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 <u>400 words</u> 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:

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 have recently written a briefing paper that explores how futures techniques can be used to help develop a net-zero strategy that is robust to uncertainties. It can be found here: https://www.imperial.ac.uk/grantham/publications/using-futures-analysis-to-develop-resilient-climate-change-mitigation-strategies.php

Here we list some initial suggestions of how to approach certain uncertainties:

- Develop a range of policy and technology options, "run" those against a large number of scenarios and see which are most robust. This is a robust decision making approach.
- R&D and piloting of GGR, especially DAC, so if we underperform, we can still make it up later.
- Embed emissions reductions accounting in every new government policy

We would also advise continued transparency about what is known and where there is uncertainty to help different actors make pragmatic and well-informed choices. We understand that it is often challenging, however, to do so whilst encouraging urgent action.

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 – most resilient or least-cost path to net-zero in 2050 won't go through same points as path to an 80% reduction by 2050. This is for a range of reasons:

- infrastructure lock in may leave too much to do later
- learning by doing and scale makes faster action later more expensive
- norms and behaviours take time to change so that process needs to start – and bear fruit – sooner.

There is a large body of evidence (mainly on a global level), that details how, when pursuing decarbonisation goals, delaying action now can lead to much very stringent decarbonisation later on, resulting in increased policy costs in the long term. Failing to revise these budgets (at least the 5th carbon budget, as the immediacy of the 4th carbon budget means it might not make sense to update it), could lead to the UK Government delaying the increase in policy ambition to the 2030s, which would lead to higher costs to the economy, as well as reduce the feasibility of meeting net-zero by 2050 or before.

References:

1. Luderer, G. *et al.* Economic mitigation challenges: How further delay closes the door for achieving climate targets. *Environmental Research Letters* **8**, (2013).
2. Strefler, J. *et al.* Between Scylla and Charybdis: Delayed mitigation narrows the passage between large-scale CDR and high costs. *Environmental Research Letters* **13**, 044015 (2018).
3. Riahi, K. *et al.* Locked into Copenhagen pledges - Implications of short-term emission targets for the

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cost and feasibility of long-term climate goals. *Technological Forecasting and Social Change* **90**, 8–23 (2015).

4. Winning, M. *et al.* Nationally Determined Contributions under the Paris Agreement and the costs of delayed action. *Climate Policy* **0**, 1–12 (2019).

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:

On the EUCalc project (Dr. Jem Woods is the Imperial PI), we have developed a 'calculator' to explore different decarbonisation pathways at the EU level.

http://tool.european-calculator.eu/intro

Dr. Marc Stettler has led on the air pollution impacts arising from the different pathways and the tool has shown that greater decarbonisation ambition leads to deeper and more rapid improvements to air pollution.

There is a decreasing trend in air pollution impacts due to improved emissions control in the BAU scenario, but we see air pollution impacts are reduced significantly to 2050 with higher decarbonisation ambition relative to BAU.

Click on 'Air' on the tool. UK results can be shown separately.

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:

Policy action is vital, and the many policy recommendations of the CCC should be taken up as soon as possible. Some further suggestions include:

- Check all new infrastructure / long-lived assets are compatible with next 10/15 years
- Accelerate EV infrastructure and increase EV subsides
- Subsidise heat pumps and accelerate hydrogen, biogas, low-carbon heat distribution.
- Copy international best practice e.g. in hydrogen DRI steel, and set emission standards for specific industrial plants.

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

ANSWER:

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

ANSWER:

Impacts of delivering carbon targets on the fiscal balance, fuel poverty and security of supply can be managed if policy is well designed and funded, and in particular if these targets are integrated within the wider policy landscape. A shift to a net zero economy is not necessarily bad for competitiveness. New clean technologies can be the basis for increasing a countries competitiveness. However, this is not necessarily true.

To maximise the UK's potential it is necessary to develop an integrated industrial strategy with both clean and growth oriented policy objectives. This can be achieved by giving targeted support to promising clean technologies that also generate knowledge spillovers for the UK economy as a whole. Dr. Muuls and Dr. Martin made this case in a 2018 report "Sustainable growth in the UK" also developing a new methodology to identify these sectors. This suggested, for instance, that ocean based energy generation is a technology with not only great potential contribution to net zero emissions but with wider beneficial productivity impacts for the UK.

