The Fifth Carbon Budget - Call for Evidence

Response from Drax Power

www.theccc.org.uk/call-for-evidence

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.

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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.

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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?***

ANSWER:

The Committee on Climate Change (CCC) should take particular note of the increasing body of evidence, at both an international, European and UK level, which suggests that generating electricity and heat from sustainable biomass, Carbon Capture and Storage (CCS), and ultimately biomass with CCS (BECCS) are all essential technologies if we are to achieve the CCC's medium and longer-term climate objective. For example:

Internationally:

- IPCC Summary for Policymakers in its Fifth Assessment Reporthttps://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf

This highlighted the key role of (and indeed it was stated in places as the reliance on) BECCS in timely, successful and cost- effective climate mitigation strategies.

It also concluded that the cost of achieving the climate mitigation objective could be as much as 138% more expensive without widespread deployment of CCS / BECCS (p.38).

- IEA, Technology Roadmap: Bioenergy for Heat and Power (2012) https://www.iea.org/publications/freepublications/publication/technology-roadmap-bioenergy-for-heat-and-power-.html

This concluded that by 2050 bioenergy could provide 3 000 TWh of electricity, i.e. 7.5% of world electricity generation. Bioenergy electricity could bring 1.3 Gt CO_2-equivalent (CO_2-eq.) emission savings per year in 2050, in addition to 0.7 Gt per year from biomass heat in industry and buildings.

- IPCC, Special Report on Renewable Energy Sources and Climate Change Mitigation (2011) https://www.ipcc.ch/pdf/special-reports/srren/SRREN_FD_SPM_final.pdf

This found that by 2050, in the median case, bioenergy contributes 120 to 155 EJ/yr to global primary energy supply, or 150 to 190 EJ/yr for the 75th percentile case, and even up to 265 to 300 EJ/yr in the highest deployment scenarios. It also highlighted

the need to implement sustainability and policy frameworks that ensure good governance of land use and improvements in forestry, agricultural and livestock management.

- The IEA 2014 Insight Report on CCS

https://www.iea.org/publications/insights/insightpublications/Insight_CCS2014_FINAL.pdf

This confirmed the necessity and viability of CCS as a CO_2 abatement technology, within a portfolio of other low-carbon technologies. This was evidenced further in the Energy Technologies Perspective (ETP) 2013, which showed 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)[i]. 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 EU:

The European Commission's Staff Working Document '*State of play on the sustainability of solid and gaseous biomass used for electricity, heating and cooling in the EU'* considers a wide range of evidence and is unequivocal when it states solid biomass –particularly wood and wood waste – used for electricity and is the biggest source of renewable energy in the EU and is expected to make a key contribution to the 20% EU renewable energy target by 2020. Sustainable biomass can play an important role in helping to address concerns about climate change and security of energy supply. According to the Impact Assessment to the 2030 Climate and Energy Framework, biomass use in the heat and power sectors will become even more central to EU efforts to create a low carbon economy by the middle of the century. In particular it notes that biomass can be stored at times of low demand and provides dispatchable energy when needed and can thus play a role in balancing the rising share of variable renewable electricity from wind and solar in the electricity system. Furthermore, it states use of biomass can help motivate forest owners to consider carrying out active and sustainable management of their forests. By incentivising forest management, biomass markets can also contribute to reducing fire risks and reduce other forms of GHG emission[ii].

In the UK:

- Committee on Climate Change, Bioenergy Review, Technical Paper 4: Biomass in Power Generation (2011) http://archive.theccc.org.uk/aws2/Bioenergy/1463%20CCC_Bio-TP4_power_FINALwithBkMks.pdf

Analysis commissioned by CCC from Mott MacDonald indicated that the economics of converting some of the UK's existing coal plants to biomass were potentially favourable and that these offer a significant opportunity for renewable generation

(e.g. over 100 TWh of generation may be available at around £80-90/MWh, compared to offshore wind costs of £100-150/MWh in 2020).

CCC concluded that, in the longer term, there was an important role for biomass generation with carbon capture and storage (BECCS) as a way of achieving negative emissions.

- DECC UK Bioenergy Strategy (2012) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48337/5142-bioenergy-strategy-.pdf

This confirmed the crucial role that bioenergy has to play in helping the UK decarbonise different parts of the energy system leading up to 2050. This was supported by analysis across a range of studies. It concluded that efficient low-carbon bioenergy deployment is crucial for the decarbonisation of the UK economy.

- ETI Insights into the future UK Bioenergy Sector, gained using the ETI's Bioenergy Value Chain Model (BVCM) (2015) http://www.eti.co.uk/wp-content/uploads/2015/03/Bioenergy-Insights-into-the-future-UK-Bioenergy-Sector-gained-using-the-ETIs-Bioenergy-Value-Chain-Model.pdf

This concluded that BECCS remains the only credible route to deliver the required negative emissions, necessary to meet the UK's 2050 GHG emission reduction targets.

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?***

ANSWER:

This is uncertain at this stage. However, the CCC will need to take into account whether, and if so how, the UN talks in Paris impact on binding EU targets for GHG emission reductions. In particular, if the outcome of the talks resulted in a more challenging target for reductions in the traded sector by 2030 this would need to be reflected in the advice provided to Government on the Fifth Budget.

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?***

ANSWER:

All evidence and conclusions from the IPCC's Fifth Assessment indicate that early action on climate change is essential to meet the 2050 and beyond objectives. The European Commission's analysis supports its conclusion that the 2030 targets are on the least-cost path to the EU's 2050 ambitions, and this seems credible. The Impact Assessment which accompanied the EC's Communication on this (http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014SC0015), outlined the energy system impacts of the agreed 40% GHG emissions reduction target and other policies for renewable energy and energy efficiency, and again these look credible.

However, the problem is that there is no real agreement between Member States on what the EU should actually be doing to combat climate change (and by when? and at what cost?). In that context, the 2030 EU package was ultimately only agreed by unanimity after some considerable negotiations / concessions on issues like the nature of the renewables and energy efficiency targets (which are for now not binding). The lack of a coherent approach has been most recently confirmed by the fact that proposed changes to the EU Emissions Trading System have been very difficult to negotiate with some Member States strongly resisting relatively limited changes designed to strengthen the carbon price through the EU ETS.

Given this lack of agreement, the EU's stance after Paris is likely to depend on the firm commitments made by other large GHG emitters. Although there are some positive signs from China and the US (but not yet India), it is unlikely that there will be much appetite within the EU to go beyond the current 40% GHG target. However, that might change if other trading blocs were to increase their level of ambition, but again that looks unlikely.

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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?***

ANSWER:

The UK's legally binding 2050 target in the Climate Change Act (CCA) is important in underlining the UK's commitment to emissions reductions effort, and this must be helpful in supporting its position in international discussions (both within the EU, but also more widely) on reducing emissions. Similarly, but almost certainly to a lesser degree, the individual carbon budgets set under the CCA must also be helpful in this regard. The budgets, and the evidence-based way in which they are set, also help provide greater certainty for investors in the power sector industry against the political risk of changes in policy by future governments.

However, in setting the budgets, the CCC must balance the benefit of setting ambitious budgets, with the potential downside if the budgets were less ambitious or missed. Any failure to meet budgets, or reduction in the ambition of UK carbon budgets, would risk being perceived as a dilution or withdrawal from the UK's climate change commitments which would harm 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?***

ANSWER:

The CCC has advised that an appropriate carbon intensity target for the power sector for 2030 would be a range of 50-100gCO_2/kWh. This will require huge changes to the generation mix and present significant challenges to the sector, the greatest of which will be balancing the three legs of the energy trilemma: minimising costs to consumers, maintaining security of supply, and at the same time decarbonising the power sector.

This change in the generation mix will require significant investment in low carbon power. However, the current funding framework for low carbon technologies is covered by the Levy Control Framework (LCF), which is designed to protect consumers from the costs of climate change policies. This does not currently provide any visibility for investors in the sector beyond 2020/21. This needs to be

addressed urgently. There needs to be a swift announcement of the next budget (ie. beyond 2020/21). That budget needs to ideally be set out to 2030, or at the very least be set on a rolling 5 year basis, so investors always have at least 5 years visibility. There is also a need for CfD strike prices to be published for the period beyond 2019 for all technologies.

In addition, the LCF budget allocation methodology needs to reflect that biomass generation and wind are to some extent complementary: when there is a lot of wind generation, biomass will be bid off the system, and where there is little wind, biomass will run harder. So, simply adding the budgets for the two technologies will overestimate the combined impact on the LCF.

Furthermore, in order to minimise the impact on residential and business consumers, serious consideration needs to be given to changing the way in which funds / contracts under the LCF are allocated to one which better reflects the whole system costs of different technologies, and not just the direct subsidy costs. For example, a recent report from Frontier Economics showed that sufficient offshore wind generation to deliver the equivalent low carbon energy otherwise produced by a single exiting (500MW) coal fired generation unit converted to run on biomass would cost the country between £650 and £900 million. This is equivalent to a total cost of between £25 and £33 per household over the investment period. (http://www.frontier-economics.com/documents/2014/11/the-relative-system-cost-of-biomass-and-offshore-wind-frontier-report.pdf).

On the delivery of the generation mix needed to meet this 2030 / 2032 challenge, power generation from biomass, conventional CCS, and BECCS will all have a vital role in achieving the significant cost-effective emissions reductions required over the period to 2030 and beyond (and probably in that order of deployment) whilst maintaining security of supply. However in order for this potential to be realised, there will need to be policy changes for each of these technologies as set out below.

Biomass generation

Electricity generation from sustainable biomass is unique in the UK electricity generation mix because it is the only renewable which can supply low carbon, dispatchable power at scale and when the true overall costs of renewables are taken into account it is one of the most cost effective renewables available. Intermittent technologies which typically have load factors of, at most, 30%. This means intermittent renewables are neither as cost effective nor carbon efficient as the headline figures suggest. Coal to biomass conversions are particularly beneficial because they make use of existing assets and infrastructure meaning they are cost effective and can start delivering significant carbon reductions far faster than many other schemes.

CCC has argued in the past that biomass conversions should only have a role as a transitional technology. This has been accepted by DECC, and as a result all state support (either RO or CfD) finishes on 31 March 2027. This was done on the basis

that conversions, by that time, would have developed the supply chain in sustainable biomass into the UK (port, rail, materials handling etc etc) that could then be used in other sectors like heat and transport and in BECCS. Unfortunately, this cliff-edge is unlikely to deliver the transitional benefits envisaged by CCC and DECC when this policy was implemented. Upstream developers and suppliers assume there is no UK market for their product beyond 2027. This means that the necessary upstream investments need to be recovered over the decreasing period to 2027, which means that later projects become more expensive or unviable.

This, together with the lack of any CfD budget for biomass conversions, has limited viable biomass conversion projects to only Drax and possibly Lynemouth. This could, and should, be easily solved by granting new biomass conversions a 15 year CfD contract like all other renewable technologies. This would create a proper transition that would then help reduce emissions in transport and heat in the most cost-effective manner.

With three units converted Drax's GHG savings will total 12 million tonnes per year. The cumulative carbon reduction this creates between now and 2030 alone is phenomenal and crucial to cost effective decarbonisation in in a relevant timeframe but, importantly, biomass generation has now been shown to create a win-win in the form of reduced emissions of geologic carbon and increased sequestration in forests. If done sustainably, it promotes better forest stewardship and better carbon sequestration. The very latest research on this matter finds pellet demand in the US increases forest area, does not deplete forest inventory and finds annual gains in forest carbon in most years it analyses: (http://onlinelibrary.wiley.com/doi/10.1111/gcbb.12273/abstract)

CCS

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 (http://www.ccsassociation.org/press-centre/reports-and-publications).

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. ETI, Targets, technologies, infrastructure and investments – preparing the UK for the energy transition (2015) (http://www.eti.co.uk/wp-content/uploads/2015/02/Targets-technologies-infrastructure-and-investments-preparing-the-UK-for-the-energy-transition.pdf).

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. This could be equivalent to £1.1bn of annual CfD payments in 2030, and would require less than 1.4% of total LCF spend in the first period to

2021/22. ETI, Building the UK carbon capture and storage sector by 2030 – Scenarios and actions (2015): (http://www.eti.co.uk/wp-content/uploads/2015/03/CCS-Building-the-UK-carbon-capture-and-storage-sector-by-2013.pdf).

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. (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/311482/Element_Energy_DECC_BIS_Industrial_CCS_and_CCU_final_report_14052014.pdf).

To realise these benefits from CCS, there is an urgent need to develop a framework that will facilitate follow on power and industrial CCS projects (ie. beyond the 2 initial CCS projects at Drax and Peterhead). This will include consideration of the following:

- Separating the transport and storage network from the carbon capture facilities
- Developing a new cost recovery mechanism for T&S (eg. regulated asset / access)
- Developing an appropriate financial investment instrument for industrial emitters which gives credits / rewards for low-carbon output, e.g. steel, cement, etc.

