The Fifth 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.

The Committee on Climate Change
1st Floor,
7 Holbein Place,
London SW1W 8NR
Tel: 0207 591 6262 Fax: 0207 591 6180 www.theccc.org.uk

Questions for consideration:

A. Climate Science and International Circumstances

Climate science and international circumstances are important criteria in setting carbon budgets.

- The science indicates the impacts associated with different levels of climate change and the limit on emissions globally if these risks are to be contained.
- International circumstances inform the prospects of future action to reduce emissions globally, potential requirements of the UK to contribute to those actions, and prospects for low-carbon technology development and carbon pricing.
- The EU places obligations on Member States to reduce emissions to contribute to reductions in the bloc as a whole. These imply a minimum level of effort for the UK's carbon budgets.

The Committee intends to draw primarily on the work of the IPCC, as published in the Fifth Assessment Report, in assessing the implications of climate science for the budget advice

The Committee's advice is based on 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 around 2020, 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. Individual parties are submitting pledges for effort beyond 2020, with the details of the agreement to be discussed in Paris late in 2015.

The EU has agreed a package that requires a reduction in emissions of at least 40% on 1990 levels by 2030, on the way to an 80-95% reduction by 2050. The UK Government supported this package, while arguing for an increase to 50% in the context of a global deal.

The US and China have jointly made pledges for the period beyond 2020. The US has pledged a reduction of 26-28% by 2025 versus 2005, requiring a doubling of the rate of carbon reduction compared to 2005-2020 and on a trajectory to economy-wide cuts of the order of 80% by 2050. China has pledged to peak CO_2 emissions around 2030, and to make best efforts to do so earlier.

Question 1 ***The IPCC's Fifth Assessment Report will form the basis of the Committee's assessment of climate risks and global emissions pathways consistent with climate objectives. What further evidence should the Committee consider in this area?***

At both an international, European and UK level, there is an ever-increasing body of evidence which suggests that Carbon Capture and Storage (CCS) will be an essential technology if we are to achieve climate objectives.

Internationally:

- In its Fifth Assessment Report, the IPCC found that achieving the climate objective was only possible in 7 out of 11 advanced economic models with significant deployment of Carbon Capture and Storage (CCS)[i]. In the same report the IPCC also concluded that the cost of achieving the climate objective could be as much as 138% more expensive without widespread deployment of CCS.

- The International Energy Agency (IEA) 2014 Insight Report on CCS concluded that "all signs continue to point to the necessity and viability of CCS as a CO2 abatement technology, within a portfolio of other low-carbon technologies"[ii]. This was evidenced further in the Energy Technologies Perspective (ETP) 2013, which demonstrates that CCS could need to deliver more than 14% of cumulative emissions reductions to 2050 in order to achieve the climate objective (the 2DS scenario)[iii]. The 2015 Energy Technologies Perspective has recently been launched whilst the World Energy Outlook is due to be published by the IEA in November 2015.

In the UK:

- Analysis conducted by Cambridge Econometrics on behalf of the Trade Union Congress (TUC) and the CCSA found that, without CCS, electricity bills could be more than 15% higher in 2030, at a potential cost to domestic consumers equivalent to £82 per annum[iv].

- The Energy Technologies Institute (ETI), has found that CCS could be worth more £200 billion to the UK energy system, and that the cost of meeting the climate objective without CCS could more than double from 1% to 2% of GDP per annum in 2050[v].

- Further evidence from the ETI suggests that just 1.5GW of installed capacity in the UK could reduce the levelised cost of power generation with CCS to below £100/MWh before 2025[vi]. This could be equivalent to £1.1bn of annual

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CfD payments in 2030, and would require less than 1.4% of total LCF spend in the first period to 2021/22[vii].

