

## 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](mailto: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:** It is important to consider relevant publications on climate science and climate economics published in the year 2018 since the effective cut-off date for consideration by the IPCC 1.5°C report. Several 2018 papers present advances in prediction of climate change and its economic impacts which are of importance for the CCC's analysis. Links to a small selection of these publications are given below:

#### **Accelerated global warming and the role of clean air policies**

Cowern, N.E.B. Current rapid global temperature rise linked to falling SO<sub>2</sub> emissions.

Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2018-83>, in review, 2018.

Xu, Y et al. Global warming will happen faster than we think.

Nature 564, 30-32 (2018); <https://doi.org/10.1038/d41586-018-07586-5>

Sevellec, F. A novel probabilistic forecast system predicting anomalously warm 2018-2022 reinforcing the long-term global warming trend. Nature Comm. 9: 3024,

<https://doi.org/10.1038/s41467-018-05442-8>

#### **Sources of rising methane emissions**

Worden, J. R. et al. Reduced biomass burning emissions reconcile conflicting estimates of the post-2006 atmospheric methane budget. Nature Comm. 8:2227,

<https://doi.org/10.1038/s41467-017-02246-0>, 2017.

#### **Climate sensitivity**

Andrews, T. et al. Accounting for changing temperature patterns increases historical estimates of climate sensitivity. Geophys. Res. Lett. 45, 8490-8499 (2018);

<https://doi.org/10.1029/2018GL078887>

#### **Economic impact of global warming**

Ricke, K et al. The social cost of global warming, Nature Climate Change 8, 895–900 (2018)

**Question 2 (CO<sub>2</sub> 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:** Traditional approaches, such as the use of global warming potentials, are not sufficient to evaluate the effect of progressive emissions reductions on the time dependent response of global climate. This is a key 'problem issue' because high-impact short- to medium lived greenhouse gases, specifically methane and tropospheric ozone, have become critical for controlling climate 'overshoot' beyond 1.5°C. The IPCC 1.5°C result makes clear the critical importance of this issue. I recommend that the CCC analysis use a procedure to estimate explicitly the time evolution of global climate response to the UK policy measures it explores in its study for HMG. It is convenient to utilise a 'simple climate

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model' such as recently described by Hansen et al. (2017). Within this approach the improved semi-empirical climate response function described by Cowern (2018) enables more accurate forecasting of underlying medium-term temperature change.

In addition to resolving the issue of time dependent response to greenhouse gases, the method also provides a framework for including the effect of decreasing atmospheric aerosols during the current phase of global pollution reductions (cuts in SO<sub>2</sub>, etc. from coal power plants, smelters, shipping and other sources) (Cowern, 2018; Xu et al., 2018). This global clean-up of aerosols, currently under observation by the Ozone Monitoring Instrument on the EOS Aura satellite, is absolutely key to understanding the ongoing acceleration of global warming which began during this decade. I have shown (Cowern, 2018) that the aerosol clearing effect currently dominates the rate of global temperature rise despite large ongoing contributions from greenhouse gases. This means that global temperature will reach 1.5°C above the pre-industrial baseline sooner than estimated in the IPCC 1.5°C report – perhaps as soon as the late 2020s. This result qualitatively alters the relative priorities for emissions reductions of different greenhouse gases, as discussed by Cowern (2018). Emissions of methane and of non-methane hydrocarbons (precursors of tropospheric ozone) become a critical target for steep reductions.

The computational procedure is available in Excel, thus fast, easy to share, and convenient for speedy evaluation of emissions scenarios. If the CCC wishes to explore this approach please contact me at [nick.cowern@ncl.ac.uk](mailto:nick.cowern@ncl.ac.uk).

#### References

Hansen, J. et al. Young people's burden: requirement of negative CO<sub>2</sub> emissions. *Earth Syst. Dynam.* 8, 577-616, doi:10.5194/esd-8-577-2017, 2017.

Cowern, N.E.B. Current rapid global temperature rise linked to falling SO<sub>2</sub> emissions. *Earth Syst. Dynam. Discuss.*, <https://doi.org/10.5194/esd-2018-83>, in review, 2018.

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*Nature* 564, 30-32 (2018); <https://doi.org/10.1038/d41586-018-07586-5>

## 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:

**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?

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ANSWER:

**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:

### 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:

**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:

**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:

**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:

**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:

#### 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:

**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:

#### 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:

1. It is crucial to consider the role of climate-cooling aerosols generated by emissions of sulphur dioxide from a range of sources in the UK and by international shipping. Steep reductions in sulphur dioxide emissions will cause substantial further cumulative global warming, yet this key climate agent has been neglected in previous UK energy and climate policy considerations. It will be of great benefit to the CCC's analysis to correct this omission.
2. It may also be important to consider near-term climate impacts, mitigation and adaptation. This has gained in importance in the last 1-2 years as it has become clear that global temperature is rising substantially faster than previously expected. For example, in my recent paper (Covern, 2018) referenced above, a near-term projection based on falling sulphur dioxide emissions and a continued rise in greenhouse gas emissions shows global warming reaching about 1.3°C by 2022 and potentially 1.5°C by the end of the 2020s.
- 3.