

## The Sixth Carbon Budget and Welsh emissions targets – Call for Evidence

### Background to the UK's sixth carbon budget

The UK Government and Parliament have adopted the Committee on Climate Change's (CCC) [recommendation](#) to target net-zero emissions of greenhouse gases (GHGs) in the UK by 2050 (i.e. at least a 100% reduction in emissions from 1990).

[The Climate Change Act](#) (2008, 'the Act') requires the Committee to provide advice to the Government about the appropriate level for each carbon budget (sequential five-year caps on GHGs) on the path to the long-term target. To date, in line with advice from the Committee, five carbon budgets have been legislated covering the period out to 2032.

The Committee must provide advice on the level of the sixth carbon budget (covering the period from 2033-37) before the end of 2020. The Committee intends to publish its advice early, in September 2020. This advice will set the path to net-zero GHG emissions for the UK, as the first time a carbon budget is set in law following that commitment.

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](#)).

The Act also specifies other factors the Committee must consider in our advice on carbon budgets – the advice should be based on the path to the UK's long-term target objective, consistent with international commitments and take into account considerations such as social circumstances (including fuel poverty), competitiveness, energy security and the Government's fiscal position.

The CCC will advise based on these considerations and a thorough assessment of the relevant evidence. This Call for Evidence will contribute to that advice.

### Background to the Welsh third carbon budget and interim targets

Under the Environment (Wales) Act 2016, there is a duty on Welsh Ministers to set a maximum total amount for net Welsh greenhouse gas emissions (Welsh carbon budgets). The first budgetary period is 2016-20, and the remaining budgetary periods are each succeeding period of five years, ending with 2046-50.

The Committee is due to provide advice to the Welsh Government on the level of the third Welsh carbon budget (covering 2026-30) in 2020, and to provide updated advice on the levels of the second carbon budget (2021-25) and the interim targets for 2030 and 2040. Section D of this Call for Evidence (covering questions on

Scotland, Wales and Northern Ireland) includes a set of questions to inform the Committee's advice to the Welsh Government.

### **Responding to the Call for Evidence**

The Call for Evidence questions are divided into five themed sections:

- A. Climate science and international circumstances
- B. The path to the 2050 target
- C. Delivering carbon budgets
- D. Wales, Scotland and Northern Ireland
- E. Sector-specific questions

It comprises more questions than previous Calls for Evidence run by the Committee, as it includes questions on the Welsh emissions targets (section D), as well as a set of detailed, sector-specific questions (section E).

***It is not expected that respondents will answer all questions. Please answer only those questions where you have specific expertise and evidence to share.***

We encourage responses that are brief and to the point, i.e. a **maximum of 400 words per question** plus links to supporting evidence, and may follow up for more detail where appropriate.

Please use the question and answer form at the end of the document and e-mail your response to: [communications@theccc.org.uk](mailto:communications@theccc.org.uk) using the subject line: 'The Sixth Carbon Budget – 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  
151 Buckingham Palace Rd  
London  
SW1W 9SZ

**The deadline for responses is Wednesday, 5 February 2020.**

**The question and answer form can be found on page 11 of this document.**

### **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).

## Further background and Call for Evidence questions

The Call for Evidence questions are divided into five themed sections:

- A. Climate science and international circumstances
- B. The path to the 2050 target
- C. Delivering carbon budgets
- D. Wales, Scotland and Northern Ireland
- E. Sector-specific questions

***You do not need to answer all the questions. Please answer only those questions where you have specific expertise and evidence to share.***

### A. Climate science and international circumstances

The Committee intends to draw on its recent [Net Zero report](#), based on the work of the IPCC as published in the [Special Report on Global Warming of 1.5°C](#) (IPCC-SR1.5) in October 2018, in assessing the implications of climate science for the budget advice. This will be supplemented with new literature summarised in the IPCC Special Reports on [Climate Change and Land](#) and [The Ocean and Cryosphere in a Changing Climate](#) and in other publications.

The Committee's advice will be based on the long-term goal of the [Paris Agreement](#) ('the Agreement') to keep warming 'well-below' 2°C and to pursue efforts to keep it below 1.5°C. The UK's net-zero long-term GHG emissions target is set based on this climate objective. In order to achieve this objective, global emissions pathways rapidly decline from 2020 to reach net-zero CO<sub>2</sub> emissions by around 2050 for a 1.5°C limit (~50% probability) and by around 2075 for the 'well below 2°C' end of the Paris Agreement ambition.<sup>1</sup>

A five-yearly cycle of global stocktakes and new pledge submissions is planned, to increase ambition of nationally-determined contributions (NDCs) and move towards achieving the long-term goal of the Agreement. This is known as the 'ratchet mechanism'. Parties will resubmit their first NDCs (covering the period up to 2030) by the end of 2020, with an aim of increasing mitigation ambition. They are also required to submit a 'long-term low greenhouse gas emission development strategy' focused on mid-century, by the same date.

Currently the UK's official contribution to the Paris Agreement is set through the EU's collective pledge to reduce emissions by at least 40% by 2030 relative to 1990. Outside the EU, the UK would need to submit its own NDC to the UN. This should be based on the pathway to Net Zero that the Committee will develop as part of the sixth carbon budget advice.

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<sup>1</sup> In scenarios that reach global net-zero emissions for all GHGs (including methane and nitrous oxide emissions as well as CO<sub>2</sub>) this occurs around 2068 for 1.5°C (~50% probability) and generally not before 2100 in scenarios 'well-below' 2°C (>66% probability below 2°C).

The CCC's sixth carbon budget advice will be produced in the run-up to this critical period for global climate ambition, which will culminate with a conference of parties held in Glasgow in late-2020.

### Questions:

1. The climate science considered in the CCC's 2019 Net Zero report, based on the IPCC Special Report on Global Warming of 1.5°C, will form the basis of this advice. What additional evidence on climate science, aside from the most recent IPCC Special Reports on Land and the Oceans and Cryosphere, should the CCC consider in setting the level of the sixth carbon budget?
2. How relevant are estimates of the remaining global cumulative CO<sub>2</sub> budgets (consistent with the Paris Agreement long-term temperature goal<sup>2</sup>) for constraining UK cumulative emissions on the pathway to reaching net-zero GHGs by 2050?
3. How should emerging updated international commitments to reduce emissions by 2030 impact on the level of the sixth carbon budget for the UK? Are there other actions the UK should be taking alongside setting the sixth carbon budget, and taking the actions necessary to meet it, to support the global effort to implement the Paris Agreement?
4. What is the international signalling value of a revised and strengthened UK NDC (for the period around 2030) as part of a package of action which includes setting the level of the sixth carbon budget?

### B. The path to the 2050 target

Carbon budgets need to be set on a path that is achievable from today, on the way to the 2050 target. The Committee has previously set out a cost-effective path to the previous long-term target (for a reduction of at least 80% in GHG emissions between 1990 and 2050) that balances effort before 2030 with potential opportunities from 2030 to 2050. The path includes ways of reducing emissions that are likely to be relatively low-cost and actions that will develop options that may need to be deployed at scale by 2050.

The new net-zero target means that:

- The current cost-effective path for decarbonisation to 2035 is unlikely to be sufficiently steep, as it was set on the basis of the previous 2050 target. The path will need to be reassessed in the light of the net-zero target.
- Near-full decarbonisation will be needed across every sector to reach net-zero emissions. This leaves less flexibility on which emissions sources need to be abated and the loss of optionality could increase risks that the legislated 2050 target will not be met. Therefore, although cost-effectiveness will continue to be an important criterion in informing abatement opportunities, measures

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<sup>2</sup> Remaining CO<sub>2</sub> budgets incorporate the effect of future emissions of non-CO<sub>2</sub> greenhouse gases and other climate pollutants such as aerosols.

which keep future options open and increase potential to achieve targets will be of increased value.

Given long lead-times for many abatement measures (e.g. large-scale new infrastructure build out, tree planting) many critical abatement options will have to be in place or well advanced by the sixth carbon budget period, if Net Zero is to be achieved in 2050.

### Questions:

5. How big a role can consumer, individual or household behaviour play in delivering emissions reductions? How can this be credibly assessed and incentivised?
6. What are the most important uncertainties that policy needs to take into account in thinking about achieving Net Zero? How can government develop a strategy that helps to retain robustness to those uncertainties, for example low-regrets options and approaches that maintain optionality?
7. The fourth and fifth carbon budgets (covering the periods of 2023-27 and 2028-32 respectively) have been set on the basis of the previous long-term target (at least 80% reduction in GHGs by 2050, relative to 1990 levels). Should the CCC revisit the level of these budgets in light of the net-zero target?
8. What evidence do you have of the co-benefits of acting on climate change compatible with achieving Net Zero by 2050? What do these co-benefits mean for which emissions abatement options should be prioritised and why?

### C. Delivering carbon budgets

The UK's statutory 2050 target requires actions across the economy to reduce emissions. Many of these actions will be driven by (UK and devolved) Government policy and implemented by businesses and individuals. There will also be an important role for Local Authorities and cities in successful delivery, with a requirement for local targets and action to be a cost-effective part of meeting the UK-wide target.

Although the carbon budgets do not mandate specific actions, they indicate the overall direction that policy will take in future. Once set, carbon budgets can only be changed if there has been a significant change in the relevant circumstances set out in the Climate Change Act. Feedback from businesses as part of the Committee's [2019 Call for Evidence to inform the Net Zero advice](#) was that stability is an important and valuable characteristic of carbon budgets.

### Questions:

9. Carbon targets are only credible if they are accompanied by policy action. We set out a range of delivery challenges/priorities for the 2050 net-zero target in our Net Zero advice. What else is important for the period out to 2030/2035?
10. How should the Committee take into account targets/ambitions of UK local areas, cities, etc. in its advice on the sixth carbon budget?

11. Can impacts on competitiveness, the fiscal balance, fuel poverty and security of supply be managed regardless of the level of a budget, depending on how policy is designed and funded? What are the critical elements of policy design (including funding and delivery) which can help to manage these impacts?
12. How can a just transition to Net Zero be delivered that fairly shares the costs and benefits between different income groups, industries and parts of the UK, and protects vulnerable workers and consumers?

#### **D. Wales, Scotland and Northern Ireland**

The Climate Change Act states that differences in circumstances between England, Wales, Scotland and Northern Ireland must be taken into account when setting the level of carbon budgets. We consider as part of this:

- Relevant legislation in the devolved administrations (e.g. the Environment (Wales) Act 2016, the Climate Change (Scotland) Act 2009) and any associated GHG reduction targets (e.g. Welsh carbon budgets, Scottish interim targets).
- A fair contribution from each of Wales, Scotland and Northern Ireland towards global decarbonisation efforts and towards the UK long-term target, based on their ability to reach net-zero GHG emissions (which relies on the proportion of economic activity in hard-to-decarbonise sectors, existing infrastructure that will impact decarbonisation in the long-term, the way land is used, opportunities for engineered GHG removals and potential to deliver more speculative abatement options).

Alongside the UK target to reach net-zero GHG emissions by 2050, our Net Zero advice also recommended a net-zero target for 2045 for Scotland and a 95% emissions reduction target against 1990 levels for Wales by 2050. These different targets reflect the opportunities for emissions reduction in different parts of the UK, rather than different levels of ambition.

The Committee is due to provide advice to the Welsh Government on the level of the third Welsh carbon budget (covering 2026-30) in 2020, and to provide updated advice on the levels of the second carbon budget (2021-25) and the interim targets for 2030 and 2040. As such, the questions below are mainly focused on Wales.

#### **Questions:**

13. What specific circumstances need to be considered when recommending an emissions pathway or emissions reduction targets for Scotland, Wales and/or Northern Ireland, and how could these be reflected in our advice on the UK-wide sixth carbon budget?
14. The Environment (Wales) Act 2016 includes a requirement that its targets and carbon budgets are set with regard to:
  - The most recent report under section 8 on the State of Natural Resources in relation to Wales;
  - The most recent Future Trends report under section 11 of the Well-Being of Future Generations (Wales) Act 2015;

- The most recent report (if any) under section 23 of that Act (Future Generations report).
  - a) What evidence should the Committee draw on in assessing impacts on sustainable management of natural resources, as assessed in the state of natural resources report?
  - b) What evidence do you have of the impact of acting on climate change on well-being? What are the opportunities to improve people’s well-being, or potential risks, associated with activities to reduce emissions in Wales?
  - c) What evidence regarding future trends as identified and analysed in the future trends report should the Committee draw on in assessing the impacts of the targets?
  - d) Question 12 asks how a just transition to Net Zero can be achieved across the UK. Do you have any evidence on how delivery mechanisms to help meet the UK and Welsh targets may affect workers and consumers in Wales, and how to ensure the costs and benefits of this transition are fairly distributed?
15. Do you have any further evidence on the appropriate level of Wales’ third carbon budget (2026-30) and interim targets for 2030 and 2040, on the path to a reduction of at least 95% by 2050?
16. Do you have any evidence on the appropriate level of Scotland’s interim emissions reduction targets in 2030 and 2040?
17. In what particular respects do devolved and UK decision making need to be coordinated? How can devolved and UK decision making be coordinated effectively to achieve the best outcomes for the UK as a whole?

## **E. Sector-specific questions**

In developing our analysis and evidence base for past reports (including, most recently, our advice on Net Zero) the Committee has identified a number of evidence gaps in specific emitting sectors of the economy, which are set out as questions below.

Many of the questions below refer specifically to CCC scenarios and analysis developed for the Net Zero advice. Please see the Net Zero [Advice Report](#) and [Technical Report](#) for further details. Chapters and page references are provided in the relevant questions where necessary.

When answering these questions please bear in mind the factors the Committee must consider in our advice on carbon budgets – i.e. the path to the UK’s long-term target objective, international commitments and considerations such as social circumstances (including fuel poverty), competitiveness, energy security and the Government’s fiscal position.

***You do not need to answer all the questions. Please answer only those questions where you have specific expertise and evidence to share.***

**Please limit your answers to 400 words per question and provide supporting evidence (e.g. reference to academic literature, market assessments, policy reports, etc.) along with your responses.**

**Questions:**

18. **Surface transport:** As laid out in Chapter 5 of the Net Zero Technical Report (see page 149), the CCC's Further Ambition scenario for transport assumed 10% of car miles could be shifted to walking, cycling and public transport by 2050 (corresponding to over 30% of trips in total):
- What percentage of trips nationwide could be avoided (e.g. through car sharing, working from home etc.) or shifted to walking, cycling (including e-bikes) and public transport by 2030/35 and by 2050? What proportion of total UK car mileage does this correspond to?
  - What policies, measures or investment could incentivise this transition?
19. **Surface transport:** What could the potential impact of autonomous vehicles be on transport demand?
20. **Surface transport:** The CCC recommended in our Net Zero advice that the phase out of conventional car sales should occur by 2035 at the latest. What are the barriers to phasing out sales of conventional vehicles by 2030? How could these be addressed? Are the supply chains well placed to scale up? What might be the adverse consequences of a phase-out of conventional vehicles by 2030 and how could these be mitigated?
21. **Surface transport:** In our Net Zero advice, the CCC identified three potential options to switch to zero emission HGVs – hydrogen, electrification with very fast chargers and electrification with overhead wires on motorways. What evidence and steps would be required to enable an operator to switch their fleets to one of these options? How could this transition be facilitated?
22. **Industry:** What policy mechanisms should be implemented to support decarbonisation of the sectors below? Please provide evidence to support this over alternative mechanisms.
- Manufacturing sectors at risk of carbon leakage<sup>3</sup>
  - Manufacturing sectors not at risk of carbon leakage
  - Fossil fuel production sectors
  - Off-road mobile machinery
23. **Industry:** What would you highlight as international examples of good policy/practice on decarbonisation of manufacturing and fossil fuel supply emissions? Is there evidence to suggest that these policies or practices created economic opportunities (e.g. increased market shares, job creation) for the manufacturing and fossil fuel supply sectors?

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<sup>3</sup> Carbon leakage occurs if costs of climate policies result in offshoring of production to other countries.

24. **Industry:** How can the UK achieve a just transition in the fossil fuel supply sectors?
25. **Industry:** In our Net Zero advice, the CCC identified a range of resource efficiency measures that can reduce emissions (see Chapter 4 of the Net Zero Technical Report, page 115), but found little evidence relating to the costs/savings of these measures. What evidence is there on the costs/savings of these and other resource efficiency measures (ideally on a £/tCO<sub>2</sub>e basis)?
26. **Buildings:** For the majority of the housing stock in the CCC's Net Zero Further Ambition scenario, 2050 is assumed to be a realistic timeframe for full roll-out of energy efficiency and low-carbon heating:<sup>4</sup>
- a) What evidence can you point to about the potential for decarbonising heat in buildings more quickly?
  - b) What evidence do you have about the role behaviour change could play in driving forward more extensive decarbonisation of the building stock more quickly? What are the costs/levels of abatement that might be associated with a behaviour-led transition?
27. **Buildings:** Do we currently have the right skills in place to enable widespread retrofit and build of low-carbon buildings? If not, where are skills lacking and what are the gaps in the current training framework? To what extent are existing skill sets readily transferable to low-carbon skills requirements?
28. **Buildings:** How can local/regional and national decision making be coordinated effectively to achieve the best outcomes for the UK as a whole? Can you point to any case studies which illustrate successful local or regional governance models for decision making in heat decarbonisation?
29. **Power:** Think of a possible future power system without Government backed Contracts-for-Difference. What business models and/or policy instruments could be used to continue to decarbonise UK power emissions to close to zero by 2050, whilst minimising costs?
30. **Power:** In Chapter 2 of the Net Zero Technical Report we presented an illustrative power scenario for 2050 (see pages 40-41 in particular):
- a) Which low-carbon technologies could play a greater/lesser role in the 2050 generation mix? What about in a generation mix in 2030/35?
  - b) Power from weather-dependent renewables is highly variable on both daily and seasonal scales. [Modelling by Imperial College](#) which informed the illustrative 2050 scenario suggested an important role for interconnection, battery storage and flexible demand in a future low-carbon power system:
    - i. What other technologies could play a role here?
    - ii. What evidence do you have for how much demand side flexibility might be realised?

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<sup>4</sup> For further discussion please see Element Energy and UCL for the CCC (2019) *Analysis on abating direct emissions from 'hard-to-decarbonise' homes, with a view to informing the UK's long term targets*, p88.

31. **Hydrogen:** The Committee has recommended the Government support the delivery of at least one large-scale low-carbon hydrogen production facility in the 2020s. Beyond this initial facility, what mechanisms can be used to efficiently incentivise the production and use of low-carbon hydrogen? What are the most likely early applications for hydrogen?
32. **Aviation and Shipping:** In September 2019 the Committee published [advice to Government on international aviation and shipping and Net Zero](#). The Committee recognises that the primary policy approach for reducing emissions in these sectors should be set at the international level (e.g. through the International Civil Aviation Organisation and International Maritime Organisation). However, there is still a role for supplementary domestic policies to complement the international approach, provided these do not lead to concerns about competitiveness or carbon leakage. What are the domestic measures the UK could take to reduce aviation and shipping emissions over the period to 2030/35 and longer-term to 2050, which would not create significant competitiveness or carbon leakage risks? How much could these reduce emissions?
33. **Agriculture and Land use:** In Chapter 7 of the Net Zero Technical Report we presented our Further Ambition scenario for agriculture and land use (see page 199). The scenario requires measures to release land currently used for food production for other uses, whilst maintaining current per-capita food production. This is achieved through:
- A 20% reduction in consumption of red meat and dairy
  - A 20% reduction in food waste by 2025
  - Moving 10% of horticulture indoors
  - An increase in agriculture productivity:
    - Crop yields rising from the current average of 8 tonnes/hectare for wheat (and equivalent rates for other crops) to 10 tonnes/hectare
    - Livestock stocking density increasing from just over 1 livestock unit (LU)/hectare to 1.5 LU/hectare

Can this increase in productivity be delivered in a sustainable manner?

Do you agree that these are the right measures and with the broad level of ambition indicated? Are there additional measures you would suggest?

34. **Agriculture and Land use:** Land spared through the measures set out in question 33 is used in our Further Ambition scenario for: afforestation (30,000 hectares/year), bioenergy crops (23,000 hectares/year), agro-forestry and hedgerows (~10% of agricultural land) and peatland restoration (50% of upland peat, 25% lowland peat). We also assume the take-up of low-carbon farming practices for soils and livestock. Do you agree that these are the key measures and with the broad level of ambition of each? Are there additional measures you would suggest?

