Committee on Climate Change

Independent advice to government on building a low-carbon economy and preparing for climate change

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: The MET Office **UK Climate Projections: UKCP18 repor**t should be considered. This provides the most up-to-date assessment of how the climate of the UK may change over the rest of this century.

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: No answer.

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:

UK emissions reductions (certainly for the period 1990-2010) have been achieved to some extent through offshoring of UK industry. UK progress in decarbonisation is much less strong when viewed from a consumption perspective.

However, the UK has been a leader in contributing to global carbon reduction goals over the past decade, both in reducing its emissions and diplomatically in terms of pushing for ambitious international action. It should aim to continue this role in future, by contributing its full share of the reductions required to deliver net zero. Crucially, it is also important that the UK provides a compelling example of the rest of the world in how to decarbonise. This means doing so cost-effectively, designing the necessary new market arrangement and by helping to develop new low carbon technologies.

To ensure the UK's full contribution in terms of its territorial emissions, there is a strong

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case to formally set carbon budgets in gross terms in future (i.e. based on UK actual emissions across both traded and non-traded sectors, excluding net trade in carbon credits). This would reduce the risk that credit trading is used as a short cut to meet carbon budgets (if set on a net basis).

In considering the implications of net zero, we also think the CCC should assess how future UK carbon budgets/National Determined Contributions (NDC) should be set and/or adjusted to take account of international trade in carbon credits by UK entities (regardless of whether the UK remains in the EUETS, or leaves and develops other carbon market linkages).

Any future regime should ideally work within the context of article 6 of the Paris agreement. For example, the CCC should consider the case for a regime under which the UK Carbon budget/NDC is adjusted to reflect net imports/exports of carbon credits, using Internationally Transferred Mitigation Outcomes under article 6. This could ensure that:

(a) UK carbon budgets and the UK NDC under the Paris agreement remain aligned
(b) Any imports (or exports) of carbon credits used by UK entities to comply with UK carbon budgets do not diminish the global decarbonisation effort
(c) The degree to which the UK allows the use of international credit trading to meet its NDC and/or comply with UK carbon budgets is considered and explicitly decided upon as part of the budget setting process.

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:

The UK has shown international leadership in climate change mitigation through the creation of the carbon budget regime under the Climate Change Act 2008.

The UK can continue to show international leadership in developing and deepening it climate policy regime and governance. Particular focus should be given to developing a soundly designed and governed set of economic drivers for long-term and deep economy-wide decarbonisation. The UK should also play a full part in the development of international collaboration and climate policy (e.g. the implementation and monitoring regimes around the Paris agreement).

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?

The UK should continue to invest significant resource in international collaboration across a full range of climate-related activities in low carbon technology transfer, technical assistance and capacity building.

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 development of effectively governed global carbon credit markets could play a key role in shaping and increasing the effectiveness of international mitigation efforts. But this depends crucially on building sound governance frameworks, accounting, monitoring and verification systems.

The UK should play a full role in contributing its regulatory, legal and financial expertise to international efforts to build global market arrangements.

International credit markets could play an important role in enhancing the efficiency of the global effort to mitigate climate change, and in stimulating and rewarding value chains that are capable of delivering greenhouse gas removal. The extent to which imports of carbon credits can be used to meet the UK's carbon budgets should be subject to explicit consideration as part of the budget-setting process. This will give market certainty to UK firms participating in international carbon markets. Imports of carbon credits should not be used as a short-cut way to side-step the need for deep cuts in the UK's territorial emissions.

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:

The Energy System Catapult team recently updated the work on the Energy Technologies Institute (ETI); *Clockwork & Patchwork – UK Energy System* scenarios[1]. This work has

[1] Energy Technologies Institute: *'Options, Choices, Actions: Updated'* (2018) https://www.eti.co.uk/options-choices-actions-2018/

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found that *'a balanced multi-vector approach can deliver an affordable, low carbon UK energy transition, with costs rising to around 1% of GDP by 2050'*. It is very unlikely that emissions can be reduced to close to zero in all sectors in a cost-effective way. The ESC/ETI study clearly demonstrates the importance of taking a whole-systems view and choosing an efficient balance of effort across the energy system.

The analysis also highlights the importance and versatility of Carbon Capture, Usage and Storage (CCUS) and biomass-based approaches to reducing emissions, with applications across power, industry and hydrogen production. The updated ESC UK Energy System Scenarios have concluded that without CCUS, the UK carbon abatement costs could be double by 2050. Sustainably grown biomass (within a wider context of GHG-friendly land use change) also has the potential to become a critical resource for the UK energy system. It can be burned directly for heat and power or converted into low carbon gases and liquid fuels to decarbonise hard-to-treat sectors.

Bioenergy and CCS are especially valuable in combination. Together, they offer the potential for negative emissions to counterbalance the continued use of fossil fuels in sectors which are difficult to decarbonise e.g. aviation.

The continued development of robust carbon accounting approaches and evidence – in particular across the food and land use sectors – will also be important in minimising the risk of 'more difficult to monitor' actions and interventions (particularly in Agriculture, Forestry and Land Use).

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:

Greenhouse gas removal technologies and value chains look extremely valuable options for the UK to develop. There is now a substantial body of evidence which suggests that bioenergy with carbon capture and storage (BECCS) is a valuable and sustainable option for the UK. It has high value even with relatively modest volumes of biomass. This is summarised in the ETI insights paper *The evidence for deploying bioenergy with CCS (BECCS) in the UK* https://www.eti.co.uk/insights/the-evidence-for-deploying-bioenergy-with-ccs-beccs-in-the-uk

The net zero agenda only increases the likely value and relevance of GGRs. It is not possible to predict the most acceptable, efficient and viable combinations of technologies and value chains for greenhouse gas removal – but it is likely that they will require substantial, patient investment to develop. This suggests that it is important for the UK to

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make progress in creating reliable long-term measurement, verification and economic reward mechanisms for investment in GGRs. There should be a level playing field which enables the most efficient balance between efforts to achieve deep decarbonisation of 'hard to reduce' sectors and efforts to deliver offsetting GGRs.

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?

ANSWER:

The ESC report *'Market Transitions'* (2017) examined key drivers in some countries' transitions to low-carbon heating, finding that a combination of market forces and policy have been instrumental in driving the transition. For instance, early deployment of heat pumps and heat networks in leading countries such as Sweden and Denmark took place as a response to the oil crises in the 1970s, as prices rose. However, in the following decades, a combination of planning, regulation, taxation and incentives drove the transformation of heat provision. In Norway, high electricity prices in the late 1990s encouraged a transition from direct electric heating to heat pumps and district heating, but this was supported by policies to facilitate take up. In other countries, such as Germany, the transitions have been almost entirely policy-led.

Where policies to facilitate the low-carbon transition have been credible and consistent, such as in Sweden and Norway, grants and subsidies have become less important and have been phased out as the new technologies became more competitive.

In principle a tighter long-term emissions target for the UK could drive increased innovation. While public expenditure and policy support for innovation is important, the evidence also suggests that clear and stable regulation can pull forwards significant private investment in innovation. A range of evidence from jurisdictions such as California suggests that flexible outcome-based regulation in key sectors can drive efficient investment in technologies to reduce emissions. See for example the international case studies produced through the ESC Rethinking Decarbonisation Incentives project.

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:

ESC experience of studying consumer motivations and working with consumers suggests the importance of working with the grain of consumer needs and aspirations. In low carbon heat, for example, it is important to understand the ways that people want to use

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heat in their homes, or the reasons why they find it difficult to adopt a low carbon alternative in place of gas boilers.

Clearly there is substantial scope for behaviour change over the next 3 decades – in how we heat our homes, in how we travel and in what we eat. But in seeking to achieve GHG-friendly change in all of these areas, it is important that low carbon alternatives deliver against people's needs and they improve outcomes. This suggests the importance of aligning policy to achieve co-benefits like improved local environmental quality, or better health outcomes.

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:

The government's Clean Growth Strategy represents a significant step forward in integrating climate policy objectives with broader industrial and economic objectives. A continued policy commitment to industrial strategy and public investment in energy innovation is important.

However, it is also important that there is a renewed focus on developing a more coherent economy-wide set of economic drivers for decarbonisation. In effect given the scale of the challenge we need to take a whole systems approach into climate and energy policy development and design.

Our Rethinking Decarbonisation Incentives project has shown how the pattern of effective carbon prices produced by the current policy mix varies inefficiently and arbitrarily across different sectors and emitting activities. The economic drivers for decarbonisation also remain for the most part too weak to meet targets.

A net zero target will increase the importance of achieving an economically efficient mix of decarbonisation (and GGR) across the economy. Emissions trading only covers 45% of emissions, while there is no economy-wide carbon pricing mechanism. There are a range of options for improving the economic framework for decarbonisation, and these extend beyond the 'traditional' carbon pricing options of cap and trade or a carbon tax. This could involve combining a role for long-term clarity in regulation (e.g. through mandating the end of new petrol and diesel car sales), alongside the use of economic instruments and trading (e.g. of carbon credits) to drive optimisation of the decarbonisation mix.

Our Rethinking Decarbonisation Incentives is also examining the role of decarbonisation policy as part of industrial strategy, and as a component of the UK's long-term productivity agenda. An inefficient and incoherent mix of sectoral decarbonisation policies, which results in a costly abatement pathway, will not improve UK productivity and industrial competitiveness.

Digitalisation and new technologies offer huge opportunities to deliver improved low outcomes that are resource efficient and low carbon. Government policy needs to shape

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market and regulatory frameworks that enable and unlock the power of digital solutions, removing barriers, empowering consumers and preventing the creation and exploitation of new forms of market power.

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:

The distribution of costs, risks and opportunities associated with cutting emissions will depend crucially on the mix of policy measures adopted to drive the change. As far as possible, a technology neutral policy framework will reduce the risk of opportunities being 'captured' by particular industrial interests. A policy framework that provides a level playing field to reward emissions reductions wherever they can be most economically delivered is most likely to deliver the lowest cost abatement burden for taxpayers and consumers.

However, there could be a range of significant distributional questions and issues which arise associated with particular technologies or policy options. Given the scale and potential cost of change, there may well be a case for a body to advise government on distributional questions associated with climate policy.

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: No answer.

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:

There are obvious regional differences between the four nations of the UK. It is significantly colder in parts of Scotland and Northern Ireland than in Wales and England. There also differences in the quality and type of construction and location (urban versus rural) of properties. There also differences in types of industrial activity, with some remaining areas of heavy industry in parts of England, South Wales and Central Scotland. However, policies to deliver the low-carbon transition are likely to be consistent across the

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UK. For instance, the low carbon transition plans for Newcastle, Bridgend and Bury have shown that, although the three areas are different in terms of size, housing stock and location, and the interventions required to deliver the low-carbon transition vary from area-to-area, the types of policy and business models required to deliver those interventions will be similar.

This highlights the potential importance of local area energy planning in enabling efficient local energy choices and infrastructure decisions.

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:

It is important that the UK develops a better understanding of the characteristics of a post-2050 energy system – this will not just be an incremental change to the current system. Different system designs have different implications for the UK, so it is important to understand the differences and potential trade-offs between future scenarios.