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.

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.

Introduction

1. The Sustainable Food Trust welcomes the opportunity to submit written evidence to this consultation by the Committee on Climate Change and would be pleased to provide further information, oral evidence, or to elaborate on any points.
2. The Sustainable Food Trust (SFT) is a small UK based charity, established in 2011, that works in the UK and internationally to accelerate the transition to more sustainable food systems. We focus our work in three main areas:
    - Leadership and Collaboration: Influencing leaders, policy makers and individuals
    - Research and Policy: Enabling policy change based on sound science
    - Communications: Providing information, sharing ideas and empowering citizens

Summary

Human actions are increasingly damaging the health of the planet, and agriculture is a critical part of both the problem, and the solution. Climate change represents the greatest threat to both the environment and society, but other planetary boundaries (e.g. biogeochemical flows, biodiversity, and water and air pollution) are also being dangerously exceeded, in part due to industrial agriculture. It is imperative that the UK adheres to international commitments on greenhouse gas emissions, but it is important that any major land use changes which help to reduce agricultural emissions do not inadvertently increase, or make it difficult to address, other environmental or diet-related health issues. The new Agriculture Bill represents a golden opportunity to transform the UK farming system in a way which helps to tackle climate change, but without great care it could also increase reliance on, for example, nitrogen fertiliser and imported food, which would have negative impacts in a wide range of ways.

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: Accurately measuring the temperature impacts of different greenhouse gases is critical to the development of robust climate policy. While the CCC's recent land use report acknowledges the weaknesses of GWP^{100} and the development of GWP* as an improved alternative when considering methane emissions, it concludes that GWP^{100} should continue to be used in the agricultural sector.[1] We feel strongly the CCC should reconsider this assessment.

[1] Committee on Climate Change, 2020, 'Land use: Policies for a Net Zero UK', available online: https://www.theccc.org.uk/publication/land-use-policies-for-a-net-zero-uk/

Ensuring consistent accounting is important, but cannot be used as an excuse to avoid adopting what is a more accurate metric in GWP*. It is essential that the temperature changes of any proposed policy are accurately modelled, and as GWP^{100} is unable to do this when applied to methane emissions, it is difficult to see how its continued use is scientifically justifiable.

The CCC report also notes that pursuing an approach where UK agricultural methane emissions remain steady will result in "methane-induced warming higher than the mid-century global average level in pathways consistent with the Paris Agreement".[2] It is unclear why this should count against adopting GWP*. Firstly, the use of GWP* does not (as the CCC report implies) presuppose a net-zero approach to agricultural methane emissions – it simply provides a more accurate means of estimating the impact on temperature of any change to methane emissions.[3] Deciding the extent to which methane emissions are reduced then becomes a political decision which can be based on more robust science.

Secondly, the IPCC's use of GWP^{100} results in an inaccurate estimation of temperature change in its 1.5°c pathways: i.e., the forecast reductions in methane emissions will result in greater-than-estimated cooling. This means that the agricultural methane reductions proposed by the IPCC (shown in Figure 2.7 of the CCC land use report) go beyond what is actually necessary to achieve 1.5°c compliance.

Thirdly, we see no reason why the UK has to reduce agricultural methane emissions in line with the rest of the world: as long as the UK agricultural sector as a whole is meeting its net-zero aims, it does not matter which measures are taken to achieve this. Climate action plans will vary considerably between nations depending on specific circumstances, and in the UK, which is particularly suited to grazing ruminant production, enteric methane emissions may remain higher than the global average for sound agricultural, environmental and social reasons. It is also worth noting that UK ruminant numbers have already declined by 25% since the mid-1980s.

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: n/a

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?

[2] *Ibid*
[3] Cain, Allen and Lynch, 2019, 'Net zero for agriculture', available online: https://www.oxfordmartin.ox.ac.uk/downloads/academic/201908_ClimatePollutants.pdf

ANSWER: One of the key priorities to arise from COP21 was the 4 per 1000 initiative, to which the UK is a signatory.[4] This initiative recognises the ability of soil to sequester carbon, and generated a commitment to increase soil carbon levels around the world by 0.4% each year, thus helping to tackle climate change and improve soil health.

Very little potential is given for soil carbon sequestration in the CCC's land use report. However, we believe the analysis this conclusion is based on is overly conservative, as it does not fully investigate the sequestration potential of returning to mixed rotational farming in arable areas where soils have lost much of their carbon, and considers increased manure application infeasible because it gives no consideration to reintegrating livestock into cropland.[5] We recognise the limited evidence-base, but still feel that soil carbon sequestration should form a key element of the CCC's approach to achieving net zero.[6] Consequently, the sixth carbon budget should recommend payments to incentivise farmers to increase the organic matter in the soil. The UK Government can use the Environmental Land Management Scheme proposed within the Agriculture Bill to support actions (for example, crop rotations, deep-rooting grasses and legumes, composted manures and optimum stocking rates) that have the capacity to improve soil health and carbon levels.

At the same time, we would ask the CCC to be mindful that its recommendations do not result in practices which result in reduced soil carbon levels. Grassland converted to continuous cropping will lose approximately 40% of its carbon over 40 years[7], while established cropland converted to grassland will gain a similar amount of carbon over a similar time period.[8] In addition, carbon is lost from grassland when it is overstocked and/or fertility is allowed to decline.[9] It is therefore imperative that we seriously consider the carbon sequestration potential of reintegrating grass leys and grazing livestock into cropland, and prevent conversion of permanent grassland to arable.

We are also concerned that if government incentives to establish woodland do not guarantee long-term compensation for income foregone (new woodlands will not return any profit for decades), then the committee's current recommendation to reduce ruminant may actually result in more grassland being ploughed for crop production, as this will be the only financially-viable land use. When this happens, in addition to the carbon lost, soils also lose substantial amounts of nitrogen in the form of nitrous oxide.[10]

[4] 4per1000, 2015, available online: https://www.4p1000.org/

[5] Moxley et al, 2014, 'Capturing cropland and grassland management impacts on soil carbon in the UK LULUCF inventory', available online: https://abdn.pure.elsevier.com/en/publications/capturing-cropland-and-grassland-management-impacts-on-soil-carbo

[6] Honor Eldridge, How Can We Achieve Healthy Soils, Soil Association, 2018, available here: https://www.soilassociation.org/blogs/2018/march/how-can-we-achieve-healthy-soils-in-the-uk/

[7] Gregory et al, 2016, 'Long-term management changes topsoil and subsoil organic carbon and nitrogen dynamics in a temperate agricultural system', *European Journal of Soil Science* 67, pp.421-430

[8] Hu et al, 2018, 'Converting temperate long-term arable land into semi-natural grassland: decadal-scale changes in topsoil C, N, 13C and 15N contents', *European Journal of Soil Science* 70:2

[9] Klumpp et al, 2009, 'Grazing triggers soil carbon loss by altering plant roots and their control on soil microbial community', *Journal of Ecology* 97:5

[10] Vellinga et al, 2004, 'The impacts of grassland ploughing on CO2 and N2O emissions in the Netherlands', *Nutrient Cycling Agroecosystems* 70, pp.33-45

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: n/a

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: n/a

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: We welcome the CCC's assessment of the risks associated with exporting emissions to other parts of the world in response to reduced UK red meat production and changing trade patterns. However, we feel the Committee is downplaying the threat this poses when it states that "risks are limited…and can be addressed through policy".[11] On the contrary, the CCC's own analysis reveals that a shift in beef imports from EU to non-EU producers would result in a 15% increase in emissions associated with UK beef consumption compared with today, even with a 20% reduction in beef intake, due to the very high carbon footprint of beef from countries like Brazil where production is often on recently-deforested land. As this is a trade scenario which appears increasingly likely post-Brexit, the CCC must treat this as a major threat and incorporate it into its proposals moving forwards.

To negate this threat, it is much better to produce beef and lamb on the UK's long-established pastures than on land recently cleared from rainforest, as is the case with much of the beef produced in South America. It is also preferable in terms of methane efficiency per kilo of meat, biodiversity and social justice to produce beef on the UK's highly productive grasslands than to import it from a country like Uganda (as is currently being contemplated by the UK Government[12]) where grazing is sparse and degrading due to over-stocking[13], the soils fragile, and a critical shortage of meat for the local population exists.

We are also concerned that the UK's high reliance on other countries for food could result in a food security crisis as climate change worsens. Twenty percent of our fresh produce comes from areas which are particularly threatened by climate change[14], and yet we, a country blessed with adequate rainfall, import irrigated crops from them. This is a particular

[11] Committee on Climate Change, 2020, 'Land use: Policies for a Net Zero UK', available online: https://www.theccc.org.uk/publication/land-use-policies-for-a-net-zero-uk/

[12] Farmers Weekly, 2020, 'Ugandan beef welcome in post-Brexit Britain, PM says', available online: https://www.fwi.co.uk/business/markets-and-trends/ugandan-beef-welcome-in-post-brexit-britain-pm-says

[13] Mugerwa and Emmanuel, 2014, 'Drivers of grassland ecosystems' deterioration in Uganda'

[14] The Guardian, 2019, 'A fifth of UK fresh food imports from areas at risk of climate chaos, MPs warn', available online: https://www.theguardian.com/environment/2019/sep/17/uk-fresh-food-imports-areas-at-risk-climate-crisis-mps-warn

concern in that many of these crops are perishable and as a result flown in by air which adds to their net carbon footprint substantially.

A further uncertainty is the reliability of current estimates around the emissions from various sectors. Research in 2016 found that global methane emissions from fossil fuel extraction have been under-estimated by 20-60%.[15] More recently, research has found that increasing methane levels are predominantly linked to shale gas production.[16] This becomes particularly relevant to comparisons between different sectors, such as between beef consumption and flying.

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: n/a

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: n/a

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 new Agriculture Bill that is currently going through Parliament will come into effect during the 2030/2035 period.[17] Through the bill's framework, the UK Government has the opportunity to create the economic conditions where farmers are financially supported for adopting climate mitigating practices that benefit planetary health. The Sustainable Food Trust has long argued that by changing economic support to reflect the positive and negative externalities of food production, agroecological techniques could emerge as the most profitable and economically-viable way of producing food.[18] To enable the widespread shift towards a food production system that is truly integrated and functions in harmony with nature, the Sustainable Food Trust recommends that the Government introduce of a suite of sustainable farming policies that include;

[15] Schwietzke et al, 2016, 'Upward revision of global fossil fuel methane emissions based on isotope database', *Nature* 538, pp.88-91

[16] Howarth, 2019, 'Ideas and perspectives: is shale gas a major driver of recent increase in global atmospheric methane?' *Biogeosciences* 16:15, pp.3033-3046

[17] Parliament, Agriculture Bill 2019-20, 2020, available online: https://services.parliament.uk/Bills/2019-20/agriculture.html

[18] Sustainable Food Trust, The Agriculture Bill: The Sustainable Food Trust's ambition for the future of food, farming the environment, Oct 2018, available online: https://sustainablefoodtrust.org/wp-content/uploads/2013/04/Agriculture-Bill-Briefing-.pdf

- Rewarding farming systems that build and maintain soil carbon through crop rotations that include a soil fertility building phase, usually with grass and forage legumes to reduce inputs and improve long-term soil health.

- Incentivizing the maintenance of holistic systems of grassland management that deliver emissions reduction, carbon sequestration, improved water management and increased biodiversity above and below the soil line.

- Applying the polluter pays principle to ensure financial accountability for practices that negatively impact environmental and public health
- Rewarding high standards of animal welfare to ensure a good life for farm animals where they can express their natural behaviour and be raised and slaughtered in an ethical way close to the point of production
- Reducing the use of chemical inputs including artificial nitrogen fertilisers and pesticides, which have damaging effects on air and water quality, biodiversity and public health.

- Incentivizing farming practices that incorporate positive in-crop biodiversity to dramatically reverse UK species loss through a whole-farm landscape-based approach

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: n/a

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: n/a

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: If the CCC's strategy is to reduce meat production in an attempt to lower emissions, upland communities need to be considered in order to ensure that they are not unfairly disadvantaged. Upland communities are strongly dependent on the livestock industry and removing the industry would dramatically impact the economic viability of these regions, and could result in a decline in local employment and liveability.[19] We want to see thriving local economies across LFAs where farmers can produce food sustainably and profitably. Extensive livestock production, if carried out in a more sustainable manner (for instance through a shift to mixed grazing systems and a major increase in

[19] RSPB, The Uplands: Time to change? Available online: https://www.rspb.org.uk/globalassets/downloads/documents/positions/climate-change/the-uplands---time-to-change.pdf

agroforestry) is entirely compatible with the need for more carbon sequestration, and would enable continued (or even enhanced) employment opportunities, as well improved delivery of a whole host of public goods, as opposed to the negative social and environmental consequences of land abandonment and a shift to commercial forestry (see Q.14b for further discussion).

Key to a fair analysis of the issues is a consideration of livestock feed. While direct emissions from poultry are lower than with beef and lamb, globally, for every 1kg of human-edible beef protein produced, cattle only consume 0.6kg of human-edible feed protein, as the bulk of their diet is human-inedible.[20] In comparison, generating 1kg of human-edible chicken protein from intensive broiler systems requires 5.1kg of human edible protein from animal feed. Viewed from this angle, grass-fed livestock production is a very efficient use of land, increasing food security from otherwise unproductive land.

Growing calls to rewild LFAs to sequester carbon could similarly damage the economic viability of upland communities. While we must make space for wilderness, the widespread abandonment of food production in the uplands, in favour of 'land-sparing', would not ultimately result in more sustainable production practices. We also feel that, for economic reasons, almost all tree planting in upland regions will be in the form of conifer plantations. These are disastrous for biodiversity and may only take carbon out of the atmosphere for a relatively short period of time, compared with hardwoods, since a high proportion of the thinnings and some of the timber is used for woodchip. Furthermore, remaining land (in the UK lowlands) would be pushed towards more intensive methods of production to meet the gap in production, which could result in increased soil carbon loss and a rise in emissions from inputs.

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: n/a

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?

[20] Mottet et al, 2018, 'Livestock: on our plates or eating at our table? A new analysis of the feed/food debate', *Global Food Security* 14

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: Many climate-friendly farming practices offer the potential to improve well-being in the agricultural community and wider society. However, the CCC's proposals around afforestation and reduced ruminant production pose inparticular concerns for the well-being of already-struggling farmers and rural communities in Wales.

The CCC envisions afforestation predominantly occurring on pasture and rough grazing, which accounts for 80% of Welsh agricultural land. There is significant scope in the Welsh uplands to increase tree cover whilst maintaining and enhancing livestock production via extensive uptake of silvopasture, which could bring multiple benefits. However, the CCC's proposals are more amenable to large-scale forestry, an approach which, as well as being detrimental to biodiversity, would create largely transitory jobs dominated by migrant labour, as opposed to the permanent nature of most farm employment in the uplands.[21] We therefore strongly encourage the CCC to re-examine its afforestation proposals, and promote silvopasture as a means of enhancing economic opportunities in LFAs whilst delivering carbon sequestration and biodiversity gains.

The CCC's proposed cuts to ruminant production also pose a major threat to the well-being of livestock farmers. This is especially true in LFAs, where environmental constraints and the relatively small size of holdings mean that farms tend to be less profitable, and so are particularly vulnerable to any decline in demand for red meat and dairy. The CCC's call for increased stocking rates may further discriminate against the predominantly extensive systems found in Wales, where intensification will often be impossible or undesirable for practical and environmental reasons. The negative portrayal of livestock production implicit in calls to reduce red meat and dairy consumption also means many farmers feel under attack.

The stresses outlined above could worsen an already worrying mental health situation amongst the farming community[22], while a decline in the number of farms would lead to further isolation amongst those that hang on. A loss of farms would also be felt at a community level in rural areas, where livestock production delivers enormous economic, social and environmental benefits. Agriculture (predominantly of livestock) employs over 12% of the workforce in some counties, has the highest share of Welsh speakers of any sector, and supports many of Wales' most charismatic species of wildlife.[23] The immense value of extensive livestock production in LFAs (in Wales and the rest of the UK) must

[21] Barbour, 2020, pers. comm.
[22] BBC, 2019, 'Farmers struggling with mental health', available online: https://www.bbc.co.uk/news/av/uk-47888402/farmers-struggling-with-mental-health

[23] Welsh Government, 2019, 'Agriculture in Wales', available online: https://gov.wales/agriculture-wales

therefore be supported, and we would urge the CCC to recognise this in their proposals moving forward.

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: n/a

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

ANSWER: n/a

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: It is necessary to integrate the approach to environmental regulation across the UK. If the UK as a whole is to make the necessary shift towards a greener future, there has to be overarching objectives for the country as a whole. We need to have a common framework to protect and maintain the UK environment. Only by creating unified policy objectives to support a more sustainable future within an agreed underlying framework will we be able to deliver a positive change. Each nation within the UK is connected and therefore the actions of one impact the others.

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: n/a

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

ANSWER: n/a

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: n/a

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: n/a

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: n/a

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: n/a

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

ANSWER: n/a

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: n/a

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: n/a

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: n/a

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: n/a

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: n/a

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: n/a

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: n/a

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: We are very concerned by the 18.4% increase in international aviation to and from the UK, between 2014 and 2018. An unknown, but increasing component of this is perishable food flown in from all over the world. This effectively discriminates again the production of seasonal fruit and vegetables in the UK. Growers cannot compete and go out of business or the land is put to other uses.

International aviation (currently exempt from emissions reductions targets) add a further 7% to the UK's emissions (slightly more than beef and sheep combined even based on GWP^{100}). As such we feel the CCC should be far more radical in its recommendations on aviation. Imagine the uproar if UK beef production had increased by a similar amount. While it is difficult to tax aviation fuel without international agreement, we recommend an airport tax on flights by UK nationals from the UK, and a similar tax of airfreight food into the UK. These should be calculated at a level to reflect the carbon cost of these activities. We would also like to see the CCC recommend an increase in home grown seasonal fruit and vegetables, and a corresponding change in consumer purchasing behaviour, away from out-of-season produce towards seasonal produce.

In total, there needs to be a substantial increase in the area of UK land producing fruit and vegetables, but in terms of soil carbon, other emissions and natural capital it would be far better to encourage production that was integrated into existing crop rotations, especially

on livestock farms, than the conversion of large areas of farmland into continuous vegetable production.

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: e are concerned that the CCC may have overlooked some potentially negative impacts. Of particular concern are the implications for biodiversity. For instance, the loss of High Nature Value livestock farms[24] as a result of reduced red meat and dairy production would lead to a deterioration in biodiversity through the loss of upland grassland ecosystems and the species which depend upon them. It is unlikely this would be replaced by high nature-conservation woodland ecosystems for more than a century. This could also have negative impacts on social sustainability, due to the potential damage done to rural communities (outlined in response to questions 12 and 14b).

Increasing productivity may also harm biodiversity, if carried out in an insensitive manner. Elevated stocking densities are sustainably achievable where pasture is currently being under utilised, but could also reduce species diversity[25] and soil carbon levels while increasing nitrate pollution.[26] A rise in crop yields would have to be achieved in a way which significantly reduces chemical inputs and improves soil health, but while the CCC recognise the dangers of intensification and correctly highlight the potential of certain soil management and breeding practices, we are sceptical that yield improvements of 25% are possible without an increase in nitrogen fertiliser application, the rate of which remains damagingly high.[27] Furthermore, the inherently unsustainable nature of continuous cultivation is not addressed, and there is no appraisal of the carbon sequestration potential of putting arable areas back into rotations with grass leys grazed by livestock.

[24] http://www.highnaturevaluefarming.org.uk/

[25] Smith et al, 2016, 'Effects of sheep stocking on the plant community and agricultural characteristics of upland *Anthoxanthum odoratum-Geranium sylvaticum* meadow in northern England', *Grass and Forage Science* 73:3

[26] Soussana and Lemaire, 2014, 'Coupling carbon and nitrogen cycles for environmentally sustainable intensification of grasslands and crop-livestock systems', *Agriculture, Ecosystems and Environment* 190, pp.9-17

[27] The British Survey of Fertiliser Practice, 2019, 'Fertiliser use on farm crops for crop year 2018', available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/806642/fertiliseruse-statsnotice2018-06jun19.pdf

We therefore urge the CCC to consider an agroecological approach to food production, which, although lower yielding per hectare, can significantly reduce net GHG emissions, increase food security and improve ecosystem services – providing appropriate shifts in diet and reductions in food waste are also achieved.[28] This shift would not require a significant drop in red meat and dairy consumption (due to the critical role grazing ruminants play in sustainable mixed farming systems) but would necessitate a major decline in pork and chicken consumption, due to the need for human-edible and imported feed in intensive monogastric production. The numerous environmental and animal welfare concerns found in intensive pork and chicken systems, and the practical limitations to growing high-protein plant crops in the UK (as well as the environmental damage caused by soya and oil palm production overseas), all point towards the need to maintain (and critically, improve) ruminant production in the UK.

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: The SFT strongly opposes bioenergy cropping at the scale envisaged by the CCC. As the committee notes, there are major environmental concerns associated with bioenergy cropping, especially on grasslands. Currently, maize is the predominant bioenergy crop in the UK and is associated with soil erosion and other severe environmental impacts.[29] Although anaerobic digestion of maize is still promoted, the CCC appears to have acknowledged these problems and instead proposes *Miscanthus* and short-rotation forestry. While these can provide environmental benefits compared with intensive agriculture, this depends upon very sensitive spatial planning.[30] With food insecurity rising in the UK, potential loss of our biggest trading partner, and climate destabilisation of major global food producing regions predicted, we believe that taking productive land out of agricultural use is unwise, and we should instead maximise the amount of food that can be grown domestically in a more sustainable way.[31]

We support the CCC's aim to increase tree cover, but feel its proposals are poorly conceived. The largely commercial afforestation approach envisaged by the committee may cause major damage to biodiversity and rural communities, as discussed in previous answers. The report also acknowledges, but fails to adequately address, the risks associated with afforestation in a changing climate. This is particularly the case in the uplands, where economics and environmental limitations are likely to drive single-species planting, thereby heightening susceptibility to disease and climate stress and consequently increasing the likelihood of plantation failure. As well as posing a danger to sequestration

[28] Poux et al, 2018, 'An agroecological Europe in 2050: multifunctional agriculture for healthy eating', *IDDRI*, available online: https://www.soilassociation.org/media/18074/iddri-study-tyfa.pdf

[29] Whiting, A and Azapagic, A (2014) 'Life cycle environmental impacts of generating electricity and heat from biogas produced by anaerobic digestion' Energy 70: 181–193

[30] McCalmont et al, 2017, 'Environmental costs and benefits of growing *Miscanthus* for bioenergy in the UK', *Global Change Biology Bioenergy* 9:3, pp.489-507; McKay (ed.), 2011, 'Short rotation forestry: review of growth and environmental impacts', Forest Research

[31] FAO, FAOSTAT, 2017, available here: http://www.fao.org/faostat/en/#home

aims, increasingly unfavourable growing conditions may also make investment in woodlands unprofitable – this is potentially key, as large-scale afforestation will generally preclude any other land use and won't return any income for decades, making massive long-term financing key to the committee's proposals.

Instead, we support a much more integrated approach to tree planting, focussing on hedgerows and agroforestry as a means of enabling continued (and even enhanced) food production alongside delivery of improved carbon sequestration and ecosystem services. A single oak tree can take 20 tonnes of carbon out of the atmosphere for 500 years and we estimate there is potential to increase the number of such trees ten-fold in existing hedgerows without losing any food production potential. While the committee does promote both these measures, its proposals could go much further, especially in Scotland where uptake is modelled at close to zero, but where other studies have predicted major potential.[32]

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: n/a

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: n/a

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: n/a

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: n/a

[32] Lampkin, Smith and Padel, 2019, 'Delivering on Net Zero: Scottish Agriculture', *WWF*, available online: https://www.wwf.org.uk/sites/default/files/2019-12/WWF%20Net%20Zero%20and%20Farming.pdf