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.***

**About Us**

Liquid Gas UK is the trade association for the Liquefied Petroleum Gas (LPG) and biopropane (bioLPG) industry in the UK, representing companies who are LPG producers, distributors, equipment and service providers, and vehicle convertors. It is dedicated to the safe and effective development of LPG and takes a leading role in consultation and negotiation with legislators and policy makers. Member companies cover 99% of the total LPG distributed in the UK.

Liquid Gas UK welcomes the opportunity to respond to the call for evidence on the Sixth Carbon Budget and Welsh emissions standards. In this response, Liquid Gas UK outlines the hugely significant role LPG and bioLPG can play in the current, and future, decarbonisation of off gas buildings.

**Introduction to LPG and bioLPG**

LPG is the lowest carbon conventional energy source available to off-grid homes and businesses in the UK, which provides immediate, expedient and cost-effective heat and energy. As LPG emits more than 33% fewer carbon emissions than coal and 15-20% fewer carbon emissions than oil[1], **LPG is a transitional solution in its own right.** It also emits virtually no NOx, SOx and Particulate Matter, enabling immediate air quality improvements.

BioLPG, alternatively known as biopropane, is a **versatile, 'drop-in' renewable solution which can provide up to 90% emissions reduction** compared to fossil based LPG.[2] Already available on the market today, bioLPG is chemically indistinct from LPG and can be used as it is, just like conventional LPG. This means it can be 'dropped-in' to existing supply chains and can be used by consumers in their existing heating appliances, stored in existing bulk tanks and cylinders, and transported using today's infrastructure and skilled workforce.

LPG boilers offer a long-term, cost effective pathway to decarbonisation through the gradual introduction of bioLPG into the mix; this means over time carbon emissions will increasingly reduce. **It is the industry's ambition to offer 100% renewable energy solutions by 2040**.[3] As bioLPG becomes increasingly available to the UK market, Liquid Gas UK wants to work in partnership with UK Government to drive consumer behaviour in rural areas towards greener solutions. To do this, LPG and bioLPG must be recognised within policy frameworks and regulations for new builds, as well as existing builds.

Switching to LPG systems today also locks-in a **seamless pathway to renewable energy use**, as bioLPG can directly replace conventional LPG going forward in a hassle-free way. LPG and bioLPG can also be used in hybrid systems, alongside heat pump technology.

Electrification of heating systems should not solely be seen as the solution to decarbonisation and low carbon heat in the UK, especially in rural areas. It is important that regulations and policy reflect that **different solutions will be required for different types of building stock and locations across the country**.

We advocate a **mixed technology approach** to fitting heating technologies to off-grid homes and non-domestic properties. Energy consultancy Ecuity has found that this approach will enable the UK to achieve its net zero target. It was found to be the most cost-effective approach. We believe it will best encourage consumers with different circumstances, earning capacities and building types to make environmentally sustainable choices.

[1] UKLPG, Response to A Future Framework for Heat in Buildings (June 2018)
[2] WLPGA, 'BioLPG: The Renewable Future' (2018), Page 52
[3] Liquid Gas UK, 2040 Vision (July 2019)

## A. Climate science and international circumstances

**Question 1:** The climate science considered in the CCC's 2019 Net Zero report, based on the IPCC Special Report on Global Warming of 1.5°C, will form the basis of this advice. What additional evidence on climate science, aside from the most recent IPCC Special Reports on Land and the Oceans and Cryosphere, should the CCC consider in setting the level of the sixth carbon budget?

ANSWER: n/a

**Question 2:** How relevant are estimates of the remaining global cumulative $CO_2$ budgets (consistent with the Paris Agreement long-term temperature goal) for constraining UK cumulative emissions on the pathway to reaching net-zero GHGs by 2050?

ANSWER: n/a

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

ANSWER: n/a

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

ANSWER: 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:

Consumer and personal behaviour can be incentivised in two ways; policy clarity (and stability) being the first. If there is a lack of policy clarity, the consumer will be less comfortable in making a decision; and status quo will likely win out. At that point, if a heating system is not 'future proofed', it could be lost for over a decade until that technology reaches the end of its life (i.e. a boiler breaks).

Second is the provision of incentives that go with the grain of people's lives (and the range of other pressures facing them). Consumers need to have access to different options which work for them, and the same time, contribute to decarbonisation. This is particularly the case for homeowners living off the gas grid; where past experiences, fabric quality, style of building and affordability will vary.

We therefore support a mixed technology approach, whereby LPG and bioLPG (standalone or as a part of hybrid heat pump systems) are one of the range of solutions. Research from energy consultancy Ecuity[4] shows that this is also the most cost-efficient way to achieve net zero. Given all the overall demands on public and private expenditure to make net zero a reality, cost-efficient approaches that can deliver should be prioritised. We support clear and easily understood public funding incentives, supporting a variety of low carbon options. Any future version of the RHI must include bioLPG as a standalone solution and LPG hybrid heat pump technologies, alongside standalone heat pumps and biomass. This can help shape and support off-grid consumers to make low carbon decisions, especially when they live off the gas grid and have the decision of decarbonising heat in their own hands.

Another approach to encourage off-grid homeowners, especially high carbon heating oil users, is an oil tank scrappage scheme for consumers moving to LPG/bioLPG or hybrid heat pump systems. Oil infrastructure is owned by the homeowner, therefore the cost of removing a tank and the value of the remaining fuel causes customer reluctance to move on to lower carbon solutions. LPG tanks on the other hand are owned and maintained by the LPG supplier.

As such, Government should incentivise off-grid homeowners to switch from heating oil to low carbon solutions, such as bioLPG, with a Government-supported oil tank scrappage scheme. The success of the diesel car scrappage scheme illustrates that consumers will proactively choose low carbon solutions if there is an incentive to make that positive choice.

**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:

Having a long-term policy framework, that supports a consumer led market approach to off-grid heat decarbonisation, will enable a mix of environmentally progressive and innovative solutions for homes and businesses. This will ensure that UK citizens are able to make low carbon, sustainable choices that work for them, irrespective of their socio-economic status.

In addition, near term policy decisions should encourage switching away from heating oil (and coal) to LPG and LPG/heat pump hybrid systems, to enable immediate carbon savings and future proof the heating system.

**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?

[4] A Practical Approach: Analysis of Off-Grid Heat Decarbonisation Pathways, September 2019.

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:

EPCs are currently more likely to encourage off-grid property owners to take up higher carbon heating solutions rather than invest in energy efficiency measures. This unintended consequence is the exact opposite of what UK Government wants to see.

Why does this happen?

The EPC rating is positioned as a measure of energy efficiency, in reality however, the rating is actually a measure of energy cost per m2. This is due to the disproportionate focus on the input fuel[5]. **This means that two identical properties, one off-grid and one on-grid, will have vastly different EPC scores just because of the cost of the fuel they use, with lower carbon fuels being penalised.**

The below table demonstrates the different EPC ratings for a typical off-grid property when changing only the fuel type and heating system.

**Case Study: Typical off-grid property (Norfolk)**

| Property features: Sandstone/Limestone as built (no insulation), pitched roof (250mm loft insulation in part), full secondary glazing, boiler and radiator – heating controls, programmer, thermostat and TRVs. Low energy lighting in all outlets. | |
|---|---|
| **Heating system** | **Current Rating** |
| Mains gas boiler | 60 (D) |
| LPG boiler | 28 (F) |
| Oil boiler | 47 (E) |
| Electric boiler | 18 (G) |
| Electric high retention storage heater | 42 (E) |

The flawed EPC methodology drives off-grid homes away from low carbon technologies and onto higher carbon, cheaper energy sources to gain a higher EPC rating, especially in England and Wales due to Minimum Energy Efficiency Standards (MEES) for the private rental sector. We are aware of EPC assessors openly encouraging sticking with or

[5] UKLPG response to Energy Performance Certificates in Buildings Call for Evidence (October 2018)

switching to higher carbon fuels, such as oil, in order to get a better EPC rating – rather than promote lower carbon solutions such as LPG/bioLPG or heat pumps.

This is self-defeating and at odds with what UK Government is hoping to achieve. Removing the input fuel cost from the EPC methodology would ensure there is no disparity between identical properties on or off the gas grid, and importantly, drive investment in actual energy efficiency and low carbon heating.

**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: Many properties off the gas grid are considered hard to treat buildings; this presents challenges in making them more energy efficient and decarbonising heat through electrification. BioLPG however is available to support the decarbonisation of these trickier properties.

As off-grid buildings are often older homes, their method of construction and lack of insulation can make retrofitting electrified technology very expensive without real heating benefits. The challenge presented by older, poorly insulated buildings, means multiple solutions are required to ensure all these property types can transition to using more renewable and carbon friendly heating options that provide reliable heating.

Ecuity found that a mixed technology approach, as well as one that relies solely on fitting heat pumps, could both help the UK realise its net zero target; but that a mixed technology approach could do so for over £7 billion less. It is therefore unrealistic to expect that a silver bullet approach of electrifying heat is the best solution to decarbonise heat in off gas grid homes.[6]

Rural communities, whether householders or businesses, can't be left behind, or given a 'one size fits all approach'. Having a long-term policy framework, that supports a consumer led market approach to off-grid heat decarbonisation, will enable a mix of environmentally progressive and innovative solutions for homes and businesses. This will ensure that UK

[6] A Practical Approach: Analysis of Off-Grid Heat Decarbonisation Pathways, September 2019.

citizens are able to make low carbon, sustainable choices that work for them, irrespective of their socio-economic status.

## 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:

d) Wales has greater levels of off-gas grid use than the UK average[7]. Indeed, outside the North and South Wales inner tips, the majority of the country has greater off-grid usage than not. The ONS also measures average gross disposable household incomes in Wales as being around £3,000 below the UK average (2017).

[7] https://www.nongasmap.org.uk/
https://www.ons.gov.uk/economy/regionalaccounts/grossdisposablehouseholdincome/bulletins/regionalgrossdisposablehouseholdincomegdhi/2015

As laid out above, older rural off-grid properties are typically less energy-efficient, which can make installing energy efficiency measures the building-retrofit for electrical heating technologies more challenging and expensive. In addition, some of these properties have a heritage value and character which may require bespoke low emission solutions.[8]

For example, a case study in the recent study by Ecuity showed that a typical pre-1918 detached family home would face levelised costs of 40% higher, equating to £22,6000, if forced to switch to a heat pump rather than to switching onto LPG/bioLPG. This is unaffordable and unattainable for most ordinary people in Wales, and with this in mind, its vital to have a consumer led, market approach to off-grid heat decarbonisation, which provides a mix of heating solutions.[9]

**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

[8] A Practical Approach: Analysis of Off-Grid Heat Decarbonisation Pathways, September 2019.
[9] A Practical Approach: Analysis of Off-Grid Heat Decarbonisation Pathways, September 2019 p.25

**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: n/a

**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: The LPG industry has already signalled its ambition to transition to bioLPG by 2040, following the launch of the '2040 Vision' in July 2019. LPG is a key part of the energy mix today and can play an even larger role in the future. The bioLPG pathway, as part of a mixed technology approach to decarbonisation, can support UK Government and Devolved Administrations to achieve climate change targets in an affordable and non-intrusive way.

The LPG industry should be supported in its transition to bioLPG, as the industry can use its skills, experience and supply chains in order to decarbonise off-grid buildings with its 'drop-in' renewable fuel.

A long-term policy vision which encourages investment in localised UK production of bioLPG would be wholly supported by the industry. There is a growing market for bioLPG which will continue to scale up in the 2020s, 30s and 40s. This is an exciting opportunity for UK Government to lead the way, by encouraging investment in bioenergy processing facilities or developing feedstock's and processes through R&D funding.

Analysis undertaken by NNFCC[10] demonstrates that a deployment pathway for a full switch from fossil LPG to bioLPG in the UK by 2040 is a feasible solution to support the Government in its ambition to move towards a low carbon economy.

NNFCC found that there is significant potential for rapid scale-up of indigenous bioLPG production in the UK, such as new HVO plants, co-processing at existing refineries, establishing gasification and fischer tropsch synthesis facilities.[11] These new production facilities could sit at the heart of a circular economy in particular regions, utilising a sustainable local feedstock, creating jobs for the local area, contributing to economic growth and ultimately creating the energy to be used in the UK's rural homes.

Examples of feedstock's which will be available to support UK production of bioLPG include used cooking oil, animal fat, vegetable oil, waste, plant dry matter, sugar and starch. The Government and devolved administrations should work with industry to look at what feedstock's are most available and appropriate in different parts of the country and if they can facilitate the development of production facilities which can in turn supply local / regional bioLPG demand. BioLPG production also could be established near high use demand in off-grid heat, such as clusters of distilleries or other industrial and commercial consumers.

Presently, the UK is a net exporter of propane[12]. By understanding the important contribution bioLPG will have in decarbonising off-grid heat in the UK and beyond, the UK can take the opportunity to position the country to become a net exporter of bioLPG. The wide range of feedstock's and processing methods for bioLPG make it an ideal candidate for export, especially as the demand for biofuels grows in other European countries and beyond.

[10] https://www.liquidgasuk.org/resources/biopropane-feedstocks-feasibility-and-our-future-pathway
[11] https://www.liquidgasuk.org/resources/biopropane-feedstocks-feasibility-and-our-future-pathway
[12] UKLPG Submission to REA Bioenergy Strategy Call for Evidence (February 2019)

**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:

a) The Ecuity research that Liquid Gas UK commissioned[13] set out that a mixed decarbonisation approach to off-grid domestic properties, instituted promptly, is the most-effective way for the UK to achieve its net zero target. We believe that the same applies to non-domestic buildings.

Ecuity found that a mixed technology approach, as well as one that relies solely on fitting heat pumps, could both help the UK realise its net zero target; but that a mixed technology approach could do so for over £7 billion less. We also believe it is the more achievable option, since homeowners and business operators will naturally want to do what works best for their situation (thinking of affordability, visual amenity, building fabric, past experience). This will at times mean an LPG/bioLPG boiler is installed as a standalone heating system or as part of a hybrid heat pump system.

In addition, there are quick and immediate benefits from switching coal or oil heated properties onto LPG today, as LPG emits more than 33% fewer carbon emissions than coal and 15-20% fewer carbon emissions than oil[14]**.** It also emits virtually no NOx, SOx and Particulate Matter, enabling immediate air quality improvements.

**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:

No. While established industries like ours have a developed supply chain in place, others like that for heat pumps are understandably nascent and will take time to scale up. This plays to our recommendation for a mixed technology approach, promptly deployed.

[13] A Practical Approach: Analysis of Off-Grid Heat Decarbonisation Pathways, September 2019
[14] UKLPG, Response to A Future Framework for Heat in Buildings (June 2018)

A vastly increased number of trained heat pump installers would be needed, as according to MCS there are only 1,800 certified heat pump installers[15] installing circa 20,000 heat pumps a year. Upskilling the existing workforce or training new engineers takes time, education policy is never changed or implemented swiftly, it would be unrealistic to assume that these numbers could be sharply increased (and geographically spread) in time to deliver necessary skills for upgrading off-grid rural new builds or existing homes.

The lack of skills available should not be underestimated and the knock on effect it could have to delivering affordable new homes, especially considering the National Audit Office recently reported that none of UK Government's planned affordable 'starter homes' were built.[16] By taking a mixed technology approach in rural off-grid areas, with a mix of LPG/bioLPG and heat pumps, it allows progress to be made faster by utilising existing expertise and supply chains, while others are developed and strengthened.[17]

**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

[15] Installer Statistics Report (31 Dec 2018) – The Microgeneration Certification Scheme
[16] National Audit Office, Investigation into Starter Homes (5th November 2019) < https://www.nao.org.uk/wp-content/uploads/2019/11/Investigation-into-starter-homes-Summary.pdf>
[17] Ecuity Consulting & Liquid Gas UK, A Practical Approach: Analysis of Off-Grid Heat Decarbonisation Pathways

**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 $CO_2$? |
| --- |
| 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 |