Bioenergy with CCS (BECCS):

- The above reports referenced from the IEA, IPCC and ETI all come to the clear conclusion that achieving negative emissions from, in particular, bioenergy combined with CCS, will be critically important to achieving climate objectives. Analysis contained within these reports suggests that 'net zero' emissions will need to be achieved at some point between 2050 and 2100 in order to achieve the climate objective, and that negative emissions from BECCS will be essential in order to compensate for slower mitigation from harder to abate sectors such as aviation.

Question 2 ***To what extent are the UN talks in Paris likely to have implications for the Committee's advice beyond the pledges and positions announced in advance of the talks?***

No comment.

Question 3 ***Based on the available evidence, does the EU 2030 package reflect the best path to its stated 2050 ambition? How might this package change, specifically its targeted emissions reduction, either before the end of Paris or after Paris?***

The Impact Assessment accompanying the European Commission Communication on "A policy framework for climate and energy in the period from 2020 up to 2030" outlines the energy system impacts of the agreed 40% GHG emissions reduction target and other policies for renewable energy and energy efficiency[viii]. Although subsequent 27% EU-level targets have been agreed for renewable energy and energy efficiency, these should place no further legal obligations on Member States beyond the 40% GHG reduction target. The Impact Assessment provides insight into the Commission's PRIMES model and suggests that under the GHG40 scenario, 0.77% of electricity will come from CCS in 2030, rising to 14.72% in 2050. Based on estimated gross electricity consumption from the same Impact Assessment, and a modest 50% Capacity Factor for CCS plant in 2050, these figures correspond to an equivalent 6.21 GW (2030) and 169.38 GW (2050) of

installed capacity respectively.

There is a risk that in concluding that CCS is only of minor importance in the period to 2030, the Commission risks delaying vital investments needed in CCS infrastructure, which could have subsequent impacts on future build out rates and impede the development of supply chains. As an example, appraising a store to the point that it can be considered bankable could take as much as 10 years[ix]. If this work is not progressed before 2030 then deployment of CCS could be constrained throughout the 2030s, which risks putting the 2030 package out of line with the stated 2050 ambition.

Comparing expected CCS deployment rates within the EU2030 Impact Assessment with alternative models - e.g. the EMR Delivery Plan (up to 13 GW by 2030) and the Committee on Climate Change's power sector scenarios reaching 50gCO_2/kWh by 2030 (at least 10 GW by 2030) - the EU pathway underestimates the potential contribution from CCS during the 2020s and expects much higher deployment rates during the 2040s. This is arguably a high risk strategy for achieving the climate objective and, by implying that there is no need for immediate and targeted CCS policies, risks deterring investment in this critical technology until later decades. As demonstrated by the ETI in its recent CCS Deployment Scenarios report, delayed deployment of CCS could significantly increase the cost of achieving the climate objective to consumers and risks the UK not meeting its emissions reductions targets[x].

The CCSA does not expect the EU 2030 package, specifically its targeted emissions reduction, to change ahead of the Paris climate talks in December 2015, however the previous UK Government, did discuss the possibility of increasing the EU targeted emissions reduction to 50% in the event of a global legally-binding deal to reduce emissions: *"If other countries come forward with ambitious commitments, the UK would argue for the EU to go further and move towards a 50% reduction, for example through use of international carbon markets."*[xi]

Question 4 ***How does the UK's legislated 2050 target affect its ability to support international efforts to reduce emissions, including its position in negotiations? Does the level of UK carbon budgets have any additional impact (over-and-above the 2050 target) for the UK in international discussions?***

The UK's legislated 2050 target substantially strengthens its ability to support international efforts to reduce emissions, particularly in the context of international negotiations such as those within the EU and beyond via the UNFCCC.

The level of UK carbon budgets not only provides increasing policy certainty to investors in the UK, it demonstrates to all stakeholders (both within the UK and

internationally) that the UK has a credible decarbonisation pathway supported by evidence-based policy intervention, and a clear expectation as to the level of emissions reductions required in each carbon budget period. In the event of a reduction in the level of UK carbon budgets, there is a risk that the UK would be perceived to be withdrawing from its climate change commitments, risking progress towards an international agreement and harming investment in low carbon sectors in the UK.

B. The cost-effective path to the 2050 target

The carbon budgets need to set a path that is achievable from today without being over-optimistic about what is achievable in later periods to prepare for the 2050 target.

The Committee has previously set out scenarios for 2030 that balance effort before 2030 with potential opportunities from 2030 to 2050. The scenarios aim to include ways of reducing emissions that are likely to be relatively low cost and actions that will develop options that may need to be deployed at scale by 2050.

These scenarios, reviewed in detail in the Committee's report *The Fourth Carbon Budget Review – the cost-effective path to the 2050 target*, 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.

The scenarios also reflect detailed assessments of what is practically deliverable, and the Committee monitors progress towards them as part of its statutory duties. The *2014 Progress Report to Parliament* indicated that current policy would not be enough to meet the fourth carbon budget, but that the 'policy gap' could be closed at affordable cost.

The set of policy options required to close the gap include:

- Strengthening the EU Emissions Trading System.
- Setting a clear objective for Electricity Market Reform (EMR) beyond 2020.
- Focusing on low-cost residential energy efficiency.
- Simplifying policies targeting commercial energy efficiency.
- Tackling financial and non-financial barriers to low-carbon heat.
- Pushing for strong EU targets for new vehicle efficiency in 2030.

The Government has subsequently published various documents, including its formal response, as required under the Climate Change Act, and the National Infrastructure Plan. The Plan includes investments of around £100 billion in low-carbon power generation in the 2020s, in line with the scenarios from the EMR Delivery Plan that reach 100 gCO_2/kWh by 2030. It also has significant investments in offshore oil and gas and in the road network. This includes £15 billion of new spending on roads and around £50 billion on offshore oil and gas.

Question 5 ***In the area(s) of your expertise, what are the opportunities and challenges in reducing emissions to 2032, and at what cost? What may be required by 2032 to prepare for the 2050 target, recognising that this may require that emissions in some areas are reduced close to zero?***

By 2050 CCS will need to deliver significant emissions reductions across a broad range of low carbon sectors, including fossil fuel power generation, energy intensive industries, and heat and transport (through decarbonised Hydrogen production). The ETI has found that CCS could be worth more than £200 billion to the UK energy system and that by combining CCS and biomass at a large scale, extra 'headroom' can be created in carbon budgets, which helps to avoid more expensive abatement measures such as curbing liquid fuel use in transport[xii].

With respect to energy intensive industries, CCS is, in many instances, the only technology able to achieve large-scale emissions reductions. A report for Government recently estimated the technical potential for industrial CCS at up to 8.2 million tCO_2 by 2025 at levelised costs between £22 and £74 /tCO_2[xiii]. The recent DECC/BIS Industrial Decarbonisation 2050 Pathways[xiv] further reinforce the importance of CCS to securing a sustainable future for energy intensive industries in a carbon constrained economy.

The challenge to delivering CCS (and therefore remaining on the least cost decarbonisation pathway economy-wide), will be in building out a sustainable CCS industry to 2030, which then enables much greater deployment in the period 2032 – 2050. Alongside delivery of the two CCS Competition projects it is essential that significant progress is made in progressing a second phase of power CCS projects and developing and deploying industrial CCS projects. The latter will involve the implementation of an appropriate financial investment instrument rewarding low-carbon output, e.g. steel, cement, etc. – something akin to the CfD in the power sector – and access to CO_2 transport and storage infrastructure. In this regard, a move towards mature a CO_2 transport and storage sector, that is decoupled from capture facilities, will be a key enabler for CCS in both the industrial and power sectors.

Early development of 'right sized' CCS infrastructure (transport and storage) will be a

critical enabler for industrial and energy sector decarbonisation. Right sized infrastructure can enable significant economies of scale, driving down aggregate socialised costs and derisking investment in other parts of the CCS chain. It can also act as an enabler for future CO_2 enhanced oil recovery (CO_2-EOR), which could further reduce the costs of CCS and help maximise economic recovery from the UK continental shelf whilst simultaneously reducing emissions.

The availability of 'bankable' storage (i.e. storage capacity that is appraised and characterised to the point that an emitter and/or investor has an appropriate level of confidence to take a final investment decision in a CCS project) will be key to the progression and deployment of CCS projects in the UK to 2032.

Recent analysis conducted for the ETI suggests that at least 680 Mt of bankable CO_2 storage capacity will be needed by 2025 in order to deliver 10 GW of CCS in the power sector by 2030 and remain on the least cost economy-wide decarbonisation pathway. Industry estimates the likely costs of appraising this level of storage capacity at around £100m (total investment costs) although there is currently no commercial incentive for the private sector to undertake such activities. In the absence of a commercial framework and business case for CO_2 storage, further intervention from Government will be required to ensure that sufficient storage capacity is available to deliver the required levels of CCS by 2032. Intervention may also be required to ensure a coordinated approach to the planning and market structure of transport and storage infrastructure.

Question 6 ***What, if any, is the role of consumer, individual or household behaviour in delivering emissions reductions between now and 2032? And, separately, after 2032?***

No comment.

Question 7 ***Is there evidence to suggest that actions to further reduce emissions after 2032 are likely to be more or less challenging to achieve than actions in the period up to 2032?***

Large scale emissions reductions in the period 2032-onwards will, to a large degree, be contingent on the cost-competitive availability of CCS. This is the case at both a global and UK level, with supporting evidence available in all of the previously cited evidence including the EU 2030 Impact Assessment, the IPCC 5th

Assessment Report, the IEA Energy Technologies Perspective and the ETI work around CCS deployment scenarios in the UK. Without significant pre-investment in CCS before 2030 – equivalent to delivering around 10GW of power sector CCS in combination with between 5 and 10 $MtCO_2$ captured and stored from industrial emitters[xv] – there is a real risk that supply chains won't develop, infrastructure won't be delivered and cost reductions won't be realised. Ultimately this will increase the cost of decarbonisation to the UK as alternative abatement technologies will need to be deployed to a greater extent and a greater cost to consumers.

In summary, if sufficient progress is made to commercialise CCS in the 2020s, the decarbonisation challenge in the period beyond 2032 is significantly more achievable and affordable. Key to this will be a firm commitment from UK Government – supported by tangible policy interventions – to support the development of a CCS industry including and beyond the two Competition projects.

Question 8 ***Are there alternatives for closing the 'policy gap' to the fourth carbon budget that could be more effective? What evidence supports that?***

The CCSA supports the options presented by the Committee for closing the 'policy gap' at an affordable cost, in line with the EMR Delivery Plan scenarios that reach 100 gCO_2/kWh by 2030. This would entail up to 13 GW of installed CCS capacity operating by 2030, which is in line with previous evidence on the least cost decarbonisation pathway presented by the Committee and other bodies such as the ETI.

Question 9 ***Are the investments envisaged in the National Infrastructure Plan consistent with meeting legislated carbon budgets and following the cost-effective path to the 2050 target? Would they have wider implications for global emissions and the UK's position in international climate negotiations?***

Investments envisaged in the National Infrastructure Plan would appear to be inconsistent with evidence on the cost effective path to the 2050 target in the sense that the Plan does not provide sufficient detail – or even statements of intent – around the expected future contributions of CCS to achieving emissions reductions.

With respect to CCS, the National Infrastructure Plan repeats the Government's commitment to the £1 billion CCS Commercialisation Programme Competition and that CCS is one of the top 40 priority investments. This in itself was warmly

received by the CCS industry; both of the Competition projects in particular are a critical first step to building a CCS industry and putting in place the infrastructure needed to enable large scale emissions reductions of power and industrial sectors in the UK. Beyond this, however, detail is lacking as to the Government's longer term policy towards CCS, particularly with respect to the implementation of EMR for CCS and the availability of CfDs for phase 2 CCS projects. Without further clarity from Government on the expected size and timing of the future CCS market, the private sector is unlikely to deliver the level of investments required to develop a UK CCS industry and a stream of projects following on from the Competition. Ultimately, this puts at risk the cost-effective pathway to the 2050 target.

C. Budgets and action

The UK's statutory 2050 target requires actions across the economy to reduce emissions. Many of these actions will be driven by (UK and devolved) Government policy and implemented by businesses and consumers. There will be an important role for Local Authorities in successful delivery.

Although the carbon budgets do not require specific actions, they provide an important indication of the overall direction that policy will take in future. Once set, carbon budgets can only be changed if there has been a significant change in the relevant circumstances set out in the Climate Change Act.

Feedback from businesses as part of the Committee's 2013 Call for Evidence for the review of the fourth carbon budget was that stability is an important and valuable characteristic of carbon budgets.

Question 10 ***As a business, as a Local Authority, or as a consumer, how do carbon budgets affect your planning and decision-making?***

No comment.

Question 11 ***What challenges and opportunities do carbon budgets bring, including in relation to your ability to compete internationally? What evidence do you have for this from your experience of carbon budgets to date?***

Not applicable.

Question 12 ***What would you consider to be important characteristics of an effective carbon budget? What is the evidence for their importance?***
No comment.

D. Other issues

The Climate Change Act requires that in designing the fifth carbon budget we consider impacts on competitiveness, fiscal circumstances, fuel poverty and security of energy supply, as well as differences in circumstances between UK nations. High-level conclusions on these from our advice on the fourth carbon budget 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 13 ***What evidence should the Committee draw on in assessing the (incremental) impacts of the fifth carbon budget on competitiveness, the fiscal balance, fuel poverty and security of supply?***
No comment.

Question 14 ***What new evidence exists on differences in circumstances between England, Wales, Scotland and Northern Ireland that should be reflected in the Committee's advice on the fifth carbon budget?***
No comment.

Question 15 ***Is there anything else not covered in your answers to previous questions that you would like to add?***
No comment.

References

[i] Fifth Assessment Report: Working Group III: Mitigation (IPCC, 2014)
[ii] CCS Insight Report (International Energy Agency, 2014)
[iii] Energy Technologies Perspective 2015 (International Energy Agency, 2015)
[iv] The Economic Benefits of Carbon Capture and Storage in the UK (CCSA and TUC, 2014)
[v] Carbon Capture and Storage: Building the UK CCS sector by 2030 – Scenarios and actions (ETI, 2015)
[vi] Carbon Capture and Storage: Building the UK CCS sector by 2030 – Scenarios and actions (ETI, 2015)
[vii] Delivering CCS: Essential infrastructure for a competitive, low-carbon economy (CCSA, 2015)
[viii] Impact Assessment accompanying "A policy framework for climate and energy in the period from 2020 up to 2030" (SWD(2014) 15) (European Commission, 2014)

[ix] Business models for commercial CO_2 transport and storage: Delivering large-scale CCS in Europe by 2030 (Zero Emissions Platform, 2014)
[x] Carbon Capture and Storage: Building the UK CCS sector by 2030 – Scenarios and actions (ETI, 2015)
[xi] Paris 2015: Securing our prosperity through a global climate change agreement (HM Government, 2015)
[xii] UK scenarios for a low carbon energy system: Clockwork or patchwork? (Scott Milne, ETI, 2014, available at: https://www.energyinst.org/filegrab/?ref=3393&f=dr-scott-milne-speaker-ppt-25.03.2015.pdf)
[xiii] Demonstrating CO2 capture in the UK cement, chemicals, iron and steel and oil refining sectors by 2025: A Techno-economic Study (Element Energy for DECC and BIS, 2014)
[xiv] Industrial Decarbonisation and Energy Efficiency Roadmaps to 2050 (DECC and BIS, 2015)
[xv] Carbon Capture and Storage: Building the UK CCS sector by 2030 – Scenarios and actions (ETI, 2015)