

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: The CCC should consider the independent advisors who work for other organisations (e.g. Willis Re reinsurance), the Office of Nuclear Regulation - ONR - (associated with the H.S.E.). In particular the TAG13 (Technical Advice Guidelines, update, 2020) provide on future weather and climate changes in a changing climate provides an analysis of what can be expected. These guidelines are based on published research, often not included in IPCC and official reports. IPCC documents have to be agreed by oil producing nations, US and Russia, are therefore "conservative" and only published with unanimous consent. Government (in all countries around the world) funded organisations and "successful" researchers who have to obtain governmental resources to obtain their funding, need to comply with their local norms. There are a few independent scientists (e.g. Wadhams, Cambridge "Farewell to Ice", 2016) who provide an analysis of the current state of climate change, who should be considered and asked to supply evidence to the committee.

History is full of examples of independent scientists, informed people, providing evidence of worse case scenario events that have been ignored. After the 2009 Lakanal House fire, government officials were advised this could happen again; nothing was done and the consequential Grenfell fire followed. The 737 Max was a classic example where independent advice on the use of heavy engines well forward of the wings would provide stability issues.

It is fortunate that sometimes independent scientists, not constrained by promotional / funding attainments, can provide critical advice. Contamination from Windscale (1957), Price's worst case scenario, although dismissed by the committee, came to pass, but fortunately the filter built in response to his concerns, managed to trap some significant fraction of the radioactive material. Currently, advisers to the ONR are providing concerns, e.g. the 1607 cat 2 hurricane or the 1703 storm could engulf New Nuclear Builds, without adequate protection. This is being acted on, although much more severe than governmental guidelines.

Thus the CCC NEEDS to be presented with all substantial research results. My research argues that 1.5C is an irrelevance, since 3-4C is now inevitable. Marine Cloud Brightening (see later) should be considered to provide a cheap stop-gap, non-invasive scheme to cool the planet to provide time for CO2 reductions to be implemented.

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: The estimates of the CO₂ budgets are relevant for quantitative studies, but of minor importance to the changes now taking place. Charney (1978, E.G.U. conference, Strasbourg) presented results which are within 10% of current values and trends. Computer numerical modelling studies give approximately the same results as Charney. RCP2.6 or RCP 8.5 results for global warming show insignificant temperature trend differences until approximately 2035 (see AR5, IPCC report, 2013). Only after then does a significant signal appear.

The assertion by Wadhams (2016) that the summer Arctic will be ice free (< 15% broken ice) by well before the end of next decade, will have huge implications on global radiational balance. The current numerical models do not include that scenario, as I would argue, a pressing limitation of current forecasts. The fact that the climate models do not permit convection, a critical factor in the changing climate, negates their validity and questions the whether the current funding is both well spent and of much use. The AMOC (Atlantic Meridional Circulation) has reduced by 15% over the last few years (Frajka-Williams et al 2019) has significant implications on the planet, and significantly our latitudes, again not included in "climate" research.

The Paris agreement of zero GHG emissions by 2050, is an irrelevance commensurate with the order to rearrange the deck chairs on the sinking Titanic. Zero emissions should be achieved as soon as possible. However, since if you reduced all GHG emissions to zero immediately, there would be only be a four week pause in the trend of rising CO₂ emissions, then what the UK does is of minor significance.

As discussed in Question 3, investment of ~ £2 billion , and recurrent costs of £1 billion p.a. on Marine Cloud Brightening to reduce the rapid ice melt and rising temperature trend, would perhaps then raise the question of how relevant these estimates are.

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: The international commitments are really of little relevance to the problem. Charney's results (see Question 2) indicate that the path of global warming of more than 3C by 2070 is almost inevitable. The consequential flooding of food producing regions, and famine, the displacement of hundreds of millions of people is a direct consequence, if the planetary temperature rise is not halted.

I consider Marine Cloud Brightening should be investigated and implemented if shown effective to cool the planet in the immediate instance. The costs are minimal, it is a non-invasive activity using natural sea salt spray, and can be turned off if there are adverse consequences. The idea is that by spraying sea water into low level stratus clouds covering less than 10% of the oceans, then the global temperature rise can be averted. Use of stratospheric sulphur is far more expensive, long lasting, dangerous and detrimental to ozone levels, but is another possibility. Relevant publications can be found on (<https://people.ncas.ac.uk/people/view/26>) , but also the work of Salter, University of Edinburgh provides technical specifications. An issue is that high resolution modelling

studies need to be completed to find the optimal size of sea spray)~ 1 micron in diameter). Those studies using low resolution models with inadequate representation of the clouds and dynamics, are largely inadequate. There is little point in trying to explain the complexities here, but my recommendations that scientists such as Salter (Edinburgh) , Wadhams (Cambridge) and myself should present evidence to the CCC.

The UK could lead on this, and assess the effectiveness of MCB, and that would be a hugely positive role. Congressman in the US (AGU 2019) are also considering the potential of this activity.

In summary, implementation of the Paris agreement is of lesser importance compared with the imminent climatic changes which are happening, and the CCC should be aware of this opinion.

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: A revised and strengthened UK NDC is of value, but as discussed above , by 2030 the effects of climate change on the planet will be so severe, that perhaps this consideration is not of high priority. What is of the highest priority is to ensure that all countries of the world realise we have only 15 years before severe consequences of climate change hit much of the world.

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: The role of the consumer is important. However it reflects into insignificance compared with the role of governments. For example,

1. When all European governments refuse to tax aircraft fuel, making it cheaper to fly than take the train, then the consumer has no role to play.
2. When all world governments refuse to put a speed limit on ships , which would then reduce CO2 emissions by 50%, then the consumer has little say.
3. When you have a Scottish government (for example) that wishes to expand North Sea Oil production (there is a close relationship between the Scottish govt and Oil companies) and when the same government has three international airports and wishes to reduce landing fees to attract more planes, then the consumer has little say.
4. Where it would be easy for governments to insist on hydrogen busses and hydrogen trucks, then that would have a huge impact.
5. The use of solar panels and electric cars would negate the need for coal power stations. However, the government would need to return incentives for consumers.
6. The government could invest in railways; not the ridiculously expensive HS2 which is not needed, but return single tracks to double tracks, and reinvest in railway infrastructure (including hydrogen trains). then the consumer perhaps will have a choice.
7. When the government invests in for example, Swansea of Morecambe bay barrages, then there will be no need for the customer to be incentivised.
8. When the government invests in power infrastructure ti enable home electric car charging then perhaps the individual would buy electric cars

There is a list of many more ideas, but it is the government not the individual that needs to act.

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: To achieve net zero, the government should implement the above suggestions. There is no uncertainty about the nature of climate warming. Zero emissions tomorrow, will see the temperatures rise for at least a decade.

This question is an irrelevance.

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: In the light of impending climate change, then net zero should be achieved as soon as possible. The committee should concentrate on providing governments with options and also emphasise what is about to happen in a changing climate.

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: This question suggests that there could be benefits in not doing anything. Other than the avoidance of mass migrations, flooding, starvation and world disorder, I cannot see any benefits in not acting.

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: Carbon credits are irrelevant, compared with the scale of the problem which will be faced by 2035.

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: This problem is planetary. Local areas will be at the whim of governments. The aim has to be net zero emissions as soon as possible

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: These questions are minor compared with mass starvation, mass migration, mass flooding and presumably mass warfare

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: Probably not, but there is little option. All groups will suffer, and that has to be appreciated. The affluent of Florida, Rhode Island etc, will have to move.

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: See above comments about transport. Reinvest in railways and hydrogen transport and electric cars.

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

ANSWER: n/a

Question 20 (Surface transport): The CCC recommended in our Net Zero advice that the phase out of conventional car sales should occur by 2035 at the latest. What are the

barriers to phasing out sales of conventional vehicles by 2030? How could these be addressed? Are the supply chains well placed to scale up? What might be the adverse consequences of a phase-out of conventional vehicles by 2030 and how could these be mitigated?

ANSWER: n/a

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

ANSWER: Hydrogen vehicles should be implemented a.s.a.p

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

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

ANSWER: n/a

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

ANSWER: n/a

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

ANSWER: n/a

Question 25 (Industry): In our Net Zero advice, the CCC identified a range of resource efficiency measures that can reduce emissions (see Chapter 4 of the Net Zero Technical

Report, page 115), but found little evidence relating to the costs/savings of these measures. What evidence is there on the costs/savings of these and other resource efficiency measures (ideally on a £/tCO₂e basis)?

ANSWER: n/a

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

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

ANSWER: n/a

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

ANSWER: n/a

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

ANSWER: n/a

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

ANSWER: n/a

Question 30 (Power): In Chapter 2 of the Net Zero Technical Report we presented an illustrative power scenario for 2050 (see pages 40-41 in particular):

- a) Which low-carbon technologies could play a greater/lesser role in the 2050 generation mix? What about in a generation mix in 2030/35?
- b) Power from weather-dependent renewables is highly variable on both daily and seasonal scales. Modelling by Imperial College which informed the

illustrative 2050 scenario suggested an important role for interconnection, battery storage and flexible demand in a future low-carbon power system:

- i. What other technologies could play a role here?
- ii. What evidence do you have for how much demand side flexibility might be realised?

ANSWER: n/a

Question 31 (Hydrogen): The Committee has recommended the Government support the delivery of at least one large-scale low-carbon hydrogen production facility in the 2020s. Beyond this initial facility, what mechanisms can be used to efficiently incentivise the production and use of low-carbon hydrogen? What are the most likely early applications for hydrogen?

ANSWER: n/a

Question 32 (Aviation and Shipping): In September 2019 the Committee published advice to Government on international aviation and shipping and Net Zero. The Committee recognises that the primary policy approach for reducing emissions in these sectors should be set at the international level (e.g. through the International Civil Aviation Organisation and International Maritime Organisation). However, there is still a role for supplementary domestic policies to complement the international approach, provided these do not lead to concerns about competitiveness or carbon leakage. What are the domestic measures the UK could take to reduce aviation and shipping emissions over the period to 2030/35 and longer-term to 2050, which would not create significant competitiveness or carbon leakage risks? How much could these reduce emissions?

ANSWER: 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 CO₂?

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: Electricity redistribution

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

ANSWER: n/a