Building a zero-carbon economy – Call for Evidence

Background

On 15 October 2018 the governments of the UK, Scotland and Wales asked the Committee on Climate Change (CCC) to provide advice on the UK and Devolved Administrations' long-term targets for greenhouse gas emissions and the UK's transition to a net zero-carbon economy. Specifically: when the UK should reach net zero emissions of carbon dioxide and/or greenhouse gases as a contribution to global ambition under the Paris Agreement; if that target should be set now; the implications for emissions in 2050; how such reductions can be achieved; and the costs and benefits involved in comparison to existing targets.

The advice has been requested by the end of March 2019.

The UK's long-term emissions target is currently for at least an 80% reduction in greenhouse gas emissions from 1990 to 2050. It covers all sectors, including international aviation and shipping and is measured on a 'territorial' basis (i.e. based on emissions arising in the UK). On a comparable basis, emissions in 2017 were estimated to be 38% below 1990 levels.

The current target was set in 2008 based on advice from the Committee. That advice considered that to avoid the worst impacts of climate change, the central expectation of global temperature rise should be limited "to, or close to, 2°C", while the probability of crossing "the extreme danger threshold of 4°C" should be reduced to an extremely low level. That meant global emissions would roughly have to halve by 2050. The 2008 advice made the assumption that the UK should not plan to have a higher level of per capita emissions in 2050 than the global average.

The long-term target guides the setting of carbon budgets (sequential five-year caps on emissions that currently extend to 2032 and require a reduction in emissions of 57% from 1990 to 2030). Both the 2050 target and the carbon budgets guide the setting of policies to cut emissions across the economy (for example as set out most recently in the 2017 Clean Growth Strategy).

Any change to the long-term targets would therefore be expected to have significant implications, not just in the long-term but on current policies to drive the transition.

The CCC will advise based on a thorough consideration of the relevant evidence. We expect that to cover:

- The latest climate science, including as contained in the IPCC Special Report on 1.5°C.
- The terms of the Paris Agreement.
- Global pathways (including those reported by the IPCC) consistent with limiting global average temperature rise in line with the goals of the Paris Agreement.
- International circumstances, including existing plans and commitments to cut emissions in other countries, actions to deliver on those plans and opportunities for going further.
- An updated assessment of the current and potential options for deep emissions reductions in the UK and emissions removals from the atmosphere, including options for going beyond the current 80% target towards net zero.
- An appraisal of the costs, risks and opportunities from setting a tighter long-term target.

- The actions needed in the near term that would be consistent with achieving the long-term targets.

This Call for Evidence will contribute to that advice.

Responding to the Call for Evidence

We encourage responses that are brief and to the point (i.e. a maximum of 400 words per question, plus links to supporting evidence, answering only those questions where you have particular expertise), and may follow up for more detail where appropriate.

You do not need to answer all the questions, please answer only those questions where you have specific expertise and evidence to share. It would be useful if you could use the question and response form below and then e-mail your response to: communications@theccc.gsi.gov.uk using the subject line: 'Zero carbon economy – Call for evidence'. Alternatively, you can complete the question and answer form on the CCC website, available here.

If you would prefer to post your response, please send it to:

The Committee on Climate Change – Call for Evidence
7 Holbein Place
London
SW1W 8NR

The deadline for responses is 12 noon on Friday 7 December 2018.

Confidentiality and data protection

Responses will be published on our website after the response deadline, along with a list of names or organisations that responded to the Call for Evidence.

If you want information that you provide to be treated as confidential (and not automatically published) please say so clearly in writing when you send your response to the consultation. It would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded by us as a confidentiality request.

All information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the access to information legislation (primarily the Freedom of Information Act 2000, the Data Protection Act 1998 and the Environmental Information Regulations 2004).

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.

Part 1: Climate Science

Question 1 (Climate Science): The IPCC's Fifth Assessment Report and the Special Report on 1.5°C will form an important part 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:

https://www.nature.com/articles/nature24672
'Greater future global warming inferred from Earth's recent energy budget'

Question 2 (CO_2 and GHGs): Carbon dioxide and other greenhouse gas gases have different effects and lifetimes in the atmosphere, which may become more important as emissions approach net-zero. In setting a net-zero target, how should the different gases be treated?

ANSWER:

Priority should be given to reducing emissions from carbon which has been previously been locked up in long term geological stores (i.e. fossil fuels) than emissions which form part of natural cycles.