35. **Greenhouse gas removals:** What relevant evidence exists regarding constraints on the rate at which the deployment of engineered<sup>5</sup> GHG removals in the UK (such as bioenergy with carbon capture and storage or direct air capture) could scale-up by 2035?
36. **Greenhouse gas removals:** Is there evidence regarding near-term expected learning curves for the cost of engineered GHG removal through technologies such as bioenergy with carbon capture and storage or direct air capture of CO<sub>2</sub>?
37. **Infrastructure:** What will be the key factors that will determine whether decarbonisation of heat in a particular area will require investment in the electricity distribution network, the gas distribution network or a heat network?
38. **Infrastructure:** What scale of carbon capture and storage development is needed and what does that mean for development of CO<sub>2</sub> transport and storage infrastructure over the period to 2030?

## Question and answer 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 answers to 400 words per question and provide supporting evidence (e.g. academic literature, market assessments, policy reports, etc.) along with your responses.***

### A. Climate science and international circumstances

**Question 1:** The climate science considered in the CCC's 2019 Net Zero report, based on the IPCC Special Report on Global Warming of 1.5°C, will form the basis of this advice. What additional evidence on climate science, aside from the most recent IPCC Special Reports on Land and the Oceans and Cryosphere, should the CCC consider in setting the level of the sixth carbon budget?

ANSWER: The CCC should consider the verified data from companies reporting under frameworks such as CDP[1] and TCFD [2]. Information from these sources will be a valuable method of monitoring the progress of the commercial sector in reducing emissions and mitigating risks from climate change, particularly the financial sector.

[1] <https://www.cdp.net/en>

[2] <https://www.fsb-tcfd.org/>

<sup>5</sup> We consider land-based removals, such as afforestation and peatland restoration, separately in the agriculture and land-use sector.

**Question 2:** How relevant are estimates of the remaining global cumulative CO<sub>2</sub> budgets (consistent with the Paris Agreement long-term temperature goal) for constraining UK cumulative emissions on the pathway to reaching net-zero GHGs by 2050?

ANSWER:

**Question 3:** How should emerging updated international commitments to reduce <sup>6</sup> emissions by 2030 impact on the level of the sixth carbon budget for the UK? Are there other actions the UK should be taking alongside setting the sixth carbon budget, and taking the actions necessary to meet it, to support the global effort to implement the Paris Agreement?

ANSWER: The EU Commission has proposed a net zero target for the EU for 2050, and the UK aligning its decarbonisation trajectory with the EU is a sensible approach. However, if the UK progresses much faster than the EU, there is a risk of carbon leakage to EU countries. We support a target of net zero emissions in the UK in 2050. The CCC states that this is achievable with known technologies and “improvements in people’s lives” and within the expected economic cost that Parliament accepted when it legislated the 2050 target for an 80% reduction from 1990 [1].

The European Green Deal document highlights the risk of carbon leakage from the EU and suggests that a carbon border tax may be needed to ensure that the price of imports reflect their carbon content to ensure that the EU meets the global climate objectives of the Paris Agreement.

UK policy needs to consider whether the UK should take part in any EU carbon border tax in future. If we do not, then the UK industry may be disadvantaged. However, if the UK does join an EU mechanism, then post-Brexit trade deals with other parts of the world could be more difficult to agree.

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[1] EU Commission, The European Green Deal, December 2019  
[https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1\\_0002.02/DOC\\_1&format=PDF](https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1_0002.02/DOC_1&format=PDF)

**Question 4:** What is the international signalling value of a revised and strengthened UK NDC (for the period around 2030) as part of a package of action which includes setting the level of the sixth carbon budget?

ANSWER: The strongest signal is a set of policies that will drive decarbonisation and meet the 4th and 5th carbon budgets. Whilst a stronger commitment would be a welcome signal, if it is not backed up by effective policies it could be seen as an empty gesture and potentially discourage other countries from setting policies to meet their own targets.

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It is important to signal that the UK is committed to reducing emissions within the UK, not through shifting industrial activity to other countries. CO2 emissions peaked in the UK in 1972, but when we consider imported emissions, they peaked in 2007 (the biggest source of imported emissions was China, followed by the EU).

A commitment to avoid carbon leakage is essential. There is a need to consider the potential imposition of a European carbon border tax, and the particular difficulties of the UK implementing this post-Brexit, given the need to agree trade deals with other parts of the world. Carbon leakage is a particularly acute problem for the UK[1].

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[1] Office for National Statistics, The decoupling of economic growth from carbon emissions: UK evidence <https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/compendium/economicreview/october2019/thedecouplingofeconomicgrowthfromcarbonemissionsukevidence>

## B. The path to the 2050 target

**Question 5:** How big a role can consumer, individual or household behaviour play in delivering emissions reductions? How can this be credibly assessed and incentivised?

**ANSWER:** Changing domestic heating to low carbon alternatives will be an important policy initiative to achieve the target. However, energy emissions in this sector rose by 4% in 2017-18 [1].

There is currently a lack of information available to consumers on the alternatives to natural gas and the response from consumers to incentives to switch to low carbon alternatives is uncertain. The latest BEIS Public Attitudes Tracker (February 2020) [4] shows that with the exception of solar thermal panels, public awareness of alternative renewable heating systems is relatively low. In December 2019, awareness of renewable heating systems stood at 57%, a slight increase from 52% in December 2018. However, over the longer term, awareness has declined from a high point of 78% in December 2013.

Among owner-occupiers who had heard of renewable heat measures but who did not want to install one, the most common barrier was cost (39%), followed by lack of knowledge about how these systems work (17%) [4].

Consumers are buying new gas boilers at a rate of over 1 million a year[1]; in 2019, a record 1.67 million gas boilers were sold[2]. In December 2019, those reporting that they had a condensing boiler reached a peak of 59%, up from 51% in December 2018 [4]. In contrast, only 53,000 heat pumps have been installed to date[3].

- A low carbon industrial product mark would provide the public sector and other larger consumers with the information to make greener procurement choices.
- A regulation requiring all new boilers to be hydrogen ready could see rapid uptake. Since condensing boilers were mandated in 2005, uptake has averaged 1.2 million per annum.[4] This would make a future hydrogen switchover far easier.

Aviation consumers cannot currently make informed choices on flight carbon emissions because this information is not available when purchasing airline tickets. One way to achieve this is the development of an A-F rating on flights available when flights are published.

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[1] [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/863325/2018-final-emissions-statistics-summary.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/863325/2018-final-emissions-statistics-summary.pdf)

English Housing Survey 2017-18, Annex Table 2.10  
<https://www.gov.uk/government/statistics/english-housing-survey-2017-to-2018-headline-report>

[2] Energy and Utilities Alliance data, see  
<https://www.eua.org.uk/record-boiler-sales-show-how-decarbonisation-will-work/>

[3] Energy and Utilities Alliance, Economic Report, October 2019

[4] <https://www.gov.uk/government/statistics/beis-public-attitudes-tracker-wave-32>

**Question 6:** What are the most important uncertainties that policy needs to take into account in thinking about achieving Net Zero? How can government develop a strategy that helps to retain robustness to those uncertainties, for example low-regrets options and approaches that maintain optionality?

**ANSWER:** An important uncertainty is consumer responsiveness to incentives for changes in transport and domestic heating. For example, the uncertainty of consumer acceptance of decarbonised heating systems, including 100% hydrogen in the home.

In certain regions, biomethane and hybrid heating systems may have the potential to play a large role. In others, hydrogen in the home may be a more effective way to decarbonise. Understanding the potential for different behavioural changes in different regions is therefore important.

Another key uncertainty is the lack of verification in carbon offsetting schemes. Offsetting is seen as a solution in some sectors (for example the CORSIA initiative in aviation). The CORSIA scheme seeks to neutralise growth, rather than reduce emissions. There is little evidence that offsetting schemes work. Although not specific to the aviation industry, an EU study in 2017 found that 85 percent of offset projects overestimated their impact or failed to reduce carbon emissions at all [1].

A net zero target reduces uncertainty because all sectors need to decarbonise. Under the previous 2050 target of 80%, there was ambiguity in what was included in the 80%.

We know that negative emissions are needed to achieve net zero, which requires carbon capture and storage (CCS) to be developed. Negative emissions can provide a level of insurance against other decarbonisation measures during the sixth carbon budget. Whilst negative emissions technologies should not replace required mitigation measures, they can be deployed from the late 2020s to help meet future carbon budgets and the net-zero 2050 target.

To tackle uncertainties, a minister for net zero may be a sensible approach, rather than responsibility being spread between different departments competing for resources.

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[1] [https://ec.europa.eu/commission/sites/beta-political/files/report-functioning-carbon-market\\_en.pdf](https://ec.europa.eu/commission/sites/beta-political/files/report-functioning-carbon-market_en.pdf)

**Question 7:** The fourth and fifth carbon budgets (covering the periods of 2023-27 and 2028-32 respectively) have been set on the basis of the previous long-term target (at least 80% reduction in GHGs by 2050, relative to 1990 levels). Should the CCC revisit the level of these budgets in light of the net-zero target?

**ANSWER:** The UK is currently off track to meet the existing Fourth and Fifth Carbon Budgets, so the most important action is to put policies in place to meet those targets and to put the UK on a cost-effective trajectory to 2050 – whatever the level of the next two carbon budgets.

However, if the Fourth and Fifth Carbon Budgets are updated with more ambitious reduction targets, it would have two beneficial effects:

- It would push the government to recognise that the UK is currently off track to meet net zero and that faster progress is needed.
- It would make it more difficult for the carbon budgets to be met by carrying forward overachievement from the earlier carbon budgets – and therefore require the government to implement necessary policies.

**Question 8:** What evidence do you have of the co-benefits of acting on climate change compatible with achieving Net Zero by 2050? What do these co-benefits mean for which emissions abatement should be prioritised and why?

ANSWER: The potential global market in low carbon industrial goods and services could be very large:

The Hydrogen Council roadmap envisages the global hydrogen market reaching £1.9 trillion a year by 2050, creating jobs for 30 million people.[1]

The future global CCS market is estimated to be around £100bn/year,[2] with 11Gt CO<sub>2</sub> needing to be permanently stored by 2060 to meet Paris Agreement emissions reduction targets.

The UK will have an opportunity to earn export revenue from manufacturing hydrogen technologies; storing CO<sub>2</sub> on behalf of other countries and/or through capturing and storing CO<sub>2</sub> from industrial processes and then exporting the low carbon products; and exporting renewable hydrogen.

Many of the jobs in these sectors would be in less affluent regions, including in the main industrial clusters in the North West, North East, Humber, South Wales and parts of Scotland. A recent Summit Power report found that developing a network of CCS projects along the East Coast of the UK, capturing 75 million tonnes of CO<sub>2</sub> per year, would provide £163 billion of economic benefits and 225,000 jobs, cumulatively, through to 2060.[3]

The UK may become more attractive to investors given recent announcements from major investors on the shift to green investment. Several large institutional investors, such as Aviva Investors, are making significant investments in this area, recognising growing demand from their investors, including from overseas [4].

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[1] Hydrogen Council, Hydrogen scaling up, November 2017, p.8 and p.20  
[http://hydrogencouncil.com/wp-content/uploads/2017/11/Hydrogen-Scaling-up\\_Hydrogen-Council\\_2017\\_compressed.pdf](http://hydrogencouncil.com/wp-content/uploads/2017/11/Hydrogen-Scaling-up_Hydrogen-Council_2017_compressed.pdf)

[2] HM Government, Clean Growth Strategy, October 2017, p.69  
<https://www.gov.uk/government/publications/clean-growth-strategy>

[3] Summit Power, Clean Air – Clean Industry – Clean Growth: How Carbon Capture Will Boost the UK Economy: East Coast UK Carbon Capture and Storage Investment Study, October 2017  
<http://www.ccsassociation.org/news-and-events/reports-and-publications/clean-air-clean-industry-clean-growth/>

[4]<https://www.avivainvestors.com/en-gb/about/company-news/2019/09/aviva-investor-launches-energy-transition-themed-fund/>

## C. Delivering carbon budgets

**Question 9:** Carbon targets are only credible if they are accompanied by policy action. We set out a range of delivery challenges/priorities for the 2050 net-zero target in our Net Zero advice. What else is important for the period out to 2030/2035?

ANSWER: We would highlight the following issues:

**Infrastructure:** Sufficient infrastructure will need to be built to encourage behaviour change. For example, to encourage a major switch from diesel to hydrogen in commercial vehicles, a national network of hydrogen fuelling stations will need to be comprehensive enough to provide national coverage.

Improving public transport, especially rail links between cities, is important so that it provides a viable alternative to road and air for both freight and passengers..

**Air pollution:** Air pollution is an important consideration, especially in UK city centres and this pollution is mainly from road transport [1]. Introducing alternatives from fuels such as diesel as soon as possible will be an important benefit.

**Less dependence on imported fuels:** In 2017 UK imports of energy were almost twice as large as its exports. Net imports made up 36% of UK energy needs. Gas and oil make up around 90% of energy imports [2].

**Affordability and security:** Fuel poverty should not be exacerbated by a move to net zero. At present, a household in England is 50% more likely to be in fuel poverty if it does not have a gas grid connection [3] and in Scotland, a household is almost twice as likely to be in fuel poverty if it is off the gas grid[4]. Moving to net zero should provide an opportunity to eradicate fuel poverty.

**Energy literacy:** An improvement in energy literacy in the general public is essential.

**Urgent policy support:** The majority of decarbonisation will require policy support to implement. There is a risk that the government may be slow to introduce the policies necessary to reach both a 2050 and 2030/35 target.

[1] <https://tfl.gov.uk/corporate/about-tfl/air-quality?cid=air-quality>

[2] <https://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN04046>

[3] BEIS, Fuel poverty statistics: Detailed tables 2016, Published June 2018, Table 10  
<https://www.gov.uk/government/statistics/fuel-poverty-detailed-tables-2018>

[4] Scottish house condition survey: 2017, Table 36  
<https://www.gov.scot/publications/scottish-house-condition-survey-2017-key-findings/pages/6/>

**Question 10:** How should the Committee take into account targets/ambitions of UK local areas, cities, etc. in its advice on the sixth carbon budget?

**ANSWER:** In our experience there is a lack of consistency in the definition and approach between regions and local authorities in the UK. For example, cities like Nottingham have committed to being net zero by 2028, but others are at an early stage of developing a net zero strategy.

**Question 11:** Can impacts on competitiveness, the fiscal balance, fuel poverty and security of supply be managed regardless of the level of a budget, depending on how policy is designed and funded? What are the critical elements of policy design (including funding and delivery) which can help to manage these impacts?

ANSWER:

**Question 12:** How can a just transition to Net Zero be delivered that fairly shares the costs and benefits between different income groups, industries and parts of the UK, and protects vulnerable workers and consumers?

ANSWER Energy intensive industries contribute £140 billion in economic value added and employ over 1.1 million people.[1] They are often located in less affluent regions and are the largest employer in the area. Their products are key to other industries – for example, the UK’s pharmaceutical industry depends on products made by the chemical industry, which in turn depends on natural gas as a feedstock; the UK’s agriculture relies on fertiliser made in plants such as Ince; and the UK’s water industry relies on chlorine made in Runcorn.

A just transition needs these foundation industries to stay in the UK, not only to protect jobs in those industries but also to support other sectors, as highlighted above, who would likely see costs rise if they had to rely solely on imports. As noted earlier, a carbon border tax would help, but could be difficult to implement post-Brexit.

A just transition is also essential to protect the 250,000 jobs that rely on oil and gas production,[2] through, for example, ensuring sufficient natural gas production to provide hydrogen at scale, and through energy integration programmes that bring together oil and gas assets with offshore wind, hydrogen and CO2 transport and storage.[3]

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[1] BEIS analysis using the ONS Annual Business Survey

[2] Oil & Gas UK, Economic Report, 2019  
<https://oilandgasuk.co.uk/wp-content/uploads/2019/09/Economic-Report-2019-OGUK.pdf> ,

[3] Oil and Gas Authority, UKCS Energy Integration: Interim findings, December 2019  
<https://www.ogauthority.co.uk/news-publications/publications/2019/ukcs-energy-integration-interim-findings/>

## D. Scotland, Wales and Northern Ireland

**Question 13:** What specific circumstances need to be considered when recommending an emissions pathway or emissions reduction targets for Scotland, Wales and/or Northern Ireland, and how could these be reflected in our advice on the UK-wide sixth carbon budget?

ANSWER:

**Question 14:** The Environment (Wales) Act 2016 includes a requirement that its targets and carbon budgets are set with regard to:

- The most recent report under section 8 on the State of Natural Resources in relation to Wales;
- The most recent Future Trends report under section 11 of the Well-Being of Future Generations (Wales) Act 2015;
- The most recent report (if any) under section 23 of that Act (Future Generations report).
  - a) What evidence should the Committee draw on in assessing impacts on sustainable management of natural resources, as assessed in the state of natural resources report?
  - b) What evidence do you have of the impact of acting on climate change on well-being? What are the opportunities to improve people's well-being, or potential risks, associated with activities to reduce emissions in Wales?
  - c) What evidence regarding future trends as identified and analysed in the future trends report should the Committee draw on in assessing the impacts of the targets?
  - d) Question 12 asks how a just transition to Net Zero can be achieved across the UK. Do you have any evidence on how delivery mechanisms to help meet the UK and Welsh targets may affect workers and consumers in Wales, and how to ensure the costs and benefits of this transition are fairly distributed?

ANSWER:

**Question 15:** Do you have any further evidence on the appropriate level of Wales' third carbon budget (2026-30) and interim targets for 2030 and 2040, on the path to a reduction of at least 95% by 2050?

ANSWER:

**Question 16:** Do you have any evidence on the appropriate level of Scotland's interim emissions reduction targets in 2030 and 2040?

ANSWER:

**Question 17:** In what particular respects do devolved and UK decision making need to be coordinated? How can devolved and UK decision making be coordinated effectively to achieve the best outcomes for the UK as a whole?

ANSWER:

## E. Sector-specific questions

**Question 18 (Surface transport):** As laid out in Chapter 5 of the Net Zero Technical Report (see page 149), the CCC's Further Ambition scenario for transport assumed 10% of car miles could be shifted to walking, cycling and public transport by 2050 (corresponding to over 30% of trips in total):

- a) What percentage of trips nationwide could be avoided (e.g. through car sharing, working from home etc.) or shifted to walking, cycling (including e-bikes) and public transport by 2030/35 and by 2050? What proportion of total UK car mileage does this correspond to?
- b) What policies, measures or investment could incentivise this transition?

ANSWER:

**Question 19 (Surface transport):** What could the potential impact of autonomous vehicles be on transport demand?

ANSWER:

**Question 20 (Surface transport):** The CCC recommended in our Net Zero advice that the phase out of conventional car sales should occur by 2035 at the latest. What are the barriers to phasing out sales of conventional vehicles by 2030? How could these be addressed? Are the supply chains well placed to scale up? What might be the adverse consequences of a phase-out of conventional vehicles by 2030 and how could these be mitigated?

ANSWER:

The most important barrier to reducing travel by car is inadequate public transport for most people's needs. The average distance travelled by car across all English regions is approximately 10 miles [1]. The government should develop radical policies to reduce the demand for cars by ensuring that public transport and cycling are viable alternatives, especially for short distances.

Home working should also be encouraged by improved broadband and tax incentives to reduce commuting.

The key barriers to phasing out conventional car sales in favour of electric cars by 2030 is whether sufficient materials exist for batteries:

Global reserves of Cobalt, 52% of which are in the Democratic Republic of Congo, are 6.6 million tonnes, which is equal to 42 years of 2018 global production [2]. But Cobalt production for EVs will expand rapidly.

A recent EU Commission report concluded: "Worldwide, demand is already perceived to exceed supply in 2020 and such a loss making trend is expected to become more consistent from 2025 on. In the EU, although the capacity to meet rising demand is projected to increase through mining and recycling activities, there is an increasing gap

between endogenous supply and demand.” [3] Cobalt availability may therefore affect the pace of EV rollout.

In addition, impacts on the electricity network of widespread EV ownership will be very dependent on the successful roll out of smart charging.

