

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: CCUS: carbon capture use and storage after fossil fuel combustion is fundamental in the energy transition until 100% renewables becomes feasible and delivered. <https://www.iea.org/reports/transforming-industry-through-ccus>

Question 2: How relevant are estimates of the remaining global cumulative CO₂ budgets (consistent with the Paris Agreement long-term temperature goal) for constraining UK cumulative emissions on the pathway to reaching net-zero GHGs by 2050?

ANSWER:

Question 3: How should emerging updated international commitments to reduce emissions by 2030 impact on the level of the sixth carbon budget for the UK? Are there other actions the UK should be taking alongside setting the sixth carbon budget, and taking the actions necessary to meet it, to support the global effort to implement the Paris Agreement?

ANSWER:

Question 4: What is the international signalling value of a revised and strengthened UK NDC (for the period around 2030) as part of a package of action which includes setting the level of the sixth carbon budget?

ANSWER:

B. The path to the 2050 target

Question 5: How big a role can consumer, individual or household behaviour play in delivering emissions reductions? How can this be credibly assessed and incentivised?

ANSWER:

Question 6: What are the most important uncertainties that policy needs to take into account in thinking about achieving Net Zero? How can government develop a strategy that helps to retain robustness to those uncertainties, for example low-regrets options and approaches that maintain optionality?

ANSWER:

Question 7: The fourth and fifth carbon budgets (covering the periods of 2023-27 and 2028-32 respectively) have been set on the basis of the previous long-term target (at least 80% reduction in GHGs by 2050, relative to 1990 levels). Should the CCC revisit the level of these budgets in light of the net-zero target?

ANSWER:

Question 8: What evidence do you have of the co-benefits of acting on climate change compatible with achieving Net Zero by 2050? What do these co-benefits mean for which emissions abatement should be prioritised and why?

ANSWER:

C. Delivering carbon budgets

Question 9: Carbon targets are only credible if they are accompanied by policy action. We set out a range of delivery challenges/priorities for the 2050 net-zero target in our Net Zero advice. What else is important for the period out to 2030/2035?

ANSWER:

Greenbackers see many innovative technologies and retrofit solutions seeking to address elements of the Net Zero challenge. Some may well be a part of delivering that. BUT all are subject to technology risk and challenges around scaling up, timelines to commercialisation, cost competitiveness and integration with the grid.

There is however a technology that appears absent from the UK's plans which suffers from none of these challenges.

Large scale Pumped Storage Hydro (PSH).

This is tried, tested and well understood – there is no technology risk.

There is a large scale pipeline ready to progress – the UK has c 4GW, which could be generating by 2030.

PSH can deliver reduced curtailment costs as it uses that power to pump water to its head pond, has black start, spinning reserve, fast and slow release capability; all characteristics that are valuable in their own right but some of which facilitate the integration of more renewables – including hydrogen, onto the grid.

PSH projects will last for up to 100 years.

It is important that this sector is part of any Net Zero solution. Energy Storage: simply has not kept pace with the deployment of renewables, especially wind power and as a result

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?

excess is spilled and bizarrely at times consumers have been paid to offtake. This inefficiency and wastage needs to be addressed both in the short term and longer term with utility scale battery and PSH development and deployment.

<https://www.theguardian.com/business/2019/dec/09/thousands-were-paid-to-use-extra-renewable-electricity-on-windy-weekend>

<https://www.independent.co.uk/environment/germany-power-grid-pays-customers-christmas-sustainability-renewable-energy-a8141431.html>

Small-scale nuclear: subject to addressing any and all safety concerns, could form part of energy mix. Benefit of shorter distribution lines and integration with existing infrastructure.

https://www.theregister.co.uk/2017/05/24/mini_nuclear_reactors_for_british_power/

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

ANSWER:

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

ANSWER:

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

ANSWER:

Inevitably this will take a range of measures; this is one area where the release from the constraints imposed by EU Membership by UK's exit could help.

1) where the Net Zero progress requires large infrastructure projects the UK could and should arrange for all those bidding in to deliver such contracts to sign up to a common set of principles – e.g. <https://scottishbusinesspledge.scot/> - around all of these issues; this should be compulsorily reported on in the businesses published annual accounts to allow investors – including ESG energised investors – to judge performance and make investment decisions accordingly (this will alleviate from the Government some of the responsibility for overseeing adherence – the markets will do that);

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?

ii) a minimum threshold of UK supply chain involvement should be an essential part of any infrastructure contract with similar reporting obligations to the above

iii) a share of any project should be available for community ownership – Scotland has some experience in delivering such a scheme and the learnings from that will be of value - <https://www.localenergy.scot/>

iv) a payment per megawatt of power generated or similar should be made to qualifying communities – again Scotland has experience of this sort of scheme- <https://www.gov.scot/publications/consultation-scottish-government-good-practice-principles-community-benefits-offshore-renewable-energy-developments/> -

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: Scotland: The Islands of Scotland should be considered as a powerful resource in helping deliver Net Zero. Connecting them to mainland grid will liberate huge renewable resources of on and off shore floating wind and, as technologies emerge, of ocean energy. The example of the Orkney Islands in embracing the use of renewable energy and its generation and use locally including its early moves to deliver renewably created hydrogen for use in ferries - <http://www.surfnturf.org.uk/> - is a great example for other communities. Learnings from work we have done in funding community owned renewables - <https://www.all-energy.co.uk/novadocuments/54455?v=635379931004270000> - suggests that communities learn well from other communities – seed and it is suggested that the changes of behaviour that are going to be a key part of achieving Net Zero would be well served by a programme of engagement facilitated by Governments but managed and run by communities themselves would be a valuable addition

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: Food miles emits CO2: Intelligent Growth Solutions based in Scotland <https://www.intelligentgrowtholutions.com/> has developed an AI enabled indoor platform to grow crops close to the point of consumption with reduced energy, water, wastage and labour costs, free of pesticides to improve overall economic viability.

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

ANSWER:

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

ANSWER: EVs: insufficient charge point infrastructure will deter the uptake of EVs over internal combustion engine vehicles, especially without the highest levels of customer service and maintenance expected by users to ensure continuous operation. <https://www.ft.com/content/dfe71424-7c07-11e9-81d2-f785092ab560>

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

ANSWER:

Question 22 (Industry): What policy mechanisms should be implemented to support decarbonisation of the sectors below? Please provide evidence to support this over alternative mechanisms.

- a) Manufacturing sectors at risk of carbon leakage
- b) Manufacturing sectors not at risk of carbon leakage
- c) Fossil fuel production sectors
- d) Off-road mobile machinery

ANSWER: re c) above: The OGTC, ONE North East and others are all running programmes to help the energy transition and the electrification and decarbonisation of the North Sea basin. A policy that obliged the capture and reporting of carbon usage and reduction and the setting and progress towards meeting carbon reduction targets in the formal accounts of quoted businesses would assist. Many of the largest investors in stocks around the world have openly declared a holding to account of such businesses to these standards and consultation with them as to the information they would like to see in these companies accounts to be able to use them as a tool to assess those businesses and executive teams they were supporting with their investments would provide a strong driver for carbon producing businesses to continue with and accelerate their transition. Regulation acknowledging that new wells will be required over the next few decades but that oblige such wells to be drilled with renewable energies – all of which is possible – would assist with this transition and could readily from a part of the licensing mechanism that such wells have to go through. NOTE 25% of the costs of any new well are in the liquid fuels used in their drilling operations.

Question 23 (Industry): What would you highlight as international examples of good policy/practice on decarbonisation of manufacturing and fossil fuel supply emissions? Is there evidence to suggest that these policies or practices created economic opportunities (e.g. increased market shares, job creation) for the manufacturing and fossil fuel supply sectors?

ANSWER:

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

ANSWER:

Question 25 (Industry): In our Net Zero advice, the CCC identified a range of resource efficiency measures that can reduce emissions (see Chapter 4 of the Net Zero Technical Report, page 115), but found little evidence relating to the costs/savings of these measures. What evidence is there on the costs/savings of these and other resource efficiency measures (ideally on a £/tCO₂e basis)?

ANSWER:

Question 26 (Buildings): For the majority of the housing stock in the CCC's Net Zero Further Ambition scenario, 2050 is assumed to be a realistic timeframe for full roll-out of energy efficiency and low-carbon heating.

- a) What evidence can you point to about the potential for decarbonising heat in buildings more quickly?
- b) What evidence do you have about the role behaviour change could play in driving forward more extensive decarbonisation of the building stock more quickly? What are the costs/levels of abatement that might be associated with a behaviour-led transition?

ANSWER:

Question 27 (Buildings): Do we currently have the right skills in place to enable widespread retrofit and build of low-carbon buildings? If not, where are skills lacking and what are the gaps in the current training framework? To what extent are existing skill sets readily transferable to low-carbon skills requirements?

ANSWER:

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

ANSWER:

Question 29 (Power): Think of a possible future power system without Government backed Contracts-for-Difference. What business models and/or policy instruments could be used to continue to decarbonise UK power emissions to close to zero by 2050, whilst minimising costs?

ANSWER: In certain jurisdictions infrastructure investors are willing to take a degree of merchant risk in delivering national assets – e.g. in Australia. In most of Europe that attitude does not typically exist.

There is significant interest in delivering PSH and battery storage projects in the UK but some mechanism is needed to allow early adopters to de-risk the significant costs that need to be committed to deliver these infrastructure projects. These interventions can be limited in duration and amount and supported by tweaks to the regulated market that establish income streams for the different types of power that these sources of generation and storage provide.

The Regulatory Asset Base (RAB) model could be applied to PSH projects to address these issues as could the approach used for interconnector projects where cap and floor mechanisms have been applied resulting in significantly lower financing costs.

With some imagination and hard work alongside possible funding investors and debt providers consultations could take place to identify the right mix of measures that will

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?

enable the clear and obvious benefits of PSH and grid scale battery storage in helping deliver Net Zero.

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:

PSH has to date been overlooked ; we believe this is for 2 reasons: a misconception that “ all of the available sites are gone” and “ the technology endures well beyond the typically used 20 or 25 years modelled into the Times tools used by advisers.

Available Sites: In fact there are some 4 GW available for development and delivery into production by 2030 i.e. well within the time frames needed for significant new, suitable generation to contribute to net zero 2050. Drax, SSE, Bucceluch Estate and ILI all have projects at different stages of development and are all in contact with one another and have consistent and simple messages for market regulators as to the market changes needed to drive these projects.

Modelling Failure: if it is correct that the Times models that are widely used to aid decision making do not allow for the benefits of a particular solution to be captured beyond a 20 year horizon – that needs to change. PSH is well understood simple technology that has demonstrated its working life to be up to 100 years.

The type of power provided by PSH is of value to the grid in balancing intermittent renewables (indeed it can help in reducing or removing ll together the need for payments to wind generators for not generating by using that power to pump water into head ponds). It can provide rapid response black start, spinning reserve, slow planned release (depending on scheme size).This range of possibilities gives the system operator necessary tools to integrate significant levels of new renewables, whilst off-setting the loss of services previously provided by more traditional thermal plant, such as inertia. Security of supply would be maintained at the same time as net zero being achieved.

Wherever it is deployed PSH can improve the economics of generation systems with significant elements of renewable generation, and can reduce the need for additional subsea transmission cables and interconnectors to be constructed to transfer renewable power between Europe and UK and between Scotland and England

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?

We suggest that Net Zero power system scenarios are modelled with the inclusion of PSH in Scotland to demonstrate the economic and decarbonisation benefits.

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: 25% of the costs of a new well are in the liquid fuel used. The oil and gas community still relies on large, expensive, heavily manned boats to deliver services. Given that oil and gas will still have a role to play to 2050 regulation and encouragement of and for the sector to transition to the use of AUV's and SUV's – powered by sea floor batteries charged by renewable sources and drill rigs similarly powered by renewable energy will make a significant difference and could be an area where UK could build on the lead Aberdeen has as a world centre of knowledge and as a leader in the Energy Transition being conducted by organisations like OGTC and ONE North East.

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: If productivity is to be increased sustainably technology will have a role to play. As an example the use of polytunnels to assist in the growth of foods is common and there are some processes by which these polytunnels can be made more efficient by treating the material from which they are constructed so that they absorb more of the light spectrum from natural sunlight. Companies like Lambda - <https://www.lambda.energy/> - are making progress with this. Companies like Algaenergy - <https://www.algaenergy.com/> - with investors like Ibedrola – producing sustainable fertilisers will also be needed. Scotland is a leader in Food & Drink and efforts to encourage such innovation and secure it for the future will need to be supported through innovations such as the newly emerging Scottish National Investment Bank BUT efforts will need to be made to ensure that its risk appetite and investment profile reflects the needs of the carbon neutral agenda.

Question 34 (Agriculture and Land use): Land spared through the measures set out in question 33 is used in our Further Ambition scenario for: afforestation (30,000 hectares/year), bioenergy crops (23,000 hectares/year), agro-forestry and hedgerows (~10% of agricultural land) and peatland restoration (50% of upland peat, 25% lowland peat). We also assume the take-up of low-carbon farming practices for soils and livestock. Do you agree that these are the key measures and with the broad level of ambition of each? Are there additional measures you would suggest?

ANSWER:

Question 35 (Greenhouse gas removals): What relevant evidence exists regarding constraints on the rate at which the deployment of engineered GHG removals in the UK (such as bioenergy with carbon capture and storage or direct air capture) could scale-up by 2035?

ANSWER:

Question 36 (Greenhouse gas removals): Is there evidence regarding near-term expected learning curves for the cost of engineered GHG removal through technologies such as bioenergy with carbon capture and storage or direct air capture of CO₂?

ANSWER:

Question 37 (Infrastructure): What will be the key factors that will determine whether decarbonisation of heat in a particular area will require investment in the electricity distribution network, the gas distribution network or a heat network?

ANSWER:

Question 38 (Infrastructure): What scale of carbon capture and storage development is needed and what for development of CO₂ transport and storage infrastructure over the period to 2030?

ANSWER: Projects of the size contemplated by Equinor and referenced here - <https://www.equinor.com/e-cooperation-carbon-capture-storage.html> - will be needed. The collaborative partners listed here are an example of who will need to be involved. As referenced here - [file:///C:/Users/Andrew/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Digital%20roadmap-2018-digital%20\(1\).pdf](file:///C:/Users/Andrew/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Digital%20roadmap-2018-digital%20(1).pdf) – page 33 – CCS can be an enabler for hydrogen production. CCS as a business model. It is suggested that commercial businesses such as Equinor are well placed to provide evidence on the scale that is deliverable and on what is needed by way of improvements to existing and new infrastructure.