Part 2: International Action

Question 3 (Effort share): What evidence should be considered in assessing the UK's appropriate contribution to global temperature goals? Within this, how should this contribution reflect the UK's broader carbon footprint (i.e. 'consumption' emissions accounting, including emissions embodied in imports to the UK) alongside 'territorial' emissions arising in the UK?

ANSWER:

The UK should include emissions embedded in imports in its carbon targets as these emissions happen due to demand from its citizens. If this was done it would also be reasonable to exclude or subtract emission embedded in products the UK exports. The current exclusion of traded emissions from targets gives UK a false sense of security, which is reaffirmed by research from Carbon Trust showing the UK has one of the highest level of consumption emissions per person globally despite our 'domestic' emissions falling for the past decade.
https://www.carbontrust.com/media/38075/ctc795-international-carbon-flows-global-flows.pdf
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/704607/Consumption_emissions_May18.pdf
The UK should also include its share of international aviation and shipping within its targets.

The UK has one of the highest per person emissions over the period since the start of the industrial revolution and therefore there is a clear justification for us decarbonising first. http://www.withouthotair.com/c1/page_14.shtml. For the world to decarbonise completely by 2040-2055 (as noted in IPCC 1.5C report) there needs to be leadership that delivers this earlier so that other countries can replicate.
http://ipcc.ch/pdf/special-reports/sr15/sr15_spm_final.pdf

Question 4 (International collaboration): Beyond setting and meeting its own targets, how can the UK best support efforts to cut emissions elsewhere in the world through international collaboration (e.g. emissions trading schemes and other initiatives with partner countries, technology transfer, capacity building, climate finance)? What efforts are effective currently?

ANSWER:

Through leadership. The UK's aid programme (both that through DFID, as well as expenditure through the FCO and BEIS) should promote transformational adaptation. Currently a significant amount of this spending focuses on either climate change adaptation, or mitigation, rather than both together.

Question 5 (Carbon credits): Is an effective global market in carbon credits likely to develop that can support action in developing countries? Subject to these developments, should credit purchase be required/expected/allowed in the UK's long-term targets?

ANSWER:
The UK should not be able to either shift emissions intensive processes abroad, buy additional emissions quotas or pay other countries to capture carbon in order to meet its targets. This includes net production of goods overseas that result in a current net import of carbon emissions to the UK, as well as the carbon emissions involved in their international shipping by sea or air. Reasoning:

- Emissions embedded in imports should be included in emission targets as these arise due to the choices of UK citizens (Therefore UK policy needed to address them).
- Due to our very high historic emissions relative to other countries it would be morally unjust to use our wealth to avoid having to reduce current emissions.
- Any payments to other countries to fund the capturing of carbon should be seen as offsetting our historic emissions rather than current or future emissions. Therefore they should not count towards targets for future emission reductions.
- Beyond UK borders it is very hard to ensure that any emissions reduction or carbon capture are additional to business-as-usual, and that captured carbon remains stored indefinitely.

https://www.carbontrust.com/media/38075/ctc795-international-carbon-flows-global-flows.pdf
http://www.withouthotair.com/c1/page_14.shtml
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/450542/Alternative_approaches_to_reporting_greenhouse_gas_emissions_report.pdf
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/704607/Consumption_emissions_May18.pdf
https://escholarship.org/uc/item/7jk7v95t
https://www.theguardian.com/business/2009/dec/14/eu-carbon-trading-fraud

Part 3: Reducing emissions

Question 6 (Hard-to-reduce sectors): Previous CCC analysis has identified aviation, agriculture and industry as sectors where it will be particularly hard to reduce emissions to close to zero, potentially alongside some hard-to-treat buildings. Through both low-carbon technologies and behaviour change, how can emissions be reduced to close to zero in these sectors? What risks are there that broader technological developments or social trends act to increase emissions that are hard to eliminate?

ANSWER:

Aviation:

- Demand Management (e.g. Frequent flyer levy, removal of implicit subsidies for aviation, carbon tax).
- Stop Expanding Airports - The failure of the Airports National Policy Statement to constrain demand. The Airports Commission report stated that Heathrow airport expansion would require a reduction in flights and emissions from other UK airports to stay within a 37.5 $MtCO_2e$ budget.
- Also see page 45 in http://www.energy-transitions.org/mission-possible.
    - Modal shift to high-speed rail
    - Hydrogen (short-distance transport)
    - Carbon tax of at least 115-230 USD per tonne CO_2 required

Agriculture:

- De-intensify animal agriculture (minimise keeping animals indoors or on hardstandings).
    - Meat: A Benign Extravagance by Simon Fairlie
    - https://sustainablefoodtrust.org/articles/grazed-and-confused-an-initial-response-from-the-sustainable-food-trust/
    - https://agroecology-appg.org/wp-content/uploads/2018/09/Meeting-notes.pdf
    - https://agroecology-appg.org/ourwork/appg-hosts-panel-on-the-carbon-footprint-of-agriculture/
- Large reduction in the use of artificial fertilisers/pesticides/herbicides
    - Improve Soil Carbon
    - Reduce GHG emission of excess fertiliser use
- Deploy farm scale AD - http://nationalaglawcenter.org/wp-content/uploads/assets/crs/R40667.pdf
- Take other steps to improve soil carbon (e.g. more crop/leys rotation, smaller tractors, smaller fields with more trees etc)
    - https://www.soilassociation.org/media/7458/7_ways_soils_final.pdf

Industry:

Supply-side solutions are insufficient to adequately address industrial emissions (see www.withbotheyesopen.com). The measures below are from the Mission Possible Report:

- Plastics
    - Banning key single-use items
    - Shift toward circular economy though increased recycling and long product life spans
    - Electrification
    - More recycled and Bio feed stock.
    - Carbon tax of at least 265-295 USD per tonne CO_2 required.

- Steel

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    - More and better scrap recycling
    - Scrap-based EAF
    - Hydrogen-based DRI
    - Electrolysis of iron
    - Carbon tax of at least of 25-60 USD per tonne CO_2 required
- Cement
    - Reusing concrete
    - Substituting concrete with timber
    - Carbon tax of at least of 110-130 USD per tonne CO_2 required

Risk:

The way transport and industry drive globalisation is inconsistent with addressing climate change. These structural aspects should be investigated, alongside how investment in fixed-capital assets increases the scale of consumption, production, urbanisation and globalisation. Infrastructure-led development locks-in future carbon emissions, and continued economic growth leads to the rebound effect (Jevons' Paradox), limiting economy-wide emission reductions (see www.sussex.ac.uk/spru/documents/sewp185.pdf). For example:

- New housing without good public/active transport links and local community facilities locks in car journeys
- Shift of freight from road to railways more difficult because:
    - New industrial plants and distribution centres are next to motorways but miles from railway lines
    - What were once railway goods yards next to stations have been built on.
- Airport expansion increase the number of flights

(More details/reference available on request)

https://b.3cdn.net/nefoundation/58e9fad2705500ed8d_hzm6yx1zf.pdf
http://www.aef.org.uk/downloads/HiddenCost.pdf
https://policyexchange.org.uk/publication/the-future-of-carbon-pricing-implementing-an-independent-carbon-tax-with-dividends-in-the-uk/
https://www.gov.uk/government/publications/airports-commission-final-report

Question 7 (Greenhouse gas removals): Not all sources of emissions can be reduced to zero. How far can greenhouse gas removal from the atmosphere, in the UK or internationally, be used to offset any remaining emissions, both prior to 2050 and beyond?

ANSWER:

Green House Gas removals should be incorporated into both UK & Global mitigation plans, however only those proven at scale processes within the UK should be relied upon when planning UK emission reduction pathways. This means the UK emission pathways should be compatible with scenario 1 from 1.5C IPCC report.

Question 7 (Greenhouse gas removals): Not all sources of emissions can be reduced to zero. How far can greenhouse gas removal from the atmosphere, in the UK or internationally, be used to offset any remaining emissions, both prior to 2050 and beyond?

This means only greenhouse gas removal from use of wood in buildings, planting of new woodland, restoration of peat bogs and soil organic matter improvements can be used to offset residual emissions. Any emissions beyond what can be removed by these processes will need to be terminated.

It is possible the UK might have capacity to produce enough biomass to allow limited BECCS, though a significant proportion of that biomass will be produced and burned in a distributed, small scale way making it unsuitable for CCS (Biomass is bulky). This includes Anaerobic digestion on farms used to produce gas to run farm machinery as well as wood produced for use locally as a fuel. Bio Gas from sewage, landfill and produced using energy crops and renewable energy (see ZCB) used for standby electricity generation in CCGT power stations maybe suitable for CCS, but if that fuel is used for transport its distributed consumption makes CCS unviable.

http://www.zerocarbonbritain.org/images/pdfs/ZCBrtflo-res.pdf
https://royalsociety.org/topics-policy/projects/greenhouse-gas-removal/

Reasoning:

- Given non linear increases in cost of adaptions and achieving other social goals between 1.5C and 2C outlined in latest IPCC report it would be a very high risk strategy to rely on unproven at scale technologies. We must follow the precautionary principle and base our emission reduction pathway on proven technologies which we know can be used at the scales required.
- Given that availability of land in the UK very much limits how much GHGs could be removed annually using proven processes we must start removing GHGs in these ways as soon as possible to maximise the amount which can be removed from the atmosphere over the rest of the century.
- Using Biomass grown in other countries for BECCS in the UK (with carbon stored in north sea), particularly at a large scale, presents a number of challenges:
    - Do the emissions captured count as GHG removals for the country that grew the biomass or that which is storing the carbon?
    - How does the UK ensure that the imported Biomass is not causing deforestation or other landuse use change associated emissions aboard?
    - What about transportation & processing emissions?
    - What about residual emissions not capture by CCS?
    - What about non GHG emissions which might affect the UK's already poor air pollution situation?
- IPCC 1.5C scenarios 2-4 rely on CCS/BECCS at a vast scale Globally:
    - Is it viable at the scale proposed?
    - Will our changing climate affect our ability to implement this?

Biomass Prioritisation - http://www.energy-transitions.org/mission-possible

Question 8 (Technology and Innovation): How will global deployment of low-carbon technologies drive innovation and cost reduction? Could a tighter long-term emissions target for the UK, supported by targeted innovation policies, drive significantly increased innovation in technologies to reduce or remove emissions?

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ANSWER:

Yes

- History shows us that deployment at scale reduces cost.
- If the UK is leading the transition to decarbonise there will be opportunities to export the innovation that has resulted from our rapid decarbonisation globally.

However, focus on low-carbon should be sufficiently low to align with IPCC 1.5C emission pathways.

For example, the sum of low-carbon transport measures do not equate to sufficiently low carbon, particularly as transport and the pattern of development tends to lock-in wider societal emissions.

Note: There is need for technologies to be linked into what the IPCC 1.5C report describes as climate resilient development pathways that are transformational (combining adaptation and mitigation across society and built environment) rather than focusing on specific technical mitigation and adaptation measures each on their own. Thus, carbon reduction pathways should not be technologically-centred but be part of wider programmes that deliver change across society.

http://ipcc.ch/pdf/special-reports/sr15/sr15_spm_final.pdf
http://www.energy-transitions.org/mission-possible

Question 9 (Behaviour change): How far can people's behaviours and decisions change over time in a way that will reduce emissions, within a supportive policy environment and sustained global effort to tackle climate change?

ANSWER:

As Mission Possible and Both Eye's Open report highlight, behaviour change as well as approach change at an organisation/societal level present significant opportunities to reduce emissions though reducing demand for difficult to decarbonise activities/products, and is essential to achieving a minimal cost transition.

- As long as maintaining and improving Quality of Life is at the centre of the change expected of people, and that this is effectively communicated to them then there is ample scope for behaviour change (even if it affects standard of living). See rapid transition alliance.
- Reluctance and refusal to change should not be confused. It should be expected that people are hesitant about proposed changes when they don't fully understand the implications of them and or they have little confidence in those enacting the changes.
    - The former could be address by the government launching an information campaign to explain to the public what changes the transition to avoid climate change will bring, how they will affect the public and on what time frame they should be expected.
    - The later is partly cause by a lack of general public trust in authority and

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partly due to people feeling that their circumstance won't be considered by those enacting the change. This could be address by:

- https://www.slideshare.net/Edelman_UK/edelman-trust-barometer-2018-uk-results/1
- https://www.instituteforgovernment.org.uk/blog/public-trust-public-servants-%E2%80%93-six-graphs
- https://www.greenhousethinktank.org/uploads/4/8/3/2/48324387/strangled_by_the_duoploy_-_inside.pdf
- https://www.lgiu.org.uk/policy-theme/public-trust-lab/

- Mobilisation for both world wars show that if the public are onboard with an objective they will accept significant amounts of disturbance and can cope with very rapid mobilisation
- People need to see the system changing around them to be able to participate. (Group effort for common cause).
- Behaviour change needs to be collective as well as individual. Society as well as people will change as levels of consumption, production, and the continued expansion of the built-environment are addressed

It is also important to note that behavioural change is most effective when integrated into wider transition. For example, a frequent flyer levy alongside stopping investment in aviation expansion.

https://www.rapidtransition.org/resources/how-did-we-do-that-the-possibility-of-rapid-transition/

Question 10 (Policy): Including the role for government policy, how can the required changes be delivered to meet a net-zero target (or tightened 2050 targets) in the UK?

ANSWER:

Start a rapid transition by:

- Set the right economic levers:
  - Carbon Tax Escalator – Clear long term carbon price pathways need laying out ASAP to avoid carbon lock in / obsolescence of assets with long life spans – http://www.energy-transitions.org/mission-possible
  - Reflect findings of Jevons' Paradox and rebound effect into economic policy
  - Change direction of new investment, limiting it to that which reduces carbon emissions by displacement and delivers significant carbon reduction return on investment.
  - Remove all subsidies to Fossil Fuels industry, Aviation etc
  - Make Grant funding available for both planning and then transitioning the public sector at all levels
  - Support climate change action locally as a mandatory function for local government
  - Ensure farming subsidies provide clear incentives for improving soil carbon, discouraging emission intensive livestock & fertiliser practices.

Question 10 (Policy): Including the role for government policy, how can the required changes be delivered to meet a net-zero target (or tightened 2050 targets) in the UK?

        - http://www.thelandmagazine.org.uk/articles/uk-agriculture-after-brexit
    - Provide funding for planting of new woodland (particularly hardwood) & restoring peat lands.
- Set pace and direction of travel in key sectors and with key technologies:
    - Set standards for demand response interface for EV chargers, Heatpumps, distributed renewable generation. (Frequency & Voltage based) https://www.green-alliance.org.uk/resources/People_power_how_consumer_choice_is_changing_UK_energy_system.pdf
    - Make it very clear what heating and hot water technologies are compatible with the transition and legislate appropriately (e.g. new heatpumps not new gas boilers). See Mission Possible Report
    - Create plan and targets for freight and short haul flights to be moved onto the railways - See Mission Possible Report
    - Set modal shift targets for achieving transport emission reductions.
    - Set clear planning guidance to require deconstruction and maximising use of UK timber in new and refurbished buildings. See BioRegional Report
- Empower devolved action:
    - National Assemblies, Regional Authorities and Country/district/parish councils should all be expected to publish their own transition plans and targets and given the powers needed to implement them. These powers might include:
        - Ability to borrow against future assets to fund building retrofit, renewable energy installation, public transport infrastructure, Electric vehicle charging infrastructure etc.
        - Ability to raise local taxes to fund transition projects.
        - Ability to bid for grants from national government for transition projects
        - Ability to run street by street retrofit program funded by central government for all dwellings.
- The public sector should set the example:
    - Clear plan & timescale for electrifying remaining railway lines.
    - Clear plan & timescale for removing the NHS's dependence on fossil fuels for electricity, heat & transport.

https://www.bioregional.com/wp-content/uploads/2015/05/ReclamationtoDemolition_Jul07.pdf
https://www.bookdepository.com/Railpolitik-Paul-Salveson/9781907103810

Part 4: Costs, risks and opportunities

Question 11 (Costs, risks and opportunities): How would the costs, risks and economic opportunities associated with cutting emissions change should tighter UK targets be set, especially where these are set at the limits of known technological achievability?

ANSWER:

As the latest IPCC report on 1.5C makes clear, the more we spend now on mitigation the less we have to spend later on adaption. The risks associated with rapid decarbonisation

Question 11 (Costs, risks and opportunities): How would the costs, risks and economic opportunities associated with cutting emissions change should tighter UK targets be set, especially where these are set at the limits of known technological achievability?

are far smaller than the long term risk of exceeding a 1.5 degree temperature rise. As well as the precautionary principle applying, there is a clear business case for rapidly transitioning to net zero. For example the faster we decarbonise the sooner we will be in a position to export low-carbon technologies to other countries. The business case and justification for investment decisions should properly integrate current and long term social and environmental externalities (e.g. adapting to climate change). New economic tools and different political decision-making is required to reflect carbon budgets in infrastructure investment (notably transport and energy sectors) and housing and spatial planning policies and plans (nationally and locally).