To address these barriers, developing infrastructure for hydrogen and biomethane refuelling can help to manage pressures on materials availability and electricity networks, by ensuring a balanced roll out of low and zero emission vehicles.

[1] <https://www.racfoundation.org/motoring-faqs/mobility>

[2]BP, Statistical Review of World Energy, 2019  
<https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>

[3] EU Commission, Cobalt: demand-supply balances in the transition to electric mobility, 2018  
[https://publications.jrc.ec.europa.eu/repository/bitstream/JRC112285/jrc112285\\_cobalt.pdf](https://publications.jrc.ec.europa.eu/repository/bitstream/JRC112285/jrc112285_cobalt.pdf)

**Question 21 (Surface transport):** In our Net Zero advice, the CCC identified three potential options to switch to zero emission HGVs – hydrogen, electrification with very fast chargers and electrification with overhead wires on motorways. What evidence and steps would be required to enable an operator to switch their fleets to one of these options? How could this transition be facilitated?

ANSWER:

**Question 22 (Industry):** What policy mechanisms should be implemented to support decarbonisation of the sectors below? Please provide evidence to support this over alternative mechanisms.

- a) Manufacturing sectors at risk of carbon leakage
- b) Manufacturing sectors not at risk of carbon leakage
- c) Fossil fuel production sectors
- d) Off-road mobile machinery

ANSWER:

**Question 23 (Industry):** What would you highlight as international examples of good policy/practice on decarbonisation of manufacturing and fossil fuel supply emissions? Is there evidence to suggest that these policies or practices created economic opportunities

(e.g. increased market shares, job creation) for the manufacturing and fossil fuel supply sectors?

ANSWER:

**Question 24 (Industry):** How can the UK achieve a just transition in the fossil fuel supply sectors?

ANSWER:

A Just Transition is essential to protect the 250,000 jobs that rely on oil and gas production [1]. There are a number of ways that this can be achieved:

#### **CCS:**

- A recent Summit Power report found that developing a network of CCS projects along the East Coast of the UK, capturing 75 million tonnes of CO<sub>2</sub> per year, would provide £163 billion of economic benefits and 225,000 jobs, cumulatively, through to 2060 [2].
- The UK has more than 100 years of CO<sub>2</sub> storage capacity [3], and can make use of oil and gas industry expertise.
- The future global CCS market is estimated to be around £100bn/year [4], with 11Gt CO<sub>2</sub> needing to be permanently stored by 2060 to meet Paris Agreement emissions reduction targets. The UK can also create jobs through storing CO<sub>2</sub> on behalf of other countries and/or through capturing and storing CO<sub>2</sub> from industrial processes and then exporting the low carbon products.

#### **Hydrogen:**

- Offshore hydrogen production from wind, piping the hydrogen to shore, and from production of hydrogen from methane by the coast, with the resulting CO<sub>2</sub> emissions transported and stored, are both viable options.
- The Hydrogen Council roadmap envisages the global hydrogen market reaching £1.9 trillion a year by 2050, creating jobs for 30 million people [5].

#### **Energy integration**

- Overall, considerable work is underway to investigate the potential for offshore energy integration programmes that bring together oil and gas assets with offshore wind, hydrogen and CO<sub>2</sub> transport and storage [6]. This work is extremely important for all offshore sectors.
- Ensuring sufficient natural gas and offshore wind production to provide cost-effective hydrogen at scale will also be essential.

[1] Oil & Gas UK, Economic Report, 2019

<https://oilandgasuk.co.uk/wp-content/uploads/2019/09/Economic-Report-2019-OGUK.pdf> ,

[2] Summit Power, Clean Air – Clean Industry – Clean Growth: How Carbon Capture Will Boost the UK Economy: East Coast UK Carbon Capture and Storage Investment Study, October 2017

<http://www.ccsassociation.org/news-and-events/reports-and-publications/clean-air-clean-industry-clean-growth/>

[3] Energy Technologies Institute, Pale Blue Dot, Costain and Axis, Progressing Development of the UK's Strategic Carbon Dioxide Storage Reserve: A Summary of Results from the Strategic UK CO<sub>2</sub> Storage Appraisal Project, April 2016 <http://www.eti.co.uk/project/strategic-uk-ccs-storage-appraisal/>

[4] HM Government, Clean Growth Strategy, October 2017, p.69  
<https://www.gov.uk/government/publications/clean-growth-strategy>

[5] Hydrogen Council, Hydrogen scaling up, November 2017, p.8 and p.20  
[http://hydrogencouncil.com/wp-content/uploads/2017/11/Hydrogen-Scaling-up\\_Hydrogen-Council\\_2017\\_compressed.pdf](http://hydrogencouncil.com/wp-content/uploads/2017/11/Hydrogen-Scaling-up_Hydrogen-Council_2017_compressed.pdf)

[6] Oil and Gas Authority, UKCS Energy Integration: Interim findings, December 2019  
<https://www.ogauthority.co.uk/news-publications/publications/2019/ukcs-energy-integration-interim-findings/>

**Question 25 (Industry):** In our Net Zero advice, the CCC identified a range of resource efficiency measures that can reduce emissions (see Chapter 4 of the Net Zero Technical Report, page 115), but found little evidence relating to the costs/savings of these measures. What evidence is there on the costs/savings of these and other resource efficiency measures (ideally on a £/tCO<sub>2</sub>e basis)?

ANSWER:

**Question 26 (Buildings):** For the majority of the housing stock in the CCC's Net Zero Further Ambition scenario, 2050 is assumed to be a realistic timeframe for full roll-out of energy efficiency and low-carbon heating.

- a) What evidence can you point to about the potential for decarbonising heat in buildings more quickly?
- b) What evidence do you have about the role behaviour change could play in driving forward more extensive decarbonisation of the building stock more quickly? What are the costs/levels of abatement that might be associated with a behaviour-led transition?

ANSWER:

**Question 27 (Buildings):** Do we currently have the right skills in place to enable widespread retrofit and build of low-carbon buildings? If not, where are skills lacking and what are the gaps in the current training framework? To what extent are existing skill sets readily transferable to low-carbon skills requirements?

ANSWER:

**Question 28 (Buildings):** How can local/regional and national decision making be coordinated effectively to achieve the best outcomes for the UK as a whole? Can you point to any case studies which illustrate successful local or regional governance models for decision making in heat decarbonisation?

ANSWER: As part of its Advancing Net Zero Programme, the UK Green Buildings Council (UKGBC) convened an industry task group in October 2018 to develop a definition for net

zero carbon buildings in the UK. The task group consisted of representatives from 37 businesses from across the building value chain and from 13 trade associations, professional institutions and non-profit organisations.

In April 2019, UKGBC has developed a framework [1] with two definitions for net zero carbon buildings – one for in-use operational energy and one for emissions from the construction process – which should be adopted by all organisations involved in the built environment. The framework is initially intended to act as guidance, with tighter standards and targets developed over time in order to drive further action and accelerate change. UKGBC recognises that this is a complex and emerging discipline for built environment professionals and everyone associated with the design, construction and operation of buildings are encouraged to engage with the framework, and to work with UKGBC in evolving the details.

[1] Net Zero Carbon Buildings: A Framework Definition

<https://www.ukgbc.org/wp-content/uploads/2019/04/Net-Zero-Carbon-Buildings-A-framework-definition.pdf>

**Question 29 (Power):** Think of a possible future power system without Government backed Contracts-for-Difference. What business models and/or policy instruments could be used to continue to decarbonise UK power emissions to close to zero by 2050, whilst minimising costs?

ANSWER:

**Question 30 (Power):** In Chapter 2 of the Net Zero Technical Report we presented an illustrative power scenario for 2050 (see pages 40-41 in particular):

- a) Which low-carbon technologies could play a greater/lesser role in the 2050 generation mix? What about in a generation mix in 2030/35?
- b) Power from weather-dependent renewables is highly variable on both daily and seasonal scales. Modelling by Imperial College which informed the illustrative 2050 scenario suggested an important role for interconnection, battery storage and flexible demand in a future low-carbon power system:
  - i. What other technologies could play a role here?
  - ii. What evidence do you have for how much demand side flexibility might be realised?

ANSWER:

**Question 31 (Hydrogen):** The Committee has recommended the Government support the delivery of at least one large-scale low-carbon hydrogen production facility in the 2020s. Beyond this initial facility, what mechanisms can be used to efficiently incentivise the

production and use of low-carbon hydrogen? What are the most likely early applications for hydrogen?

ANSWER:

**Question 32 (Aviation and Shipping):** In September 2019 the Committee published advice to Government on international aviation and shipping and Net Zero. The Committee recognises that the primary policy approach for reducing emissions in these sectors should be set at the international level (e.g. through the International Civil Aviation Organisation and International Maritime Organisation). However, there is still a role for supplementary domestic policies to complement the international approach, provided these do not lead to concerns about competitiveness or carbon leakage. What are the domestic measures the UK could take to reduce aviation and shipping emissions over the period to 2030/35 and longer-term to 2050, which would not create significant competitiveness or carbon leakage risks? How much could these reduce emissions?

ANSWER: Air travel emissions represent a major portion of the total carbon footprint of the professional services sector in the UK, so this sector has immense buying power to drive progress. As the clients of professional services firms set science-based carbon reduction targets, they will look to increase the sustainability of their own supply chain, which includes their management consulting and legal experts. In addition, investors are increasingly asking firms to disclose their carbon impact.

Our work with professional services firms has highlighted that there is a data transparency issue that is preventing businesses and individuals from being able to choose to fly on low-carbon flights.

Mandating a carbon-ranking system would make it easier for people to know the carbon performance of airlines, this would be useful at contracting stage. However, there are currently several challenges to providing accurate data. Air travel emissions can vary significantly, depending on several factors – aircraft type, seat class, load, route etc. Therefore, there is a need for a more supplier-specific reporting methodology that is standardised and comparable.

Businesses currently rely on the UK government's average emission factors to calculate the carbon impact of their flights. Average emissions factors such as those published annually by DEFRA will become irrelevant as more aircraft rely on biofuels and planes become hybrid-electric.

“Flight shaming” has highlighted the problem of carbon emissions from aviation and policy initiatives are likely to be popular with the public. According to the DfT, 1% of the UK population took 20% of flights in 2018 and 10% of the most frequent flyers took more than 50% of flights [1]. For example, a frequent flyer levy under which each citizen would be allowed one tax-free flight per year but would pay progressively higher taxes on each additional flight taken would send a powerful signal and discourage frequent air travel.

Another important consideration by the government is the need to improve the rail network in the UK between cities. A recent study by the international Union of Railways in 2016 showed that when the infrastructure carbon footprint is added to the CO<sub>2</sub> emissions from

the operation of the train, the rail sector remains competitive with cars and trains. As electrification increases, and the carbon intensity of electricity improves, CO2 emissions of trains can be close to zero [1]. Electrification and modernisation of the railway system, including the development of hybrid trains, must be promoted by government action as soon as possible, so that rail travel becomes the preferred alternative to domestic flights.

[1]<https://www.theguardian.com/environment/2019/sep/25/1-of-english-residents-take-one-fifth-of-overseas-flights-survey-shows>

[2]Carbon footprint of railway infrastructure, June 2016  
[https://uic.org/IMG/pdf/carbon\\_footprint\\_of\\_railway\\_infrastructure.pdf](https://uic.org/IMG/pdf/carbon_footprint_of_railway_infrastructure.pdf)

**Question 33 (Agriculture and Land use):** In Chapter 7 of the Net Zero Technical Report we presented our Further Ambition scenario for agriculture and land use (see page 199). The scenario requires measures to release land currently used for food production for other uses, whilst maintaining current per-capita food production. This is achieved through:

- A 20% reduction in consumption of red meat and dairy
- A 20% reduction in food waste by 2025
- Moving 10% of horticulture indoors
- An increase in agriculture productivity:
  - Crop yields rising from the current average of 8 tonnes/hectare for wheat (and equivalent rates for other crops) to 10 tonnes/hectare
  - Livestock stocking density increasing from just over 1 livestock unit (LU)/hectare to 1.5 LU/hectare

Can this increase in productivity be delivered in a sustainable manner?

Do you agree that these are the right measures and with the broad level of ambition indicated? Are there additional measures you would suggest?

**ANSWER:**

**Question 34 (Agriculture and Land use):** Land spared through the measures set out in question 33 is used in our Further Ambition scenario for: afforestation (30,000 hectares/year), bioenergy crops (23,000 hectares/year), agro-forestry and hedgerows (~10% of agricultural land) and peatland restoration (50% of upland peat, 25% lowland peat). We also assume the take-up of low-carbon farming practices for soils and livestock. Do you agree that these are the key measures and with the broad level of ambition of each? Are there additional measures you would suggest?

ANSWER:

**Question 35 (Greenhouse gas removals):** What relevant evidence exists regarding constraints on the rate at which the deployment of engineered GHG removals in the UK (such as bioenergy with carbon capture and storage or direct air capture) could scale-up by 2035?

ANSWER:

**Question 36 (Greenhouse gas removals):** Is there evidence regarding near-term expected learning curves for the cost of engineered GHG removal through technologies such as bioenergy with carbon capture and storage or direct air capture of CO<sub>2</sub>?

ANSWER:

**Question 37 (Infrastructure):** What will be the key factors that will determine whether decarbonisation of heat in a particular area will require investment in the electricity distribution network, the gas distribution network or a heat network?

ANSWER:

**Question 38 (Infrastructure):** What scale of carbon capture and storage development is needed and what does that mean for development of CO<sub>2</sub> transport and storage infrastructure over the period to 2030?

ANSWER: