

## 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:**

We would advise the CCC to review the European Commission long-term GHG gas reduction strategy released recently<sup>1</sup>. The Commission presents eight scenarios for the EU's future emissions reduction effort with two of these scenarios charting a path toward net zero emissions by 2050. One net zero scenario pushes for heavy decarbonisation of all sectors as well as increasing energy efficiency and relies on the development and deployment of negative emissions technology in the form of bioenergy combined with carbon capture and storage to balance remaining emissions. The other net zero scenario builds upon the first but also assesses the impact of a circular economy with increased reuse and recycle rates as well as the potential beneficial role of changes in consumer choices that are less carbon intensive.

In addition, we would recommend that the CCC review the recent report on Greenhouse Gas Removal technologies from the Royal Society and Royal Academy of Engineering<sup>2</sup>. This report highlights the essential role of these technologies in achieving a net zero emissions economy and highlights the potential role of a variety of differing technologies including afforestation, bioenergy with carbon capture and storage, and direct air capture.

**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:**

Under the Kyoto protocol six greenhouse gases (Carbon Dioxide, Methane, Nitrous Oxide, Hydrofluorocarbons, Perfluorocarbons and Sulphur hexafluoride) are recognised as having a significant impact on the climate system with the impacts and lifetimes of each of these greenhouse gases varying considerably. We recommend that the CCC, when accounting for these greenhouse gases, do so on a Carbon Dioxide equivalency basis, which includes climate-carbon feedbacks, as defined by the IPCC. Doing so will allow for easier comparisons between greenhouse gas reduction technologies allowing the UK to meet its climate targets at the lowest possible cost.

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<sup>1</sup> [https://ec.europa.eu/clima/sites/clima/files/docs/pages/com\\_2018\\_733\\_en.pdf](https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_en.pdf)

<sup>2</sup> <https://royalsociety.org/~media/policy/projects/greenhouse-gas-removal/royal-society-greenhouse-gas-removal-report-2018.pdf>

## 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:**

Whilst 'consumption' emissions could play an important role in raising awareness of the carbon impacts of certain actions or products, for example in carbon labelling of products, we would urge caution when considering how to account for these emissions.

If these emissions are already accounted for within national inventories there is a risk that emissions are double counted, and if these emissions are accounted for within a tax or trading system there is a risk they will be double charged.

We believe there is scope to manage supply emissions when imported into the UK but would advise caution particularly when accounting for other countries, or companies, emissions. The primary focus of the CCC report should be on those emissions which a country or company is directly responsible for e.g. scope 1 and scope 2 emissions.

**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:**

Drax is an advocate for a strong and robust carbon price which has been extremely effective in transiting coal off Great Britain's power system. The GB carbon price floor has showcased British climate leadership, and we believe that there is a need to apply this more widely across the EU and later, the world. This combined with a global pricing scheme based on the EU-ETS will help to develop a global inventory of emissions which can then be reduced at least cost.

The UK has also proved itself as a world leader in decarbonising its power sector. As recent research by Imperial College London for Drax has shown, the GB power grid has reduced its carbon intensity by over 250g CO<sub>2</sub>/kWh in the last decade<sup>3</sup>. The research also found that the UK has seen the world's fastest rate of phasing out coal power generation. Therefore, there is a role for the UK to act as a climate leader and share knowledge, technical expertise and best practice with other countries that are seeking to follow its path, through international initiatives such as the UK-Canadian Powering Past Coal Alliance. The UK also has an opportunity to leverage its leadership position to export emerging technologies where it still has a first-mover advantage globally, such as bioenergy with carbon capture and storage, subject to providing sufficient policy support domestically to enable those technologies to mature.

<sup>3</sup> <https://www.drax.com/wp-content/uploads/2018/12/Energy-Revolution-Global-Outlook-Report-Final-Dec-2018-COP24.pdf>

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Due to its geological characteristics, particularly in the North Sea, the UK can store vast amounts of CO<sub>2</sub> (around 78Gt of CO<sub>2</sub>)<sup>4</sup>. This provides the UK with the opportunity to safely store the CO<sub>2</sub> of other countries which do not have access to similar storage locations.

**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:**

There is a possibility that a global market in carbon credits could be developed to assist in global decarbonisation. The deployment of Negative Emissions Technologies (NETs) in countries like the UK could mean that the UK could eventually reach net negative emissions. These negative emissions could play an important role in decarbonising other countries, however some sort of credit system would need to be in place to support this.

However, we believe that any use of carbon credits should be limited to 'difficult to decarbonise' emissions such as those in industrial, agricultural, aviation and shipping sectors, and should be carefully controlled allowing for offsets produced by Negative Emissions Technologies such as BECCS. Since it is likely (according to IPCC projections) that global net zero emissions will be required in the latter half of the century it is important that the role of carbon credits is limited to certain areas. There is also a risk that a carbon credit scheme could create domestic complacency, where countries are not motivated to take action to reduce their emissions now.

### 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:**

Several options to decarbonise aviation, agriculture, and industry exist such as fuel switching and mass electrification.

In industry, for specific sectors including concrete, CO<sub>2</sub> is emitted as part of the

<sup>4</sup> <https://s3-eu-west-1.amazonaws.com/assets.eti.co.uk/legacyUploads/2016/04/D16-10113ETIS-WP6-Report-Publishable-Summary.pdf>

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manufacturing process. For these sectors the only option for decarbonising is through the deployment of carbon capture utilisation and storage (CCUS)<sup>5</sup>. To ensure that this technology can be readily deployed when required, the CCUS Cost Challenge Taskforce recommended that CCUS be deployed as part of a cluster, which is supported by a power generation anchor project. We welcome the Government's recent CCUS 'action plan', which looks to progress some of these recommendations<sup>6</sup>.

Over time, it will be necessary for the CCC in conjunction with the government to recommend when industrial sectors should begin to join the CCUS cluster. This analysis will need to ensure that industrial sectors can remain internationally competitive, but also remain compatible with carbon budgets.

Negative Emissions Technologies will also have a role to play in decarbonising all three hard-to-abate sectors, as they can remove expensive residual emissions which remain after easier and cheaper actions have been taken.

For aviation, low carbon synthetic fuels can be created by combining hydrogen with CO<sub>2</sub> captured by Negative Emissions Technology. The resulting carbon neutral synthetic fuel will have similar characteristics to traditional fossil airline fuel which can be utilised by international flights, where battery electric and hydrogen-based flights will be unable to operate due to unfavourable characteristics.

**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 Removals, or Negative Emissions Technologies (NETs), will be absolutely vital in achieving net zero emissions by 2050 and beyond. The IPCC SR 15 report highlighted the utilisation of NETs in all four pathways considered<sup>7</sup>. Whilst the utilisation of NETs varies across the pathways considered, two of the 'middle-of-the-road' scenarios have significant levels of NETs operating at scale including a role for Bioenergy with Carbon Capture and Storage (BECCS).

At Drax we have recently begun a pilot project exploring the potential of deploying BECCS

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<sup>5</sup> [http://www.energy-transitions.org/sites/default/files/ETC\\_MissionPossible\\_FullReport.pdf](http://www.energy-transitions.org/sites/default/files/ETC_MissionPossible_FullReport.pdf)

<sup>6</sup>

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/759637/beis-ccus-action-plan.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/759637/beis-ccus-action-plan.pdf)

<sup>7</sup> <https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/>



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at scale within the UK. This pilot project is attempting to assess the feasibility of a specialised solvent and will aim to capture 1 tonne of CO<sub>2</sub> per day<sup>8</sup>. If the trial proves successful, it will move Drax one step closer to achieving negative emissions at scale – ‘at scale’ being up to 4MT of CO<sub>2</sub> captured per converted biomass unit.

As an already large user of sustainable biomass for power and considering the vast levels of potential storage capacity of CO<sub>2</sub> around the UK (78GtCO<sub>2</sub>), the UK is well placed to repurpose existing biomass generation assets and supply chains to enable BECCS deployment and to achieve negative emissions at scale.

The role of NETs in the UK was recently highlighted in a report from the Royal Society and the Royal Academy of Engineering which estimated that around 130 MtCO<sub>2</sub> of residual emissions would remain by 2050 even under the most stringent of decarbonisation routes. Of this target, around 50 MtCO<sub>2</sub> could be removed utilising sustainable sources of biomass with carbon capture and storage and, combined with other removal methods, a net zero target would be achievable<sup>9</sup>.

In order to properly realise the benefits of deploying NETs at scale in the UK a long-term and investable policy environment is needed, which includes the deployment of a transport and storage infrastructure for CCUS, and a need to consider how negative emissions will be properly rewarded. At present there is no mechanism or incentive to reduce emissions past zero; furthermore, significant risks remain across the CCUS chain as referenced in the CCUS Cost Challenge Task Force report. Unless these points are rectified, the deployment of NETs at scale in the UK remains challenging.

**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 cost of deploying renewable generation technologies has decreased sharply over the last 10 years thanks to robust and wide-ranging government policies and support which have allowed technologies to reduce in deployment costs. This has been particularly highlighted in recent Contracts for Difference auction results where it has been shown that offshore wind can now be deployed for a cost of £57/MWh down from a cost of £117/MWh in 2015.

Similar support should now be provided to other technologies vital in achieving a net zero emissions target, for example CCUS and BECCS. This commitment and support for early projects can help to drive down the costs of deploying the technology. Since CCUS is a technology that can be utilised in a multitude of different sectors globally it stands to

<sup>8</sup> [https://www.drax.com/press\\_release/europes-first-bioenergy-carbon-capture-storage-pilot-now-underway/](https://www.drax.com/press_release/europes-first-bioenergy-carbon-capture-storage-pilot-now-underway/)

<sup>9</sup> <https://royalsociety.org/~media/policy/projects/greenhouse-gas-removal/royal-society-greenhouse-gas-removal-report-2018.pdf>

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reason that the UK could become a world leader in the development and deployment of CCUS technology.

There is a need for the CCC to recommend, and the government to implement policies which drive behavioural change over the long term. One of the most significant drivers of change is a robust and strong carbon price. Since the introduction of the Carbon Price Floor in 2013, the UK has seen a steep reduction in the carbon intensity of its power generation. Britain climbed from a 2012 ranking of 20th out of 33 industrialised countries to 7th on the low-carbon electricity league table in just 4 years following its introduction<sup>10</sup>.

As the UK's energy system decarbonises through an increasing amount of intermittent renewable generation, and through the increasing electrification of other sectors of the economy, the ability and need to balance the energy system will become increasingly important. Whilst some balancing can be achieved through the utilisation of hybrid heat pumps and smart chargers, it will be important to realise that in the interim gas will have a significant role to play. Closer to 2050, the role of CCUS, and the role of both long- and short-term storage should not be understated in any policies which aim to tackle the problem of intermittency.

**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:

In our experience, through our retail business in dealing with commercial consumers of energy, we have found that uncertainty is the greatest hindrance to encouraging behavioural change. This is particularly true when decarbonisation, or low carbon, technologies are often expensive with long payback periods.

We believe that the development of roadmaps to decarbonisation which (whilst remaining technology neutral) can provide consumers, and industry participants with the confidence to invest in alternative technologies.

**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:

We believe that the UK's current Climate Change Act will need revising to reflect the

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<sup>10</sup>

[http://res.cloudinary.com/dgofwp0my/image/upload/v1510677459/dra\\_283\\_electric\\_insights\\_carbon\\_table\\_v1.1-1\\_lu9tyc.gif](http://res.cloudinary.com/dgofwp0my/image/upload/v1510677459/dra_283_electric_insights_carbon_table_v1.1-1_lu9tyc.gif)



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increased ambition agreed under the Paris Climate Accords. It is fairly widely accepted that the UK's target is likely to need to include a net zero emissions target by around 2050.

This initial request from the Minister of State for Energy & Clean Growth Claire Perry indicated that carbon budgets 3-5 covering the periods 2018 to 2032 are out of scope of the request<sup>11</sup>. However, a recent letter from Claire Perry to the legal charity Plan B indicated that these carbon budgets can be amended if required<sup>12</sup>. If it is found that current carbon budgets are incompatible it is important that any changes to budgets are conducted early, and with minimal disruption, whilst taking into account any investment decisions which may have been made based on previous carbon budgets.

It is likely that both the transportation and heating sectors will need to fully decarbonise in order to meet future carbon targets. In order to do so it will be important to develop clear and concise roadmaps to decarbonisation in these sectors, particularly in the heating sectors. These roadmaps, based on CCC advice, should include key dates and policies to assist the transition. These policies should include flexibility particularly around the technological aspect so that the UK is not locked in to technologies which may not be the most cost-effective in the future.

#### 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:

One of the pathways in the IPCC SR 15 report allows for some overshoot in emissions, with the assumption that Negative Emissions Technologies are deployed at very large scale to allow worldwide emissions to become negative in the latter half of the century. Whilst we would not advocate planning for an overshoot in emissions, it is important to ensure that if a contingency of very high levels of negative emissions technologies are needed these technologies should be readily available for deployment.

The UK has a significant opportunity to become a world leader in decarbonisation technologies such as CCUS. Doing so would provide export opportunities of both technology and knowledge. For this to be realised there is a need to provide significant policy support to the technologies during their initial deployment stage.

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<sup>11</sup>

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/748489/CCC\\_commission\\_for\\_Paris\\_Advice\\_-\\_Scot\\_UK.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/748489/CCC_commission_for_Paris_Advice_-_Scot_UK.pdf)

<sup>12</sup> <https://planb.earth/wp-content/uploads/2018/11/Letter-from-Claire-Perry.pdf>

**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:

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## **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:

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## **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:

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