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.***

### 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: n/a

**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?

ANSWER: n/a

**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: Leading by example and showcasing that climate action at scale is not just necessary but possible is crucial to encourage followers. NDCs are too weak to be in line with the commitments of Paris effectively across the bank. The UK has already sent a strong signal through the net-zero announcement last year. The adjustment of its NDC shows the country's commitment. Other countries will find it difficult to advocate themselves as climate leaders and pioneers if they do not follow suit.

The UK's leadership in sectors that are considered hard to abate, such as industry, which many governments are reluctant to address will be of particular importance. Here, the identification and implementation of necessary technologies is as crucial as the innovative policy and regulatory framework surrounding them. The UK is set to lead in both, due to its unique governance set up through the CCAs and CCC, which other countries should be

encouraged to imitate as they ensure a science- rather than ideology-based policy making process.

## 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 has to play a fundamental part in achieving net-zero emissions; from reduced meat consumption, conscious choices to drive demand for clean products, etc. For changes in consumer behaviour to take place and be somewhat ensured and relied upon in the estimation of policy pathways though, government has to influence the market of goods available.

Fundamental to many product focused approaches is a set of standards to identify the carbon content (direct and indirect) of a product, as well as an understanding of the value chains to find policy and oversight systems to trace carbon content along the production chain. This process will, however, take time and likely require international coordination as value chains in a globalised world are spread across different countries. Potential regulatory loopholes due to the complexity of tracing carbon across production chains need to be prevented.

The most straightforward regulation to stop certain consumption behaviours is the ban of goods, such as plastic bags, straws, or combustion vehicles, at a certain point in time. To ensure alternative products are available where possible to maintain living standards and reduce public resistance. This allows time for investments and infrastructures.

Where government is reluctant to use bans, bridging market failures is key. Making polluting products more expensive vis a vis clean products, or making the latter cheaper than the former are the two general levers to pull. This can be achieved through direct subsidies, additional levies charged or reduced taxation etc.

Public sector leadership through the procurement of net-zero compliant products both leverages the purchasing power of government to create initial niche markets and acts as a role model for private sector to follow. From application in public construction projects, for example, planning frameworks offering incentives or mandates to use low carbon materials can be expanded across new buildings.

https://bellona.org/publication/brief-counting-carbon-a-lifecycle-assesment-guide-for-plastic-fuels

https://bellona.org/publication/keeping-business-as-usual-co2-avoidance-in-the-eu-ets-monitoring-and-reporting-regulation-2

**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: For the private sector, the biggest uncertainty is the commitment to net zero itself. For many companies, there remain doubts over the immediate and distant implications. Ensuring there is clear messaging on what is expected and necessary with

precise targets for the near and distant future is crucial. Offshore wind development is a successful example in which clear target trajectories led to UK becoming the world leader. Clear expectation/ expansion corridors provide private entities with the planning security to make decisions and investments. Even if this means sending out a difficult message, for example setting a carbon price that seems excessive today, it gives clarity and makes investments into new plants or technologies more budgetable in the long-term as cost expectations can be accounted for.

Many climate solutions also require additional framework conditions for goods to be produced or sold at scale. Naturally, the private sector will need protection against potential competitive disadvantages, which link to Question 5: the necessity to create a market for the products, and financial incentives that ensure companies can still do business even if production costs increase. Infrastructures, such as access to hydrogen and CO2 storage, or charging stations for EVs need to be provided for.

Complementarity of policy is crucial. Parallel to setting clear and ambitious targets with a clear trajectory of expectation, government needs to enable a market for new products, and provide the context in which the private sector can make necessary investments and changes. Supply and demand policies need be in tune with each other: infrastructures provided so that companies are incentivised to invest in new production lines and processes with markets established to sell their net-zero compliant products at.

**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: Potentially.

On the one hand, the scale and pace of CO2 reductions will need to be picked up significantly to achieve net-zero. The reduction shares will be proportionately higher in the early decades than the latter, when residual emissions and more difficult to abate emissions (the final percentages) will need to be addressed. Ensuring the right policies are encouraged over the next ten years is fundamental.

On the other hand, if budgets are changed significantly, policies necessary to achieve those probably should have been put in place years ago. There is little gained by missing targets, when instead a steeper decline post-2032 is more realistic and gives government and private sector time to deliver, e.g. on appropritate policy frameworks, infrastructures and markets (compare Q6).

**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: For any company or business to still exist in 40 years, it will have to have transformed itself to still have access to market, which at that point will be a net zero emissions compliant market. As with the industrial revolution, countries and companies

that lead the technological way towards that future, will be the ones shaping this market. Their competitive advantage will be crucial to still play a role on globally.

From a mere resource perspective, Europe and the UK fall behind other global regions. As all regions at some point will have to be green, those with greater access to the resources of the future, will become new economic centres. For industry in Europe today, the question therefore stands where new production plants of the future will be built. Lacking direct access to raw materials, the UK will have to build on the qualities that make it a major economy today: political stability, as a crucial soft factor, and an existing, developed infrastructure that ensures the necessary ingredients of production are delivered and at a fair price. While the UK government should therefore continue its defence of a free global market, it needs to develop the appropriate infrastructures needed in the future for the delivery of the new ingredients. By doing so as early as possible, the private sector will see new investments into the British market as more attractive, safeguarding domestic production, jobs and value added of those industries.

For the prioritisation, next to focusing on the big emitting sectors, it should be prioritised to safeguard domestic production in sectors that currently generate value and that are needed to create value and products in the future. The industry sector is therefore an important focus zone for current climate strategy as it provides the basic products needed to decarbonise other parts of the economy.

Bellona works with the University of Strathclyde to conduct ground-breaking, first of a kind, research into the macro-economic impacts of industrial decarbonisation. Whilst this research would have provided peer-reviewed evidence to answer this question, regrettably, our first outputs will not be completed before Summer 2020, at the earliest. Over the course of the two years' research, we hope to answer a number of questions related also to Q8 and Q22, in an economically-robust, peer-reviewed, HMT-compliant manner.

https://zeroemissionsplatform.eu/role-of-ccus-in-a-below-2-degrees-scenario/

## 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: As mentioned earlier, access to climate infrastructures is key. In order to incentivise investment in new technologies and production plants on the industry side, the pace and scale of developing respective networks of CO2 pipelines and hydrogen is of utmost importance to save costs and encourage timely investments.

**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: Policy design is fundamental to ensure least negative effects on consumers, economic growth and employment. For infrastructures themselves, different ownership models can also affect the cost distribution. A key question is therefore who ultimately pays.

There are different mechanisms to bear costs of climate technologies; through socialisation to all (e.g. renewable energy levy on all energy consumers), transferral to end-consumers (e.g. additional cost of raw material is added along value chain to final product), certificates on initial fossil fuel producers (e.g. demonstrate storage of CO2 as percentage of fossil extraction), through taxes and levies (e.g. as a VAT reduction for clean products, or tax cuts for process industry) etc. Prices can be set, or established through tenders or contracts for difference (CfD). For internationally traded goods Border Carbon Adjustments (BCAs) can protect domestic economies from carbon leakage.

While there have been indications on the economic, financial and societal cost of different policy approaches, most have not been founded in sound economic principles, which is why our current project with the University of Strathclyde seeks to identify the exact macroeconomic implications of different policy models to inform government of the best, i.e. least harmful, policies and regulations.

https://www.sccs.org.uk/images/expertise/reports/working-papers/wp-2015-04.pdf

https://www.iddri.org/sites/default/files/PDF/Publications/Catalogue%20Iddri/Etude/201910-ST0619-CCfDs_0.pdf

https://www.diw.de/documents/publikationen/73/diw_01.c.575021.de/dp1714.pdf

https://sandbag.org.uk/project/the-abc-of-bcas/

**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: This is a key question to be answered by our project with the University of Strathclyde. In general, it is important to consider different business models, including having HMG reconsider the merits of energy and infrastructure assets as ‘on balance sheet’.

## 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?

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: n/a

**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: n/a

## 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:
B)
Internalising the external costs of transport can establish the real 'level-playing field' so often discussed. Passenger cars are a burden to society in many ways, such as air pollution, congestion, and particularly climate change. In fact, including the health costs of air pollution into the purchase of an average ICE, would almost double its price. It is therefore important to properly tax the external costs of the various modes of transport, while providing incentives for those modes which have external benefits.

Establishing urban access regulations are necessary to prioritise greener modes of transport and greener 'fuels'. In parallel, affordable and efficient public transport must be available and ready to meet the increase in demand resulting from restricting access to passenger cars.

https://ec.europa.eu/transport/sites/transport/files/studies/internalisation-handbook-isbn-978-92-79-96917-1.pdf

https://network.bellona.org/content/uploads/sites/3/2017/03/BellonaBrief_Rethinking-the-cost-of-conventionally-fuelled-road-transport_FINAL.pdf

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

ANSWER: Pairing autonomous driving with electrification of HGVs would overcome current challenges of mileage. By law, HGVs have to make breaks of 45 minutes every 4.5 hours with a maximum driving time of about 9 hours. Joining autonomous driving with HGV-EVs could follow a similar rhythm in which trucks drive for a certain number of hours to be recharged for several minutes to an hour and return to the road, overcoming the current sense of inefficiency of direct electrification of heavy road transport compared to the current system.

**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: A significant barrier is the perceived and real lack of alternatives. This could be addressed via financing and deploying refuelling/charging infrastructure, alongside public

campaigns to ensure there is sufficient knowledge to mitigate potential anxieties.

An adverse consequence could be the export of old vehicles to other markets which could still allow them. A way to mitigate this could be to encourage and finance retrofitting of existing ICE vehicles into EVs.

**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: This transition can be facilitated through a CO2 regulation for trucks, low/zero emission zones, incentives for the purchase of zero emission trucks, bonuses for manufacturers of zero emission HGVs. This will likely require changing the taxation of energy, in favour of zero emission energy carriers and to the detriment of GHG-emitting energy carriers.

**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: For manufacturing sectors policy complementarity is key. This involves three levers irregardless of carbon leakage:

(i) financial support in the development of new innovation, such as grants and loans.
(ii) Any investment in (i) needs to be complemented with necessary infrastructures and access to resources in order to scale.In order to encourage significant investments into new production processes in steel, cement and chemicals in the UK, each sector needs access to CO2 storage systems and hydrogen at scale as soon as possible. Timelines here need to be aligned. Infrastructure business models can vary. Government's role will be needed to ensure fair access and pricing. Over time, business models may change as markets for CO2 storage and hydrogen are established. There are current examples in Norway, the Netherlands and the US how demonstration projects and infrastructures can be started, funded, and coordinated.
(iii) Policy mechanisms need to ensure industries can continue to sell their products at market or investments into new technologies and infrastructures will be perpetually reliant on subsidies. This will require a combination of pull (incentives etc.) and push (mandates, certificates, bans). Our project with the University of Strathclyde will evaluate different policy paths and their macro-economic consequences to answer the question which mechanisms are best suited hopefully in the coming months.

For a) We are currently not aware of any alternative to BCA barring the global implementation of regulations, such as a CO2 price.

C) The oil and gas sector may have a role to play in a decarbonised net-zero

future.However, their involvement in these is not a given. O&G operators need clear requirements to reshape their business and their license to emit revoked. There are other organisations capable of providing the technical expertise to implement CCS and hydrogen networks. Policy mechanisms, need to similarly be a combination of carrot and stick. Carbon Certificates, or CO2 Storage mandates for fossil exploration can help reduce fossil use, incentivise alternatives and finance the CO2 infrastructure directly.

d) public procurement is an effective way to incentivise equipment manufacturers towards zero emission technologies. A key example of this is the city of Oslo. https://network.bellona.org/content/uploads/sites/3/2019/10/ZECS_Status2019.pdf

**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: Many of the skillsets of the oil and gas sector can help deliver new climate technologies. Unlike the coal ase-out, the existing expertise can be re-used with minimal retraining. This applies for technologies such as CCS, either on industrial emitters or for the production of blue hydrogen, and the hydrogen downstream value chain. Our ongoing research with the University of Strathclyde (referenced previously) will yield detailed conclusions relating to the socio-economic impacts of industrial decarbonisation and the effect that different policy measures have on aspects relevant to the just transition, including jobs, wages, supply chain impacts within and beyond UK industrial sectors. In addition, the analysis will look into the macro-economic impacts of policy to retain UK industry (including fossil fuel supply sectors) versus offshoring these industries and importing their products.

Fundamental to all of this, is the central proposition that without CCS, the fossil fuel supply sector in the UK cannot be otherwise compatible with net-zero. This means that a socially and environmentally –just approach to CCS deployment becomes a key mechanism for achieving a just transition in fossil fuel supply sectors. As we discuss elsewhere, we believe that this type of policy approach to CCS is contingent on: (1) Central government control over the where's, when's and how much when it comes to CCS infrastructure deployment; (2) intervention to ensure appropriate rates of return throughout the CCS value chain, including the adoption of RAB models, when appropriate. It is Bellona's view that government ownership and operation (potentially via a CCS Delivery Authority or Government-owned company) is the most appropriate mechanism for ensuring that CCS deployment is in line with the public interest and does not simply perpetuate economic returns for polluters. We also believe that there is a strong public-interest case in a certification and mandate system for CO2 storage to be developed for producers and importers of fossil fuels as discussed by, e.g. Prof Myles Allen.

Our ongoing research will shed further light on these issues and provide robust evidence that may be of relevance to the Committee in future. Unfortunately, the project is not yet advanced enough to provide tangible and robust evidence to inform decisions relating to the 6th Carbon Budget.

**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: Hydrogen holds considerable promise as a zero carbon energy vector for the UK, with potential applications across the economy. Whilst further research is needed to bring the costs of electrolysers down, and far greater deployment of renewable energy required to ensure the necessary quantities of low carbon electricity are available to provide energy to electrolysers, we agree with the Committee's view that at one large-scale low-carbon production facility in the 2020s is an appropriate ambition.

In our view, early applications should focus on industrial installations (e.g. foundation industries, which provide inputs and materials across the economy) where other decarbonisation technologies may be unavailable, less available, or simply more expensive. This, alongside applications in other hard to abate sectors such as non-electrified railways, shipping and potential heavy duty road transport. In the longer term, once a large-scale supply of Hydrogen becomes available, and a clearer trajectory towards zero carbon hydrogen being produced from electrolysis at the costs and scales necessary, then hydrogen for domestic heat may also become a desirable option to pursue for widespread deployment in some regions.

In terms of incentivsing production, we are currently working to determine our own views on this topic as an organisation. It is clear from our analysis thus far that merely incentivising the production without complementary measures on the demand side is unlikely to achieve the desired outcome. We therefore would recommend that a Regulated Asset Base model for SMR/CCS-based Hydrogen production (as per the BEIS CCUS Business Models consultation from 2019) is explored further, alongside a Government-owned (on balance sheet) CCS infrastructure, alongside either a mandate or incentive to industry to use the hydrogen and/or new public procurement standards to ensure that industrial outputs produced using low carbon hydrogen (and/or emit no CO2) are given

preferential access to markets controlled by the public sector.

We will provide further input and evidence to the Committee in due course.

**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: n/a

**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: n/a

**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: n/a

**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: The proximity to, and availability (across time periods) of, CO2 transport and storage infrastructure will have a profound impact on the political and economic case for investing in the gas and electricity distribution networks and local heat networks. Regions with access to CO2 T&S (to a certain extent depending on the eventual business model adopted by the government) will have a stronger rationale for investing long-term in the gas distribution network and the use of Hydrogen as a zero carbon energy vector, including potentially in distributed heat networks. This is because low-carbon Hydrogen can only currently be produced at the quantities and costs required for decarbonisation of heat through steam methane reforming and CCS, although we expect the market for green hydrogen produced via electrolysis to develop rapidly in the period 2020-2030.

As suggested above, there is a reason to assume that the extent to which CO2 T&S availability is likely to impact on investments in the distribution networks regionally will be determined by the government's choice of business model for CCS. If a private sector-led business model is adopted (whether RAB –based or otherwise) then one would expect the vested interests of fossil fuel companies (upstream and downstream) to directly and/or indirectly favour investment in the long-term future of the gas network. This doesn't mean that the case for investment in the gas network doesn't exist, or that it is inextricably tied to these interests, but it nonetheless is an inescapable factor to consider. However, if government adopts a more public sector –led business model for CCS, e.g. direct ownership and operation of T&S infrastructure, on-balance sheet, (albeit with operational services provided by the O&G sector), then one would expect the issue of vested interests to be less of a determining factor, thereby potentially having less impact on the investability in the different distribution networks.

Although CO2 T&S will have an impact on the rationale for investment in and by the networks, we believe that electrification will, irrespective of the future of CCS, be a vital component of the UK's net zero transition and we therefore see a very strong case for investment in electricity distribution networks across the UK. This should be a priority for the government as the supply and demand of clean electricity is likely to evolve considerably over the coming decades.

**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:

We believe the evidence developed by the CCC in support of this target is compelling, however, we agree that the scale of CCS likely to be needed by 2050 is far greater and therefore we propose a more nuanced approach to CCS targets in the period 2020-2030.
(1) the 10 Mt CO2 storage target should be explicitly from manufacturing and other industrial sectors alone, and that any contribution from the power sector should be additional to this target; and,
(2) an appropriate commercially-available storage target for 2030 needs to be set at a higher level , in the region of 15 Mt CO2.

The first of these two points is based on rapidly increasing industrial awareness and interest in CCS and Hydrogen.he accepted wisdom that CCS is too difficult, too expensive and too risky, politically has changed dramatically in recent years, particularly in the UK where the Net Zero legislation, revitalised interest from government, and the prospect of a lengthy Parliamentary majority for the government have had a tangible impact on industry. This is mirrored to a degree in some European countries.

The second point around adopting a more ambitious target for storage space commercially-available is intended to send stronger signals to the CO2 capture market that space can be made available as quickly as possible to emitters, subject to meeting the necessary technical criteria around purity and availability of CO2.

Historically, the case for building overcapacity in CO2 storage was uninvestable without major interventions from government.This proposition was based on the premise that government wanted the private sector to own and operate CO2 T&S. Now though, with the reclassification of a wide range of infrastructure assets on the basis of new Eurostat rules likely to lead to more energy projects being deemed ‘on balance sheet’.
Direct ownership has three benefits:

(1) Significantly reduced cost of capital;
(2) Ability to manage cross-chain risks; including,
(3) ability to develop s over-capacity initially, without having to require the first projects to cover the total capex and opex costs .

On this basis, there is a rationale for a) amending the recommendation for the 10Mt to prioritise industrial emitters (thereby increasing target once power is included) and b) government focus includes firm co2 as well as ambition for higher purchasable co2 storage capacity for 2030.