

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 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 CO₂ 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.¹

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.

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.

¹ In scenarios that reach global net-zero emissions for all GHGs (including methane and nitrous oxide emissions as well as CO₂) 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).

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 CO₂ budgets (consistent with the Paris Agreement long-term temperature goal²) 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 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.

² Remaining CO₂ budgets incorporate the effect of future emissions of non-CO₂ greenhouse gases and other climate pollutants such as aerosols.

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 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):
 - 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?
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 leakage³
 - 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?
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 £/tCO₂e 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:⁴
- What evidence can you point to about the potential for decarbonising heat in buildings more quickly?

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

⁴ 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.

- 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?
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 engineered⁵ 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 CO₂?

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 CO₂ transport and storage infrastructure over the period to 2030?

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

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:

Question 2: How relevant are estimates of the remaining global cumulative CO₂ 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 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:

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:

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:

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:

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:

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:

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:

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:

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:

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:

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:

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 £/tCO₂e 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:

An estimated 70-80% of buildings that will be standing in 2050 have already been built. There will be a need to address challenges which exist in relation to knowledge and skills particularly for traditional (pre-1919) buildings. In order to ensure measures are appropriate to a diverse range of building types, a good level of understanding about how these building types work and how they react to different energy efficiency improvements is important to ensure measures are not going to cause long term damage to a building. A lack of knowledge at all stages of the planning, specifying and installation of energy efficiency measures may prove a barrier to meeting carbon targets. To increase skills, companies must look beyond simply training in the installation of one system or product and enhance their knowledge of different building types and how they may be improved. There is a real risk to traditional buildings from a 'one size fits all' approach, where a company can only work with one system and will install that to all building types, which may harm the character or special interest of these assets. There is a lack of specific assistance for traditional buildings or designated historic assets.

Work ongoing in Scotland to address the skills gap is summarised in the following:

Establishing the need for Traditional Skills:

<https://www.historicenvironment.scot/media/2236/establishtraditionalskills.pdf>

Traditional Building Skills: A strategy for sustaining and developing traditional building skills in Scotland.

<https://www.historicenvironment.scot/media/3359/traditionalbuildingskills.pdf>

Skills Investment Plan for Scotland's historic environment sector

<https://www.skillsdevelopmentscotland.co.uk/media/45467/historic-environment-sip.pdf>

Historic Environment Scotland is planning to deliver the following course leading to a Level 3 Award in Energy Efficiency Measures for Older and Traditional Buildings, at the Engine Shed, Scotland's Building Conservation Centre in Stirling. This will help to address skills for retrofit in traditional buildings: <https://www.sqa.org.uk/sqa/84013.html>. It is expected that this course will become mandatory for those working on EES (Energy Efficient Scotland) schemes.

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:

The Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act 2019 which set a target, in law, of no more than 5% of Scottish households being in fuel poverty by 2040 and includes challenging interim targets and the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 each set ambitious targets - to eliminate poor energy efficiency as a driver of fuel poverty, and to end Scotland's contribution to climate change by reaching net zero emissions by 2045. <https://www.gov.scot/publications/energy-efficient-scotland-improving-energy-efficiency-owner-occupied-homes/pages/6/>. Improving the energy efficiency of Scotland's buildings has been a national infrastructure priority since 2015. In May 2018, Scottish Ministers published a Route Map to an Energy Efficient Scotland, setting out a pathway to 2040 to make our buildings warmer, greener and more energy efficient.

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?

National and regional authorities should collaborate on best practice; our Short Guide on Energy Efficiency in Traditional Buildings is a good example of this

<https://www.historicenvironment.scot/archives-and-research/publications/publication/?publicationId=179c1909-3679-4486-9583-a59100fa98c1>.

Historic Environment Scotland works closely with CADW (the Welsh Government's historic environment service) on skills and this is a good example of devolved governments working together.

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:

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: Farmers and land managers should be incentivised for land management practices which safeguard public goods including the historic environment.

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 CO₂?

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 CO₂ transport and storage infrastructure over the period to 2030?

ANSWER: