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.

Anglo American

1. As one of the world's leading mining companies and one of the world's largest producers of platinum, Anglo American has an interest in the future of hydrogen technologies, including hydrogen for decarbonising mobility, heating, industry and storage.
2. Platinum is a vital component in fuel cell technology that can be used in hydrogen-powered vehicles (rail, road, maritime), the production of green hydrogen via electrolysis, or energy storage. The metal acts as a catalyst in the chemical process that converts hydrogen into electricity, with the only by-product being water.
3. We believe in the potential of the "Hydrogen Economy", which uses hydrogen for various applications ranging from fuel cell electric vehicles (FCEVs) and storage, to heat and power. We support the development of hydrogen and fuel cell value chains through several initiatives, including investing in start-up companies that are developing new hydrogen and fuel cell products. This is done via an Anglo American founded venture capital fund, AP Ventures. We also invest directly in hydrogen and fuel cell demonstration projects in some jurisdictions, including co-funding the roll-out of hydrogen refuelling stations in the UK. Further to this, we actively participate in various industry associations such as the UK Hydrogen and Fuel Cell Association amongst others.
4. Anglo American is also an active member of UK H2 Mobility, a partnership of UK industry leaders and the government, working to make hydrogen-fuelled transport a reality. And through this, enabling the UK to become global player in hydrogen and FCEV manufacture.
5. We are proud to be an important industry partner in the low carbon transition. Anglo American is a founding member of the global Hydrogen Council[1], launched at the World Economic Forum's Annual Meeting in Davos in 2017. The Council now consists of 81 leading companies from across the hydrogen value chain (including fuel producers, automotive OEMs, equipment providers etc.), promoting hydrogen as a key solution within the transition to a low carbon economy. In 2017, Hydrogen Council members agreed to collectively invest EUR 1.9 billion per year in hydrogen technology until 2022,[2] though it is likely this figure has increased given that the Council has increased in size six-fold since it was formed.

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?

[1] Hydrogen Council vision document: "How hydrogen empowers the energy transition".
[2] Hydrogen Council, "How hydrogen empowers the energy transition"

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: n/a

B. The path to the 2050 target

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

ANSWER: n/a

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

ANSWER: n/a

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

ANSWER: n/a

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

ANSWER: n/a

C. Delivering carbon budgets

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

ANSWER: n/a

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

ANSWER: n/a

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

ANSWER: n/a

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

ANSWER: n/a

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: n/a

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

ANSWER: n/a

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

ANSWER: n/a

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

ANSWER: Last year, to coincide with the launch of the ultra-low emission zone (ULEZ) in London, Anglo American undertook research with Opinium to understand the perspectives of fleet operators in London as to how the zone would affect their operations. The research sample was 345 senior managers+ that were either based in the ULEZ or whose operations meant they travel in and out of the zone, and 145 respondents who are decision-makers with responsibility for vehicle purchasing/leasing based in Greater London. We sought to understand the perspectives of fleet operators regarding low emission vehicles, and hydrogen fuel cell vehicles specifically.

This research provides useful data to understand the considerations of fleet operators. This included insights into the barriers preventing fleet operators in London from switching to low emission vehicles, and importantly what changes would be required to encourage them to make the switch. The document has been attached as supporting evidence, and below we have summarised the key findings:

• 48% of those responsible for purchasing or leasing vehicles said that cost is a barrier to acquiring a ULEZ-compliant vehicle.
• Two thirds (63%) said they would support the government providing financial or other incentives for businesses to purchase vehicles that meet the ULEZ requirements.

In terms of the steps required to encourage operators to switch their fleets, when discussing hydrogen fuel cell vehicles specifically we found that:

• Almost two-thirds (61%) said that refuelling infrastructure would be a barrier. 59% also identified cost as a barrier.
• Seven in ten (71%) said their business would support more investment in hydrogen infrastructure.
• After receiving more information on hydrogen fuel cell vehicles through our survey, 62% said their business was more likely to consider purchasing or leasing hydrogen fuel cell vehicles.

Our research thus demonstrated that refuelling infrastructure for hydrogen vehicles is currently a major obstacle to fleet owners and operators making the transition to these vehicles. Importantly, however, our survey has demonstrated an appetite amongst London fleet operators for switching to hydrogen fuel cell vehicles. They have also demonstrated a willingness to support more investment in this infrastructure. Greater support of and investment in infrastructure will therefore be vital to accelerate the transition towards hydrogen fuel cell vehicles – from both the public and private sectors.

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: The Hydrogen Council's recent *Path to Hydrogen Competitiveness* report identified a national strategy as one of the key steps in enabling and accelerating a hydrogen economy. The lack of a clear strategy from government on the roll-out of hydrogen has disincentivised private investment - a clear plan will instil confidence and help leverage private investment.

We therefore recommend the government firstly prioritise developing a clear roadmap for developing low-carbon hydrogen use, production and infrastructure for distribution. This roadmap should include a strategy for producing green hydrogen through the process of electrolysis – in particular focusing on the potential of offshore wind as a source of renewable electricity to power this process.[3]

We also recommend as a further priority that the government commits to an investment fund for fuel cell and electrolysis technologies. The government has already launched, in 2017, the Faraday battery challenge - a £246 million investment fund for research into developing battery technology[4] Similar support for investment and research in hydrogen fuel cell technology is vital in scaling the technologies up and bringing costs of electrolysis to produce 'green' hydrogen down.

Viable early applications are already emerging for hydrogen. Government support has already been proven to help incentivise industry investment in hydrogen applications, particularly in the transport sector:

• Trains are a particularly pertinent example of how government support has incentivised early applications of hydrogen. The government has already committed to the deployment of hydrogen trains, and Alstom and Eversholt Rail are converting more than 100 existing

[3] IRENA "Hydrogen from renewable power"
[4] GOV UK "Faraday battery challenge: Industrial Strategy Challenge Fund"

Class 321 electric trains into a new generation of “Breeze” trains that run on hydrogen, and expect them to operate on British tracks by early 2021.

• Local authorities – with support from national government – are also supporting the deployment of hydrogen fuel cell electric buses. Northern Irish company WrightBus will deliver 20 double decker hydrogen fuel cell electric buses for TfL in 2020.[5]

Freight is another promising early application for hydrogen. Zero emission hydrogen technology allows companies to decarbonise without compromising payload capacity or the economics of their business.[6] This is because hydrogen technology allows energy to be stored more efficiently than batteries, making them suitable for vehicles with heavy payloads and long ranges.[7] The National Infrastructure Commission’s April 2019 freight study identified hydrogen as one of the most viable alternatives to diesel in the freight sector. Hydrogen fuel cell heavy good vehicles (HGVs) look set to beat their battery electric equivalents to market:
• Hyundai intends to introduce a total of 1,600 fuel cell trucks onto the Swiss market by 2025. The first 50 will be delivered this year.[8]
• Nikola intends to begin production on its heavy truck for the European market by 2023.[9]

The government’s priority should therefore be to lay out a national strategy for the development of hydrogen technologies, which should contain clear and specific policies for the development of low-carbon hydrogen. This will help to support the emerging hydrogen applications that have great potential to decarbonise several sectors of the UK economy.

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: In responding specifically with regards to shipping, the UK government faces a notable challenge in decarbonising this sector. On an international scale, the International Maritime Organisation’s (IMO) member states (which includes the UK) have agreed to reduce the total greenhouse gas annual emissions from international shipping by at least 50% by 2050 compared to 2008.[10] The UK must step up its domestic efforts to reduce the amount of pollution created by the sector.

The average lifespan for commercial ships is 25 years. To meet the 2050 net zero target, therefore, zero or ultra-low emission ships must be available by 2025. This is an ambitious timescale. Hydrogen provides a tested and proven option for decarbonising shipping, and in the short-term an added advantage in that it is already being developed:[11]

[5] Interreg “Wrightbus hydrogen double decker buses to help tackle London's toxic air”
[6] Ballard, “Fuel Cell Trucks: Solution to Heavy Duty Transport Emissions”
[7] McKinsey, “Hydrogen: The next wave for electric vehicles?”
[8] Electrive, “Hyundai gives details on H2 trucks for Switzerland”
[9] Nikola Motor, “Nikola launches stunning truck for European market”
[10] International Maritime Organisation, “UN body adopts climate change strategy for shipping”
[11] World Maritime News: “IMO Symposium: Ammonia and Hydrogen Are Fuels of the Future”

• The Energy Observer was launched in April 2017 and it is the first vessel in the world to both generate and be powered by hydrogen. The ship makes zero-emission hydrogen using renewable energy which powers the vessel. Clean water, the only by-product, is released into the sea.

• In the US, the "Water-go-Round" is expected to be the first fuel cell powered vessel in the US and the first commercial fuel cell ferry in the world. Operating in the San Francisco Bay area, the 84-seater ferry is currently under construction and is expected to start operating imminently.

However, these vessels require supporting infrastructure like hydrogen production, storage/bunkering, refuelling and transportation. In order to ensure the potential of hydrogen technology in decarbonising shipping, it is therefore important that the wider hydrogen ecosystem is considered. We recommend the UK government take a holistic approach to domestic measures, which will benefit the use of hydrogen technology in shipping. Specifically:

• The government should urgently invest in large scale hydrogen production facilities like steam methane reformers combined with carbon capture and storage (CCS), as well as electrolysis using spare capacity from renewable electricity generation. With electrolysis, we recommend a similar ambition to the government and industry's reductions in costs for offshore wind.

• We recommend coupling this with a broader roadmap for the rollout of hydrogen, comprising a range of applications from mobility refuelling infrastructure and industrial uses to heat and power. A clear plan from government will help instil confidence and help leverage private investment.

• We also recommend government provides financial incentives for the development of commercially available low carbon vessels.

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: n/a

Question 38 (Infrastructure): What scale of carbon capture and storage development is needed and what does that mean for development of CO_2 transport and storage infrastructure over the period to 2030?

ANSWER: n/a