Review of the Fourth Carbon Budget - Call for Evidence

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Question and Response form

When responding please provide answers that are as specific and evidence-based as possible, providing data and references to the extent possible. Please limit your response to a maximum of 400 words per question.

Questions for consideration:

A. Climate Science and International Circumstances

The Committee's advice assumes a climate objective to limit central estimates of temperature rise to as close to 2°C as possible, with a very low chance of exceeding 4°C by 2100 (henceforth referred to as "the climate objective"). This is broadly similar to the UNFCCC climate objective, and that of the EU.

In order to achieve this objective, global emissions would have to peak in the next few years, before decreasing to roughly half of recent levels by 2050 and falling further thereafter.

The UNFCCC is working toward a global deal consistent with such reductions, to be agreed by 2015. Earlier attempts (e.g. at Copenhagen in 2009, before the fourth budget was recommended or legislated) have failed to achieve a comprehensive global deal to limit emissions.

It is difficult to imagine a global deal which allows developed countries to have emissions per capita in 2050 which are significantly above a sustainable global average, implying the need for emissions reductions in the UK of at least 80% from 1990 levels by 2050.

The EU has not yet agreed a package beyond 2020, but the European Commission is consulting on a range of issues relating to development of climate and energy targets for 2030. In its 2011 Roadmap for moving to a competitive low-carbon economy, the Commission suggested a reduction in emissions of 40% on 1990 levels by 2030, as being on the cost-effective path to an 80-95% reduction by 2050. The UK Government has signalled its support for a 40% reduction by 2030, and for an increase to 50% in the context of a global deal.

China has made ambitious commitments to 2020 which would, if delivered, cut carbon-intensity relative to GDP by around 45%.

The United States could achieve its Copenhagen Accord commitment to reduce emissions by 17% on 2005 levels without the need for further federal legislation.

Question 1: Does the scientific evidence justifying the climate objective remain the same as in 2010? In particular, is there new evidence on climate change impacts?

ANSWER:

The UK's current emission reductions targets for 2050 remain valid as a minimum requirement for the legal commitments under the 2008 Climate Change Act. However, the translation of the UK's stated climate objective into emissions targets is currently inconsistent. This has substantial implications for impacts that would be anticipated in the UK and overseas as a result of this degree of warming, were a similar position to be taken by all Annex 1 nations. This is therefore of substantial relevance to international negotiations.

In considering a review of the budget, it should be acknowledge that "the climate objective" (as defined above) is highly inconsistent with UK statements and international commitments. From the Copenhagen Accord (2009) and subsequent COPs through to the G8 Camp David Declaration (May 2012) the UK has repeatedly committed to making its fair contribution to "hold the increase in global temperature below 2°C, and take action to meet this objective consistent with science and on the basis of equity". In the absence of any explicit quantification, probabilities may be inferred by adopting the approach developed for the IPCC's reports, whereby a correlation is made between the language of likelihood and quantified probabilities (IPCC, 2010). Following this approach, the Accord's, EU's and UK Government's statements all clearly imply very low (0%-10%) probabilities of exceeding 2°C. Even a highly conservative judgement would suggest the statements represent no more than a 33% chance of exceeding 2°C. However in 2013, and with the UK's preferred probability density function (PDF) of temperature increase for a given trajectory (taken from Murphy et al, 2004), a 0%-10% chance of exceeding 2°C would leave almost no available carbon budget. Stretching the probabilities much further really starts to detract from any reasonable interpretation of the "must not exceed" language; though given the emissions released since 2000, it is now difficult to envisage anything much lower than 30%-40% chance of 2°C being either physically viable or deliverable in practice.

We are currently preparing a research paper in which provisional findings suggest that UK budgets, if extrapolated across Annex 1 countries, are in line with a much higher than 1% probability of 4°C warming (as referred to by the CCC in its 2010 report). If the UK is not to renege on its expressed international commitments on 2°C then the carbon budgets ought to be tightened substantially.

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Question 2 ***Have the emissions pathways consistent with achieving this objective changed? In particular, is there new evidence on climate sensitivity to emissions?***

ANSWER:

We have computed near-term projections in global CO2 emissions using the projected World GDP from the International Monetary Fund (IMF, April 2013), and applying the mean improvements in the fossil intensity of the economy of the past decade as in Raupach and Canadell (2010). The recent global emissions trajectory is at the high end of IPCC emissions scenarios, and correlates with a central global warming projection of 4.9°C. Such a rise would exceed any warming level thought to have occurred in the past 5 million years.

There is a range of climate sensitivity estimates based on different lines of evidence (both observations and models). Even if the low-end of the range is chosen (i.e. 1.5°C for a doubling CO2 concentration), this would still cause a rise in temperature of 3.5°C by 2100 under a high emissions scenario. Conversely, if the climate sensitivity was at the high end of the range (i.e. of 4.5°C for a doubling of CO2), for instance due to a strong feedback with carbon stored in the natural reservoirs (Previdi et al., 2013), warming could reach as high as 7.9°C by the end of the century. The uncertainties above the central projection are larger than those below due to the many processes that are poorly understood, but could add considerable warming to the planet if the carbon stores were destabilised (e.g. frozen soils, wetlands and gas hydrates). A range of studies suggest that the most likely value of climate sensitivity is around 3°C (Hegerl et al. 2007), even considering global temperature trends of the past 15 years, which can be accounted for by natural variability in the climate (Foster and Rahmstorf, 2011; Guemas et al., 2013).

Question 3 ***Does the climate objective remain in play given international developments? Has the likelihood of getting global agreement changed significantly since the budget was set, and if so why?***

ANSWER:

Global emissions of CO2 have increased by 3.1% per year since 2000 on average, three times faster than the 1.0% per year increase observed in the 1990s (Peters et al., 2013). Such trajectories are following the upper end of the emissions scenarios

that will be used in the upcoming assessment of the Intergovernmental Panel on Climate Change (IPCC; Fig. 1). Observed emissions are increasingly diverging from the emissions required to limit global warming to the 2°C characterisation of "dangerous global climate change" (Peters et al., 2013). The emissions projections we calculated for 2012-2018 suggests that the recent trend will persist well into this decade unless improvements in energy efficiency strongly depart from the tendencies observed since 2000, or unless reductions in energy consumption occur.

The CO2 emissions from fossil fuel combustion in the UK have decreased by 20% since 1990 when considering territorial emissions only. However they have remained approximately constant when considering emissions from the consumption of goods and services produced elsewhere but consumed in the UK ((Le Quéré et al., 2013) updating the analysis of (Peters et al., 2011)). In contrast, the emissions in Germany have decreased by about 25% since 1990, for both territorial and consumption emissions, while the German economy has continued to grow.

CO2 emissions from the EU accounted for 11% of global emissions in 2012 and 24% over the period 1751-2010 (Le Quéré et al., 2013). As Anderson and Bows (2011) demonstrates, the UK's proportion of the global carbon budget for a 63% chance of exceeding 2°C is currently premised on an apportionment regime that is highly partisan and certainly far removed from the UK's explicit and international commitments on equity. Current legally binding budgets already essentially reject a low probability of 2°C in favour of maintaining some emission space out to 2050 and hence a relatively slow transition to a lower-carbon society.

The UK and EU need to maintain and enhance their commitments to emissions reduction in support of the successor to the Kyoto Protocol (to be decided by 2015). Any loosening of the UK commitments could be seen as a weakening of leadership and risk derailing the UNFCCC process and the credibility of the Prime Minister as Chair of the UN committee tasked with establishing the new UN Millennium Development Goals for 2015.

Question 4 ***How have the prospects for a new EU package for 2030 changed since the Committee's advice and the setting of the budget? What implications do the latest expectations have for the fourth carbon budget?***

ANSWER:

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Question 5 ***What flexibilities are appropriate to reflect possible future changes in EU and international circumstances?***

ANSWER:

It seems unlikely that flexibilities which would see the UK's territorial emissions falling at lower rates than those outlined in the 4th Budget would be compatible with the climate objective. If UK emissions were to be above the trajectory then even greater reductions would have to be made by a counterparty and given the strong constraint of a meaningful budget it is hard to see which nation (or sector) this could be.

In brief, and to put some perspective on the change in the scale of the challenge, if non-Annex 1 nations can peak by 2025, and reduce emissions thereafter at around 7% p.a. (approximately twice the level Stern et al suggest is possible with economic growth), then there is no discernible emission space remaining for Annex 1 nations within a budget with a low probability of breaching 2°C. Only if the growth to a 2025 peak in non-Annex 1 emissions is radically curtailed to just 1% p.a. and subsequently reduced at over 7% from 2025, is there any space for Annex 1 emissions – but still only if the latter's emissions begin reducing at over 10% p.a. immediately.

B. Technology and economics

In recommending the level of the fourth carbon budget, the Committee developed scenarios which embodied cost-effective emissions reductions to meet the 2050 target.

These scenarios, set out in detail in the Committee's report *The Fourth Carbon Budget – Reducing emissions through the 2020s*, include substantial investment in low-carbon power generation, roll-out of low-carbon heat (heat pumps and district heating), development of the markets for ultra-low emissions vehicles and a combination of energy efficiency measures and fuel switching in industrial sectors.

They were based on official emissions projections together with an assessment of the cost and feasibility of abatement options. Since 2010, official emissions projections have been significantly reduced in the industry and waste sectors, meaning that meeting the legislated 4th carbon budget would require less effort than originally envisaged.

Question 6 ***Is there any new evidence to suggest that the type of scenarios upon which the budget was based are no longer feasible or cost effective?***

ANSWER:

Question 7 ***In particular, does the possibility of shale gas in the UK change the economics of the fourth carbon budget?***

ANSWER:

There are substantial uncertainties in the price and quantity expectations for shale gas in the UK. However, it is not anticipated to substantially reduce wholesale gas prices in the UK for a number of reasons, *inter alia* our liberalised energy markets, interconnection to continental Europe, environmental regulation, and the expectation of a low proportion of high value natural gas liquids (Energy and Climate Change Committee 2013). Indeed there are limited expectations for near term replication of US developments anywhere worldwide (e.g. BP 2013). However, increased production within the US could reduce the rate of price rises experienced by the UK. Carbon budgets, in absolute terms, ought to be robust to these changes, however subsidiary policy, e.g. in stimulating power sector decarbonisation, also needs to be robust. Further, the potential for the failure of affordable, timely, high performance, commercial scale CCS must be considered and contingency made.

The DECC Gas Generation Strategy is potentially problematic in this regard; a number of the gas rich scenarios presented are incompatible with existing traded sector carbon budgets and overall implied climate objectives. Were power sector emissions to exceed their allocation this would place greater pressure on other sectors for reductions. This issue is of relevance to the shipping, aviation, cement and chemical industries which are expected either to have higher mitigation costs than the power sector, or in certain circumstances may be vulnerable to relocation overseas with associated 'carbon leakage'. Solely registering emissions in producer based accounts exacerbates some of these problems.

Taking a specific example, cutting the non-CO2 emissions associated with the agricultural sector is considered to be more challenging than mitigating CO2. Specifically, there is more uncertainty over how to significantly curb and quantify N2O emissions, particularly those associated with soil processes, than there is for the CO2 associated with energy consumption. This is exacerbated when taking into account a rising demand for food and future climatic change (Flynn et al., 2005, Popp et al., 2010, Reay et al., 2012, Smith et al., 2008, Smith and Olesen, 2010).

Having separate sectoral targets, as well as an aggregated 'carbon budget' is therefore essential to ensure that limited progress in one sector can be compensated for by greater progress in another, when budgets are reviewed periodically. Therefore, consideration of sectoral progress should be used to maintain, weaken or strength targets in other sectors, in order to remain within the overall carbon budget associated with the 2°C target. One likely outcome of taking this approach, is that mitigation effort aimed at CO2 will need to be *strengthened* in the short-term, given technical limits to N2O emissions associated with food production over the longer term (Bows et al., 2012a). This is a further problematic issue for the persistence of natural gas in power and domestic heating.

Question 8 ***Should the budget be tightened to reflect headroom due to significantly lower emissions projections (e.g. due to slower than expected economic growth) since 2010?***

ANSWER:

Referring to the answers to Q1 and Q2, given that existing budgets are incompatible with a good chance of avoiding a 2°C threshold, and global trends are for much greater warming, it seems prudent to tighten budgets. This would prevent increases in emissions at a later point in time and provide a coherent platform for international negotiation.

C. Other issues

As required by the Climate Change Act, in designing the fourth carbon budget we considered impacts on competitiveness, fiscal circumstances, fuel poverty and security of energy supply, as well as differences in circumstances between UK nations. Previous high-level conclusions on these were:

- **Competitiveness** risks for energy-intensive industries over the period to 2020 can be addressed under policies already announced by the Government. Incremental impacts of the fourth carbon budget are limited and manageable.
- **Fiscal impacts**. The order of magnitude of any fiscal impacts through the 2020s is likely to be small, and with adjusted VED banding and full auctioning of EU ETS allowances could be neutral or broadly positive.

- **Fuel poverty**. Energy policies are likely to have broadly neutral impacts on fuel poverty to 2020, with the impact of increases in electricity prices due to investment in low-carbon generation being offset by energy efficiency improvement delivered under the Energy Company Obligation. Incremental impacts through the 2020s are likely to be limited and manageable through a combination of further energy efficiency improvement, and possible income transfers or social tariffs.

- **Security of supply** risks due to increasing levels of intermittent power generation through the 2020s can be managed through a range of flexibility options including demand-side response, increased interconnection and flexible generation. Decarbonisation of the economy will reduce the reliance on fossil fuels through the 2020s and thus help mitigate any geopolitical risks of fuel supply interruption and price volatility.

- **Devolved administrations**. Significant abatement opportunities exist at the national level across all of the key options (i.e. renewable electricity, energy efficiency, low carbon heat, more carbon-efficient vehicles, agriculture and land use).

Question 9 ***Is there any new evidence to suggest that (incremental) impacts of the fourth carbon budget on competitiveness, the fiscal balance, fuel poverty and security of supply have become unmanageable?***
ANSWER:

Question 10 ***Is there any new evidence on differences in circumstances between England, Wales, Scotland and Northern Ireland that suggest the need to change the budget?***
ANSWER:

Question 11 ***Is there anything else not covered in your answers to previous questions that you would like to add?***

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ANSWER:

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