

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.

COMMITTEE ON CLIMATE CHANGE SIXTH CARBON BUDGET

CALL FOR EVIDENCE

OGUK is the leading representative organisation for the UK offshore oil and gas industry. Our membership includes around 400 organisations with an interest in the UK's upstream oil and gas sector. As the champions of industry, we work on behalf of the sector and our members to inform understanding with facts and evidence, engage on a range of key issues and support the broader value of this industry in a changing energy landscape. From exploration through to decommissioning and located across the length and breadth of the UK, our members are critical to safely providing security of energy supply, while supporting around 270,000 jobs and contributing billions of pounds to the economy each year.

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?

OGUK does not have comments on this question.

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?

The CCC should set carbon budgets with reference to the legally binding target that the government has established based on the CCC advice in May 2019; namely net-zero by 2050, which the oil and gas sector supports. The 2050 target is already challenging and, among other things, is likely to require investment in the energy sector to roughly double compared to current levels.

Carbon budgets and targets need to take account of issues relating to; (i) competition with resources for other policy objectives, (ii) potential carbon leakage from economic activity moving to other locations; (iii) bottlenecks in the supply chain or skills; (iv) development of appropriate legal and regulatory structures. OGUK discussed some of these issues in its Energy Transition Outlook 2019.¹

¹ <https://oilandgasuk.co.uk/product/energy-transition-outlook-report/>

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?

Carbon budgets do need to take account of the level of ambition in other jurisdictions. Although OGUK supports the net zero and the need for the UK to demonstrate a leadership role, its emissions of greenhouse gases represent around 1.5% of the global total. It is imperative that other countries are encouraged to follow a successful example that supports economic activity and maintains the competitiveness of key industries.

It's also important to stress that, for the UK, energy production is itself a key industry and one that can further contribute to the net zero objective. It is therefore important to ensure that the UK continues to produce oil and gas while also making efforts to lower production emissions.

With COP26 being held in the UK in 2020, the CCC and other government agencies should encourage other nations to establish similar targets and the required policies. In addition, the UK should also promote progress in developing policy on carbon capture (CCUS) and Hydrogen which will be a central element to achieving net zero and the objectives of the Paris Agreement both in the UK and elsewhere.

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?

The UK has already committed to a 2050 net zero target and this already represents a strong signal so amending the 2030 NDC may not be necessary. With this in mind, it is more important for the UK to develop detailed policy to deliver this objective for other jurisdictions to emulate and begin to make clear decisions and policies on industry, domestic heating and heavy and long distance transport (including aviation) and the important role of CCUS and Hydrogen will play in these sectors of the economy. Successful policy development and implementation is more important than target setting since it will demonstrate how targets can be achieved.

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?

Although behavioural change is important, rapid economic change is driven where this is aligned with technology development and government policy and regulation. Changes to consumer behaviour are more likely to be sustained where these are driven by economic signals. Therefore, more consistent carbon price signals, across the range of domestic and business consumers would go a long way towards improve the incentive structures for energy users.

Consumers also need to be provided with realistic choices between different low carbon solutions. This is likely to be more successful than, for example, a regime based on obligations or outright

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prohibitions. This is particularly true for sectors that are harder to decarbonise and where consumers' energy needs are bespoke, or technologies are still developing.

There is also a large educational element associated with changing behaviours in a way that is acceptable and sustainable. This requires honest communication about the choices associated with different technologies and taking account of the degree of disruption and cost that consumers may face.

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?

The adoption of a legally binding net zero target has, in fact, reduced the degree of uncertainty. This is particularly the case with respect to different technology solutions since it is now clear that all available low carbon technologies will be required at scale in order for the target to be achieved successfully. Government policy should therefore avoid favouring or neglecting particular sectors or technologies/projects and retain as many technology options as possible.

Uncertainty can be further reduced by the government developing detailed and long terms commitment to policies across the full range of technologies. In particular, new institutional arrangements and infrastructure are required for the development of totally new products, markets and economic activities, particularly for CCUS and Hydrogen. Government activity can also help reduce uncertainty from other potential policy obstacles such as the planning regime and by ensuring consistency across government departments and across regulators. Cooperation between government departments and regulators is central and this may involve changes to regulators' duties and powers.

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?

It is expected that the fourth and fifth carbon budgets will be reviewed in the light of the new legally binding objective. However as noted above, revision of interim budgets and targets are less important than developing the detailed policies required.

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?

The development of new technologies and sectors provide an opportunity to create a new industrial advantage to the UK focused in particular locations that have, in recent years, seen reductions in industrial output and activity. This particularly applies to the potential areas for CCUS

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clusters and Hydrogen technology. If policies and developed and implemented quickly there will be considerable immediate and long-term benefit for those sectors and regions as well as the potential to develop capabilities that can be exported globally.

The potential global market in low carbon industrial goods and services could be very large:

- The Hydrogen Council roadmap envisages the global hydrogen market reaching £1.9 trillion a year by 2050, creating jobs for 30 million people, with global demand for hydrogen increasing tenfold to almost 80 EJ (over 20,000 TWh).²
- The future global CCS market is estimated to be around £100bn/year,³ with 11Gt CO₂ needing to be permanently stored by 2060 to meet Paris Agreement emissions reduction targets.

Retaining activity, skills and the supply chain in important sectors and locations and avoiding the further offshoring of activity must be a key strategic objective for climate policy.

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?

The UK oil and gas sector has specifically developed Roadmap 2035 to emphasise the opportunity for our sector from the energy transition, as well as responding to questions raised by stakeholders and investors concerning the robustness of businesses to the forthcoming changes in the energy sector.⁴ Roadmap 2035 sets out the vision of the oil and gas sector and its contribution to making progress for the net zero objective. A crucial component for government policy is to develop a framework for CCUS, decarbonisation of heat and the development of Hydrogen across a range of transport and heating applications.

Experience in other sectors, and particularly offshore wind, has demonstrated the need for policy to provide a long terms framework for new sectors to be developed that are investable at scale and across the whole of the UK. In the initial stages this requires: (i) certainty with respect to the required infrastructure, (ii) new institutional market design frameworks, (iii) investment in a range of first-of-a-kind projects. In the medium-long term, visibility about the revenue stream(s) for the investments in question and the use of effective carbon pricing mechanisms that will incentivise roll out to the whole economy.

² Hydrogen Council, Hydrogen scaling up, November 2017, p.8 and p.20 http://hydrogencouncil.com/wp-content/uploads/2017/11/Hydrogen-Scaling-up_Hydrogen-Council_2017.compressed.pdf

³ HM Government, Clean Growth Strategy, October 2017, p.69 <https://www.gov.uk/government/publications/clean-growth-strategy>

⁴ <https://oilandgasuk.co.uk/roadmap-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?

Localised initiatives are important to provide a test bed for new energy systems and to ensure projects can take advantage of economies of scale and scope. For example, hydrogen provision will eventually have to be rolled out on a localised basis for industrial and domestic users and this will need wide support from consumers' local government and industry.

At the same time, a degree of central coordination is also required for a number of such infrastructure issues and government should avoid adopting a piecemeal or retail driven approach which has not always been successful in previous iterations of energy policy.

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?

The CCC and government should continue to communicate honestly the cost and impact of the energy transition and the net zero objective. The CCC estimate of 1-2% of GDP amounts to (roughly) a doubling in investment in the energy sector from the current level of around £20 billion per annum meaning additional investment of several hundred £billion over the next thirty years. This will inevitably have some impact on consumers and/or government during the period to 2050.

To deliver high levels of investment, fiscal and regulatory certainty is an important element of policy, including for existing energy businesses such as oil and gas production. Government should look to provide further certainty through the Energy White Paper on the energy policy framework going forward. This framework should also encourage efficient operation, cost reduction and the application of new technologies over time.

Investors are already taking account of the increasingly costs of emission allowances. Further increases in costs or obligations are likely to provoke offshoring and carbon leakage from energy intensive sectors, including oil and gas production. This would be contrary to the objectives of achieving the net zero targets and with respect to security of supply.

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?

See question 24

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?

OGUK does not have specific comments on the targets for Scotland or Wales but notes that emissions from offshore oil and gas production counts against the UK-wide targets.

Many elements of policy should be strongly coordinated at UK level. This includes policy development for CCUS and Hydrogen and the replacement to the EU ETS after Brexit (which should be a consistent UK wide regime).

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?

No comments

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

No comments

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?

As discussed above, the CCC and government should exercise judgement when designing policy around obligations or outright prohibitions. Although there is a place for this in establishing clear expectations and removing uncertainty, these should only be introduced where there is a clear pathway to new technologies with evidence of support from consumers. Likewise, policy makers need to acknowledge that individual business and household consumers' often have bespoke requirements which may not be met by alternative technologies at a particular point in time.

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?

Such definitive policy statements should be used carefully and usually towards the end of the adoption phase of new technologies rather than at the beginning (as was the case for e.g. condensing gas boilers). Policy development during earlier phases could be better focused on development of positive economic frameworks and ensuring the required network infrastructure is available since without these the desired phasing from one technology to another is unlikely to be successful regardless of what headline “target” dates are set.

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?

All these potential technologies are likely to play a role and each of them is dependent on proactive support for the necessary infrastructure and the development of institutional frameworks and business models to support a market for new technologies. Hydrogen is a particularly important technology for long distance transport involving both freight and public transport as well as some household transport options.

Government needs to move urgently to support a market design for the Hydrogen economy and identify how the necessary infrastructure will be financed and delivered. In many cases this will necessitate regulators and/or government supporting anticipatory investment in infrastructure.

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

The UK economy will continue to need oil and gas over future decades, albeit in lower amounts and increasingly in decarbonised form. This also is true at global level as discussed in the recent IEA report on the oil and gas sector and Energy Transition.⁵ Policies leading to premature decommissioning of assets or which disincentivise new investment will simply cause more oil and gas to be imported (or use of higher GHG intensity solid fuels) which will lead to carbon leakage in the same way as for manufacturing sectors. Government analysis suggests that UKCS gas has pre-

⁵ <https://www.iea.org/reports/the-oil-and-gas-industry-in-energy-transitions>

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combustion emissions estimated at 9-17 gCO₂/kWh, compared with LNG pre-combustion emissions estimated at 38-89 gCO₂/kWh.⁶

As summarised in OGUK Environment Report 2019⁷, emissions from offshore oil and gas production are largely the result of power generation and flaring and venting of methane for safety reasons.⁸ OGUK is currently working with its members and regulators on exploring routes to make significant improvements to the carbon intensity of production for which there are a variety of potential techniques which the CCC discussed in the Technical Annexes to its May 2019 advice.

Government needs to take account of the scope for reducing emissions from oil and gas production (and the manufacturing sector more widely) and to avoid carbon leakage in designing the post-Brexit replacement for EU ETS. This needs to include suitable UK-specific elements including measures relating to (i) allocation of certificates, (ii) recognition of the impact on electricity costs for manufacturing and fossil fuel production, (iii) establishment of a suitable modernisation fund.

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?

Policies aimed at de-carbonisation must maintain a balance between positive and negative incentives and, in particular, avoid carbon leakage and offshoring of emissions. One of the objectives of the net zero target is to demonstrate to other jurisdictions that reducing and removing greenhouse gas emissions is possible without damaging or de-industrialising the economy and moving production and emissions to other locations.

Maintaining indigenous production of oil and gas (and energy intensive products generally) both allow governments to exert more influence on emission reduction and provide a better model for other jurisdictions to follow. This will increasingly need to be recognised in wider trade policy at UK and EU level.

⁶ DECC, Potential Greenhouse Gas Emissions Associated with Shale Gas Extraction and Use, 2013, Tables A4 and A5 <https://www.gov.uk/government/publications/potential-greenhouse-gas-emissions-associated-with-shale-gas-production-and-use>

⁷ <https://oilandgasuk.co.uk/product/environment-report/>

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There are some international examples of good practice listed below. However, to some extent the UK is at the forefront of policy development and is expected to set an example for others to follow. For example, the success of the offshore wind sector has been a good model of sustained positive support for new technology.

- Tax incentives in the USA to implement carbon capture have been successful in progressing a number of projects. Recent figures suggest that the USA already has 10 large scale facilities capturing 25mt/annum.⁹
- A recent report by the NPC for the US Secretary of State for Energy set out the scope for capture to increase to 500mt/p.a. based on further policies.¹⁰
- Norwegian operators have successfully reduced emissions for oil and gas production over a number of years.

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

Roadmap 2035 sets out a framework for a measured transition of the oil and gas sector into new technologies, allowing for the continued exploitation of the skills and supply chain of the successful UKCS sector. The Roadmap underlines the following requirements:

- (i) maintaining UK production: i.e. continuing to provide over half of UK oil and gas demand (although at lower levels than today),
- (ii) support net zero (reducing the oil and gas sector's emissions and contributing to decarbonisation of consumers' needs, in particular through CCUS and Hydrogen,
- (iii) technology and innovation through a collaborative approach to development and support for the OGTC Net Zero solution centre,
- (iv) people and skills by continued recruitment a diverse industry with transferable expertise across a range of low carbon sectors,
- (v) economy and exports through a responsive and vibrant supply chain serving the needs to new sectors at home and around the world.

Progress towards net zero will enhance the UK offshore sector as the cornerstone of energy supply and generate positive benefits in a range of industrial locations in coastal areas and provide opportunities to existing and new workforce. This will include both existing offshore employees and a diverse range of new recruits which will still be needed.

⁹ <https://www.globalccsinstitute.com/resources/global-status-report/>

¹⁰ <https://dualchallenge.npc.org/downloads.php>

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)?

OGUK is currently working with our members examining different technological solutions to reducing emissions from the oil and gas sector. Part of this work will include further estimates of various efficiency measures on a cost £/CO₂e basis, but these will not be available until Q2.

Based on our initial research it is clear that reducing emissions is possible from a range of different practices and technologies. In particular, existing sites are more suitable for incremental improvements in terms of operations, while new facilities are able to take advantage of totally different methods of energy provision leading to step changes in emissions intensity. In some cases these may involve higher upfront costs but deliver savings in lifetime costs.

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?

Decarbonising all of the UK 25 million homes is an enormous challenge and a date of 2050 is a realistic objective especially given the parallel requirements relating to businesses and industry. Although some buildings are likely to be more suitable for electric heating e.g. more efficient new build and flats, other householders will be more familiar with gaseous fuels and less inclined to choose to restructure their heating systems around electricity. For these consumers hydrogen is likely to be a less disruptive and more popular low carbon solution.

As noted above, some investment has already taken place at distribution level to prepare networks for carrying hydrogen. Support for this transition from government and regulatory agencies needs to continue with respect to anticipatory investment and modifications to the gas quality regime.

With respect to consumer behaviours, it is important for all aspects of the energy transition to look to work with and not against consumer requirements. As considerable changes will, in any case, be required to the cost of energy and the way it is used, there is a need to make any other aspects of the transition as simple as possible and to minimise associated disruption.

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?

Conversion to decarbonised gas may also be more achievable in terms of skills and expertise. The UK already has a large body of engineers and fitters that are used to installing and maintaining gas fired equipment.

Manufacturers are already working on prototype “Hydrogen ready” boilers which can quickly be switched to handle higher concentrations of Hydrogen and eventually 100% Hydrogen input. One of the key requirements for this to be implemented is through more flexible arrangements related to the Gas Safety Management Regulations (GSMR).

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?

Decarbonisation of heat will require some top down coordination at both national and regional level. One of the most relevant precedents is the conversion from town gas to natural gas in the 1970s. Blending of decarbonised gas and hydrogen will be an initial first step requiring a modification of the GSMR regime.

In the medium term, switching over to 100% decarbonised gas and developing the necessary distribution and storage infrastructure will require a localised approach which will, among other things, need to be accommodated within the current regulatory regimes for gas transmission and distribution businesses.

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?

[See answer to question 30.](#)

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?

There are already a number of technologies that are able to offer flexibility into the electricity market and benefit from either producing additional output or reducing demand at times of high-power prices. However, the degree to which demand side flexibility will be used is difficult to assess on an ex-ante basis and this will probably evolve over time. Likewise, interconnection will also continue to be used provided that the UK continues to participate in the EU electricity market which is currently unclear.

However, it is very likely that electricity generation from gas (and eventually decarbonised gas in the form of Hydrogen) is likely to be required as part of the net zero energy system to provide the necessary flexibility to support renewable production and meet the needs of end users.

Development of initial hydrogen generation projects, for example through the OGCI Teesside project, is therefore an important supplementary reason to progress the available CCUS cluster projects.

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?

Hydrogen has a large range of applications across the heating and transport sector for applications that currently have few alternative low carbon technologies. Large scale development of Hydrogen supply is an important part of all of the proposed CCUS clusters and these all have the prospect of being delivered before 2030. A high level of ambition is therefore needed in order to attract potential investors to this sector, which is expected to contribute at least 200 TWh by 2050 of output across a range of applications. The need to develop multiple projects for hydrogen deployment at scale needs to be strongly reflected in CCC advice and in the development of the sixth carbon budgets for 2032-37.

Although the initial projects are current at feasibility and FEED stage, investors already require some visibility of nature of enduring frameworks in order to incentivise matched funding of studies and first-of-a-kind projects. A business and regulatory model needs to be developed that allows for the full range of production technologies and uses of hydrogen to be exploited and government

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should move quickly to consult on different options following the Energy White Paper in early 2020. The potential uses of hydrogen in both the heating and transport sectors should get equal attention.

One particular priority area is the interface between the nascent hydrogen market and the current gas market, particularly if and when excess hydrogen is to be blending into the existing gas network and/or stored:

- the gas quality specification needs to be modified as soon as possible to allow for blending of up to 2-3% in existing gas networks,
- mechanisms may be required within economic regulation to remunerate potential hydrogen storage facilities and other balancing actions,
- hydrogen producers/users may need to avoid being exposed to large and unfavourable movements in short term and imbalance prices so the interface between hydrogen production and use and the traded natural gas market needs clarification.

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?

Aviation and shipping will continue to require liquid and gaseous fuels into the future and probably indefinitely. International initiatives alone are unlikely to be sufficient to support the UK objective of net zero.

Domestic measures will be required to reduce the carbon content of fuels and move toward biofuels, synthetic fuels and hydrogen. Increased use of liquified gas could be a useful transition route for these sectors, particularly marine transport.

In order to avoid the clear risk of carbon leakage and jurisdictional issues (flags of convenience) policy should take the form of positive incentives rather than obligations or prohibitions.

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?

No comments

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?

The recent CCC report highlighted the important role of changes in land use in reducing net emissions for the UK and more widely. Achieving net zero will require the deployment at scale of a range of different technologies and new practices.

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?

Both direct air capture and BECCs will require CO₂ transport and storage facilities to be available providing an open access service to a range of capture projects. In order to serve a range of capture projects effectively, a suitably regulated T&S sector with sufficient capacity. See response to Q38.

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?

No comments

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?

Successful decarbonisation of heat will require consumers to adopt new technologies. Their preferences and bespoke requirements will determine whether different solutions are appropriate, and it is unlikely that consumers will accept any deterioration in performance. Although new homes with higher levels of energy efficiency may be suitable for electric heating, the vast majority of households in existing stock will face less cost and disruption from maintaining a modified version of their existing systems.

Currently 80% of UK households are heated with gaseous fuels. Thanks to ongoing renovation of the networks (iron mains replacement programme) the UK already has distribution networks that can be used for decarbonised gases, including hydrogen. With manufacturers already developing hydrogen-ready boilers, this technology would appear to have a number of advantages for much of the existing housing stock.

In some areas, electricity-based or heat network solutions may also function well. In general, a large amount of investment will be needed across all these technologies and it may be that these continue to co-exist, even within a particular locality which, in any case, provides for a more resilient and secure overall energy system which is not overdependent on a particular individual technology. This reduces systemic risk across the energy system as a whole.

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?

CCUS is a crucial technology for net zero particularly, in the first instance, for industrial applications and also to support the scaling up of the Hydrogen supply sector. There is therefore an urgent need to develop CCUS infrastructure over the coming years to support a range of capture projects. OGUK is a member of the CCUS Advisory Group and supports its work and its recommendations so far.

It is particularly important that all of the potential CCUS cluster projects are advanced rapidly in order to achieve deployment at scale and in line with the CCC estimates in its May 2019 report. The five projects have the scope to deliver 20-30 million tonnes per annum of capture, transport and storage in the initial phases to 2030 and this is proportionate to the overall 2050 objective.

As discussed above, for all transformational technologies it is necessary to develop the necessary infrastructure ahead of deployment and CCUS is no exception. As well as supporting the feasibility and FEED studies we are expecting the government to develop a clear (and separate) regulatory

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?

framework for open access transport and storage infrastructure, that can be financed independently, capable of serving a range of different industrial and other sectors.

As well as this, carbon capture projects will also need to be supported through some combination of carbon pricing, direct government support or some form of contracts for difference mechanism. The development of the CCUS and Hydrogen business models need to be a key area of focus for government during 2020.