BECCS

BECCS is widely recognised as a key part of the solution to climate mitigation – particularly between 2030 and 2050. For example:

- DECC UK Bioenergy Strategy, 2012 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48337/5142-bioenergy-strategy-.pdf

"[BECCS] could be a key mitigating option for the future through production of 'negative emissions', significantly increasing the cost effective options towards 2050."

- IPCC, Special Report on Renewable Energy Sources and Climate Change Mitigation (2011) https://www.ipcc.ch/pdf/special-reports/srren/SRREN_FD_SPM_final.pdf

"[BECCS] could lead to long-term substantial removal of GHGs from the atmosphere

(also referred to as negative emissions).

- Stanford University Global Energy and Climate Project, Assessment Report from the GCEP Workshop on Energy Supply with Negative Carbon Emissions (2013). http://gcep.stanford.edu/pdfs/rfpp/Report%20from%20GCEP%20Workshop%20on%20Energy%20Supply%20with%20Negative%20Emissions.pdf

"[BECCS] may be one of the most cost-effective, efficient and practical ways to move toward achieving net negative emissions on large stationary sources. The potential to increase net negative emissions through the production lifecycle of biomass for this purpose and others is a powerful incentive for this approach."

However, for this potential to be realised, clearly the sustainable biomass supply chain needs to be developed, as does conventional CCS. In addition, there is currently no recognition of "negative emissions" in any of the existing CO2 reduction incentive schemes in either the UK (eg. CfDs) or EU (e.g., EU ETS). This means there is no incentive at all to run a capture plant on biomass as opposed to coal or gas. This needs to be addressed.

Biomass Heat

Heat accounts for almost half of the UK's carbon emissions so decarbonising the heating sector is a key challenge in meeting emissions reduction targets for 2030/2032. Unlike most electricity investment (with the exception of biomass conversions), there is no need for accompanying grid infrastructure upgrades to accommodate new renewable heat capacity, which can therefore come at a lower overall cost to the UK.

The role of sustainable biomass in this sector could be significant. However, although the coalition government committed to keeping the RHI open to applicants to 2020, funds beyond April 2016 have still not yet been allocated. So clarification from the new government on future funding and policy support under the RHI for biomass heat as well as electrification of transport and heating is urgently required.

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?***

ANSWER:

To deliver the necessary reductions, there is a role to be played by both households and businesses. They must both use their energy more efficiently and smart metering should help with that. In addition, micro-generation and a wider use of CHP may also contribute.

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?***

ANSWER:

Deployment of new and emerging technologies at volume and at least cost to the consumer, will require investment and support in the short term to cultivate the necessary innovation and industrial commercialisation. While competitive allocation of subsidies for established technologies is essential, separate support will still need to be maintained for emerging technologies (for example maintaining a separate CfD pot for less established technologies). Without this interim support the cost of delivering post 2032 emissions targets could rise steeply.

As set out above, the success in delivering large scale emissions reductions in the period 2032-onwards will, to a large degree, be contingent on the cost-competitive availability of CCS / BECCS. 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 both the biomass supply chain and in CCS before 2030 however, there is a real risk that the necessary infrastructure will not be delivered. Ultimately this will increase the cost of decarbonisation to the UK economy as alternative abatement technologies will need to be deployed to a greater extent and a greater cost to consumers.

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

ANSWER:

The options presented by the CCC for closing the 'policy gap' at an affordable cost, are in line with the EMR Delivery Plan scenarios that reach 100 gCO_2/kWh by 2030. However, CCC could place more emphasis on bioenergy in both electricity and heat – including BECCS. It should perhaps re-assess how best to develop the biomass supply chain required to facilitate this, and in particular the potential issues with the adverse impact of the 2027 cliff-edge for support for biomass conversions.

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?***

ANSWER:

The National Infrastructure Plan does not really provide sufficient detail – or even statements of intent – around the expected future contributions of bioenergy and/or BECCS to achieving emissions reductions on the pathway to 2050.

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?***

ANSWER:

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?***

ANSWER:

No Comment

Question 12 ***What would you consider to be important characteristics of an effective carbon budget? What is the evidence for their importance?***

ANSWER:

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).

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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?***

ANSWER:

In terms of evidence on system security, the CCC should draw on the work of National Grid, particularly in terms of the system operability impacts of an electricity generation mix with a high penetration of renewables, particularly at an embedded level. The CCC should also consider whether allocating LCF funds on the basis of whole system costs would be more appropriate. See Qn 5.

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?***

ANSWER:

No Comment

Question 15 ***Is there anything else not covered in your answers to previous questions that you would like to add?***

ANSWER:

No

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