Please see: http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2018/12/Sustainable-Growth-in-the-UK_Full-Report_78pp.pdf

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

ANSWER:

D. Scotland, Wales and Northern Ireland

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

ANSWER:

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

- The most recent report under section 8 on the State of Natural Resources in relation to Wales;
- The most recent Future Trends report under section 11 of the Well-Being of Future Generations (Wales) Act 2015;
- The most recent report (if any) under section 23 of that Act (Future Generations report).

a) What evidence should the Committee draw on in assessing impacts on sustainable management of natural resources, as assessed in the state of natural resources report?

b) What evidence do you have of the impact of acting on climate change on well-being? What are the opportunities to improve people's well-being, or potential risks, associated with activities to reduce emissions in Wales?

c) What evidence regarding future trends as identified and analysed in the future trends report should the Committee draw on in assessing the impacts of the targets?

d) Question 12 asks how a just transition to Net Zero can be achieved across the UK. Do you have any evidence on how delivery mechanisms to help meet the UK and Welsh targets may affect workers and consumers in Wales, and how to ensure the costs and benefits of this transition are fairly distributed?

ANSWER:

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

ANSWER:

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

ANSWER:

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

ANSWER:

E. Sector-specific questions

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

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

b) What policies, measures or investment could incentivise this transition?

ANSWER:

Dr Marc Stettler contributed two evidence reviews for the Government Office for Science Future of Mobility report that may be useful on these points:

https://www.gov.uk/government/publications/future-of-mobility-the-uk-private-road-transport-system

https://www.gov.uk/government/publications/future-of-mobility-the-uk-passenger-road-transport-network

Our experts didn't find any existing research on these questions – the uptake and effectiveness of shared modes is a significant research gap. Department for Transport travel forecasts should investigate this.

Essentially, there is significant variation across the UK in towns and cities in trip rates, trip distances, commuting distances, use of bicycles.

As a recent example of it not working out: BlueCity and Drive Now are pulling out of London due to poor uptake. Both companies were using a large proportion of EVs.

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

ANSWER:

Autonomous vehicles, their appearance and their impacts are highly uncertain. They may significantly increase/decrease demand for mobility in road vehicles

- [Increase] Automation could reduce the generalised cost of travel by eliminating labour costs and allowing passengers to be productive while in the vehicle. This may induce more people to travel more, to shift away from highly efficient public transport modes, and further may encourage people to travel longer distances – thereby increasing transport energy consumption
- [Decrease] Autonomous vehicle fleets may be able to promote ride sharing services that increase rates of carpooling, and increase the number of passenger km serviced by a number of vehicles.
- [low-carbon] If automation increases vehicle utilisation, then electric vehicles are more cost competitive (Dr. Greg Offer has a paper on this). Synergies exist between automation and electrification suggesting that automation may accelerate electrification.

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

- Strong policy required to set standards on autonomous vehicles, set conditions on how they are deployed, and so that they do not pull users away from highly efficient public transport modes, e.g. in London.

We have additional experts who work on these issues but were unable to contribute in time to this submission. Please do contact us if you would like to be connected to them.

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

ANSWER:

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

ANSWER:

Hydrogen – retrofit solutions exist, however no OEM supplier. A project was funded by Innovate UK.

https://left.trl.co.uk/ulemco-ltd/

Strategic-level planning is required to assure operators of supply.

Electrification

Successful projects on light commercial vehicles have been completed and there may be a gap for short journeys into towns/cities, however unlikely for long haul routes due to limited energy storage.

Overhead wires

Trial project in Germany underway

https://new.siemens.com/global/en/products/mobility/road-solutions/ehighway.html

Demonstration in UK would be helpful. But Govt. needs to signal to operators about long term strategy, how expensive would it be for operators.

Evidence:

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?

Imperial's Sustainable Gas Institute produced a paper on the role of natural gas to decarbonise transport (HGVs and shipping). The paper conclude that fossil derived LNG offers GHG reductions of ~10-16% for truck, but this is highly dependent on technology. (biogas was not in the scope of the project)

https://www.sustainablegasinstitute.org/can-natural-gas-reduce-emissions-from-transport/

Review paper in Progress in Energy on LNG for HGVs and Shipping

https://iopscience.iop.org/article/10.1088/2516-1083/ab56af/meta

Here is a related article from perspective of the operator on LNG. Also stating that differential on fuel duty applied to LNG versus diesel does not accurately represent the wells to wheels (WTW) carbon impact of LNG

https://www.sciencedirect.com/science/article/abs/pii/S0301421519307475

In terms of facilitating the transition:

Banning of diesel, petrol and hybrid vehicles in the UK has just been moved up from 2040 to 2035 today so the transition is inevitable. The barriers to adoption for fleet operators remains economic and logistical. Capital cost of EV based heavy goods vehicles has not decreased at the same rate as consumer vehicles. Fewer major automotive companies, who have the scale, are developing vehicles leaving this more niche area for smaller OEMs who may struggle for economies of scale. Arguably, potentially battery EVs might not be the best solution here given the weight and the need for upgrading of the charging infrastructure.

Case studies of successful integration of large EV fleets including all of the associated costs would be helpful to make the case to fleet operators as would certainty in future policy, especially around the end of life of these vehicles i.e. will there be a disposal cost for the vehicle batteries.

Potentially a white paper on the electrification of heavy good vehicles might be useful to answer some of the questions around charging limitations, practicalities and evolution in other technologies like fuel cells which might be better suited for larger goods vehicles.

Thus, a two-pronged approach of an evidence piece with case studies for fleet operators to assess the economic and logical challenges of going electric would be useful as well as a stimulus programme supporting developers of electric heavy goods vehicles in the UK would be useful for fleet operator transition. Opening the data from current EV buses in London could also help.

Related evidence: Dr Oliver Schmidt's previous work on the cost reduction in energy storage and fuel cells

https://www.nature.com/articles/nenergy2017110/

https://www.sciencedirect.com/science/article/pii/S0360319917339435

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It is also important to consider the circular economy aspects of this transition and the impact on the electrical grid. Dr. Billy Wu helped to produce the below report for the EU on battery circular economy which has relevant recommendations.
https://ec.europa.eu/jrc/en/publication/circular-economy-perspectives-management-batteries-used-electric-vehicles

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:
a.

Carbon Contracts-for-Difference (CCfDs) could help create a viable business case for commercial scale investments which could allow industrial decarbonisation to start *now.* A CCfD would work very like the CfDs successfully promoted in the electricity market, but instead of providing a guaranteed electricity price, it would provide a guaranteed carbon price to low-carbon industrial technologies, allowing commercial investments to be made in these technologies. See reference below for more details on how CCfDs may outperform other mechanisms such as innovation funds/carbon price floors/border carbon adjustments/consumption charges, by providing greater focus on individual technologies, and being able to be implemented much more rapidly than some solutions (e.g. border carbon taxes).

For example: Innovation funds in the UK/EU are useful, but it is unlikely that they will generate sufficient funds to support commercial demonstration of low-carbon industrial technologies (e.g. the EU ETS innovation fund only covers around 60% of the incremental capital and operational expenditures from a low-carbon project, so on its own would not be able to kickstart commercial investment in industrial decarbonisation). Border carbon adjustments could prevent leakage of manufacturing sectors, but on its own a BCA would not deal with the fact that the internal carbon price could be too low/fluctuating to allow investments to be made, and would take a long time to agree and design due to international trade concerns. A CCfD would provide a guaranteed, long-term carbon price which would allow these investments to be made. The financial cost for such a scheme would also be relatively low.

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

b. Many of the above arguments for a CCfD would apply equally to manufacturing sectors which are not at risk of carbon leakage.

Sartor, O. & Iddri, C. B. Decarbonising basic materials in Europe : bring breakthrough technologies to market. (2019).

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 EASAC Energy Steering Panel is currently working to produce a report on decarbonisation of heat in buildings (see https://easac.eu/programmes/energy/), second last sentence. The outcome of that will help answer the questions but won't be ready till 2021. Some of the members on that panel may have some advance insight.

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:
It is worth being aware of the work of the Active Building Centres, based in Swansea but with involvement from Imperial (EE) https://www.activebuildingcentre.com/

This public and industry funded initiative is addressing linked aspects of low carbon buildings initially focussing on new build but moving to retrofit.

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

ANSWER:

As an example the ABC (last question) is building a set of social housing homes in Neath (in Wales) with cooperation with local council
https://www.activebuildingcentre.com/project/active-homes-neath/

That might not answer the question on governance but it is at least evidence of cooperation.

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:

We should be thinking about non-CO_2 impacts of aviation, which are significant and similar in magnitude to CO_2 impacts. Dr. Marc Stettler's group had a forthcoming paper in ES&T on the benefits of flight diversion for mitigating the effects of aviation contrails. The paper is due out shortly. A big concern is that flight diversions may increase CO2 emissions, but we

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have shown that this is not necessarily the case and that significant benefits are achievable with no increase to CO_2.

This is a conference abstract

https://agu.confex.com/agu/fm19/meetingapp.cgi/Paper/496394

We have provided some input into a POST note on aviation and climate change which should be published shortly, and can provide further evidence.

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:

The Grantham institute has published a paper on BECCS that can be found here: http://www.imperial.ac.uk/grantham/publications/briefing-papers/beccs-deployment-a-reality-check.php which considers issues of BECCS and scale up at a global scale. We have further expertise available to discuss these issues in a UK-relevant manner.

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: