EU targets. However, there are a number of important differences in the coverage of emissions and the timescale of the two frameworks.

- Carbon budgets will be set for a 15 year period from 2008 to 2022, starting before and going further than the non traded targets set out in the Package. Therefore the costs and benefits of the carbon budgets will be considered over this longer timeframe.
- Carbon budgets also include emissions from domestic aviation, but not international aviation.
- Carbon budgets include net emissions from land use, land use change and forestry, (LULUCF) which are not included in the EU C&E package.

97. The interim budgets as suggested by the CCC included traded and non-traded sector elements. As discussed earlier we have adjusted the CCC's interim budget to take account of the changes to the traded sector element that resulted from European negations that concluded after the CCC's report was published. Based on our analysis the CCC's non traded element of the budgets are broadly consistent with the EU's suggested trajectory. However, there are some marginal differences between the CCC's non-traded budgets and our estimate of the EU's non-traded trajectory. The cumulative difference between our estimate and that implied by the CCC is less than a few $MtCO_2e$ and this appears to be well within the range of projection uncertainty. Therefore we have concluded that we should accept the budget numbers for the non-traded sector as suggested by the CCC. The analysis in this section uses the targets for the non traded sector as suggested by the CCC and therefore differs very slightly for the analysis undertaken earlier for the UK's EU non-traded targets.

[24] Whilst the Budgets are termed carbon budgets they are, however, based on GHG emissions and reductions and thus Carbon budgets is used to imply GHG budgets.

4.2 Costs and benefits for the first budget 2008

98. The CCC recommended that for the first budget period (2008-12) the level of the budget should be set in line with current projections for emissions(given by the 2007 Energy White Paper). Assuming actual emissions turn out equal to the projections there will be no additional costs and benefits in setting the first carbon budget over the counterfactual. This is because the level of emissions here is dictated by EWP policies and these emissions are the counterfactual being considered. However, because the carbon budgets cover a longer timeframe than the UK's target for the non-traded sector[25], which ends in 2020, this means that the will be some additional carbon savings in the years 2021 and 2022 from the budgets. There would also be additional costs associated with meeting these targets. As these timeframes are not consistent with counterfactual case in this IA, these cost and benefits are not estimated here, but that there are additional cost and benefits in 2021 and 2022 should be noted and explored in the Government's summer Energy and Climate Change strategy, which will set out the proposals and policies to meet the budgets.

99. There is some uncertainty in the projections for non-traded sector emissions in the first budget period. It is possible that the actual level of emissions may be higher than the projected emissions used to set the budget level. There would be an additional cost in this case to reduce UK net emissions to within the prescribed budget level.

4.3 Overcoming the Discrepancies in Scope.

100. The carbon budgets as recommended by the CCC also included emissions from LULUCF and domestic aviation. However, this additional coverage in emissions scope of the carbon budgets does not need additional cost analysis. This is because the emissions from LULUCF and domestic aviation are included in the budgets on the basis of their projected emissions and hence there is no gap, or effort, for which costs need to be estimated. It is also not necessary to estimate the carbon benefits associated with the carbon budgets as they will be same as those for the package as a whole. The differences in the approach recommended by the CCC compared to the package are purely driven by the different approaches taken to use of project credits.

4.4 Cost of meeting the package with and without project credits.

101. Analysis of the effort required in the non-traded sector presented in Section 3.3 shows that under the projected emissions scenario modelled there is sufficient negative-cost abatement potential available to meet the anticipated shortfall. This suggests that there would be no requirement to use project credits, as sufficient abatement at lower (negative) cost is available. Therefore, under this, there would be no need to use project credits, and subsequently no additional cost of constraining their use.

102. It is again important to bear in mind that these results are based solely on the additional resource costs of meeting the target which are

[25] The revised directive on the EU ETS sets out a trajectory for the Traded sector that last out to 2050 and hence a 'de facto' cap for the UK can be inferred in the years 2021 and 2022.

estimated in the non-traded sector MACC. Section 3.2 notes that the estimated costs and quantities of abatement may be overestimated as the MACC does not take account of the hidden and policy costs of certain abatement options. Therefore, in a scenario where negative cost abatement potential cannot be unlocked, the benefits from allowing non-traded sector targets to be met through the use of project credits may be higher. Projected emission levels are also uncertain.

103. There are wider issues relating to the question of whether to undertake abatement domestically or by purchasing project credits from overseas abatement. These include:

- Uncertainty over domestic emissions projections meaning that some risk management is needed;
- Uncertainty over the nature and supply of future credits;
- Uncertainty over the quality of some credits;
- The possibility that strategic purchases of credits may help to engage other countries in a global trading system; and
- The potential for lock-in to carbon-intensive technology in the non-traded sector that could make meeting future targets more costly.

Section 5 Electricity price and fuel poverty impacts

5.1 Energy prices and bills

104. The implementation of policies required to meet our obligations under the Climate & Energy Package are likely to have an impact on energy prices and bills. The revised ETS Directive will result in a higher carbon price than in the counterfactual scenario - the estimates presented in this Impact Assessment suggest that the revised Directive results in a 20% increase in the average EUA price to 2020. We assume that the EUA price will be fully passed through to the wholesale electricity price by generators. As such, we expect that the revised ETS Directive will result in higher electricity prices for domestic and industrial consumers. Policies to increase the deployment of renewables will also add to electricity prices and bills. The increase in renewable electricity will affect electricity prices, as the costs identified in the previous section are passed through to prices and bills.

105. The analysis in this section builds on the wok done for the partial EU ETS impact assessment and impacts assessments on the RE strategy. The figures presented here differ from those reported in the RE strategy because they cover different timescales, however, the estimates use the same methodology and the results are similar. The estimates of the impact of the EU ETS on electricity prices are lower than those shown in the partial impact assessment on the revised directive. This is because the EU allowance price estimate have reduced since the analysis for the partial impact assessment was undertaken. The analysis presented here brings together the impacts of both the changes to the ETS and the Renewable energy target to provide combined price impacts for the first time.

106. Table 12 and 13 show estimates of the impact of the revised ETS Directive and the renewable energy target on domestic and industrial electricity prices. These are based on a central fossil fuel price projection and are shown relative to a counterfactual scenario that includes existing climate change related policies.

107. The estimates suggest that the impact of the ETS and the renewables target will increase over time (particularly for the renewables target where deployment is assumed to accelerate as we approach 2020). The impact on bills may not be as large as is shown in the table below if the higher prices result in a reduction in energy use[26].

Table 12 – impact of revised ETS Directive and renewables target on domestic electricity prices and bills

	2015	**2020**
Increase in electricity prices	£6 - £8/MWh (5.5% - 7%)	£16 - £18/MWh (12.7% - 14.1%)
Of which:		
Revised ETS Directive	£3/MWh (3.0%)	£4/MWh (3.0%)
Renewables target	£3 - £5/MWh (2.5% - 4.6%)	£12 - £14/MWh (9.7% - 11.1%)

[26] This impact is likely to be small, however, as the demand for energy is fairly inelastic.

Increase in average electricity bill	£19 - £24 pa (5.5% - 7%)	£44 - £49 pa (12.7% - 14.1%)
Of which:		
Revised ETS Directive	£10 pa (3.2%)	£10 pa (3.0%)
Renewables target	£8 -£13 pa (2.5% - 4%)	£33 - £38 pa (9.7% - 11.1%)

Table 13 – impact of revised ETS Directive and renewables target on industrial electricity prices and bills

	2015	2020
Increase in electricity prices	£6 - £8/MWh (7% - 8.9%)	£15 - £17/MWh (16.4% - 18.2%)
Of which:		
Revised ETS Directive	£3/MWh (3.8%)	£4/MWh (3.9%)
Renewables target	£3 – £4/MWh (3.1% - 5.1%)	£12 - £13/MWh (12.5% - 14.4%)
Increase in average electricity bill	£29,006 - £37,247 p.a. (7% - 8.9%)	£72,961 - £81,201 p.a. (16.4% - 18.2%)
Of which:		
Revised ETS Directive	£15,947 p.a. (3.8%)	£17,180 p.a. (3.9%)
Renewables target	£13,059 - £21,299 p.a. (3.1% - 5.1%)	£55,781 - £64,022 p.a. (12.5% - 18.4%)

Note: estimated impacts based on average energy consumption for a medium sized industrial consumer

108. The cost of measures to incentivise the uptake of renewable heat would be expected to be passed on to customers by suppliers, so there will be an impact on gas bills and other fossil fuels used for heating. The precise scale of such impacts will depend on the scale of the renewable heat options, their costs, and how well targeted a financial incentive is in the heat sector could be made to operate in practice. The estimated impact of the renewable energy target on domestic and industrial gas prices and bills is shown in Table 14. The revised ETS Directive will also have an effect on the gas price paid by some larger industrial customers. However, this impact has not been modelled.

Table 14 – impact of the renewables target on gas prices and bills

	2015	2020
Increase in gas prices		
Domestic	£1/MWh (1.4% - 3.4%)	£6 - £10/MWh (14.4% - 23.6%)
Industrial	£1/MWh (2.7% - 6.7%)	£6 - £9/MWh (28.5% - 46.6%)
Increase in average gas bill		
Domestic	£9 - 23 p.a. (1.4% - 3.4%)	£97 - £159 p.a. (14.4% - 23.6%)
Industrial	£2,703 - £6,690 p.a. (2.7% - 6.7%)	£29,351 - £47,986 (28.5% - 46.6%)

Note: estimated impacts based on average energy consumption for a medium sized industrial consumer

5.2 Fuel poverty

109. The revised ETS directive and the renewable energy target will have impacts on the number of people defined as being in fuel poverty. This is because the changes and targets will increase the cost of energy as the costs of EU allowances increases and as the costs of renewable technologies are factored into energy prices. This section discusses the estimates of the impact of the C&E package, and the 'interim budgets' on the levels of fuel poverty, where fuel poverty estimates represent the number of additional households that will be required to spend greater than 10% of their income on energy in order to maintain an adequate standard of warmth.

110. In their December report the Committee on Climate Change presented estimates of the impact of meeting the proposed budgets on the levels of fuel poverty in UK . These estimates suggested that by 2017 the 'interim budgets' could increase the number of fuel poor households by 0 .5 -1.3 million and by 0.6 -1.8 million in 2022[27].

111. The analysis conducted for this impact assessment uses the same the methodology used by the CCC to produce estimates of the fuel poverty impacts for England only. The estimates suggest that the cumulative impact of higher electricity and gas prices will have a substantial impact on the number of fuel-poor households. The estimates suggest an additional 0.2-0.4 million fuel-poor households by 2015 and an additional 0.7-1.4 million by 2020[28]. These estimates are of a similar magnitude to those estimated by the CCC. The estimates highlight the scale of the challenge given the Government's target of eliminating fuel poverty in England by 2016.

112. The Government considers taking action to reduce fuel poverty as a key objective . Since 2000 the Government has spent £20 billion on benefits and programmes to tackle fuel poverty. A review is underway that will examine whether existing measures to tackle fuel poverty could be made more effective and will also consider whether new policies should be introduced to help us make further progress towards our targets. Initial findings of the review are expected in the summer of 2009

[27] The CCC made estimates of the number of households in fuel poverty in the UK in the 2008 report, 'Building a low carbon economy the UK's contribution to tackling climate change'.
[28] Figures are estimated using the 2006 English Household Condition survey and make no assessment for the changed household size, age of population or energy efficiency levels by 2020.

Section 6 Macroeconomic Costs of the C&E Package

1. Climate change mitigation policies can impact the economy directly and indirectly. The direct costs of mitigation are the first order effects of the policy on a particular sector. These direct costs estimates are generally generated from Marginal Abatement Cost (MAC) curves, which show the technical abatement potential across sectors.
2. The macroeconomic costs take into account knock-on effects on other sectors as well as direct costs as the economy adjusts to a new equilibrium. For example, a more stringent ETS cap will not just increase costs in sectors that are direct participants in the ETS, but will also affects other sectors of the economy through increase of electricity prices. Macroeconomic costs can also cover rebound effects (the potential for money saved through energy efficiency measures to be spent on other goods and services that lead to increased emissions), the effect of allocation mechanisms and exchange rate effects.
3. This section discusses the Commission's estimates of the direct and macroeconomic impact of the Climate and Energy package as well as the HMRC Computable General Equilibrium (CGE) estimates of the macroeconomic costs of the Package for the UK economy.

6.1 Commission estimates

4. In order to inform Member States about the impacts of their proposals for implementing the commitments agreed in the 2007 European Spring Council Conclusions, the Commission completed an extensive impact assessment of their proposed package. A number of tools were utilised including the PRIMES and the GAINS model for estimating the direct costs and the general equilibrium GEM-E3 model for the macroeconomic impacts.[29]
5. The Commission's modelling estimated that, relative to 'business as usual',[30] the direct costs of meeting both the RE and GHG targets would be equivalent to 0.58% of EU GDP and that for the UK direct costs would be equivalent to 0.49% of GDP.
6. Using the general equilibrium model GEM-E3, the Commission estimated that the macroeconomic costs of meeting a 20% reduction in GHG emissions in 2020 (note the Commission's macroeconomic estimates does not reflect the costs of the RE target) were 0.54% of EU GDP, with macroeconomic costs to the UK of 0.4% of GDP.
7. The Commission's analysis suggests that other key policy choices, such as the extent to which access to project credits is permitted and the extent of auctioning, can significantly alter these costs. The direct costs of meeting the GHG and the RE targets would fall to 0.45% of EU GDP in 2020 when auctioning rights are redistributed back to consumers. The same estimate for the UK would fall to 0.34% of UK GDP in 2020. For the macroeconomic costs, access to CDM credits is expected to reduce the "macroeconomic impacts" of meeting the GHG target only at the EU level where the EU GDP in 2020 is expected to decline by 0.21%. As for the UK, the macroeconomic impacts would be 0.2% in 2020.

[29] http://ec.europa.eu/environment/climat/pdf/climat_action/climate_package_ia_annex.pdf.
[30] This is defined on a country by country basis, according to policies that have already been agreed. For example, in the UK, 'business as usual' includes all policies included in the Energy White Paper.

6.2 HMRC estimates

8. HMRC CGE model is used to estimate the impact of the C&E Package on the UK economy up to 2050 (see box below for a description of the HMRC CGE model). The main scenario includes a EU ETS cap under a 20% world, the renewable target and the CDM limits under the Commission proposal (including aviation). In addition, from 2030 all sectors are assumed to be part of a global trading system and the long term target of 80% reduction in GHG by 2050 is forced in the model.

Box 3: HMRC Computable General Equilibrium (CGE) model

The HMRC Computable General Equilibrium (CGE) model is a large-scale dynamic model of the UK economy. It has explicitly defined linkages between sectors, the government and households and uses equations derived from microeconomic relationships which maximise consumer welfare and industry profits. It ensures that (after the economy has adjusted, depending on structural rigidities in the form of factor employment, adjustment costs and time lags) the supply and demand of all factors and products are balanced.

The model has a relatively simple representation of the energy system, distinguishing between industry sectors supplying electricity, oil, gas, coal, nuclear and renewable energy. A environmental extension of the model has been developed to allow analysis of changes in economic variables and emissions in response to environmental policy changes (including carbon pricing and a range of abatement measures).

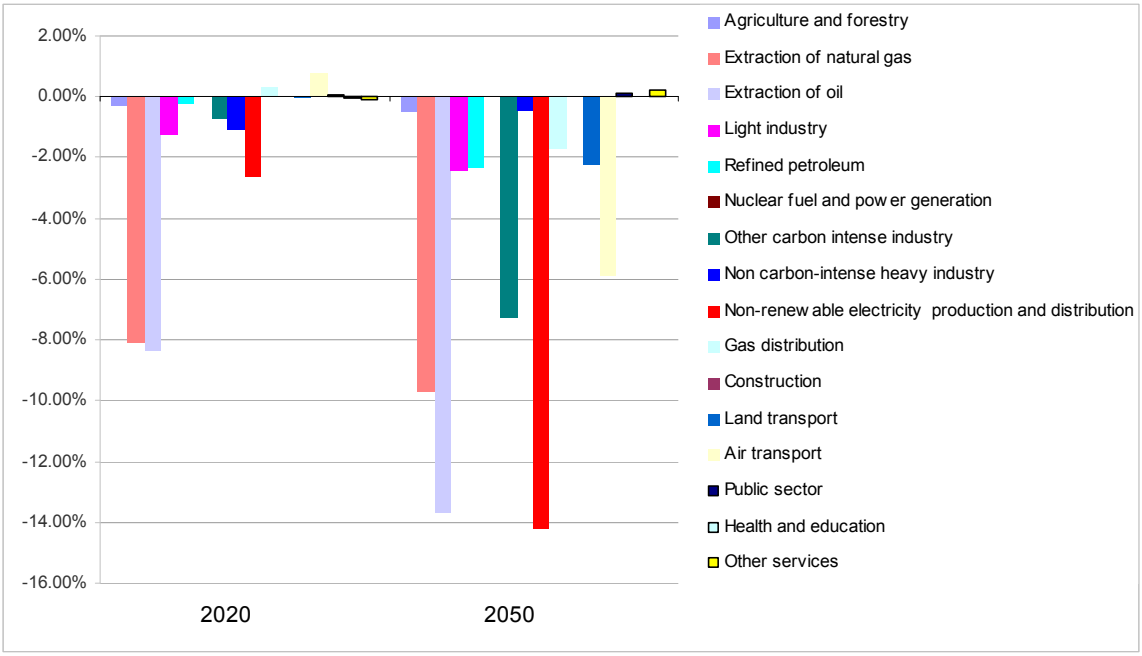
The model describes the behavioural adjustments of the economy back towards a general equilibrium through feedback loops between agents after policies are introduced, incorporating any direct, indirect and induced impacts of relative price changes on the economy. This makes the model suitable for assessing the longer-term impact of such policy changes once adjustments back to equilibrium have occurred.

9. The HMRC CGE model suggests that the Climate and Energy package will lead to a GDP reduction of about 0.35% (relative to baseline) in 2020 and about 0.85% (below baseline) in 2050. Interestingly, the results are broadly insensitive to the presence of CDM projects.

10. Whilst overall macro costs are deemed to be manageable, impacts vary widely across sectors. Most notably (see Figure 3), energy production and distribution sectors are more significantly affected than other sectors. For example, output in gas and oil extraction sectors both fall by around 8% in 2020 and then by around 10% and 14% respectively in 2050. Falls appear larger in the

extraction sectors as their relative size to the equivalent distribution and refining sectors are smaller. The sector shown to be most significantly affected in 2050 is the non-renewable electricity sector. Electricity consumption is shown to be fairly constant as a proportion of GDP and the renewable electricity sector (not shown) is estimated to more than double in size by 2050.

Figure 3: Real GDP costs (relative to baseline) by sector



11. This analysis is of course sensitive to assumptions. Extensive sensitivity testing of the model (not shown) has been undertaken, in particular to the areas of carbon caps, fossil fuel/carbon prices and economic growth. However, these factors are less important in determining the economic outcome than other drivers such as the elasticity of inter-temporal substitution (that governs how agents will react to changes in their future purchasing power), productivity of energy technology and supply constraints (see annex A4 for further discussion of this sensitivity).

12. The most important result of this sensitivity analysis is that the potential adverse economic effects of implementing carbon caps and renewable technology can be significantly reduced if the technology becomes more productive and there is an increase in supply. This will facilitate higher investment returns which will dampen any adverse inter-temporal impacts.

13. In conclusion, it appears that the HMRC CGE modelling results are consistent with the results by the EU Commission and the CCC. Whilst these macro costs are not negligible, they are deemed manageable and they are likely to be significantly lower than the costs of not tackling climate change.

SECTION B THE DESIGN OF THE EU EMISSIONS TRADING SYSTEM

Section 1 Introduction

1.1 Background to the EU ETS and performance to date

1. The EU Emissions Trading System (EU ETS) was established under the European Directive 2003/87/EC that came into force on 25 October 2003. The purpose of the System is to promote cost effective reductions in greenhouse gas (GHG) emissions. It supports the EU's commitment to a global carbon market as a key instrument for tackling climate change, and will be central to enabling the EU to achieve its stated goal of reducing emissions by 20% in 2020 compared to 1990 levels. The Stern Review[31] stated the necessity of carbon pricing as a response to climate change and highlighted the benefits of using emissions trading as the principal policy mechanism for mitigation as it provides both certainty over emission reductions and an economically efficient outcome.

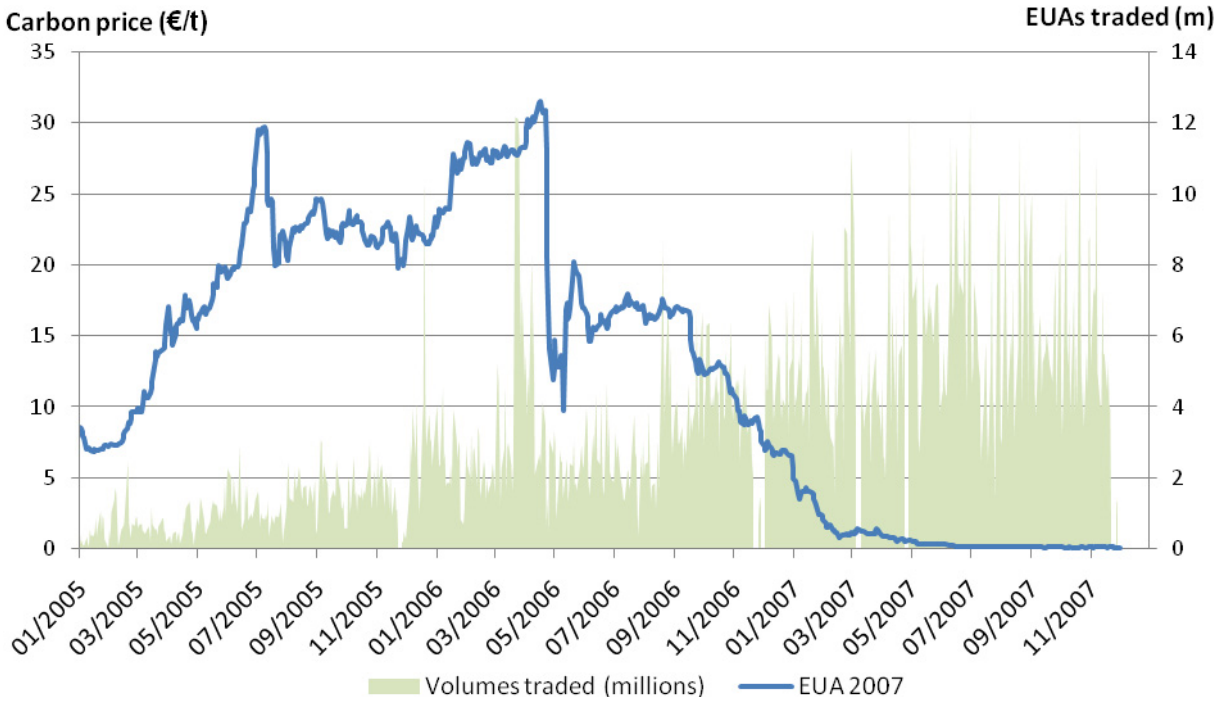
Experience of Phase I

2. Phase I of the EU ETS ran from 1 January 2005 until 31 December 2007. The first phase was designed as a learning phase in which policy makers and System participants could become familiar with the rules and realities of trading emissions reduction allowances. The experience of Phase I was mixed.

3. The System has performed well in terms of the level of compliance, with rates across the EU reaching 99% for 2005 and 100% for 2006. As Figure 4 illustrates, the volume of trades grew steadily; in 2005, 320 million over-the-counter trades were reported with a value of more than €6.5billion. During 2006, the EU ETS was confirmed as the dominant force in the global carbon market, accounting for 80% of monetary value and over 60% of the total volume of carbon trades.

Figure 4: EU ETS Phase I Prices and Volumes

[31] Available from http://www.hm-treasury.gov.uk/stern_review_report.htm



4. However, Phase I failed to establish a robust carbon price, as the Chart 1 above illustrates. The release of the first verified emissions data resulted in a dramatic collapse in the carbon price, and with the release of the second year's verified emissions data the value of an EU allowance (EUA) dropped to below half a Euro. The low prices that were observed in Phase I reflected the fact that that the cap was not set sufficiently tightly. This was the key weakness of the System in the first phase of operation.

Prospects for Phase II

5. Phase II of the EU ETS began on 1 January 2008 and will run until 31 December 2012. Initial analysis of Member States' proposed National Allocation Plans (NAPs) for Phase II suggested a risk that the mistakes of Phase I would be repeated, with overly generous allocations requested by many Member States. The Commission subsequently rejected all but two of the initial NAPs on the basis that they were over allocated, and developed a formula to set a maximum level of allowances per Member State. This formula embodied levels of emissions reduction effort required of Member States under the Kyoto agreement[32]. The Commission's approach of applying a formula has resulted in a 9% reduction in the cap compared with Member States' proposed NAPs. This has significantly increased the prospects for Phase II providing a sufficiently tight cap to drive emissions reductions.

Purpose of the review of the EU ETS Directive

6. The Commission's review of EU ETS provided an opportunity to draw on the experience from Phase I and II, and to strengthen the design of the System in order that it is able to meet the strategic objectives to deliver cost

[32] See the cap setting section for a discussion of the Commission's formula.

effective emissions reductions without distorting the playing field for competition.

7. On 23rd January 2008 the European Commission put forward a package of proposals aimed at delivering the European Union's commitments to fight climate change and promote renewable energy. The Commission set out three overall objectives for the review of the EU ETS:

- Fully exploiting the potential of the EU ETS to contribute to the EU's overall GHG reduction commitments in an economically efficient manner.
- Refining and improving the EU ETS in the light of experience gathered.
- Contributing to transforming Europe into a low greenhouse-gas-emitting economy and creating the right incentives for forward looking low carbon investment decisions by reinforcing a clear, undistorted and long-term carbon price signal.

8. The final details of the revised ETS Directive (alongside the other components of the Climate and Energy Package) were agreed by the European Council on 12th December 2008 and passed a vote in the European Parliament on 17th December 2008.

1.2 Purpose of this Impact Assessment

9. This Impact Assessment discusses the potential impact on the UK of the revisions to the EU ETS Directive. The design of an emissions trading system requires a number of decisions, many of which are interdependent. The following sections cover the areas that were the focus of the ETS review:

- Section 2 presents the outcomes relating to amending the scope of the emissions/sectors covered by the scheme, harmonisation of definitions of installations and the treatment of Carbon Capture and Storage (CCS) under the System;
- Section 3 discusses outcomes on cap setting – e.g., who sets the cap, how is the level of the cap determined, how many years in advance is the cap is determined, and provisions for banking and borrowing of allowances;
- Section 4 looks at how allowances will be allocated under the revised Directive, including whether installations buy allowances through auction or receive them for free, how any free allowances would be allocated to installations, provisions for new entrant installations, and how the rights to auction allowances would be distributed between Member States.
- Section 5 discusses the impact of decisions on the use of credits from project based mechanisms (the Clean Development Mechanism and Joint Implementation).
- Section 6 presents a discussion of the impacts of reforming the Monitoring, Reporting and Verification (MRV) provisions.

10. This Impact Assessment presents the outcomes of the negotiations on the revised ETS Directive across each of these areas against a counterfactual scenario where system design is the same as under the existing ETS Directive.

11. This Impact Assessment only considers the functioning of the ETS under its 20% GHG reduction target. The details of how the system will function under a 30% GHG reduction target (e.g., level of the cap, access to

project credits, level of auctioning, etc.) are as yet undecided and will be the subject of negotiations in the coming year. It is, therefore, not possible at this moment in time to assess the likely impacts of revisions to the ETS under a 30% GHG reduction scenario.

Criteria for assessment of options:

12. In developing the analysis a set of objective criteria has been used to assess the outcomes across each of the areas of the review. The following criteria have been used:

- **Effectiveness of the system:** this is assessed as the extent to which the option is likely to achieve the overall objectives of the EU ETS, principally in terms of emissions reductions. This would include a discussion of the scope of emissions covered and the integrity of the System such as creating the right long-term signals for low carbon investment in the EU, and creating the incentives to minimise the risk of carbon leakage.
- **Efficiency:** this is assessed as the ability of an option to meet a given emissions reduction target at least cost. This would include both direct impacts (technological cost) and indirect impacts (such as air quality benefits).
- **Consistency with the other policies and targets in the package:** where applicable, this assesses whether an option is consistent with the other elements of the Commission's package i.e. the overall GHG target (including burden sharing) for 2020, the targets for renewable energy and energy efficiency.
- **Harmonisation within the ETS:** to assess whether an option minimises the unequal treatment of equivalent operations within or between Member States. However this criterion is subject to wider principles of flexibility and subsidiarity and the fact that there is only likely to be a material impact on competition in a relatively small number of sectors.
- **Predictability of carbon framework to support low-carbon investments:** where applicable, the extent to which an option creates a credible long-term signal of the future carbon framework.

2. Scope

2.1 Introduction

13. Widening the scope of the EU ETS has the potential to enhance its environmental effectiveness as well as increasing its cost-effectiveness. Increasing the number of emissions that are covered by the system can potentially lower costs of meeting the cap by providing access to a wider pool of abatement opportunities. Expansion to additional industrial sources of CO_2 and other GHGs as well as non-industrial sectors is considered in the following section.

Current scope of the System.

14. In Phase II the EU ETS includes carbon dioxide emissions from electricity generators and industrial sources. The system covers around half of EU CO_2 emissions which in Phase I was equivalent to 37% of EU GHGs.

15. The emissions that are currently outside the scope of the system are remaining CO_2 emissions industrial sources but also from non-industrial sources, namely transport, domestic heating and agriculture.

UK objectives for expansion

16. Expanding the scope of the EU ETS is desirable to enhance its environmental effectiveness and to drive cost efficient emission reductions. It is important to ensure that such expansion doesn't undermine the credibility or long term sustainability of the system. With this in mind, the UK's objectives for the expansion of the EU ETS are to:

- Ensure opportunities for expanding to new sectors are considered fully, thus enhancing the environmental effectiveness of the system;
- Avoid expansions which weaken incentives in the current EU ETS sectors; and to
- Ensure Carbon Capture and Storage (CCS) benefits fully from a carbon price[33].

17. To assist with the achievement of these objectives, a clear and consistent framework for analysis and decisions on scope has been sought by developing criteria that could be used for assessing the desirability of expanding the EU ETS. Both the UK and the Commission have developed different, but related, criteria. These are discussed in section 2 of Annex B.

18. The sections that follow discuss the impact of decisions in the revised Directive relating to the definition of combustion, the treatment of small emitters, the inclusion of new sectors and gases and the treatment of CCS installations.

[33] The Stern Review (2006) advocates the role of CCS in mitigating emissions. It estimates that CCS has the potential to contribute up to 28% of global CO_2 mitigation by 2050. Furthermore, to achieve stabilisation at 550ppm (or +2°C) without CCS would increase costs by more than 60%.

2.2 Streamlining the current scope – combustion definition

19. Different interpretations of the combustion installation definition were adopted by Member States during Phase I – medium and broad definitions[34]. As a result, competitive distortions were created in the internal market as some competitor installations in different Member States faced differing treatment.

20. For Phase II, Commission guidance supported a broad interpretation for combustion installations. However it recognised the difficulty that some Member States would have implementing this in the time available, and so provided a list of activities that should be included as a minimum.

21. The following options are considered here:

Option 1 - do nothing: In Phase II, the Commission supported the use of the broad definition of combustion and provided a list of activities that should be included as a minimum if Member States decided against applying the broad definition; and,

Option 2 – revised ETS Directive: Codifying a broad interpretation of combustion installation in the Directive. The Commission will provide a more precise definition of the scope of the EU ETS, which will be codified in the Directive. Where necessary to ensure a consistent application, this will be supplemented by a list of activities in Annex I of the Directive.

22. Assessment against the criteria:

i) Effectiveness: Option 1 does not address any of the problems identified above and thus would not provide the opportunity to improve the effectiveness of the System. The revision to the Directive (Option 2) addresses these distortions and enables greater legal clarity, helping a consistent application of the Directive. In addition Option 2 will expand the coverage of the EU ETS by bringing a greater number of combustion installations into the System, although some of these might be excluded under the proposed opt-outs for small emitters.

ii) Efficiency: Option 1 could give rise to efficiency costs because the distortions created by different applications of the combustion definition might prevent abatement occurring at least cost. Where Option 2 leads to coverage of more firms, there is a risk that these firms would be small operators who would experience disproportionate costs compared to larger firms. To avoid this risk provisions for small emitters are considered in the next sub-section. It is not expected that Option 2 will lead to significant increases in administrative costs incurred by public authorities.

iii) Harmonisation: Option 1 will not address the unequal treatment of equivalent operations across Member States. Option 2 will allow a consistent approach, improving harmonisation and helping to eliminate distortions. The list of activities should ensure more consistent coverage of process emissions within the EU ETS.

iv) Predictability: It is expected that Option 2 will enhance predictability of the EU ETS by providing greater clarity about the System's scope and remove the risk that individual Member States might alter their interpretation in the future.

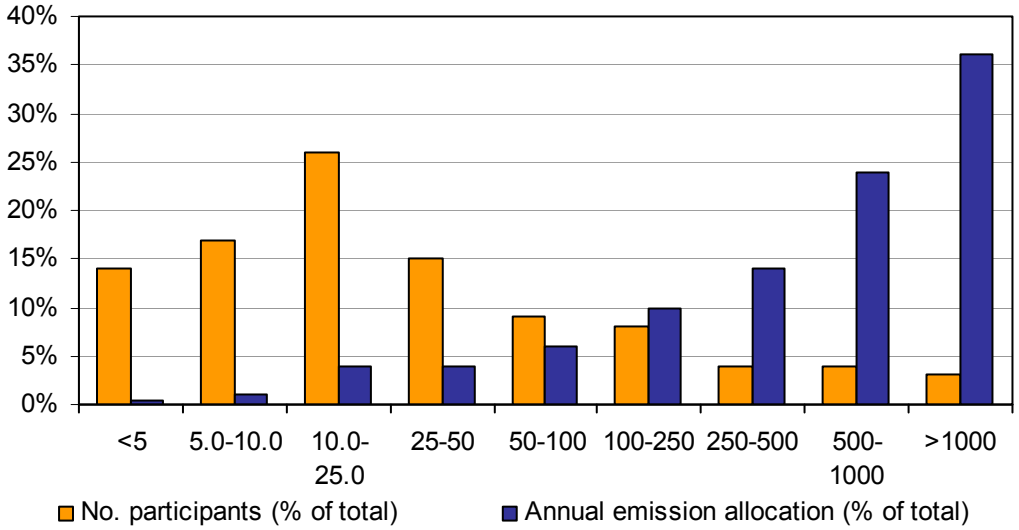
[34] A medium definition refers to all combustion installations that produce electricity heat or steam where the purpose is energy production. A broad definition refers to all combustion installations that produce electricity, heat or steam even if the purpose is not energy production.

2.3 Exclusion of small emitters.

23. Currently there are approximately 11,000 installations included in the EU ETS, with annual emissions varying from just over 5,000tCO_2 up to more than 5MtCO_2. The largest 7% of emitters represent 60% of emissions, while the smallest 14% represent 0.14% of emissions. This is evident in Figure 5 that shows the distribution of ETS installations by size against their allocations during Phase I. There are a large number of firms (the orange bars) that represent a small share of total emissions (the blue bars). It is likely that the costs of inclusion and compliance (in terms of monitoring, reporting and verification rather than costs of complying by buying allowances) outweigh the benefits of including these small emitters. In its guidance for Phase II NAPs the Commission indicated the need to ensure or improve the cost-effectiveness regarding these small installations.[35]

[35] European Commission: Further guidance on allocation plans for the 2008 to 2012 trading period of the EU Emission Trading Scheme COM(2005)703 final, Brussels, 2005

Figure 5: Number of installations and corresponding allocations per installation size class



Source: "Small installations within the EU Emissions Trading Scheme" Graus & Voogt

24. The revised Directive notes that any small firms excluded from the EU ETS would have to be covered by other policies to ensure equivalent reductions are still achieved. In the UK, the Climate Change Agreements (CCAs), Climate Change Levy (CCL) and future Carbon Reduction Commitments (CRC) would cover small emitters, and in some cases installations could be covered by both the EU ETS and these domestic measures. Since the opt-out is optional the UK government will be able to decide which measure would be the least-cost option in their case.

25. Chart 2 illustrates the trade-off between emissions coverage of the EU ETS and the number and size of installations included. The fact that a small number of installations dominate the emissions covered by the EU ETS suggests that the small and medium-sized emitters play a role in diluting the market, reducing the possibility of market power and gaming that could arise if a large number of the small emitters were opted-out. In addition, if a significant level of emissions were removed from the System this would have implications for the stringency of the proposed cap and also the efficient split between the traded and non-traded sectors. There could be a sector-splitting effect from removing small installations, whereby firms in close competition with each other were covered by differing emission reduction policies, affecting their relative costs of production.

26. The following options are considered:

Option 1 - do nothing: For Phase II, the UK NAP applied a 20MW thermal threshold and a 3MW *de minimis* rule. However there was not a harmonised approach across Member States; and

Option 2 – revised ETS Directive: The revised Directive entails a combination of 35MW capacity and 25kt emission threshold with a conditional opt-out that can be exercised if the installation is covered by equivalent measures.

27. Assessment against the criteria:

i) Effectiveness: Option 2 could exclude a number of installations and a percentage of emissions from the EU ETS. In the UK, Option 2 is estimated to exclude 115 installations from the System that would have been included under

Option 1.[36] The sectors that will potentially experience the greatest reduction in the number of installations covered by the EU ETS under a 25kt threshold alone will be Food & Drink, Chemicals, Glass and Offshore Oil & Gas. It is important to note that these are only illustrative numbers, based upon the medium interpretation of combustion installations. Using the broad combustion definition will alter the number of installations under each threshold.

ii) Efficiency: The lack of harmonisation under Option 1 will have distributional consequences whereby similarly sized installations in different Member States could be treated differently. Option 2 would help to address this distributional issue. Whilst there would be cost savings due to excluded installations not having to comply with the EU ETS and surrender allowances, some costs would remain – for example, they would still be required to monitor emissions. Additionally, the excluded installations will be covered by alternative measures to ensure equivalent emission reductions. These measures should be more cost-efficient for operators, but there may be some set-up costs where Member States have not yet implemented such measures. In the UK, the CRC and CCAs could cover the removed installations, which may mean such costs are likely to be lower than for other Member States. Options 2 will alter the relative quantities of emissions covered by the traded and non-traded sectors. Option 2 will effectively make the proposed cap less stringent. A downward adjustment to the cap in line with the emissions removed from the System is warranted, as well as an accompanying adjustment to the non-traded sector target.

iii) Harmonisation: Distortions would remain under Option 1, while Option 2 will enable a more harmonised treatment of small emitters across sectors and Member States.

iv) Predictability: The options are not expected to have any significant impacts of the predictability of the carbon framework, given that Option 2 requires that excluded installations are still obligated to undertake emission reduction efforts.

2.4 Inclusion of new sectors and gases

28. Expanding the coverage of the EU ETS by including new sectors and gases would have two main effects:

- by covering a larger share of total GHG emissions in the EU the environmental effectiveness of the system will be enhanced; and
- the efficiency of the system will be increased by introducing additional abatement opportunities, potentially lowering the overall costs of making the emission reductions required by the cap.

29. Assessment of the suitability of different sectors for inclusion in the EU ETS has been undertaken using the scope-specific criteria detailed in the introduction to this section. A key criterion when considering the expansion to a new sector is the ability of that sector to undertake adequate monitoring, reporting and verification (MRV) of emissions. Ensuring robust MRV is central to maintaining the System's environmental integrity.

30. An assessment of each of the proposed new sectors can be found in Annex B. The options considered are as follows:

Option 1 - do nothing: Continuing with the current Directive would imply that the scope of the System under Phase II would remain through to 2020; and,

[36] See Annex B for a table giving the breakdowns by sector within the UK.

Option 2 – revised ETS Directive: The scope of the system will expand in Phase III to include CO_2 emissions from petrochemicals, ammonia and aluminium along with N_2O emissions from the production of nitric, adipic and glyoxalic acid, and PFC emissions from the aluminium sector.

31. Assessment against the criteria:

(i) Effectiveness: Inclusion of the sectors proposed under Option 2 would enhance the coverage of the EU ETS by an estimated 97MtCO_2 or up to 4.6% of Phase II allowances. In combination with streamlining the scope of the EU ETS, overall coverage would increase by up to 137-147MtCO_2 (or a 6.6-7.1% increase).

(ii) Efficiency: Option 1 would not create any additional costs in the short-term, since the Phase II state would continue. In the long-run, however, there could be costs to the EU ETS of not having access to the potentially cheaper abatement in the proposed expansion sectors.

(iii)Harmonisation: Where sectors are already partially covered by the EU ETS due to energy use or Member State opt-in, Option 2 could bring harmonisation benefits through a more consistent treatment of installations.

(iv)Predictability: Option 1 would not help the objective of reinforcing a clear and long-term price signal across as large a proportion of the economy as possible. Adding sectors to the EU ETS would help achieve this.

2.5 Carbon Capture and Storage (CCS)

Option 1 - do nothing: Under the existing Directive, CCS is not covered and as a result any installation fitted with CCS would have to surrender EU allowances corresponding to all CO_2 produced, regardless of whether it was captured; and,

Option 2 – revised ETS Directive: Include the capture, transport and geological storage of GHGs in the scheme. No free allocation granted for captured emissions. The Commission notes that further development of CCS is necessary in order to exploit its full potential in the long term. Therefore there is a case for the provision of economic incentives which can help advance CCS.

32. Assessment against the criteria:

i) Effectiveness: The current Directive does not incentivise the uptake of CCS, as installations that are covered by the EU ETS would have to continue to surrender allowances for any carbon that is captured. A key issue with including CCS in the EU ETS is that of developing suitable monitoring and reporting for all CCS projects and resolving environmental and liability issues. The Commission is currently addressing this issue and developing new annexes for the Monitoring and Reporting Guidelines (MRG) decision. Also the legal framework for the onshore and offshore geological storage of carbon dioxide is being developed in a proposed EU Directive[37], which is accompanying the amended EU ETS Directive in the Commission's Climate and Energy package. It is expected that the monitoring and reporting issues can be resolved by the end of 2009.

ii) Efficiency: Amending the Directive as Option 2 proposes will ensure that CCS receives the same incentive as other abatement technologies and options. In Phase II this is not the case because allowances must be surrendered for emissions that are captured and stored in sectors covered by the EU ETS.

37 http://ec.europa.eu/environment/climat/ccs/pdf/com_2008_18.pdf

Option 1 could increase costs of meeting emission reduction targets in the long term.

iii) Consistency with package objectives: Including CCS in the EU ETS will be consistent with the overarching objectives of the Commission's Climate and Energy Package, which looks to support the development of CCS.

iv) Harmonisation: Under Option 1, CCS projects can be included via a unilateral Member State opt-in. Option 2 will enable CCS to be treated equally across all Member States.

v) Predictability: Option 1 won't create the long-term signals supporting a key technology in the transition to a low carbon economy. Option 2 will recognise that CO_2 which is produced but captured is different from CO_2 which is emitted, incentivising uptake of CCS where it is the most cost-effective compliance option. Currently the high costs of CCS exclude the possibility of such incentives, but in the future these costs are expected to fall while the price of EU Allowances is expected to rise. Demonstration of commitment to CCS within the EU will also benefit the development of CCS internationally.

3. Cap setting

3.1 Introduction

33. The setting of a cap that drives real emissions reductions is paramount to the success of the EU ETS. It is the level of the overall cap that determines the environmental effectiveness of the System.

34. For the first two Phases of the System the EU-wide cap has been set as an aggregate of individual Member State caps. The process involved Member States proposing national caps and then agreeing them with the European Commission.

35. The practice of Member State cap setting result in problems with over-allocation. The release of verified emissions data for 2005 showed that overall emissions were lower than had been projected, and that there were more allowances than emissions, resulting in a surplus of allowances and a collapse in the carbon allowance price. By May 2007 the EUA price had fallen below one euro.

36. The process for Phase II of the EU ETS may have addressed some of the problems of Phase I. The Commission revised many of the caps in the National Allocation Plans submitted to it by individual Member States, with the first 18 Member States' caps revised downwards by more than 9% on average[38].

37. The revised ETS Directive will result in a substantially different approach to cap setting than in the existing Directive. This Impact Assessment examines four questions regarding the cap setting process. They are:

- Who should set the cap?
- How should the cap be set?
- How far ahead should the cap trajectory be set?
- What rules on banking and borrowing should apply?

3.2 Who should set the cap?

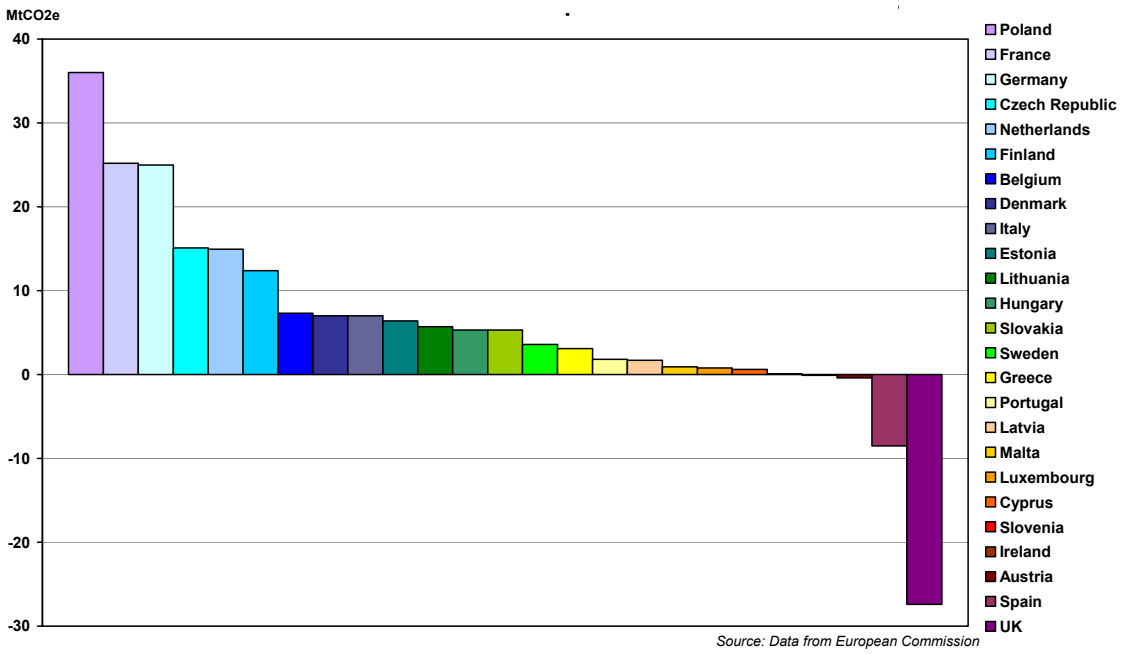
38. As set out in the previous section, the cap setting process in the EU has so far been undertaken on the basis of individual Member States setting their own caps (subject to the approval of the European Commission). This process gave Member States a significant amount of flexibility to take account of their differing national circumstances. However, it appears that the total EU wide cap was not sufficiently tight to generate scarcity.

39. Figure 6 below shows the difference between 2005 emissions and the number of allowances allocated for that year by each Member State. There could be several good reasons for Member States allocating significantly higher numbers of allowances compared to their installations' verified emissions – for instance, lack of data availability. However, the chart suggests that there may be free-riding/gaming incentives when allowing Member States to set their own caps. The temptation is for Member States to set a higher cap than is efficient for their traded sector on the assumption that other Member States will make a serious effort,

[38] See: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/459&format=HTML&aged=0&language=EN&guiLanguage=en

reducing costs for one's own Member State. However every Member State faces this decision and all will be tempted to reduce their effort thus leading to a worse outcome for everybody as no real effort is taken in the traded sector. There could be knock-on effects in the non-traded sector as more effort is necessary here to achieve the EU's target. Such a situation can be classed as a 'Prisoner's Dilemma'.

Figure 6: Difference between 2005 emissions and the Phase I cap



Source: Data from European Commission

40.

41. In Phase II of the EU ETS the Commission took steps to rectify the problems faced in Phase I. A short time into the Phase II NAP process the Commission issued a statement[39] containing a formula that would now be used for the calculation of Member State caps and project credit limits. The formula is as follows:

Maximum allowed annual average cap = (CIVE * GTD * CITD) + ADD

Where:

CIVE = corrected independently verified emissions for 2005

GTD = growth trend development 2005 to 2010

CITD = carbon intensity trend development 2005 to 2010

ADD = additional emissions covered by an extended scope of combustion installations

42. From this, maximum allowed cap deductions are made on the basis of:

a) Progress towards Kyoto targets and remaining gap;

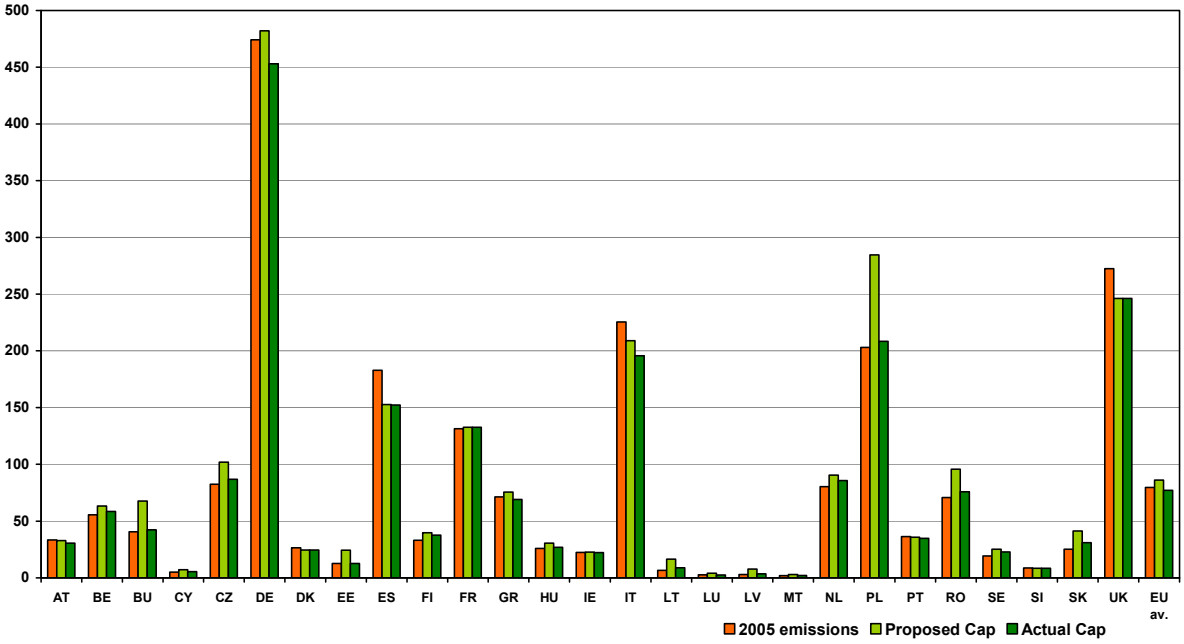
b) Intended government purchase of Kyoto units; and

[39] Further information available in COM (2006) 725 from the Commission, at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2006:0725:FIN:EN:PDF

c) Projections of carbon dioxide emissions in the transport sector.

43. Using this formula the Commission then adjusted downwards the majority of the Member State caps. Figure 7 captures a comparison between each Member State's 2005 verified emissions, its proposed Phase II cap and its actual cap as decided by the Commission.

Figure 7: Proposed and actual caps vs. 2005 emissions



Source: Data from European Commission

N.b. 2005 UK emissions include 30Mt from sectors opted out for Phase I but included for Phase II

44. The Commission's intervention in the cap setting process should ensure that there is some genuine scarcity in Phase II. However, the Commission's approach of using a formula may not have resolved all the issues concerning how the cap is set. As can be seen from Figure 7 above (by comparing the differences in the actual cap and 2005 verified emissions) the Phase II approach still allows Member States to have substantially differing effort levels. This implies internal market distortions may be created and a lack of harmonisation of effort. There have also been problems in that the Commission's formula is open to some degree of interpretation, leading some to dispute the transparency of the criteria and how they have been applied.

45. The revised ETS Directive says that there will be a single EU-wide cap, set by the Commission. The following options have been considered:

Option 1 - do nothing: Member States continue to submit National Allocation Plans for approval by the Commission. The overall ETS cap is the sum of Member State caps;

Option 2 – revised ETS Directive: an EU-wide cap set in the Directive. A clear set of criteria could also be provided suggesting how the cap would be set for later periods and with a review facility.

46. Assessment against the criteria:

i) Effectiveness: Option 1 is considered unlikely to resolve the Prisoner's Dilemma and as a result is unlikely to meet the criterion on environmental effectiveness. Option 2 is considered environmentally effective as the Commission will set the cap in line with 2020 targets.

ii) Efficiency: Option 1 is considered to be the least cost effective solution as it is likely to result in Member States undertaking less effort in the traded sector than would be economically efficient. As a result of this the UK would then be likely to receive tougher non-traded sector targets, implying greater costs of meeting the 2020 target. Option 2 is considered the most efficient as it results in the greatest

likelihood that the ETS share of abatement is close to its efficient level, and therefore is more likely to help achieve the 2020 target at least cost.

iii) Consistency: It is difficult to separate out the differences in performance against this criterion as both options could conceivably be consistent with the 2020 GHG target and the RES target.

iv) Harmonisation: Options 2 is far more likely to achieve a harmonised approach since it removes Member State discretion in the cap setting process. It is, therefore, more likely to achieve harmonised effort levels.

v) Predictability: Option 2 provides the more predictable approach as the cap will be known significantly before the start of the post-Kyoto period and will set out a trajectory for the cap in the longer-term.

3.3 Cap Setting: How should the level of the cap be determined?

47. The absolute emissions cap for the EU ETS is the key determinant of the environmental effectiveness of the system and is the key driver of the scarcity that creates the demand for allowances. The emissions cap is the single most important tool in the EU for achieving the EU's 2020 GHG targets, because it covers a large share of emissions and its cap is inherently binding.

48. Theoretically speaking, the cost of meeting the EU's GHG target is minimised when the marginal cost of abatement between the traded and the non-traded sectors is equalised. The size of the EU ETS cap will also have an impact on the achievement of the EU's 2020 RES target as the cap will determine the price of carbon which will then affect the profitability of renewable energy investments within the traded sector. Therefore it is important that the level of the cap is seen within the context of the package as a whole.

49. The revised ETS Directive ensures that the cap is set on the basis of the least-cost approach. This approach results in a cap of 1,720MtCO_2e for 2020. It is important to note that the Commissions proposed cap does not include aviation as this is being dealt with through separate negotiation.

50. The following cap setting options are considered:

Option 1 - do nothing: Assuming that the ETS cap remained at the same level as in the current Phase, this would see a cap in 2020 of around 2,083 MtCO_2e. This approach would see the EU ETS undertaking just 12% of the absolute effort (i.e. effort compared to 1990 levels) required to meet the 20% GHG reduction target in 2020.

Option 2 – revised ETS Directive: set the level of the cap based on the efficiency split of abatement. The cap is set such that marginal abatement costs are equalised in the traded and the non-traded sectors. This results in a cap of 1,720 MtCO_2e in 2020 (excluding aviation). Under this scenario the EU ETS would undertake 59%, of total absolute effort towards the GHG targets. It should be noted that the RES target is likely to have some impact on the efficiency of this approach as it imposes higher cost options on the EU ETS and therefore the overall result is unlikely to be the most cost effective solution.

51. Assessment of the options against the criteria:

i) Effectiveness: Option 1 compares least well to this criterion. Option 1 implies that the non-traded sector would have to undertake unrealistically large

reductions which appear to be very costly - implying a low likelihood of achieving the 2020 targets. Option 2 offers the best chance of environmental effectiveness because it gives the largest share of effort to the EU ETS and as the cap is binding it provides a strong guarantee of achieving the emission reductions.

ii) Efficiency: Option 2 is the optimal cap setting methodology from an efficiency perspective as it results in the ETS undertaking a level of effort that is consistent with achieving the 2020 GHG target in a least cost manner. Options 1 implies that the non-traded sector would have to undertake a significant amount of abatement at high cost and that overall costs to the UK would be higher compared to Option 2.

iii) Consistency with package objectives: Option 1 requires unrealistic abatement effort from the non-traded sector, which it is unlikely to achieve owing to disproportionately high costs. Option 2 is considered to be most consistent with the 2020 RES target as it is likely to result in a higher EUA price and therefore is more likely to incentivise the deployment of renewable energy.

iv) Harmonisation: Any level of the cap could be consistent with the harmonisation objective.

v) Predictability: both options are considered to have equivalent effects on firms' investment decisions as the cap is deemed equally predictable up to 2020.

3.4 How should the cap trajectory be set up to 2020 and beyond?

52. The first two phases of the EU ETS allowed Member States to allocate yearly allowances as they chose. In Phase II this resulted in the majority of Member States basing their cap, and their allocation, on an average effort level over the phase, effectively meaning the cap was the same in each year even if it had been calculated on the basis of a decreasing cap and increasing effort. However, there were also some Member States that set declining caps over the phase. In practice because of banking and borrowing rules this had little effect on firms and on the price level[40].

53. The revised Directive implies a move away from the current system of multi-annual phases (3 years in Phase I and 5 years in Phase II) to a system based on an annual reduction in the total allowances put into circulation, and flexibility for operators to bank unused allowances.

54. The following options are considered:

Option 1 - do nothing: set a five-year phase to 2018 and then a new cap negotiated in 2018 for the next five years; and,

Option 2 – revised ETS Directive: an annual reduction in the cap based on a linear trajectory up to 2020 and beyond, to be reviewed no later than 2025.

55. Assessment against the options:

i) Effectiveness: It is difficult to fully assess the environmental effectiveness of Option 1 as it is not entirely clear what the cap would be, however, it seems reasonable to assume that this would follow the same emissions savings as in Option 2. Options 1 & 2 are therefore considered equivalent in terms of emissions reductions.

ii) Efficiency: both options are potentially consistent with an efficient approach.

[40] Looking at the banking rules shows clearly that whether Member States allocate on an average basis or an annual reduction makes little difference as firms receive their following year's allowances before the compliance period for the next phase.

iii) Consistency with package objectives: both options can potentially be consistent with package objectives.

iv) Harmonisation: It is considered that there is little difference between the approaches when assessed against this criterion.

v) Predictability – Options 1 offers a clear statement about the cap up to 2018. However, Option 3 provides greater predictability by providing a clear signal about what emissions reductions are required beyond 2020.

3.5 Banking and Borrowing

56. A key risk in setting a longer-term framework is that a degree of flexibility could be lost. This might result in future caps which are inappropriate (e.g. with regard to the imperatives to mitigate, or the imperatives to maintain economic growth and business competitiveness). It is, therefore, important to consider mechanisms which might add flexibility to the EU ETS framework.

57. In addition, within a series of fixed caps, or a longer-term cap, banking and borrowing could provide an added degree of flexibility without unduly harming the certainty of the framework. Banking and borrowing can help smooth compliance over time and investment cycles.[41]

58. Banking allows those participants which have verified emissions below their allocations to carry over emissions for use in later periods. The banking of allowances is attractive to participants when it is expected that the price of allowances will rise more quickly than the rate of return on other assets[42]. Under these circumstances, allowances are more valuable when used to offset future emissions.

59. Borrowing allows participants to use allowances in future periods for compliance in the current phase. Borrowing will become attractive when it is anticipated that the price of allowances will rise more slowly than the rate of return on other assets. This could occur because the composition of energy saving capital is more flexible in the longer-term and also because tough short-term requirements provide relatively less opportunity to embed technical improvements over time.

60. It is important to distinguish between banking and borrowing within and between phases. The current Directive allows borrowing up to one year ahead within a phase, but none between phases. Unlimited banking is currently allowed between compliance years within phases and from Phase II will be allowed between phases.

61. In terms of economic efficiency both banking and borrowing should have the following positive impacts:

- Reduced cost of overall mitigation as installations can adjust their abatement decisions over time and cost savings can be traded over time;
- Dampened price volatility/smoother EUA price trajectory in periods and between periods;
- Reduced risk of sudden price spikes/crashes: banking should reduce price crashes as it encourages installations to hold allowances. Initial modelling

[41] As asserted in the Stern Review, 2006 (15.4, p332)

[42] Ellerman and Pontero (2002) confirm that banking has been 'optimal' i.e. that the allowance price in one year is related to future prices by rate of interest.

work[43] suggests that there could be severe price drops towards the end of the period without banking. Whilst the current evidence hasn't proved that banking has reduced the large price drops, it is likely that this is due to the substantial over allocation;

- Owing to the above benefits it is likely that the investment environment for installations would be improved for installations as they have more freedom to manage their allocation and asset portfolio over time, and thus have greater certainty with which to make investment decisions.

62. Banking has additional benefits:

- It can provide operators with a vested interest in the long-run success of the system. In the US Acid Rain Programme the ability to bank allowances for future use proved crucial to the success of the program because once operators had built up a bank of unused allowances, they had a vested interest in maintaining their value and thus in furthering the program itself[44];
- It allows for early abatement and therefore offers potential environmental benefits. For example the US Acid Rain Programme saw 31% of allowances banked in Phase I and drawn down during Phase II, allowing a smooth adjustment to a tighter limit in Phase II. This represented 11.6 million tonnes of sulphur dioxide reduced ahead of schedule, on average by 6 years[45];
- However, there are potential downsides to banking:

63. Over-generous allocation in one Phase effectively loosens the cap for future Phases, since that allocation can be carried forward into those future Phases.

64. Borrowing also has additional benefits:

- It would allow for a longer term framework to avoid constant re-adjustments to future caps, as it would allow some flexibility of emissions reductions within the existing framework of caps.

65. On the downside, borrowing could:

- Weaken the environmental integrity of the system because it encourages installations to delay abatement;
- Reduce incentives for installations to uphold the long-term running of the system.
- Gives incentives for plants that are closing in a few years' time to borrow allocation from a time after they have closed (although this is only a problem with free allocation);
- Without limitations, borrowing could distort the emissions reduction pathway significantly, potentially creating a more costly long-term abatement pathway. Analysis done for the UK's draft Climate Change Bill[46] shows that too much borrowing in one period would greatly reduce the probability of being able to meet a future period's cap. In the context of the UK this means limiting borrowing to 1% of the next phase's cap.

66. The revised Directive has rules on banking and borrowing will continue as in the current Directive. This means that:

[43] Grohman (2001)
[44] Burtraw & Palmer (2003)
[45] From Ellerman and Pontero (2005)
[46] UK draft Climate Change Bill partial Regulatory Impact Assessment, p43.

67. Full banking will continue between compliance years.

68. Borrowing in effect continues to be allowed in the limited form of permitting the use of allowances for the year *n+1* to be used to cover emissions from year *n* (since installations are only required to present allowances to cover their emissions for year n after the point at which year *n+1* allowances are issued), but not to any greater extent.

4. Allocation Methodology

4.1 Introduction

69. While the level of the EU ETS cap determines the level of scarcity in the System, and hence the level of effort required, the allocation methodology determines how allowances are distributed to specific installations. During the first two phases of the System a number of different methodologies were applied to allocate allowances in different Member States. In this area the UK supports an approach from 2013 that involves greater "approximation" (partial harmonisation) of the rules for allocation of allowances rather than full harmonisation of these rules.

4.2 Free allocation versus auctioning

Macroeconomic impacts of auctioning

70. The European Commission has presented results from the GEM-E3 model to assess the macroeconomic implications of introducing a carbon value in the different sectors that generate revenues for the authorities that can then be recycled into the economy. Increased auctioning in the EU ETS sectors or the introduction of taxation schemes in the sectors not covered by the EU ETS could generate substantial revenues. Three scenarios were calculated with the GEM-E3 model to assess the potential impact of the introduction of a carbon value together with revenue recycling:

- First, a carbon price to achieve cost efficient reductions across all sectors and Member States but with 100% free allocation in the EU ETS and cost efficient optimal command and control regulation in sectors not covered by the EU ETS.
- Second, as above but with 100% auctioning to EU ETS sectors, but no such revenue generation in the non-ETS sectors. The revenues generated through auctioning are recycled through the tax system.
- Third, as above, with 100% auctioning to EU ETS sectors, and revenue raising policies in the non-ETS sectors. Revenues generated through both the ETS and non-ETS sectors would be recycled to households.

71. Table 16 below shows the macroeconomic effects on the UK predicted by the Commission's modelling. This shows that scenarios which allow for revenue to be raised in both the ETS and non-traded sectors would reduce the macroeconomic effect of the EU ETS. These results suggest that auctioning would have a positive effect on the economy compared to a scenario where no revenue was generated.

Table 16: Macroeconomic impact of auctioning on the UK

	Cost efficient case: no revenue generation in the EU ETS and non-ETS	Cost efficient case: auctioning in the EU ETS and no revenue generation non-ETS	Cost efficient case: auctioning in the EU ETS, revenue generation non-ETS e.g. through taxation
Change GDP	-0.4%	-0.3%	-0.3%

Change Private Consumption	-0.2%	-0.1%	-0.2%
Change Employment	-0.3%	-0.1%	-0.1%

Source: Commission Impact Assessment modelling (GEM-E3 Europe)

4.3 Levels of auctioning, and method of free allocation.

72. The existing EU ETS Directive sets a maximum level of auctioning for each Member State at 10% of the Member State cap. The majority of allowances will therefore be distributed for free to installations during Phase II, typically on the basis of their historical emissions (grandfathering). The revised Directive sets out the levels of auctioning for three groups of sectors:

Table 17 – Levels of auctioning for sector groups in revised directive

Box	Sector group	Allocation method	Levels
1	Electricity Generation	Auctioning	100% auctioning from 2013 with limited derogations.[47]
2	Sectors at risk of 'carbon leakage'	Ex-ante Benchmarking	Free allocation based on sector's share of the ETS cap.
3	Other industrial sectors	Combination of ex-ante Benchmarking & auctioning	Transitional free allocation (80% of benchmark in 2013 declining to 30% in 2020). Full auctioning by 2027.

73. Industrial sectors will be divided into two categories depending on an assessment of the risk of 'carbon leakage'. Carbon leakage concerns could arise in some sectors if the EU were to unilaterally undertake policies to reduce emissions. Sectors in the EU which are particularly carbon intensive, or which are internationally traded, may face competitive pressures from non-EU firms that do not face similar carbon constraints. In the short-run this could lead to a reduction in production in the EU, offset by greater imports from the rest of the world. In the longer-term investment decisions will be influenced by the relative costs of carbon emissions in different regions, and therefore new plants may be built outside the EU.

74. Free allocation is one policy response that may limit the amount of carbon leakage. Although this will only be an effective measure if the sectors choose not to pass through the opportunity costs of free allowances, and instead choose to defend their market share from extra-EU competitors.

75. In order to assess a sector's risk of carbon leakage, the revised Directive proposes that sectors (defined at NACE code level 3) be assessed on their expected (based on a projected carbon price) change in gross value

[47] Article 10c allows Member States to give auction less than 100% to the electricity generation sector if they meet conditions relating to the level of interconnectedness or if more than 30% of electricity production was by a single fossil fuel. These Member States can provide free allocations to their electricity generation sector, starting at 70% free allocation in 2013, with full auctioning reached by 2020.

added and historical trade intensity. The Directive sets thresholds for these metrics, above which sectors would qualify for assessment.

76. Article 10a of the agreed Directive sets out the thresholds for assessing sectors at risk of Carbon Leakage. A sector or sub-sector is deemed to be exposed to a significant risk of carbon leakage if:

- Their change in production costs (direct and indirect, as a proportion of Gross Value Added) exceeds 5% and their non-EU trade intensity is greater than 10%; or,
- Their change in production costs is greater than 30%, regardless of the non-EU trade intensity; or,
- Their non-EU trade intensity is greater than 30%, regardless of the change in production costs.

77. In addition, these criteria may be supplemented with qualitative assessment which can consider the abatement potential, market characteristics and profit margins in each sector.

Allocation of free allowances

78. Grandfathering was the main method used in Phases I and II to allocate allowances to installations. Grandfathering is a favoured option, where different industrial characteristics may mean that benchmarks are not applicable. It is favourable to those with high emissions and does not reward sectors who have taken early action to reduce emissions.

79. Under the revised Directive, free allocation will be determined on the basis of benchmarks, i.e. a fixed number of allowances per unit of output. The Directive lays down the procedures by which the benchmarks will be established and the principles on which they are to be based.

80. The options that are considered are as follows:

Option 1 - do nothing: Maintain Phase II levels of free allocation which would ensure at least 90% of allowances allocated for free. Method for allocating allowances to installations is at the discretion of Member States and we assume a continuation of the use of grandfathering as the primary allocation methodology.

Option 2 – revised ETS Directive: Full auctioning to the electricity generation sector from 2013 (with derogations for some Member States). Transitional free allocation for those sectors not exposed to carbon leakage which declines from 80% of sector benchmark to zero by 2027. Sectors at risk of carbon leakage will start at 100% of sector benchmark and decline in line with the System cap.

81. Assessment against the criteria:

i) Effectiveness: Free allocation of allowances can weaken the effectiveness of the EU ETS by lessening the incentives for firms to abate, but the declining cap means that this is not business as usual, although this will depend on how the allocation mechanism is designed. Continuing to use grandfathering (option 1) may create perverse incentives for installations to increase emissions if they believe that baselines will be updated in the future. Carbon leakage would undermine the effectiveness of the EU ETS as emissions would be displaced from the EU, with the worldwide level of emissions possibly increasing. Free allocations to sectors identified at risk of carbon leakage (option 2) may mitigate the possibility of carbon leakage, depending on whether sectors choose to

defend their market share or pass through the cost of the EU ETS to their customers.

ii) Efficiency: Option 1 would result in substantial subsidy to a number of sectors that are not at risk of leakage. This would not be consistent with the polluter pays principle. Evidence from the European Commission (table 2 above) also highlights the efficiency gains from auctioning compared to free allocation. Revenue from auctioning may be used to reduce the need for other sources of Government revenue. Option 2 would provide for greater levels of auctioning, increasing the efficiency gains as set out above. High levels of free allocation (based on sector benchmarks and the sectors share of the declining EUETS cap) would be available for sectors at risk of leakage, with decreasing levels of free allocation for other industrial sectors.

iii) Consistency with package objectives: While Option 1 would provide for free allocation for the majority of allowances, it is not clear that this option would be effective at reducing the risk of carbon leakage. Firms could choose not to pass through the cost of allowances in order to defend market share, or could chose to use the windfall profits from free allocation to finance investment, possibly outside the EU. Option 2 would balance the benefits from greater auctioning against the possibility of carbon leakage.

iv) Harmonisation within the EU ETS: Option 1 would not harmonise the level of auctioning, nor the method of free allocations between Member States. This may result in a distortion in the market where similar installations in different countries face different allocations. Option 2 would create harmonised levels of auctioning for all sectors across the EU. Harmonised benchmarks would ensure similar treatment of similar installations across the EU, removing the intra-EU distortions seen in Phases I and II.

v) Predictability: It is not expected that these decisions would have a significant effect on the level of predictability of the EU ETS.

4.4 Allocation to New Entrants

82. The purpose of a New Entrant Reserve (NER) is to ensure that new entrant installations are not unfairly disadvantaged by the EU ETS compared with incumbent installations. In Phases I and II, Member States had discretion to set aside a share of their Member State cap for new entrants, and to determine the eligibility to these allowances.

83. Access to the NER will only be required for those sectors that receive some level of free allocation. Therefore, no access is permitted for electricity production. The Commission has, however, recognised that from 2013 there will be some level of free allocation to most sectors and therefore some consideration of the design of the NER from 2013 will be required. The revised Directive sets aside a central EU NER with an allocation of 5% of the total cap with up to 300 million of the allowances in the NER being set aside for CCS demonstration projects.

84. The size of the NER is important in determining whether it achieves the objectives. Setting the NER too small risks creating a barrier to entry if the NER is exhausted before the Phase is over, whereas over-allocating allowances to the NER may increase the incentive for new firms to invest in new plant, depending on the allocation method used. While unused allowances will be auctioned, correct estimation of the size of the NER ensures that the allocation of auctioning rights to Member States is transparent.

Access to the NER

85. The revised Directive allows for new installations or significant extensions[48] to existing installations access to the NER. The Commission will adopt harmonised rules for the application of the definition of new entrant.

Funding for Carbon Capture and Storage Demonstration projects

86. The EU has committed to develop up to 12 projects to demonstrate Carbon Capture and Storage (CCS) technologies. The revised ETS Directive sets aside 300 million allowances from the NER to finance the development of the demonstration projects. No project can receive more than 15% (45 million allowances) from this fund. Comitology procedures will be required to agree the details of this funding mechanism.

87. The following options have been identified:

Option 1 - do nothing: Member States have discretion to determine size and administer their own new entrant reserve.

Option 2 – revised ETS Directive: Creation of a single, EU wide NER with an allocation of 5% of the cap.

88. Assessment against the criteria:

i) Effectiveness: Providing free allocations to new entrants may act to reduce the possibility of carbon leakage by encouraging investment in the EU by granting new entrants the same allocation of allowances as an incumbent installation.

ii) Efficiency: Allocation to new entrants has the effect of acting as an investment subsidy, weakening the signal from pricing carbon. However, an NER may be justified if it ensures that there is fair treatment between incumbent installations and new entrants; increasing the likelihood of new entrants, making the markets more competitive.

iii) Consistency with package objectives: In determining the size of the NER, consideration of the expected number of allowances required should take account of the different growth rates Member States are expected to have up to 2020. Option 2 provides for a large NER, which, while benefiting new entrants in those Member States which expect significant growth, would also have the effect of reducing the amount of allowances to incumbent installations in all Member States.

iv) Harmonisation within the ETS: In Phases I and II, Member States had discretion to determine the size of the NER, which led to different treatment of similar new entrants between Member States. Option 1 would continue to allow Member States discretion to set the size of the NER and rules for access which would perpetuate the unequal treatment of similar installations across Member States. However, not having a NER would distort competition in favour of incumbent installations. Option 2 harmonises the NER across the Community.

v) Predictability: Setting the size of the NER will not affect the long-run predictability of the EU ETS.

[48] The recitals state that wherever appropriate this should be defined as an extension of at least 10% of the installation's installed capacity or a substantial increase of the emissions of the installation, linked to the increase of the installed capacity.

4.5 Closure rule

89. The current ETS Directive does not establish rules concerning the closure of existing installations. Accordingly, Member States set up their own provisions. There are four key elements to determine:

- definition of 'closure', which currently varies between Member States, e.g., some set minimum levels of production below which an installation is assumed to be closed;
- the period after closure during which operators continue to receive allowances varies. Member States generally set the rule that no allowances are given for closed installations from the year following closure;
- how to treat temporary closures, where an installation temporarily ceases activity during the normal course of business; and,
- the treatment of transfers in production, where allocations to closed installations are transferred to replacement investment by the same operator, on the same site or, more generally, within the same Member State.

90. The revised Directive states that there shall be no free allocation for any installation that ceases its operations, unless the installation can demonstrate that it is a temporary closure i.e. that it will resume production within a specified and reasonable time. The Directive lays down the procedures by which the closure and transfer rules will be established.

91. The following options are considered:

Option 1 - do nothing: this option would continue with the current position where 'closure' is determined by each Member State; and,

Option 2 – revised ETS Directive: harmonised closure and transfer rules. The revised Directive will have a harmonised closure definition that will limit access to free allocation after closure. A harmonised transfer rule will allow an installation that transferred operations to another location in the EU to keep their access to free allocation; and any remaining allowances would be auctioned.

92. Assessment against the criteria:

i) Effectiveness: Having no harmonised closure rule (Option 1) may provide an incentive for firms to close installations in the Community while continuing to receive free allocation. Providing closure and transfer rules (Option 2) may help reduce the risk of carbon leakage though minimising the amount of free allocation given to installations which close.

ii) Efficiency: Option 2 would significantly reduce the incentive to close down installations, and may minimise the risk of carbon leakage (as discussed above).

iii) Harmonisation within the EU ETS: Option 1 would provide for no increase in harmonisation between Member States. This could provide an incentive to firms to relocate production between Member States in order to benefit from allowances allocated after closure. There would seem to be few offsetting benefits from allowing Member States to retain flexibility in this area in contrast to other aspects of the allocation process. Option 2 would minimise the competitive distortions created by un-harmonised closure rules.

iv) Consistency with package objectives: Both options identified are consistent with the EU's GHG targets and the Commission's other policy measures.

v) Predictability: Neither option would have a significant effect on the predictability of the EU ETS.

4.6 Allocation of auctioning rights to Member States

93. In Phases I and II the allocation of auctioning rights between Member States was determined by Member States' NAPs. However, with the Commission's proposal for central cap setting, consideration needs to be given to how auctioning rights are allocated to Member States. The method used should set allocations in advance of the start of the phase, to give certainty to Member States.

94. In Phases I and II of the EU ETS Member States had the right to auction up to 10% of their allowances. Given the increase the levels of auctioning in Phase III and beyond that will result from the revised Directive, the Commission has considered ways of allocating the rights to auction between Member States.

95. The allocation of auctioning rights will have a significant impact on the cost to each Member State. Reducing a Member State's allocation of auctioning rights will effectively increase the cost of meeting a given GHG target, while increasing auctioning rights will reduce the overall cost.

96. The following options have been identified:

Option 1 - do nothing: Member States retain the right to auction up to 10% of their Member State cap. No reallocation of rights between Member States.

Option 2 – revised ETS Directive: Distribute auctioning rights based on Member States' proportionate shares of the greater of either 2005 verified emissions or their average 2005-7 verified emissions. This initial allocation would then be reallocated to benefit certain Member States, those with below average incomes, and those who took early action to reduce emissions[49]. This reallocation would result in 12% of the UK's auctioning rights being reallocated to other Member States.

97. Assessment against the criteria:

(i) Effectiveness: The options presented concern only the distribution of auctioning rights between Member States, not the number of allowances auctioned which will be determined by prior decisions. Environmental effectiveness of the System will not be affected by the distribution of auctioning rights between Member States.

(ii) Efficiency: The Commission has presented modelling results in its Impact Assessment for two scenarios, distributing auctioning rights according to Member States' shares of real emissions in each year (Option 1) and based on 2005 verified emissions modulated according to GDP/capita. These results suggest that the redistribution would not have an impact on GDP at an EU level, but would benefit all those Member States with lower than average GDP per capita, with mixed results for those above. Option 2 would allocate more rights to other Member States, reducing the revenues to the UK and therefore increasing the cost of the package.

(iii)Harmonisation within the ETS: Decisions on the method chosen to allocate auctioning rights to Member States would by default be harmonised across the

[49] 10% of the UK's auctioning rights would be distributed to Member States with GDP per capita below the EU27 average. An additional 2% will be distributed amongst Member States whose emissions in 2005 were at least 20% below their Kyoto base year emissions.

Community. Using the greater of either 2005 or average 2005-7 verified emissions as the basis for allocations will ensure Member States with lower emissions in one year than in other years are not disadvantaged.

(iv) Consistency with package objectives: Reallocating auctioning rights to those Member States with GDP/capita below the Community average would simply be a transfer to these Member States at the expense of others. There are existing mechanisms for allocating funding that would be a more transparent way of supporting these Member States.

(v) Predictability: Decisions on allocation of auctioning rights would not appear to have a significant impact on the predictability of the System.

5 Linking with other systems

5.1 Introduction

98. There are five key economic reasons why linking trading systems can be desirable. The Stern Review argues that widening a system to as many markets as possible could offer several key economic advantages:

- **Overall cost of compliance can be reduced** by exploiting different abatement opportunities that exist.
- **Increasing liquidity** should enhance the system's ability to allocate resources efficiently.
- **Reducing volatility** in the market. A larger, more liquid market that is less susceptible to market manipulation will be less volatile.

99. There are additional potential economic advantages of linking:

- Certain **competitiveness concerns** can be tackled by linking to sectoral schemes.
- **International co-operation** strengthens the momentum for collective action and may facilitate further benefits such as economies of scale in technology diffusion and decreases competitiveness concerns.

100. While there are many reasons for linking the ETS with other trading systems, there are also risks. Poorly designed linking may undermine the functioning of the systems involved. For example, the environmental effectiveness of the EU ETS would be undermined if it were to link with a different system that had a price cap on emission reductions – this would increase the risk of higher emissions throughout the linked system as the price cap would effectively apply across both schemes. For a discussion of a set of criteria that could be used to assess the desirability of linking the EU ETS with emerging systems, please see Annex C.

5.2 Access to project credits

101. Allowing for the use of Kyoto project credits (Joint Implementation and Clean Development Mechanism) provides access to a pool of low-cost emission reduction opportunities for installations covered by the EU ETS. These projects also provide a source of finance to help developing countries become low carbon economies by supporting investment in emissions reducing projects. Against this, allowing access to a large amount of project credits is likely to keep the carbon-price low, reducing the amount of domestic abatement and possibly preventing installations within the scheme from investing in low-carbon technologies. In particular, it will reduce the incentive to invest in renewable electricity – reducing the chance of the EU meeting the 20% target on renewable energy.

102. The current EU ETS Directive states that NAPs shall specify the maximum amount of project credits which may be used by operators as a percentage of the allocation of the allowances to each installation. Member States have different limits on the use of project credits for Phase II, with the UK specifying a maximum of 8%. Other MSs have allowed their operators much higher levels of access. At EU level, this process has resulted in a total limit on the use of project credits which exceeds total Phase II effort. Whilst global emissions will be reduced by

this amount compared to business as usual, this could potentially result in emissions from within the EU's borders increasing in Phase II. However, in practice there are abatement opportunities in the EU that are cheaper than the price of CDM credits so domestic reductions are likely.

103. The revised Directive sets out the limits on the use of project credits in the scheme before the entry into force of a future international agreement on climate change. It says that:

104. Before the entry into force of an international agreement on climate change, access to project credits is limited to 50% of the absolute reductions required, measured against 2005. Access will also be restricted to credits from projects that were registered before 2013 and those starting from 2013 in Least Developed Countries

105. If the negotiations on an international agreement on climate change are not concluded by the end of 2009 then the Commission will seek agreements with third countries. The agreements are limited to providing credits from renewable energy or energy efficiency technologies which promote technological transfer and sustainable development and which go beyond a 'business as usual' scenario.

(ii) Additional access to project credits should be provided for once an international agreement on climate change is reached. In this scenario, only credits from projects from third countries which have ratified the agreement shall be accepted in the scheme from 2013.

(iv) Credits restricted under the Linking Directive, including those from Land Use, Land Use Change and Forestry (LULUCF) projects and those generated from nuclear facilities continue to be excluded from the system.

Impacts of harmonised limits on CERs

106. The revised Directive allows for a small increase in the access to project credits in the post-Kyoto period to help harmonise some of the discrepancies in CDM allocation that occurred during Phase II. The revised Directive ensures that the overall use of credits during the period 2008-2020 does not exceed 50% of the EU-wide reductions of all sectors included in the system. This implies a total limit in the use of project credits in Phase II and III of the scheme of around 1,550MtCO_2, (compared with the Phase II limit of 1,400MtCO_2) plus a small additional allowance for the aviation sector.

107. There are different mechanisms for distributing the additional access to project credits provided for in Phase III. For existing operators the distribution mechanisms are as follows:

108. The first method tops up access for operators that had low levels of CDM access as a % of allocation in Phase II. This tops up access so that all operators have CDM access at the least equal to 11% of their allocation in Phase II;

109. The second method takes into account both levels of free allocation in Phase II and levels of access to CDM. At least one third of the <u>additional</u> access (after access has already been distributed according to the first method) will be distributed according to this mechanism.

110. New sectors and new entrants will be allowed access to project credits equivalent to at least 4.5% of their verified emissions. Aviation will get access not less than 1.5% of their verified emissions over the period.

Since verified emissions are not currently known, the % figures will need to be updated when verified emissions data becomes available.

111. There are significant differences in project credit limits between Member States in Phase II (ranging from a limit of 0% in Estonia to 40% for power generators in Spain). The UK's Phase II NAP set a limit on the use of project credits equal to 8% of total emissions. As this is lower than the EU average, the UK will receive a relatively high proportion of the additional access in Phase III. This increased access to project credits should provide some financial benefit to UK firms (as greater access to project credits is likely to lower compliance costs). Currently it is not possible to calculate the exact level of access to for UK firms as the distribution of the additional access between the various mechanisms has yet to be decided through comitology.

Impact of allowing access to CERs

112. The following discussion considers the potential market impact of the increase in project credits access within the EU ETS that has been agreed by the new Directive.

113. The following options are examined to illustrate how the access to project credits can affect costs:

Option 1 - do nothing: maintain the current level of access to project credits as set out in the Phase II National Allocation Plans. Any use of JI/CDM in Phase III would, therefore, be limited to any unused Phase II allowances. The total amount of project credits available in Phase II is around 1400MtCO_2.

Option 2 – revised ETS Directive: a small increase in the amount of project credits available within the system so that total access to CERs/ERUs over Phases II and III equals around 1,600MtCO2e.

114. Assessment of options against the criteria:

i) Effectiveness: On the assumption that the project credits procedure has similar environmental integrity to the EU ETS then access to project credits should not affect the environmental effectiveness of the ETS[50]. Lower carbon prices that are likely to result from a larger supply of project credits may increase the possibility of firms making high carbon investment choices and, therefore, increase the possibility of lock-in. However, there is as yet, no firm evidence that 'lock-in' exists and there may be advantages to being a 'fast follower'. The increase in the level of access to project credits from the revised Directive is likely to result in a relatively small fall in the level of the carbon price (relative to the level of access in the do nothing option) and is therefore unlikely to have a significant impact on investment decisions.

ii) Efficiency: a more generous limit on the number of project credits permitted into the system will increase the volume of low-cost abatement options that are available to ETS participants. A more generous limit is therefore likely to decrease the cost of compliance relative to a scenario where there are more stringent limits. The lower compliance costs in ETS sectors and lower electricity prices across the entire economy will reduce the likelihood of carbon leakage in

[50] It is recognised that the assumption that project credits are of the same environmental integrity as EU allowances is a strong one. In response to ongoing concerns that have been raised about the environmental integrity of CDM, the CDM executive board is currently revising the methodology used to scrutinise and approve CDM projects, to ensure that such projects are actually additional.

exposed sectors. Lower compliance costs from greater access to project credits may, at least in part, be offset by a worsening of air quality that may result from a lower level of domestic abatement.

iii) Consistency with other Package objectives: a less stringent cap on the use of project credits is likely to reduce the carbon price, thereby reducing the incentive to invest in domestic deployment of low-carbon technologies. This may be important in the context of the 2020 renewables target as a large amount of the new renewables that will be deployed to meet this target will be in the ETS sectors (e.g., renewable electricity and industrial heat). A lower EU ETS price means that there has to be greater support from other policies to bring forward the amount of renewable technology to meet the RES target in 2020. However, the increase in the level of access to project credits from the revised Directive will only result in a small fall in the level of the carbon price and is therefore unlikely to have a significant impact on investment decisions.

The approach to project credits adopted by the EU is likely to have implications for how the EU's approach to climate change mitigation is perceived and this could affect negotiations towards an international agreement. It is however not possible to evaluate this properly in this Impact Assessment.

iv) Harmonisation within the ETS: the revised Directive should result in a more harmonised approach to the use of project credits across Member States. This will help to address the competitive distortions that result from firms in different Member States that produce the same products having different levels of access to low-cost project credits. However, the significant differences in the level of access to project credits that characterised Phase II will not be entirely resolved in Phase III.

v) Predictability: It is difficult to assess the options against this criterion because the options do not necessarily affect the predictability of the system.

6. Monitoring, Reporting and Verification

6.1 Introduction

115. The Commission has emphasised the pivotal role that robust MRV and compliance procedures have in ensuring the good functioning of the EU ETS. Robust compliance and enforcement is critical for the environmental integrity of the scheme, for meeting emission reduction targets and in anticipation of future linking with systems in third countries. The verified emissions of each installation ultimately decides whether the operator has a surplus or deficit of allowances and thus the level of compliance buying within the system. The monitoring, reporting and verification (MRV) approach also influences the trust and confidence that participants have in the market and the overall reputation of the EU ETS. Market participants, governments and international partners require confidence in the reliability and consistency of the emissions data.

6.2 Monitoring and Reporting

116. Under Article 15 of the Directive, all annual emission reports should be verified. Pursuant to Article 14, the Commission have published Monitoring and Reporting Guidelines (MRG), outlining how installations should record their emissions throughout the year. All Member States must ensure the guidelines and underlying principles are followed by regulators, verifiers and operators.[51] The second version of the guidelines came into force on 1 January 2008. It is up to each Member State as to how they implement the guidelines. In the UK Regulation 10(2)(a) obliges the relevant regulator to include conditions in accordance with the MRG decision.

117. In its Impact Assessment, the Commission identifies its objectives as ensuring a common approach, seeking higher consistency and transparency and improving the cost effectiveness of the standards used.

118. Two options are compared:

Option 1 - do nothing: This option would keep the system as it is, retaining the requirements of the MRG 2007 until 2020; and,

Option 2 – revised ETS Directive: As set out in the 2020 package, adopt a Regulation on Monitoring and Reporting Guidelines. A regulation on monitoring and reporting could be used in place of a Commission decision.

119. Assessment against the criteria:

i) Effectiveness: It has been suggested that there are inconsistent interpretations of the monitoring guidelines and approaches to reporting[52]. Option 1 does not address these problems, which undermines the environmental effectiveness of the EU ETS. Option 2 could help with these issues and encourage more certainty about how monitoring and reporting standards are being applied across the EU ETS. However it is difficult to assess the extent to which regulating the approach would improve the effectiveness of the EU ETS. Additionally, the 2007 MRG has not been designed to cover the implementation of benchmarks post-2012 so would not ensure the necessary collection of data. Option 2 could overcome this potential issue.

[51] http://ec.europa.eu/environment/climat/emission/mrg_en.htm
[52] Commission Impact Assessment, 4.1.1

ii) Efficiency: In the short-term the costs of maintaining the existing reporting practices would be lower than the costs of Option 2. However in the long-term, the new reporting approaches under the 2007 MRG could lead to some efficiency improvements over time due to experience effects, resulting in lower overall costs.

One risk is that the comitology process could make Option 2 a lengthy, and potentially costly, process. An EU Regulation is less flexible than a Decision to amend, so Option 2 could weaken the ability of the MRG to adapt to changes. These risks need to be balanced against the benefits to the Commission from a strengthened ability to ensure Member States apply the MRG appropriately and consistently.

iii) Consistency: Neither Option 1 or Option 2 is expected to have any adverse impacts on the other elements of the Commission's package of climate change and energy policies.

iv) Harmonisation: Option 1 does not address the inconsistent approaches to monitoring and reporting across Member States. If Option 2 improves the consistency of the EU ETS there would be benefits from greater harmonisation of practices across the system. This is likely to enhance the credibility of the EU ETS, which would be of benefit in view of future linking with systems in third countries.

v) Predictability: The EU ETS is a central part of the framework required for transition to a low-carbon economy. Robust monitoring and reporting systems underpin the functioning of the market and help to provide certainty about the emission reductions that will be achieved. While both options are likely to be of benefit in predicting the future framework for tackling climate change, there may be greater benefits from Option 2, given the greater clarity that may result from it.

6.3 Verification and Accreditation of Verifiers

120. Article 15 states that emissions should be verified and reported to the competent authority by the end of March each year. There are various methods of verification. In the majority of states, including the UK, verification is carried out by private verifiers who are independent of the operator and the competent authority. In others, verification may be carried out by the competent authority while a hybrid system exists in others, with verification undertaken either by the competent authority or a private verifier.

121. Many Member States insist that verifiers must be accredited by an accreditation service. Annex V to the Directive sets out the minimum requirements for verifiers. However, it is important that these are further developed and enforced. The European Co-operation for Accreditation (ECA) have developed formal standards for the verification process and act as an international accreditation body for national accreditation organisations. However not all Member States are members of this body, giving rise to concerns of less rigorous accreditation requirements and a lack of uniformity across the system.

122. In its Impact Assessment, the Commission identifies its specific objectives as:

- Achieving consistent and comparable levels of verification and accreditation;
- Harmonising the internal market; and,
- Improving cost-effectiveness.

123. Two options have been identified:

Option 1 - do nothing: The current verification system allows Member State discretion, according to their own views on the benefits of independent verifiers versus competent authorities. This option would retain the MRG 2007 and any potential changes would have to be implemented through subsequent reviews. There is currently no single harmonised accreditation standard in place in all EU Member States. As a result verifiers are not measured to consistent standards; and,

Option 2 – revised ETS Directive: As decided in the 2020 package, adopt regulation for verification and accreditation of verifiers. Providing a legal basis under Article 15 for a regulation on verification and accreditation would enable the Commission to develop a regulation in consultation with verifiers, operators, Member States and Competent Authorities. It would then be passed through comitology to the Climate Change Committee.

124. Assessment against the criteria:

i) Effectiveness: Option 1 would not assist the Commission toward meeting its verification and accreditation objectives. Adopting a regulation on verification and accreditation would have the potential to improve the environmental effectiveness of the system by increasing the consistency of approach. The quality of verifications would improve, as would the integrity of the data published. In addition, adopting a regulation on verification would apply directly to individuals with no need to interpret the requirements into national legislation, which could result in differences and delays.

ii) Efficiency: Option 1 represents the option with the lowest expected costs. However, this comes at the expense of it not addressing the objectives with regard to improving the consistency of approach to both accreditation and verification within the EU ETS.

There would be development costs of a Regulation on verification and accreditation, although in the case of verification these could be minimised by basing the regulation on existing frameworks. The Commission Impact Assessment suggests that to develop verification regulations each Member State would spend 20-40 days on it, equating to up to €1 million. The costs to operators would depend upon whether the Regulation added or removed requirements compared to current approaches, and as such would vary between Member States. A Regulation on accreditation is unlikely to significantly affect verification costs for operators. The costs associated with development of a Regulation would be short-term, and the benefits in terms of improved harmonisation and effectiveness would continue into the long-term.

iii) Consistency: Neither of the options is expected to produce inconsistencies with relation to the rest of the Commission's package.

iv) Harmonisation: Continuing with the current Directive would mean that the objective to improve harmonisation within the EU ETS was not tackled. The unequal approaches adopted would undermine the general attempts to improve coordination across the system.

Introducing Regulations for accreditation and verification would remove the distortions created by the variance in existing approaches. The Commission Impact Assessment argues that a Regulation on verification would be the most efficient way to achieve a harmonised approach to verification since once passed they do not need to be converted into national legislation as well. More

consistent accreditation may reduce concerns that verifiers in some Member States do not meet standards equivalent to those in other Member States.

6.4 Compliance and enforcement

125. Compliance and enforcement provisions currently differ between Member States with the exception of the penalty levied upon failure to surrender sufficient allowances by 30 April each year. In Phase I this penalty was €40 per allowance, while for Phase II it has increased to €100 per allowance.

126. Reinforcing compliance and ensuring compliance in the longer term are the objectives stated in the Commission's Impact Assessment.

127. Two options are being considered:

Option 1 - do nothing: Keeping the Directive as it stands currently would maintain the penalty for not surrendering sufficient allowances at €100/t; and,

Option 2 – revised ETS Directive: As decided under the 2020 package, change penalty level to allow adjustment with inflation. The penalty level would rise by the European Index of Consumer Prices. Inflation causes fixed penalties to decline in real terms over time so this option would maintain the real level of the penalty.

128. Assessment against the criteria:

i) Effectiveness: Option 1 would provide incentives to operators to comply. Over time, however, this incentive for compliance would be expected to decline owing to the effects of inflation eroding the value of the fixed penalty. Option 2 would ensure the environmental effectiveness of the system by preventing the penalty for non-surrender of allowances from being eroded by inflation. This would help to maintain the incentive for compliance. Over time, however, it is possible that the evolution of the price for EU Allowances could dilute the compliance incentives and so the penalty could require occasional adjustments in addition to those relating to inflation.

ii) Efficiency: Maintaining the status quo would not lead to additional costs being incurred. It is not expected that adjusting the level of the penalty to take into account inflation would incur anything more than minor costs, which would in any case represent a transfer rather than a cost to society.

iii) Consistency: neither option is expected to impact adversely on other aspects of the Climate and Energy Package.

iv) Harmonisation: The existing penalty for not surrendering sufficient allowances is uniform across all Member States. Thus maintaining this situation would not have any effect on harmonisation.

6.5 Registries

129. Under the current Directive each Member State has its own national registry which ensures the accurate accounting of all Kyoto units and EU Allowances. The Community Independent Transaction Log (CITL) records the issuance, transfer, cancellation, retirement and banking of allowances that take place within and between registries.

130. The Commission's objectives in its Impact Assessment are to:

- Improve the cost-efficiency of the registries system, while maintaining the existing level of service

- Ensure the system can reliably meet the requirement of EU ETS operators without dependence on the International Transaction Log.
- Enable linking with trading schemes in third countries without having to route trades through the ITL.

131. Two options are discussed here:

Option 1 - do nothing: each Member State has its own national registry; and,

Option 2 – revised ETS Directive: Create a single EU-wide registry to replace the current national registries as decided in the 2020 package.

132. Assessment against the criteria:

Option 1 is not particularly cost-effective owing to the IT-infrastructure required under the existing legislative framework. Under the Kyoto Protocol, Member States' registries must be connected to the ITL, meaning that all transfers must pass through the ITL. In addition to the costs of this process the risks of technical problems are increased and the successful functioning of the EU ETS becomes dependent upon the ITL. It is likely, therefore, that continuing with the existing system means that the high operating costs would remain.

Option 2 provides the potential to reduce the operating costs of the registry architecture, improving the cost-effectiveness of the system. Provided that the Commission's objectives were met, this option would not undermine the environmental effectiveness of the EU ETS. Having a single EU-wide registry could also harmonise the processes between Member States.

Specific Impact Tests: Checklist

Type of testing undertaken	Results in Evidence Base?	Results annexed?
Competition Assessment	No	Yes
Small Firms Impact Test	No	Yes
Legal Aid	No	No
Sustainable Development	No	No
Carbon Assessment	Yes	No
Other Environment	Yes	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

Annexes

Part A:

Annex A1: EU Allowance Price Scenarios 2008-2020.

Annex A2: The non-traded sector marginal abatement cost curves

Annex A4: Macroeconomic costs sensitivities

Part B: Design of the EU ETS

Annex B1: Specific Impact Tests

Annex B2: Expansion of the scope

Annex B3: Criteria for linking with other systems

Annex A1 EU Allowance Price Scenarios 2008-2020.

Introduction

1. This annex provides Government's EU ETS allowances (EUA) price scenarios following the recent deal on the Climate and Energy Package and the revised EU ETS Directive. The results are not forecasts as such but are estimates of EUA prices based on a range of scenarios reflecting the uncertainty in the price of fossil fuels.
2. This annex is structured in the following way. Section one describes the modelling approach. Section two explores the base case assumptions and provides a central case estimate of the EUA price. Section three explores sensitivities regarding fossil fuel price assumptions. Section four discusses the approach to annualised prices using the 'cost of carry' is described.

The Modelling Approach.

3. The modelling approach to estimate the EUA price is based on estimating the level of abatement effort required in ETS sectors across the EU and then identifying what the implied marginal abatement technology will be for this level of effort. Effort is defined as the difference between the ETS emissions cap and the business as usual (BAU) projection for the ETS sectors. The marginal abatement technology is identified by the DECC carbon price model. The remainder of this section explains in more detail how these elements are constructed.
4. Defining effort: The key input into the carbon price model is the level of effort that the ETS sectors face. This relies on knowing what the ETS cap is and what the relevant BAU projections are for those sectors in the ETS; effort is simply the gap between the emission cap and the relevant BAU projection. The level of Kyoto project credits allowed into the scheme has a significant impact on the EUA price because it gives scheme participants access to an additional number of tradable units, at a cost of abatement that is usually lower than domestic options. All things being equal, greater access to project credits reduces the need for EU domestic abatement and will thus affect the price. The key inputs to determine effort are then:

- The ETS cap (which can be calculated with and without emissions from aviation);
- An estimate of BAU emissions; and
- Estimates of savings from policies/targets that affect the ETS BAU.

5. The cap for the ETS sectors in 2020, with the scope of the system the same as Phase II, is clearly set in the Directive and a linear trajectory to that target is also set out in the package paraphernalia. As aviation is entering the system in 2012, knowledge of the aviation cap, and of course the BAU for aviation, is required for an estimate for the post Kyoto ETS price that properly reflects the actual scope of the system.
6. The BAU projection for carbon emissions are taken from the latest runs of the Commission's PRIMES[53] model. This BAU model run was done as a base case

[53] The PRIMES model (which has been developed for the EU Commission by the University of Athens) simulates a market equilibrium solution for energy supply and demand in the EU. The latest projections (that were published alongside the draft directives on the climate &

for analysis of the Climate & Energy Package and reflects just currently implemented policies. Table A1 summarises the BAU projections for the traded sector with and without aviation. It is important to note that the PRIMES model does not produce a pure BAU scenario, it does include some Climate Change mitigation policies, most significantly it includes an EU ETS price of €25. It is also important to note that the aviation cap and BAU estimate in the base case are based on the 'all departing flights' scenario only. This is contrary to how aviation will actually come into the scheme, with caps based on an 'all arriving and departing' flights, but represents an acceptable assumption given the current data constraints.

energy package) can be found at:
http://ec.europa.eu/environment/climat/pdf/climat_action/analysis.pdf

Table A1: BAU projections with and without aviation.

	1990	2000	2005	2020	2030
EU 27 All GHGs	5578	5101	5211	5496	5380
EU 27 All CO_2	4379	4128	4267	4610	4639
ETS	NA	2290	2340	2557	2573
ETS - without aviation		2156	2193	2339	2319
Aviation		134	147	218	255

7. In order to work out the relevant BAU for the ETS sectors it is necessary to take account of the targets and policies in the Climate and & Energy Package that will affect the BAU projections for the traded sector but are not accounted for in the PRIMES projections. There are two EU-wide targets that are deemed to significantly affect the BAU projections; the Energy Efficiency (EE) target to improve energy efficiency by 20% across the EU by 2020, and the Renewables Energy Supply (RES) target to have 20% of all energy across the EU coming from renewable sources by 2020. The reason behind reducing the BAU emissions projections to take account of the EE and RES targets is that these targets will require actions that reduce emissions in the ETS sectors but these actions are unlikely to be because of the ETS. It is assumed that the EE target will be based on downstream measures that affect the realisation of carbon benefits because they tackle an aspect of the climate change externality that are not the result of the absence of the carbon price (such as information asymmetries). The RES target is deemed to reduce effort ETS effort because, for the cap dictated by the 2020 targets, the abatements costs for most RES technologies are significantly above the EUA price that would be achieved in the absence of the RES target. Meeting the RES target will therefore have the effect of reducing the amount of effort undertaken by the ETS. It is also expected that the stated aspiration for 12 CCS demonstration projects would also affect the level of abatement that the ETS would be required to make; this is because the projects would reduce the ETS sectors emission, but again this is would require additional support above that created by the carbon price.

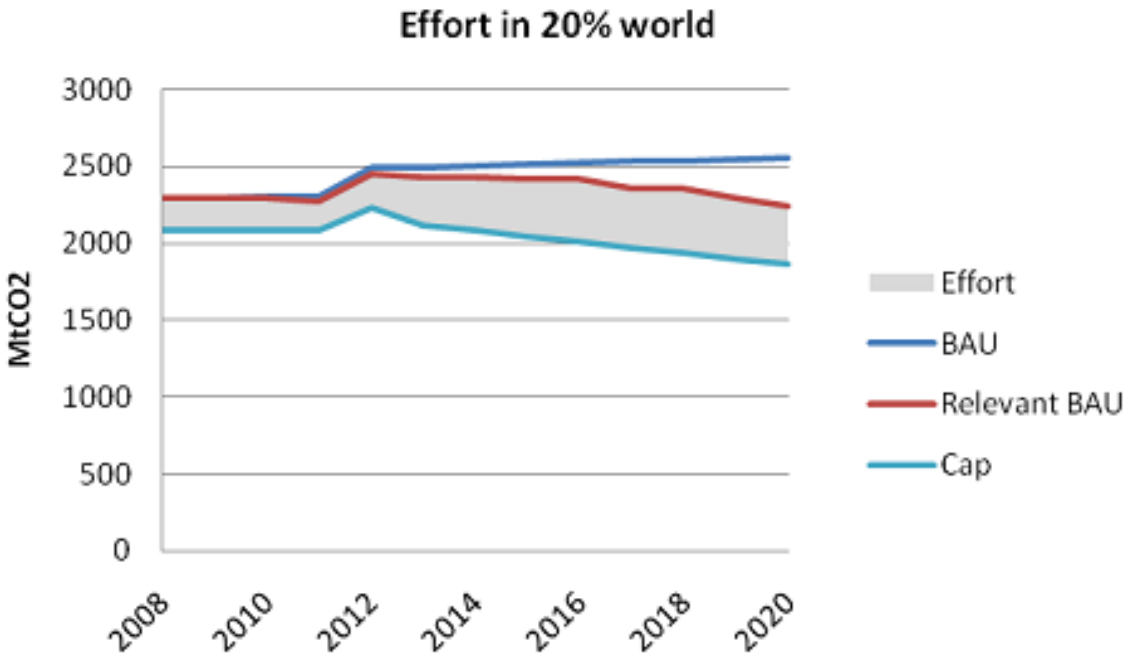
8. In order to take account of these impacts, assumptions are required on how much such policies will reduce EU ETS effort. The baseline scenario assumes that the renewables target will be met in full in 2020. The target is met by Member States meeting the 10% target for transport bio-fuels and then implementing policies that will bring on heat and electricity options in cost order. The base case takes a rather more conservative approach to EE and assumes that only 20% of the target is met across the EU and that 60% of these savings will occur in the ETS sector. This assumption that the EU fails to meet its stated objective on energy efficiency reflects that fact that the target is non-binding and also because that so few EU Member States have developed coherent EE plans[54].

9. The implied effort for the base case scenario is illustrated by the grey area in chart 1. Note that effort is stipulated for the years 2008-2020. This is because of the impact of banking and borrowing on participants implies that the price of EUAs in the Kyoto period (2008-12) and for the post Kyoto period are linked. The assumption used in the base case is that market participants

[54] It appears that the Commission are now also assuming relatively low level of achievement in the EE savings.

have perfect foresight and would, therefore, identify the arbitrage opportunities presented by two differing prices such that they would bank/sell allowances such that prices equalise across the two phases.

Figure A1. ETS effort for a 20% EU GHG target.



10. Having determined the relevant BAU for the ETS sectors and identified the correct cap (with aviation included) an estimate of the EUA price can be made. The estimate of total abatement effort that is required from EU ETS sectors from 2008-20 is combined with a marginal abatement cost (MAC) curve to determine the ETS carbon price. The MAC curve represents the costs and availability of abatement options that are available to scheme participants. The curve focuses on three main types of abatement: (a) merit order switching in the power sector; (b) purchase of Kyoto project credits (JI/CDM); and (c) industrial abatement potential.

The Base Case Assumptions and Results.

11. The base case EUA price is based on the following key assumptions:

- An ETS cap based on a 20% GHG reduction world as set out by the Commission (adjusted for aviation with the aviation cap based the EP decision);
- BAU projections from PRIMES;
- Reductions to the BAU based on a) a fully achieved RES scenario, b) 20% of the EE target met with 60% of the savings coming in the ETS sectors, and c) no CCS demonstration projects.
- A limit on the use of project credits as proposed by the Commission in the draft ETS Directive, i.e., 1427 $MtCO_2e$ allowed in from project credits from 2008-2020. Comprised for 1400 for ETS sectors covered in phase II and with an allowance of 27 $MtCO_2e$ project credits for aviation.
- A central fuel price scenario. This is deemed to most closely match the current situation and is therefore used as the most likely case.
- Perfect foresight amongst market participants such that prices are equalised across the period up to 2020.

- No additional price impacts from linking to other schemes.

12. The base case EUA price scenario results for a world in which the EU has a 20% GHG target in 2020 are shown in table 2 below. The DECC carbon price model suggests that under the base case assumptions the EUA price forecast will be €32 for the period 2008-2020 (in 2008 prices). The model estimates that: the power sector will undertake the majority of abatement required (abating 2125 $MtCO_2e$ over the period 2008-2020); all available CDM will be used; and that the smallest share of abatement will be undertaken by the industrial sector (515 $MtCO_2e$ abatement between 2008-2020). The electricity price impacts and the ancillary effects on air quality of the base ETS assumptions are discussed later in the note.

Table A2: base case EUA price projection and abatement

	$MtCO_2e$	€/tCO_2	Industrial	Power	CDM	Total
Effort over Phase II & III						
Effort						
Phase II	1042	12.1				
Phase III	2979	43.5				
Additional effort in Phase II	1219					
Phase II	2171	32	125	688	1357	2171
Phase III	1850	32	391	1238	220	1850

Fossil Fuel Price Sensitivities.

13. Fossil fuel prices have a significant effect on the choice of inputs used in power generation. Up to 2020, fuel switching between coal and gas in the power sector, is likely to be the predominant abatement technology in the EU ETS. Given that the costs of fuel switching is determined by relative prices of coal and gas[55], and that fossil fuel prices are subject to significant uncertainty it appears sensible to undertake sensitivity analysis on the affect of different fossil fuel assumptions on the EUA price. The fossil fuel price scenarios used in the DECC carbon price model are consistent with DECC fuel fossil price scenarios. These scenarios are set out in annex B. A fifth fossil fuel price scenario is shown that is not explicitly a DECC scenario, labelled 'High-High-High'. This scenario, captures the affects of having high-high gas prices and high coal prices; this illustrates the worst case fuel price scenario in which abatement will be at its most costly because of the high price of gas-fired generation relative to the price of coal-fired generation.

[55] Electricity generation with coal tends to be cheaper per MWh than generation with gas. However, a unit of electricity produced using coal will produce significantly more CO2 emissions than producing that unit using gas. Requiring generators to pay for every tonne of carbon that they produce will, therefore, reduce the price differential between coal and gas. If the carbon price is sufficiently high a generator with a portfolio of generation capacity may begin to substitute coal-fired generation with less carbon-intensive gas generation. The point at which a generator will switch will depend on both the level of the carbon price and on the level of the coal and gas prices. All things being equal, we will see more fuel switching when: (a) the carbon price is higher; and/or (b) the gas price is low relative to the coal price.

14. It is important to note that these sensitivities are only measuring the impact of changes to the fossil fuel prices on the supply-side of the carbon market (i.e., on the level of abatement). We would expect that changing fossil fuel price would also impact on the demand-side – i.e., higher prices should result in lower demand for energy and lower BAU emissions. However, given that we do not have the capability to flex the fossil fuel prices in the PRIMES model; this demand response is not reflected in these sensitivities.

15. Table A3 below illustrates the impact of the different fossil fuel price assumptions on the EUA price. The table shows only the impact of changing the fossil fuel price assumption when all other base case assumptions are held constant.

Table A3: Sensitivity of EUA price projections to fossil fuel price assumptions

Fuel price scenario	EUA price t/CO_2e
Low	€18.1
Central	€31.9
High	€39.8
High-High	€62.5

16. The full range of EUA fuel price sensitivities using the base assumptions illustrates the importance of fossil fuel prices to the EUA price up to 2020. This is no surprise given that fuel switching is expected to be the dominant abatement technology up to 2020 and that the cost of this abetment is determined by relative differences in the price of coal and gas. The full range of EUA price scenarios is quite large with a difference of €xx between the cheapest and the most expensive scenario. These sensitivities suggest that fossil fuel prices will be crucial in determining the EUA prices up to 2020.

The Cost of Carry and the annualised price schedule.

17. The DECC carbon price model provides an estimate of the marginal cost of abatement obtained as an equilibrium price in the EU carbon market. However, this approach differs from how financial markets usually price commodities; the forward carbon market provides a vintage of prices for each compliance year of Phase II, whereby yearly estimates differ because of the opportunity cost of holding EUAs. In order to derive the future carbon price profile consistently with standard financial market practise, the marginal abatement cost is interpreted as the average forward price across the EU ETS Phase II and III and a standard cost of carry relationship is used to derive yearly forward prices.
18. A future carbon price profile for the 2008-2020 period is derived under two different assumptions on the level of the opportunity cost of holding EUAs (i.e. the cost of holding rather than selling EUAs and investing the money elsewhere). In the first case, the analysis is based on a 1.5% real interest rate, which is consistent with the risk-free rate as proxied by the annual real interest rate of long-term German bonds. In the second case, a 2.5% real interest rate is used in order to capture the idea that investing in EUA is riskier than investing in government bonds.
19. The resulting risk-adjusted forward carbon curve is steeper than under risk neutrality suggesting relatively higher (lower) prices towards the end (beginning) of the period than when the risk free rate is used (Table A4). For instance, in the first scenario (i.e. using a 1.5% real interest rate) the EU allowance increases from €29.1/t in 2008 to €34.8/t in 2020. By contrast, in the second scenario with a risk adjusted interest rate, the EUA price increases from €27.4/t to €36.8/t over the same period.

Table A4: Forward Carbon Price Curve

2008 €/t	Risk free rate (1.5%)	Risk adjusted rate (2.5%)
2008	29.1	27.4
2009	29.6	28.1
2010	30.0	28.8
2011	30.5	29.5
2012	30.9	30.2
2013	31.4	31.0
2014	31.9	31.8
2015	32.3	32.6
2016	32.8	33.4
2017	33.3	34.2
2018	33.8	35.1
2019	34.3	35.9
2020	34.8	36.8

20. It is suggested to use a risk free rather than risk adjusted rate as a proxy for the opportunity cost of holding EUA because of the significant uncertainty over the size of a possible premium. Nevertheless, the risk that the recommended price profile is likely to be a biased estimate of the future EUA price is appreciated.

Next Steps

21. This annex has set out the scenarios for the EUA price following the changes to the ETS Directive. The scenarios shown here relate only to a world in which the EU achieves a 20% GHG emissions reduction in 2020. Should there be an international agreement and the EU adopts a 30% GHG reduction target then new price scenarios will be needed.

Annex A2 The non-traded sector marginal abatement cost curves

1. This annex describes the marginal abatement cost (MAC) curves that have been used for the analysis to cost the meeting of the UK's 16% emissions reduction target in the non-traded sector.

2. The abatement costs and potentials used in this analysis are based largely on the MAC curves that were developed by the Committee on Climate Change (which the Committee used as the evidence base to underpin the recommendations in their first report[56]).

3. The costs in the MAC curves are based purely on technical costs and do not incorporate any 'hidden' or policy costs. It should be noted that in certain cases this will be underestimating the costs associated with meeting the non-traded target. Inclusion of these costs could have an impact both on the estimated cost, the ordering of measures in the MAC curve and on the estimated split of abatement between domestic effort and project credits.

4. For example, in the domestic buildings sector, extending solid wall insulation beyond the level expected to be delivered under the current Supplier Obligation is likely to require additional regulation which may be costly to enforce and will also have distributional impacts that would need to be carefully assessed. Additional work is underway to attempt to estimate some of the additional costs of certain carbon abatement measures that are not currently captured in the UK non-traded MAC curve.

5. Table A5 provides an overview of the abatement technologies by sector which are still available on the MAC curves once our Energy White Paper 2007 commitments and renewable energy target commitments have been fulfilled. The MAC curve suggests that there are some negative and low-cost abatement options in the non-traded sector – mainly energy efficiency measures and the use of project credits.

Table A5: abatement potential remaining in the UK non-traded sector after accounting for the EWP policy package and the 15% renewable energy target

Sector	Measure	Potential in 2022 (Mt CO_2e)	Cost / tonne (2020 or 2022)
CO_2			
Domestic buildings	Additional solid wall insulation	0.5	£12/t CO2e
Non domestic buildings	Small non-energy intensive – various measures (non EU-ETS, non CRC)	3.3 (2.7)	Up to £200/t (<£0/t)
Industry	Small non-energy intensive – various measures (non EU-ETS, non CRC)	1.5 (1.2)	Up to £200/t (<£0/t)
Transport	Various powertrain (engine/transmission related technology) and non-powertrain	15.8 (6.1)	Up to £200/t (<£0/t)

[56] http://www.theccc.org.uk/reports/

	measures		
Non CO_2			
Agriculture	Various measures relating to animal management, manure management…	6.2 (4.1)	Up to £200/t (<£0/t)
Waste	Various measures – in particular anaerobic digestion and Mechanical Biological Treatment	7.4 (0.1)	Up to £200/t (up to £20/t)
Project credits (CDM)[57]	Project credits	11Mt / year with banking	Approx €17/tonne

6. Along with the transport *technologies* in Table A5, the Committee on Climate Change also identified about 10MtCO_2 of abatement potential from transport-related *behavioural* measures. The Committee expect this to be relatively cost effective, but this potential has not been included in this analysis presented in this impact assessment due to the fact that Committee did not estimate the cost effectiveness of these measures.

7. It is also important to note that the Committee recommended that non-carbon abatement should not be relied upon, but rather used more as risk management. This is due to a number of reasons. Firstly, there is an issue that the non-CO2 projections have a much higher level of uncertainty than the CO_2 projections. Secondly, due to current inventory methodologies which incorporate standard generic emission factors, most of the abatement potential from agriculture would not currently register against our GHG inventory (therefore would not count towards meeting our target). However, it is possible that inventory methodologies can be updated in order for these emissions to register and therefore count toward our targets.

8. The estimates of the costs of meeting the non-traded sector targets that are presented in Section 3.2 use a MAC curve that includes all the available abatement options (including both negative-cost and non-carbon abatement options). However, to take account of the concerns on the robustness of the estimates of the non-carbon abatement potential, a sensitivity is run on the costs of meeting the non-traded sector targets where these options are removed from the MAC curve. Table A6 shows some estimates of the cost of meeting the non-traded sector targets with and without the non-carbon abatement options. Restricting the use of project credits does not change the cost of meeting the targets as there is sufficient negative cost abatement available to meet the target, suggesting that project credits would not be required. These results should be interpreted with some caution as the quantity and cost of the negative costs abatement options may not reflect the full costs of these measures, including policy and hidden costs.

Table A6: costs of meeting the non-traded sector target (£bn)

	Costs in the non-traded sector

[57] Project credits are include in the table above as abatement potential, but it should be noted that project credits did not form part of the Committee's MAC curves. The project credit limit is equal to that in the final EU agreement (i.e. annual limit of 3% 2005 emissions[0]).

Costs (including all abatement options)	-1.2

Annex A3 HMRC Computable General Equilibrium sensitivity analyses

1. Extensive sensitivity testing of the model (not shown) has been undertaken, in particular to the areas of carbon caps, fossil fuel/carbon prices and economic growth, however, these factors are less important in determining the economic outcome. Instead we find that the key drivers of the model results are as follows:

The elasticity of 'intertemporal substitution'

2. The elasticity of intertemporal substitution (EIS, currently set at 0.2): this parameter governs how agents will react to changes in their future purchasing power. The response of agents to the EIS is similar for the RES package and the ETS. For the RES, agents will see that there is a technological implementation cost associated with the RES measures. These costs rise in the future so their purchasing power falls. Agents will save in the early years of the model to offset these costs. The ETS reaction is the same but stronger, the ETS expands to a global trading agreement post-2030 and caps tighten to the 2050 80% target. Agents will see that the caps will reduce their purchasing power and will also save.

3. If the EIS is zero, agents will over-react to the lower levels of purchasing power and save larger amounts. However, productivity is lower in future years so returns to savings will be lower. The increased savings lead to an excess supply of investment which compounds this problem. Correspondingly, the level of GDP is lower in this case. A higher value of the EIS (0.4) will almost neutralise the adverse GDP impacts in Phases II and III of the ETS, but the reaction to 2050 targets will be worse than for lower EIS values. A higher value of the EIS means that consumption smoothing preferences are less strong and there are less savings in the early years; this leads to an adverse income effect in the future. Although the net adverse GDP impact is smaller.

The underlying assumptions on productivity of technology.

4. There are underlying technology improvement assumptions in the CGE model. However, results show that small increments in the productivity of energy technology can significantly reduce the adverse GDP impacts of the carbon constraints.

Supply Constraints

5. If there are supply constraints in implementing abatement technology they can increase the cost of these options significantly. The main supply constraint observed relates to the construction industry and the implementation of the renewable heat element of the RES package.

Conclusion

6. In conclusion we note that the potential adverse economic effects of implementing carbon caps and renewable technology can be significantly reduced if the technology becomes more productive and there is an increase in supply. This will facilitate higher investment returns which will dampen any adverse intertemporal impacts.

Annex B1 Specific Impact Tests for the EU ETS

1. Competition Assessment

7. In the following we will assess how the transition to the revised ETS Directive will affect competition in the UK, based on the main areas of change. This competition assessment is concerned with the effects of the proposed changes in the UK and the internal EU market.

General effect of EU ETS on competition

8. The introduction of the EU ETS in 2005 (Phase I) and its extensions post-2012 affected UK business costs, increasing costs of both energy and some non-energy inputs. An increase in electricity prices will lead to higher energy costs regardless of whether or not firms are covered by the ETS. The proportionate increase in marginal costs will vary between sectors and potentially reduce firm profit margins (if additional costs cannot be passed through to prices), thereby impacting on the competitiveness of UK business as a whole (relative to firms in non carbon-constrained countries).

9. The EU ETS applies to covered sectors in all Member States of the EU (plus Switzerland and Norway). If rules are applied in a harmonised manner as proposed by the Directive it is unlikely that the additional costs on the production of energy or carbon intensive processes will directly or indirectly limit the number or range of suppliers that can compete in the market, reduce supplier incentives to supply or limit the ability of suppliers to compete.

Specific considerations:

Scope

10. The EU ETS post-2012 regulation will exclude small installations below a certain minimum threshold from its scope. Administration costs have been shown by the Commission to be up to 300 times higher per tonne of CO_2 for small emitters than for large companies. This large difference distorts competition in the internal market. It can be argued that exclusion from EU ETS will reduce distortions provided that excluded emitters are still covered by equivalent environmental measures (as stipulated in the draft Directive) and increase incentives to compete in the market.

11. Within a sector, the exclusion of some emitters below the fixed threshold, and inclusion of others may raise competition concerns in terms of limiting suppliers' abilities to compete. There may be a limited number of cases where, among substitute products, some products fall under the EU ETS and others do not – which could affect competition between these substitute products. However as the excluded emitters will still be covered by environmental regulation the resulting negative effect should be small and counteracted by the above discussed reduction in distortion.

12. Expanding the EU ETS to more industrial processes and streamlining the scope of the EU ETS will allow a better and more harmonized coverage of processes. This will reduce any previous competitive distortions within sectors and between Member States. There should be no limitations on

competition from those measures covered under the new scope of EU ETS post 2012.

Cap setting

13. Centralised cap setting will prevent distortions of competition between Member States' trading sectors and within sectors, that would occur if different levels of environmental ambition translate into different allocations and thus different costs within the same industry within the EU. Thus the transition post-2012 aims to reduce any previous competitive distortions that arose from different stringencies of cap-setting, and will enhance the ability of suppliers to compete.
14. Different methodologies for splitting the central cap into Member States' caps (i.e. distribution of burden/level of auctioning across the EU) also will not affect the ability of suppliers to compete, the range of suppliers in the market or incentives to supply.

Allocation

15. Free allocation of allowances almost inevitably reduces the signal from the allowance price needed in order to incentivise behavioural change. Thus, free allocation methodologies give rise to concerns of giving wrong incentives to industry. '*Auctioning best ensures efficient functioning of the ETS as the cost taken into account in decisions on abatement measures will be equal to the allowance price and as there is no need to set rules for allocating allowances for free which may generate wrong incentives*'[58]. The increased levels of auctioning as proposed in the Directive will limit distortions due to methodologies used to determine free allocation.
16. The impact of the revised Directive will potentially lead to higher costs for UK businesses due to the introduction of direct cost of buying allowances for a larger number of EU ETS participants. However, this should not have an impact on the ability of suppliers to compete, the range of suppliers in the market or incentives to supply, as all firms within a sector should receive equal treatment under the new rules.
17. The revised Directive creates a single EU-wide new entrant reserve (NER) with the same allocation rules for all new entrants. This best ensures equal treatment for all installations compared with other proposals for reserves set at Member State level (which could result in unequal treatment across countries if Member States use their discretion to maximise the size of their NER) or no NER (which distorts competition in favour of incumbent installations).
18. **Harmonised levels of auctioning** will enable sectors to be treated equally across Member States which should ensure that distortions are minimised. Harmonizing auctioning levels across EU industries should therefore have no negative or distorting effects on the ability and incentives of firms to compete or the numbers of suppliers.
19. **Allocation methodologies - grandfathering vs. benchmarking:** the Commission's Impact Assessment suggests that while benchmarks have the potential to create distortions in internal competition, these problems can be minimised through careful design (e.g., setting benchmarks for broad product categories and at appropriate levels) and are likely to

[58] European Commission Impact Assessment Com(2008) 16 final, SEC(2008) 53.

create fewer distortions than a system of grandfathering (i.e., where allowances are allocated for free on the basis of historic emissions – thereby penalising firms that have taken early action to reduce emissions).

Linking

20. Linking to other emissions trading systems should not affect the ability of UK or EU companies to compete in internal markets. Thus the provision for linking should not affect competition in the internal market. Linking the EU ETS with other systems will reduce possible distortions of competitiveness between European companies covered by the EU ETS and international companies that are not covered by any carbon reduction commitments.

21. Currently, limits on JI/CDM credits are not harmonised between Member States and/or sectors in different Member States. Although the revised Directive will restrict overall access to project credits in Phase III compared to Phase II, for the UK, there will be a small increase in access to project credits. In addition, the Directive sets out rules that should ensure greater harmonisation in the access to low-cost project credits across Member States. This move towards greater harmonisation should reduce distortionary effects created by different offset entitlements for installations in the same sector but different Member States.

2. Small firms impact tests

22. The EU ETS covers the largest emitting installations across the EU27, from a wide range of sectors. Given the breadth of coverage of the EU ETS it is not possible to say for certain what the impact on small firms will be from the proposed amendments to the EU ETS will be.

23. Without detailed information at a firm level, it is not possible to analyse the overlap between small firms and smaller emitters. However, the Commission's proposals would be expected to reduce the costs to small emitters by excluding them from the EU ETS, though the exact reduction in costs would depend on the policy instrument implemented in place of the EU ETS.

3. Overall Assessment of Administration Costs

Scope

24. Streamlining the scope of the EU ETS could lead to higher administrative costs for the firms brought into the System. There would be one-off costs related to buying a permit and preparing to comply, as well as annual costs of monitoring, reporting and verifying emissions. The proposals to exclude small emitters might reduce their administration costs but this would depend upon the costs of achieving emission reductions under alternative policies, as required by the conditional opt-out. In the UK the CRC would be expected to cover those installations that were opted out of the EU ETS. Additional work would be required to assess the relative administrative burdens of these two policies. In relation to expanding the scope of the EU ETS to new sectors and gases, the administration costs incurred would vary by sector. For instance the Commission's Impact Assessment suggests that if aluminium producers and N_2O emitters joined the EU ETS they would face one-off administration costs when setting up the necessary monitoring and reporting facilities, but notes that these costs would not be considerable in relation to their levels of emissions.

Monitoring, Reporting and Verification

25. The proposed MRV regulations could lead to some increased administrative costs in the short term. However in the longer-term cost savings are expected to outweigh these short-term costs.

Annex B2 Expansion of the scope

1. Cost-effectiveness for small emitters

Table B1: Breakdown of UK installations covered by the EU ETS by installation size and sector

Sector	No. of installations in EU ETS	No. of installations below 25kt	No. of installations below 10kt
Engineering & Vehicles	45	33	18
Food and Drink	138	101	43
Ceramics (inc brick production)	112	98	49
Chemicals	104	43	11
"Other" combustion	9	7	5
Glass	30	12	5
Iron & Steel	15	5	3
Lime	9	1	0
Offshore	112	11	4
Other Oil and Gas	33	13	8
Power Stations	123	58	51
Pulp & Paper	79	38	24
Services	208	197	150
Refineries	12	1	0
Aluminium	1	0	0
Cement	20	0	0
Mineral wool	4	1	0
Total	1054	619	371

Source: UK Phase II NAP and verified emission figures from the CITL.

2. New sectors and gases

Criteria for assessing expansion of the EU ETS

1. The UK's criteria to assess the scope of the EU ETS in terms of new sectors and gases are as follows:

i) Impact on emissions - The contribution of the source to current EU GHG emissions and the projected growth of this source in the future. Even if there is limited abatement potential within the sector, capping its emissions would still force the sector to internalise the full costs of its production and, by having to purchase allowances, emissions elsewhere would have to reduce, provided the overall cap was sufficiently tight.

ii) Monitoring and enforcement - The ability to conduct robust MRV of emissions at reasonable cost is key for maintaining the environmental integrity of the system.

iii) Transaction costs - The complexity of the installation or process concerned can mean that compliance costs are high. Small installations may experience disproportionately high costs. Expansion should not introduce significant administrative burdens for operators or regulators. If the sector is already partially included in the EU ETS then expansion to include additional emissions on site could reduce the complexity of monitoring, reporting and verification.

iv) Competitiveness – The inclusion of EU sectors subject to significant international competition could lead to a transfer in production and therefore emissions to outside the EU where non-EU competitors are not covered by similar measures. This is known as carbon leakage. The previous lack of a harmonised application of the Directive's scope also means that installations covered by the EU ETS may be in competition with similar installations in different Member States which are not included. Including specific sectors could help reduce these competitive distortions.

v) Carbon market functioning - Additional sectors would in general be expected to increase liquidity in the market, but this ultimately depends on abatement potential, the cap that is set and the allocation methodology. While a lack of abatement opportunities does not preclude a sector's inclusion, the inclusion of new sectors should not undermine the functioning of the carbon market – indeed, ideally it should enhance it.

vi) Compatibility with wider policy framework - Existing targets or regulations could reduce the ability of the EU ETS to deliver efficient outcomes. In certain sectors, other instruments may provide a more effective means of achieving a given emissions reduction – for instance where transaction costs would be very high or where monitoring, reporting and verification is difficult or uncertain. Limited abatement potential should not exclude a sector but high transaction costs may mean that for the same impact on emissions, regulation under other legislation could be more effective. Inclusion could incentivise abatement additional to that incentivised by existing policies. Policy goals other than climate change may be of particular importance in some cases and potentially adverse secondary impacts may need to be considered such as: air quality, local environmental quality, water, waste and/or biodiversity. It is possible that compliance with the EU ETS could have perverse impacts on the ability of the UK and EU to meet their other international commitments.

2. A similar set of criteria have been used by the Commission in their assessment of the inclusion of new sectors and gases:

- Significance of the source
- Feasibility to monitor emissions
- Proportionality of transaction costs
- Interaction with existing policies and regulation
- Compliance costs

3. The key difference between the two is that the UK's criteria include explicit consideration of competitiveness and the effects of any new inclusion on the functioning of the market. The UK criteria frame the assessments in such a way as to enable consideration of both impacts on the EU ETS as a whole and UK specific effects, where proposals would impact upon Member States differently.

Sector consideration

CO_2 emissions from petrochemicals production and other chemicals

4. The Commission Impact Assessment estimates that 66% of the petrochemicals sector[59] is already in the EU ETS through the inclusion of crackers in Phase II and under a broad interpretation of combustion installation. Of the remainder, much is likely to be excluded under the provisions for small emitters. The sector will be included in the System under the revised Directive to assist with legal clarity of the scope and consistency of coverage across Member States.

i) Impact on emissions: EU25 CO_2 emissions falling outside the current scope of the EU ETS from the petrochemicals sector were approximately 0.9% of EU25 in 2003 (45MtCO_2). In the UK emissions from all classes of installation are estimated to be 4.8MtCO_2 per year. Of this, 2.5MtCO_2 are captured by the Phase II expansion to crackers. A proportion of the remaining 2.3MtCO_2 is likely to be excluded under the provisions for small emitters.

ii) Monitoring and enforcement: Petrochemicals plants are highly integrated and there are a number of options for defining the coverage of the sector beyond its energy activities. The cost and feasibility of defining the sector and monitoring, reporting and verifying emissions is dependent upon the definition of the sector. The integration of installations means monitoring uncertainty is medium to high. It is expected that developing methodologies for the entire sector should be relatively straightforward.

iii) Transaction costs: Installations are generally large, with complex but highly monitored processes, so medium to low transaction costs are expected. Costs at the installation level will vary depending on the size and complexity of the installation and the existing process control measures. Administrative costs for the competent authorities could be relatively high due to the large number of installations involved.

iv) Competitiveness considerations: Commission modelling suggests that the increase in costs within the sector compared to non-EU competitors are not expected to have significant competitiveness implications. EU industry is exposed to global competitive pressures, particularly changing patterns of investment towards the Middle East which has low-cost feedstock advantage, and the Far East where market growth is rapid. There is significant trading of ethylene derivatives within and outside the EU and prices are set globally limiting the pass-through of costs[60]. Whilst there may be some adverse impacts of inclusion in the EU ETS, these are not so significant as to rule out inclusion.

The UK petrochemicals sector is highly exposed to international competitive pressures. It faces competitive disadvantages within the EU due to distributional costs, low growth of the UK customer base and growing regulatory loads. Downstream products generally are more exposed to international (intra and extra-EU) competition than primary petrochemicals, so their ability to pass through costs is more limited.

v) Market functioning: Increasing the coverage of the petrochemicals sector would increase the quantity of emissions in the System and thus market liquidity.

vi) Compatibility with wider policy framework: Petrochemicals plants are already covered by the IPPC and LCP (Large Combustion Plant) Directives. However according to the LETS report their effect as a driver of emission reductions is

[59] See Commission Impact Assessment, 3.3.4.2 (pg. 38) for an explanation of the substances and processes covered by this definition

[60] Source: Chemical Industry Association

expected to be limited. If inclusion of the sector in the EU ETS led to greater efficiency, there could be ancillary benefits in terms of reducing other air pollution. Part of the sector is already covered by voluntary agreements in some countries (but these do not allow interaction with other sectors or gases where emissions reductions might be possible at lower costs. They also do not provide the same level of certainty that environmental targets will be reached.) Though there is a need to develop appropriate monitoring and reporting protocols, the same would presumably be true for other regulations if they were used.

CO_2 emissions from soda ash

5. There are only two plants in the UK producing soda ash. The power generation element (CHP) of these plants is already included in the EU ETS. The processes involved in soda ash production are similar to processes undertaken by installations already covered by the EU ETS, and are covered by a broad definition of a combustion installation which other Member States have adopted in previous phases. Whilst these are not in competition with soda ash, there is a case for including soda ash given this similarity, although obviously sector specific analysis is also required to assess particular risks and impacts, for instance in relation to competitiveness impacts.

(i) Impact on emissions: The majority of soda ash emissions in the UK are due to the steam and power consumption, accounting for 400,000tCO_2/yr, and these are already included in the EU ETS. Process emissions account for 190,000tCO_2/yr. In the UK, the sector's emissions represent 0.25% of the Phase II cap; the process emissions not currently covered represent one-third of this. Given that two sites are responsible for these emissions, reference to Chart 2 (Section 2) indicates that the emissions are significant on a per installation basis. The abatement potential from soda ash is expected to be limited but inclusion in the EU ETS is likely to incentivise those which are available.

(ii) Monitoring and enforcement: The feasibility of monitoring, reporting and verifying emissions is expected to be straightforward, given that the sector is similar to other processes already covered by the EU ETS. There are 2 main sites in the UK, and both combustion and process emissions are verifiable.

(iii) Transaction costs: The soda ash process is easily definable and there is one site in the UK which is already permitted under the EU ETS. As similar lime kiln processes are included in the EU ETS, costs of compliance should be similar to those for existing installations. The sites in question are reasonably large so transaction costs are likely to be relatively low. Moreover, costs incurred by central agencies due to the inclusion of soda ash would be low.

(iv) Competitiveness considerations: The soda ash industry competes with exports from the US, China and Russia. Sector specific analysis is required to determine whether there might be risks of carbon leakage, but these risks are not expected to be so great as to rule out inclusion in the EU ETS.

(v) Carbon market functioning: Inclusion of this sector would increase the quantity of emissions in the System, improve liquidity and not have any detrimental impact on the functioning of the market.

(vi) Compatibility with wider policy framework: The Climate Change Agreements and IPPC regulation already cover the UK's soda ash sites. The absolute cap provided by the EU ETS will assist emission reduction efforts and inclusion of the sector will enhance the consistency of the System by covering processes similar to those already included.

Hydrogen

6. The Commission have clarified that this sector is included under a broad definition of a combustion installation and have listed it as a combustion activity in Annex I, with a production capacity of 25 tonnes.

(i) Impact on emissions: Hydrogen will be included under a broad definition of combustion, which the Government supports. Other Member States that already apply a broad definition will include it in Phase II. It is in part already included under mineral oil refineries even without a broad definition. Therefore, explicitly including production of hydrogen will ensure consistency in coverage across the EU.

(ii) Monitoring and enforcement: This sector includes a small number of large installations with broad combustion and process emissions. Emissions are already monitored, reported and verified in other Member States, and the installations involved are not expected to differ significantly from other installations covered by the EU ETS combustion definition in the UK.

(iii) Transaction costs: Only the largest installations would be included under the proposal, therefore transaction costs are not expected to be considerable. Similarly, additional costs to central agencies should be low.

(iv) Competitiveness considerations: Including hydrogen as a sector will remove competitive distortions that might have arisen both from its partial inclusion during Phase II by Member States applying a broad combustion definition and within mineral oil refineries. As hydrogen production can be outsourced rather than produced on site the proposal to include hydrogen as a sector could create distortions between these two sources. This risk is already present given its partial inclusion in Phase II.

(v) Carbon market functioning: Inclusion of this sector would increase the quantity of emissions in the System, improve liquidity, and not have any detrimental impact on the functioning of the market.

(vi) Compatibility with wider policy framework: Inclusion of the sector enables greater harmonisation of coverage across the EU as in some countries installations already producing hydrogen are included.

Ammonia

Emissions from ammonia production equate to 2.25% of the GHG emissions currently covered by the EU ETS. One-third are from combustion (about 15 $MtCO_2$) while the remainder (about 30 $MtCO_2$) are process emissions. The broad combustion definition would cause the former to be included in the system but process emissions from ammonia production would still be excluded.

i) Impact on emissions: The sector contributes 0.6% of the EU's CO_2 emissions, equivalent to approximately 30$MtCO_2$/year and this is projected to increase slightly in the future. The key emitting countries in the EU are Belgium, France, Germany, the Netherlands and the UK – together responsible for over 80% of the CO_2 emissions from ammonia. UK ammonia plants emit 2-3$MtCO_2$ annually. There are reasonable abatement options in the sector (~15% for combustion emissions) and inclusion could incentivise implementation of abatement techniques and drive emissions reductions within the sector. Including all emissions from ammonia production would prevent the possibility of operators shifting the energy input between the combustion and reaction parts of the

installation and counting it as an emissions reduction[61]. Thus inclusion of the sector would have particular environmental effectiveness benefits.

i) Monitoring and enforcement: The sector covers a small number of large installations with broad combustion and process emissions. There is low uncertainty in emissions reporting and MRV feasibility is not dissimilar to installations already covered by the system (e.g. refineries, iron and steel).

iii) Transaction costs: As these are large emitters, with complex but highly controlled processes, transaction costs are likely to be low.

iv) Competitiveness considerations: In the short-term it is probable that ammonia producers may suffer from greater competitive pressure from non-EU producers, particularly those located in Russia and the Middle East. However the Commission Impact Assessment suggests that greater anticipated demand from Asia in the longer term, combined with the existing logistical costs of handling and transportation into the EU, mean that such pressures may decrease in the future. So while additional short term competitive pressures cannot be ruled out, in the longer term it is anticipated that such pressures will diminish[62]. The Western European ammonia market structure is highly competitive with 16 producers competing with imported product. There have been a number of plant closures in Europe in recent years (2 in France, 1 in Ireland) resulting from poor profitability[63]. Inclusion of this sector would reduce competitive distortions within the EU as the various interpretations of a combustion installation would no longer determine the coverage of plants included in the ETS.

v) Market functioning: Inclusion of this sector would increase the quantity of emissions in the System, and so greater liquidity would be expected. Regulation on the downstream use of fertilisers means that the impact on the sector's flexibility to trade needs to be considered in the allocation methodology.

vi) Compatibility with wider policy framework: Ammonia production is covered by the IPPC and LCP (Large Combustion Plant) Directives. However the LETS report suggests these are unlikely to drive emission reductions. Part of the sector is already covered by voluntary agreements in some countries, but these do not allow interaction with other sectors or gases where abatement may be more cost-efficient. They also do not provide the same level of certainty about meeting emission reduction targets. Though there is a need to develop appropriate monitoring and reporting protocols, the same would presumably be true for other regulations if they were used. In addition to being a GHG, ammonia is also detrimental to human health as it leads to the formation of secondary particulate matter, in the form of ammonium nitrate. Therefore if the inclusion of this sector were expected to reduce its use it could have significant air quality benefits.

Aluminium (CO_2 and PFC emissions)

i) Impact on emissions: The majority of emissions from aluminium production come from primary aluminium production, which is responsible for all direct CO_2 and PFC emissions. Secondary aluminium production accounts for only 6% of indirect CO_2 emissions and does not produce any PFC emissions. Secondary aluminium production recycles existing aluminium and as such has an energy requirement of just 5% of primary consumption. Primary production is

[61] Commission Impact Assessment, section 3.3.4.3
[62] Ibid. p.g. 40
[63] Source – Chemical Industry Association

undertaken by a small number of large installations whereas secondary production is composed of many more small installations

Primary production requires large amounts of electricity, so the aluminium sector already experiences the indirect price effects of the EU ETS. The long-term electricity supply contracts used by many producers may alleviate some of these price effects, although this is dependent upon the provisions of specific contracts. Including PFC emissions from aluminium would be of environmental benefit because of its high global warming potential and also would benefit participants because of greater abatement potentials for PFC than for CO_2 in the aluminium sector, reducing compliance costs. Overall, the sector would be expected to be a net buyer.

ii) Monitoring and enforcement: With a limited number of installations representing a comparatively large level of emissions, it appears that there could be adequate monitoring, reporting and verification. For primary aluminium, large single-point sources lead to simple site definitions and robust reporting across all EU countries at plant level. Monitoring protocols are likely to be quite straightforward to develop as sites are already required to monitor emissions under other Directives. As well as combustion, emissions are related to fuel use and process emissions are directly linked to the degradation of the carbon anode.

iii) Competitiveness considerations: The Commission's Impact Assessment details the strong international competition faced by the EU aluminium market[64]. These competitive pressures would make it difficult for firms to pass-through the costs of the EU ETS without a loss of market share or avoiding carbon leakage. Modelling has shown that (based upon full auctioning) even without being included in the EU ETS, EU aluminium producers may experience cost increases exceeding the average earning before interest and taxes (EBIT) by 1.4% of total costs.[65] These would be the result of indirect cost increases from power generation. If the sector were itself included in the EU ETS another 5.6% may be incurred. The Commission Impact Assessment suggests transitional measures could be used to alleviate some of the competitiveness impacts for the aluminium sector.

The competitiveness effects of including the aluminium sector in the EU ETS may have an adverse impact on employment if relocation of production occurs. However, it is unlikely that such decisions would be due entirely to the inclusion of the sector in the EU ETS. Additional factors including energy prices would be key and thus relocation could occur irrespective of the sector's inclusion in the EU ETS.

iii) Transaction costs: The small number of large installations (with clear boundaries) in the primary aluminium sector means that regulatory costs are not expected to be significant. The greater number, and smaller size, of installations involved in secondary production, means regulatory costs may be slightly greater. Administrative costs are not expected to be great on a per tonne basis, and would decrease over time due to efficiency gains.

iv) Market functioning: It is noted in the Commission's Impact Assessment that significant emissions reductions have occurred in recent years, and with the exception of PFC emissions, there may be limited abatement opportunities in the

[64] Commission's Impact Assessment, section 3.3.4.4 pg. 44

[65] ENTEC UK Ltd: Support for the Impact Assessment in the Context of the Review of Directive 2003/87/EC, London, 2007 (not published yet)

next few years. However, inclusion may encourage research and development into new commercially available abatement technologies. The liquidity and depth of the market would be expected to improve if the sector were included.

v) Compatibility with wider policy framework: The aluminium sector is covered by the IPPC and Climate Change Agreements in the IL. There is a strong voluntary initiative by the sector in monitoring the PFC emissions, identifying best practice and benchmarking. Emissions trading would seem a suitable form of regulation for the sector as it ensures a level playing field against other sectors already covered in the EU ETS against which the products compete (e.g. iron and steel, paper and glass). However the international nature of the sector means that with the limited abatement potential and opportunity to pass on costs, competitiveness of EU industry could be negatively impacted and production may transfer out of the EU to uncapped economies.

Nitric, adipic and glyoxalic acid production emitting N_2O

i) Impact on emissions: N_2O emissions from nitric, adipic and glyoxalic acid production correspond to approximately 2.5% of Phase II allowances, with a slightly declining trend between 2010 and 2020. There is no production of glyoxalic acid in the UK.

ii) Monitoring and enforcement: There is low uncertainty and good MRV capacity within these sectors. The technical feasibility of inclusion in the EU ETS is considered to be good.

iii) Transaction costs: Commission screening suggests that relatively low administrative costs would be incurred by operators and regulators from inclusion of these emissions. With some Member States planning unilateral opt-in of N_2O emissions from nitric acid production during Phase II, monitoring and reporting guidelines measuring emissions from the production of nitric acid, adipic acid, caprolactam, glyoxal and glyoxylic acid are currently being developed. This will reduce the Community level costs of including this sector post-2012.

iv) Market functioning: Member States could opt N_2O sectors in for Phase II. France and the Netherlands chose to do so and are in the process of applying for the opt-in; a key part of the inclusion will be agreeing a suitable benchmark. Such partial inclusion could create competitive distortions and inconsistency. Formal inclusion of the sector post-2012 could improve market functionality.

v) Competitiveness considerations: Formal inclusion of the sector would remove any competitive distortions arising during Phase II on account of some Member States choosing to opt in N_2O unilaterally. The Commission's Impact Assessment suggests that there is no particular competitive pressure in comparison with non-EU competitors due to low exposure to international competition.

Annex B3 Criteria for linking with other systems

1. The existing Directive allows linking to other emissions trading systems in countries listed in Annex B of the Kyoto Protocol that have ratified the Protocol. Under the current Directive, the EU is unable to link with: (1) Annex B countries that have not ratified; (2) non-Annex B countries; (3) non-national governments (e.g., US State schemes); or (4) non-governmental schemes (e.g., Chicago Climate Exchange).
2. The Commission proposals include a provision for the EU ETS to link to other mandatory GHG emission trading schemes in a national, sub-federal or regional entity.
3. Any link of the EU ETS with other emissions trading systems would require the Commission to make a recommendation to the Council to authorise the Commission to open up negotiations on linking arrangements. These negotiations would be conducted by the Commission in consultation with the Council committees and the final agreement would be approved by Council by qualified majority.
4. Against this background, the Commission Impact Assessment that accompanies the ETS Directive deals only with general principles related to linking rather than the specific impacts of linking the ETS with another scheme. The Impact Assessment sets out a series of criteria that could be used to assess the desirability of linking the ETS with emerging schemes. They are as follows:

Criterion 1 – units used: the EU ETS could not be linked to systems directly using AAUs without undermining its effectiveness and environmental integrity.

Criterion 2 – registry standards: if trading schemes are to be linked, their registry systems must be able to accurately exchange data.

Criterion 3 – type of system: linking to schemes with relative targets may undermine the environmental integrity of the scheme. For this reason, the EU ETS should only link with systems aimed at absolute targets.

Criterion 4 – voluntary/mandatory: linking to a voluntary scheme might affect the environmental integrity of the system and risk competitive distortions. For this reason, only links to mandatory systems will be considered.

Criterion 5 – stringency of cap: the target in both schemes needs to be tight enough to impose a binding constraint on emissions (i.e., total quantity of allowances is less than Business As Usual emissions).

Criterion 6 – monitoring and reporting: monitoring and reporting standards must be reliable and accurate. The use of EU standards or the definition of minimum requirements would be relevant criteria.

Criterion 7 – compliance and enforcement: standards of a linked system must be rigorous enough to avoid leakage and gaming.

Criterion 8 – intervention measures: there are a range of intervention measures (e.g., price caps) generally designed to control costs. Potential criteria for linking the EU ETS with systems employing intervention measures may not be to establish links to systems with such measures or to define a list of acceptable intervention measures.

Criterion 9 – direct/indirect approach: links will only be made with systems that trade direct emissions reductions.

Criterion 10 – banking/borrowing: differences in banking/borrowing provisions can be problematic in situations where there are doubts about the appropriateness of the allocation and the differences in allocation stringency between trading periods. For this reason, only a certain level of banking and borrowing should be acceptable.

5. The ETS Review Project undertaken by the Office of Climate Change proposed a similar a set of criteria that would help to ensure that environmental effectiveness, economic efficiency, confidence and credibility are maintained when two systems are linked.

i) Mutual recognition of trading units: every allowance that is allowed to enter every system must represent a true emission reduction.

ii) Monitoring, verification and reporting of emissions: in order to maintain confidence and credibility in the system, reported emissions must be accurate and verifiable, enforcement must be effective and the integrity of the allowance registry must be ensured.

iii) Sufficient stringency must be maintained: in terms of cap setting, this means that the quantity of allowances allocated should be less than is required under the BAU scenario.

iv) Boundaries must be well defined: if the boundaries of the trading system are not well defined, linking may reduce the level of emissions reductions compared to two separate schemes. To reduce emissions leakage, scope must be complete and emissions reductions should not be counted more than once.

v) Market function: any restrictions on market function that exist in a scheme may transfer over into the linked system and may reduce liquidity. If linking causes large and sudden changes in the carbon price, this may disrupt the market functioning of the scheme and compromise economic efficiency.

vi) Administrative burden: there is a trade-off between the complexity and increased administrative costs to make a system more compatible and the advantages of compatibility in terms of improved environmental effectiveness, confidence and economic efficiency of the scheme.