http://ipcc.ch/pdf/special-reports/sr15/sr15_spm_final.pdf

Tighter UK carbon budgets could also allow the UK to comply with the no overshoot pathway to 1.5C. Although there would be significant economic and social cost in immediately halting sources of emission which have yet to transition (e.g. cement works, blast furnaces) this will always be an option available to the UK government if either the infrastructure transition is delayed or emission budgets have to be reduced because climate is more sensitive to emissions than predicted. However if the UK ends up on a pathway which requires negative emissions and for unforeseen reasons these fail to materialise at the scale needed (e.g. Biomass isn't available for BECCS or CO_2 leaks from stores or soil and bog carbon restoration measure aren't as effective as predicted) there will be nothing the UK can do to compensate for this in a short time. This presents significant risk for pathways that rely on very large amounts of negative emissions in 20/30 years time to compensate for little action to reduce emissions in the next decade.

https://agroecology-appg.org/ourwork/appg-briefings-on-the-precautionary-principle-climate-change-and-animal-welfare/

Question 12 (Avoided climate costs): What evidence is there of differences in climate impacts in the UK from holding the increase in global average temperature to well below 2°C or to 1.5°C?

ANSWER:

The UK climate impacts will both be direct and indirect. Indirect impacts could include impacts on globalisation, security, and social trends – as well as more direct impacts on our environment. The IPCC report on 1.5C makes clear that cost of adaption and achieving UN Development Goals increases steeply between 1.5^{o}C and 2^{o}C and given the UK's current interdependence with the rest of the world this is a good indicator what 2^{o}C rather than 1.5C could do for the cost of UK imports, as increased global costs manifest as higher prices or increase poverty in other counties).

http://ipcc.ch/pdf/special-reports/sr15/sr15_spm_final.pdf

Part 5: Devolved Administrations

Question 13 (Devolved Administrations): What differences in circumstances between England, Wales, Scotland and Northern Ireland should be reflected in the Committee's advice on long-term targets for the Devolved Administrations?

ANSWER:

Part 6: CCC Work Plan

Question 14 (Work plan): The areas of evidence the Committee intend to cover are included in the 'Background' section. Are there any other important aspects that should be covered in the Committee's work plan?

ANSWER:

Consider proposal for a 5-10 year rapid transition in the context of the below.
https://www.rapidtransition.org/resources/how-did-we-do-that-the-possibility-of-rapid-transition/

A review of whether the precautionary principle is currently being appropriately applied when considering climate budget and targets and therefore the level of ambition needed. In order to keep us safe, budgets need to keep us well *within* safe limits, not just always pressing up against them. In this regard it is import to recognise that it is cumulative emissions which effect climate, not emission reduction targets.

We would welcome a review into the application of the precautionary principle in the Setting of UK 4th & 5th Carbon Budgets in light of the latest guidance from IPCC on 1.5 Degrees, particularly focusing on:

- Whether in order to minimise risk to humanity the UK should be pushing for pathways consistant with >75% chance of 1.5 Degrees rather than minimum of 50% chance of 2 degrees which current budgets are based on.
- To what extent the remaining global carbon budget should be reduced further as a result of significant uncertainty (+/-300% of remaining budget in some combinations) associated with carbon budgets for >66% chance of 1.5C.
- Whether the UK should lead globally by reducing it's own carbon budget beyond it's share by population of the above due to concerns of lack of action by other countries on reducing thier emissions?
- Whether when setting carbon budgets the UK should assume a global emission pathway which includes any 'overshoot', given the uncertainty in the scale and pace of roll out of negative emissions infrastructure required to make such pathways plausible. Particularly given that the Royal Society report on CCS makes clear that the UK currently has very limited domestic scope for negative emissions due to limited land area.
- Whether the UK should directly calculate its carbon budget by taking our share of remaining the global budget by population, to avoid risk of urgency lag arising from working from EU targets, which may themselves take years to respond to changes in science or climate situation.

We would also suggest that the committee consider whether the UK needs to set a total cumulative carbon budget till 2100, a portion of which would then be allocated to each 5-year carbon budget. This could not only send clear long term signals to industry, but also

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ensure that the UK can't stay within all it's carbon budgets but still emit more than it's fair share of emissions when considered cumulatively.

https://agroecology-appg.org/ourwork/appg-briefings-on-the-precautionary-principle-climate-change-and-animal-welfare/
https://royalsociety.org/topics-policy/projects/greenhouse-gas-removal/