Committee on Climate Change

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

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 CO_2 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 CO_2) 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 CO_2 budgets (consistent with the Paris Agreement long-term temperature goal[2]) 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 CO_2 budgets incorporate the effect of future emissions of non-CO_2 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. 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):

    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.
    a) Manufacturing sectors at risk of carbon leakage[3]
    b) Manufacturing sectors not at risk of carbon leakage
    c) Fossil fuel production sectors
    d) 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]
    a) 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 engineered[5] 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_2?

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_2 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 CO_2 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: Consumer behaviour, either at an individual or household level, is a central driver of demand for goods and services. Changes in behaviour are essential to both reducing demand for high-emission goods and services and adopting low-emission technologies. It should be noted that individuals from lower-income groups often have less

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?

choice about issues which affect emissions, such as their location of work or residence, ability to work remotely, or access multiple travel options.

Consumption data for electricity, petrol, diesel and natural gas usage are good indicators of the collective impact of individual choices. Planning data, such as demographic change, the location, form and volume of development, and travel patterns, provide a valuable spatial context to where change is occurring.

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: Consumer behaviour lies at the heart of policy uncertainty. Market driven methods, which depend on bottom-up changes to individual consumer choices, are slow and may not yield the scale of change required in the time allowed. There is a natural wish to maintain the broadest set of options for consumers, however it cannot be constructive to maintain options which do not contribute to the net zero.

The government therefore has a role in top-down directives which can preserve consumer choice, within a band of options which are compatible with achieving net zero. One example is banning the sales of petrol and diesel vehicles after 2040. However, the number of options must fall necessarily as the deviation grows between the net zero trajectory and actual emissions. Unfortunately, the government is also guilty of contradictory policies: for example by spending far more on the road network than active and local public transport[6].

More coherent action across all Government ministries would be the best way to ensure changes in consumer behaviour in the shortest possible time, through coherent, integrated and well-planned measures. In this respect, strategy should recognise the critical role of spatial planning in enabling a place-based approach to decarbonisation, which is informed by local circumstances and can identify low-regret options and approaches. There are a number of mechanisms within the planning process that can achieve this objective, including:

- The plan-making process which can direct development towards locations which can be served by sustainable transport and energy networks, and identify the infrastructure needed to enable growth while reducing carbon emissions

- The development management process, which can influence designs to reduce heat, cooling and power demand through orientation, shading, onsite technologies and fabric requirements, and which has the regulatory power to prevent development which does not comply with planning policy and building standards for carbon reduction

[6] For example, see: assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/856146/tsgb-2019.pdf

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?

- The use of planning obligations and conditions which secure financial contributions for measures to reduce carbon emissions, such as public and active transport infrastructure, electric vehicle charging points, green infrastructure, and low/zero carbon on-site energy generation)

- The ability of planning to proactively bring together the diverse range of stakeholders who are needed to make change happen, including local communities, infrastructure providers, businesses and investors, and engage in a broader conversation about climate action

A robust and resilient strategy for decarbonisation is therefore dependent on appropriate powers and resources being devolved to strategic and local planning authorities, who can implement national priorities through plans, policies and governance arrangements. Further information on low-regret options that deliver co-benefits are outlined in Q8.

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: Yes – this is needed to ensure that local action is sufficiently ambitious.

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 RTPI has produced an evidence base to summarise the multiple co-benefits that can be achieved through planning compact settlements with higher levels of residential and transport density. These include reduced transport emissions through modal shift and reduced energy emissions through support for district heat, along with wider benefits which include improved physical and mental health, improved economic productivity through agglomeration, reduced air pollution, and the ability to protect open land for biodiversity, carbon sequestration, flood mitigation, agriculture and recreation[7].

The range of co-benefits indicates that planning compact settlement patterns should be prioritised as a low-regrets abatement option. However, it is important to deliver complementary measures. These include improved street connectivity, increased land use mix and smaller block sizes, along with the provision of high quality green space to offset the negative impacts of density[8].

By increasing population density, intensification can also increases the amount of vehicle trips in a given area, leading to congestion and exposing a greater amount of people to

[7] RTPI. 2018. *Settlement Patterns, Urban Form and Sustainable Development.* Available from: rtpi.org.uk/media/2822766/settlementpatternsurbanformsustainability.pdf

[8] Ibid

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?

polluted air. In the vast majority of urban environments, the health benefits of walking and cycling are even thought to outweigh the potential health risks from increased exposure to air pollution, especially if they replace car journeys. However, it is important to recognise and mitigate the trade-offs between intensification and air pollution. Policies to promote modal shift require complementary measures to restrict car movement, limit parking spaces, and locate key facilities like schools and hospitals in places which can be accessed without a car. Green infrastructure can help to filter pollutants in street canyons, where high buildings limit air circulation, while also supporting climate adaptation.

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: The CCC should carry out a cross-departmental assessment of existing government policies and strategies, and their compatibility with the net zero target. Much greater coordination will be required across government departments, and across the UK Nations, to deliver the packages of infrastructure investments identified by the CCC. With limited time remaining, government should be encouraged to move towards a more agile system which uses real-world data to monitor policy performance against actual and forecast emissions, and make adjustments where necessary.

In addition to those described in Q18b, priorities should include:

- Ensuring that the Planning Inspectorate has the capacity to assess the carbon reduction trajectories of local and strategic plans
- Ensuring that the duties placed on utility companies by Ofwat, Ofgem and Ofcom include climate mitigation, and that the strategies produced by the emerging Sub-National Transport Bodies also contain a clear emissions reduction trajectory
- Ensuring that local authorities are properly resourced to develop local and strategic plans which are compatible with the net zero target

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: Many local and strategic authorities have declared climate emergencies and set ambitious decarbonisation targets, while also pursing aspirations for housing and economic growth. The RTPI has provided advice on planning for climate change[9], but additional tools and resources will be required from government to ensure these objectives are compatible, including to coordinate infrastructure delivery through planning.

[99] TCPA and RTPI, 2019: Planning for Climate Change: A guide for local authorities. Available from: rtpi.org.uk/knowledge/better-planning/better-planning-climate-change/planning-for-climate-change/

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?
It is also important that national policies and standards do not undermine the ability of local areas to go further and faster in pursuing decarbonisation.

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:

a) The SoNaRR (State of Natural Resources Report) Interim Report for 2020, by Natural Resources Wales is a useful evidence base. We assume this is the report referred to at 14 (a) of the report. For information, slides from a recent webinar are attached and the full recording of the webinar is available online[10]. This is also a useful webpage[11].

b) The Active Travel Act (including planning policy changes to further embrace active travel) are all working towards acting on climate change and addressing the requirements of the Well-being of Future Generations Act[12].

c) The Wales Infrastructure Commission has produced its first Annual Report, along with baseline data, and this may have useful evidence[13].

d) Issues around the resourcing of local planning authorities (LPAs) is particularly timely in light of the developing responsibilities of the Welsh Government on planning issues, and the underfunding of LPA services. RTPI Cymru would support moves to LPAs achieving full cost recovery from development management services to improve planning service delivery. However it is essential that any proposals to increase planning fees are accompanied by rules to ring-fence this

[10] See: youtube.com/watch?v=SjR08f_tB34&feature=youtu.be
[11] See: naturalresources.wales/evidence-and-data/research-and-reports/state-of-natural-resources-interim-report-2019/sonarr-2020/?lang=en
[12] See: legislation.gov.uk/anaw/2013/7/contents/enacted; and rtpi.org.uk/media/3609728/cynllunio_winter_2019.pdf
[13] gov.wales/national-infrastructure-commission-wales-annual-report-2019

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income to the planning service and that LPAs effectively resource their planning services, so that they are in a position to tackle future issues.

A combination of sufficient officer capacity and the right skills are required not only to deliver planning functions, but to ensure that land use plans are fully integrated with other local authority strategies and plans, such as Local Transport Plans (LTPs) and Active Travel Network Maps, ensuring that planning decisions support their delivery. We support the continued preparation of LTPs by local authorities. These are a useful mechanism to achieve co-ordination with land use development, and need to be well integrated with the preparation of LDPs. In regions where journey to work areas typically cross local authority boundaries, there is a strong case for LTPs to be prepared on a regional basis, and to be integrated with regionally based City Deals and SDPs.

Any guidance in relation to transport services must recognise the important links to land use. The implications for existing and planned land use development must be considered. The additional powers given to the Welsh Government by the Wales Act 2017 will enable it to take a more proactive role in relation to bus services and that is welcomed. This would need to involve a closer relationship with the Traffic Commissioner for Wales.

Housing accounts for 9% of all greenhouse gas emissions in Wales, and Welsh Government are currently consulting on changes to Part L of the Building

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Regulations to improve the energy efficiency requirements for new homes[14]. The UK's largest carbon neutral development is also being built in Tonyrefail, Wales[15].

The Welsh Government established a working group in 2018/19, with RTPI Cymru as a member. Its report sets out proposals to decarbonise existing homes[16]. The RTPI Cymru Director was also a member of Independent Review panel on the supply of affordable housing, which made recommendations to increase standards to combat energy inefficiency, not only for climate action reasons, but also in the interests of tenants and fuel poverty[17].

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:

[14] See: gov.wales/building-regulations-part-l-review-0
[15] See: bbc.co.uk/news/uk-wales-51151032
[16] See: gov.wales/sites/default/files/publications/2019-07/independent-review-on-decarbonising-welsh-homes-report.pdf
[17] See: gov.wales/sites/default/files/publications/2019-04/independent-review-of-affordable-housing-supply-report_0.pdf

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: An example recently where there was an imbalance between thinking between Governments was the (former) Secretary of State's decision to remove the tolls from the crossings on the Severn without a full impact statement. This has reportedly led to a 16% increase in private car journeys, particularly for leisure purposes, rather than using local services.

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: In considering this question it is important to set targets which recognise the potential of different places, as much higher levels of mode shift should be possible within city-regions.

The CCC has previously noted that current government policies are insufficient to increase walking, cycling and the use of public transport to the levels needed to reduce car usage and associated greenhouse gas emissions, along with the associated benefits to public health, air quality, reduced noise and congestion[18]. Building on the response to Q8, specific interventions to incentivise this transition include:

Effective working between the DfT and the Ministry for Housing Communities and Local Government (MHCLG), along with other departments, to ensure that housing growth is coordinated with measures that enable significant modal shift to healthy, spatially efficient and low-carbon modes of transport. There is no room for complacency on this issue, as demonstrated through our *Location of Development* project. This analysed the location of permissions for over 220,000 new homes in 12 English city-regions between 2012 and 2017, and found that only 17% were within easy walking or cycling distance of a railway station[19]. We have also supported the *Transport for New Homes* project, funded by the Foundation for Integrated Transport, which visited a number

[18] Committee on Climate Change. 2018. *Reducing UK emissions: 2018 Progress Report to Parliament.* Available from: theccc.org.uk/wp-content/uploads/2018/06/CCC-2018-Progress-Report-to-Parliament.pdf

[19] RTPI. 2018. *The Location of Development.* Available from: rtpi.org.uk/locationofdevelopment

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of major housing developments and urban extensions and found that many are not located or designed to facilitate active modes of transport[20].

This research highlight systemic factors which can lead to housing development in locations and forms which are inconsistent with modal shift targets. These are complex and include changes to planning policy, a lack of resourcing for local authority planning departments[21], fragmented governance structures, the appraisal and funding regime for major transport infrastructure, and cycles with land and property markets. In a situation where national calculations of housing need are resulting in significant pressures for housing growth within and around urban areas, and where transport systems which are stretched or at capacity, we are concerned that the 2018 National Planning Policy Framework (NPPF) does not go far enough to prevent car-dependent patterns of development and to maximise accessibility by public and active modes of travel[22].

Better cross-departmental working is needed to ensure that growth is coupled with measures to reduce travel demand, maximise the efficiency of existing transport infrastructure, increase provision and capacity of public and active transport infrastructure, and promote relatively dense and compact patterns of development.

The allocation of national transport infrastructure investment to projects which encourage sustainable transport modes and reduce car dependency. This will be challenging to achieve when national transport investment is strongly geared towards the strategic and major road network, with far less spent on bus subsidy, walking and cycling. This imbalance can induce and lock-in high carbon travel patterns by increasing road accessibility to peripheral land which a) encourages the relocation of residents and businesses to cheaper, car dependent locations and b) incentivises low-density development on lower-value land. This can increase overall traffic volumes, congestion and air pollution, including in urban centres, which makes active travel less attractive[23].

Wider measures, such as road user charging, can ensure that new and expanded road infrastructure does not increase transport emissions by improving access to more peripheral and remote locations. In the interim, increased fuel duty could also reduce private vehicle use and create a source of tax revenue for public and active transport infrastructure.

[20] Foundation for Integrated Transport. 2018. *Transport for New Homes.* Available from: transportfornewhomes.org.uk/wp-content/uploads/2018/07/transport-for-new-homes-summary-web.pdf

[21] English local authority planning departments have seen an average 14.5% reduction in resourcing between 2006 and 2016. See: rtpi.org.uk/media/2908296/InvestingindeliverySENW.pdf

[22] RTPI. 2018. *Briefing note on the 2018 NPPF.* Available from: rtpi.org.uk/media/2945680/RevisedNPPFbriefingnote.pdf

[23] RTPI. 2018. *Settlement Patterns, Urban Form and Sustainable Development.* Available from: rtpi.org.uk/media/2822766/settlementpatternsurbanformsustainability.pdf

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Ensuring that combined authorities and other strategic partnerships are sufficiently resourced and incentivised to develop integrated strategies which can effectively decarbonise transport by:

- Planning new development in locations which minimise the need to travel, regulate parking provision and secure links to public and active transport networks
- Integrate demand management on the transport network, for example through emissions or congestion charging zones or other forms of pricing which internalise the costs of transport
- Integrate land-use and transport planning with decision-making for other infrastructure programmes with spatial implications, such as healthcare, education, and urban regeneration

Measures to more effectively integrate bus services with rail and metro need to be given greater priority. It should be recognised that the planning system has a number of mechanisms which can enable improvements to bus facilities (bus lanes, stops etc.) as well as local service benefits. Ensuring that all relevant guidance and regulation recognise the links between transport planning and land use planning will ensure such benefits are able to be achieved. Bus priority measures are particularly important in seeking to steer modal change towards more sustainable forms of transport. The planning profession have recently been called upon to be bolder in embracing digital technology and public transport providers should do the same, keeping abreast of new technologies such as more efficient electric buses, real time service information, and ensuring that any supporting infrastructure such as charging points and information panels and apps are provided. Mobility hubs, bus stations, bus stops and taxi ranks need to be well designed and maintained, with good links to pedestrian and cycle routes.

Reducing private motorised travel through policies which promote compact settlement patterns with higher levels of density, land use mix and accessibility. There is strong evidence that these urban forms facilitate public and active transport when compared to low-density and dispersed developments, and thereby reduce overall vehicle use[24]. There is a close relationship between residential density and accessibility, with larger local populations providing patronage for a wider range of local shops and services in convenient locations, within easy walking or cycling distance. Higher levels of residential density and land use mix around public transport stops also helps to make high-frequency services financially viable, and increases the number of public transport stops at the city-region scale. This in turn improves accessibility across the entire network, creating a virtuous cycle that reduces car dependency, increases levels of public and active transport,

[24] Ibid

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and reduces the number of physically inactive 'door to door' trips. For example, London has higher than average levels of walking and cycling, and is the only city in England where the majority of journeys are not made by car. This is enabled in part by high public transport density, which means that a single stop can be used to access to a wide range of destinations.

Strengthened national planning policy to direct development to locations which can be effectively served by sustainable modes of transport. This means concentrating development in a small number of strategic locations, and prioritising brownfield sites within large existing settlements or immediately around them, before expanding smaller towns, villages and rural areas. In order to promote sustainable mobility and reduce congestion, any development outside of large existing settlements should be located alongside well-served bus corridors and in close proximity to rail stations and other transport interchanges, in order to encourage patronage and reduce the use of the strategic road network. Similarly, any new sustainable transport infrastructure, like rail and bus routes, should be located based on their potential to connect existing car-dependent settlements to major concentrations of jobs and services, and to support new public transport-oriented development patterns.

At the neighbourhood and development scale, urban form can encourage sustainable travel through the design of fine-mesh grid networks, and by limiting the use of cul-de-sacs and other street layouts with poor levels of connectivity. Parking spaces should be set at a maximum of one per household, and ideally lower. This can also be achieved through proactive planning so that ambitions for better safety, better mobility and better streets can form the basis of development and infrastructure proposals, rather than being retrofitted in at a later date.

Active travel also requires that there are sufficient local facilities and services, such as food stores, pharmacies, GPs, schools and parks, which are accessible by foot from all residential areas. However, this is not just the responsibility of transport and land use planners and their respective government departments, but relates more broadly to the issue of local government funding, which is needed to ensure that facilities like parks, libraries and community centres are kept open, and the extent to which decisions over the location of schools and healthcare facilities are integrated with wider transport and land use concerns.

An inter-departmental group has been established between DfT and MHCLG to address the need for greater integration between land use planning and transport, and we strongly encourage greater collaboration on this issue. To support this, the RTPI has worked with

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the Chartered Institute for Highways and Transportation (CIHT) and other bodies to develop new advice on the integration of planning and transport[25].

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

ANSWER: Autonomy removes the role of the driver, not the role of the private vehicle. Convenience, cost, comfort and other factors combine to influence the choice of mode used to satisfy mobility demands, therefore making private vehicles more attractive by any metric risks eroding the proportion of trips made by active and sustainable modes.

If the technological barriers to autonomous vehicles are overcome, then it is important to have strategies in place which manage overall demand. Input from strategic planners and other professionals can, for example, help to ensure that automation is designed and regulated to fit into pedestrian-friendly urban environments, rather than inadvertently redesigning the urban environment to enable the free flow of automated vehicles at the expense of walking and cycling. It would also be sensible to set out guidelines for data-sharing obligations for new mobility services and operations at an early stage in their development.

Some level of monitoring and reporting, if not real time information, should be made publicly available, for example in the same way as traditional public transport, to enable autonomous vehicles to form part of an integrated transport network.

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: These barriers are largely political due to the role of car manufacturing in the UK economy, coupled with some practical barriers from the lack of investment in active and sustainable transport alternatives. The phase-out of conventional vehicles should be preceded by committed investment in active and sustainable transport infrastructure and charging infrastructure, particularly in more remote locations and areas where car dependence has been highest.

[25] CIHT. 2019. *Better planning, better transport, better places.* Available from:ciht.org.uk/media/10218/ciht-better-planning-a4_updated_linked_.pdf

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However, the phase-out of conventional vehicles in support of electric and hybrid vehicles needs to be considered alongside interventions to reduce existing demand for private vehicle use. The CCC have previously recommended that 60% of all new car sales will need to be electric vehicles (EVs) by 2030 in order to meet the legally binding carbon budgets of the 2008 Climate Change Act, while scenario modelling by the National Grid indicates this may need to rise to almost 100% by 2050. The National Grid also suggest that the uptake of EVs could add between 6GW and 30GW to peak electricity demand, which currently stands at 60GW. While the transition to EVs will help to reduce emissions from the transport sector and tackle localised air pollution, it will require both increased capacity and faster decarbonisation in the power sector in order to reduce net emissions.

Additional emissions and pollutants will also be generated from the production of EVs, including lithium ion batteries, the installation of charging infrastructure, and the recycling and scrapping of conventional vehicles. And finally, replacing conventional vehicles with EVs misses valuable opportunities to change the way that consumers engage with different mobility options. This requires the policies, measures and investments described in Q18b, to reduce overall private vehicle demand, along with efforts to promote shared, public and active travel.

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: The current energy regulatory structure must oversee a rapid transition to a flexible and decarbonised heat and electricity network, which meets the requirements of the Climate Change Act 2008. Here, Ofgem should work closely with local and strategic authorities to extend the regulatory framework to district heat, with provisions to ensure investment can take place ahead of demand, such as when planning for new settlements. Local and strategic authorities will require support to identify zones where district heating is viable alternative to conventional means, and to develop a strong policy framework for connecting new and existing developments to the network.

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:

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:

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_2?

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_2 transport and storage infrastructure over the period to 2030?

ANSWER: