Dear Chris and the CCC team,

Thank you for the opportunity to submit evidence to the consultation on the 6th carbon budget.

Since the IPCC report on 1.5°C, the CCC has produced a very significant body of high-quality work which will be critical to ensure the UK achieves its highly ambitious targets at least cost.

Primarily, in the 2016 report, 'The compatibility of onshore petroleum with UK carbon targets', the CCC set the industry three key tests – which the industry is confident it can meet. The Net Zero documentation resets the UK in terms of the decarbonisation end goal, however in our view the three tests from 2016 remain pertinent to the industry in the context of an upgraded decarbonisation target.

The Net Zero report highlighted that there is a recognised need for oil and gas to achieve net zero, with a smaller role than the 75% of UK energy it currently provides. It also detailed that the oil and gas import dependency in 2050 would reach almost 90% when economy-wide demand is considered. To UKOOG, this presents a range of economic, environmental and social costs, as well as opportunities.

It is our strong view that the UK should retain and grow high-value industry where possible. In your Net Zero report, you conclude that 't*he design of the policy framework to reduce UK industry emissions must ensure it does not drive industry overseas, which would not help to reduce global emissions, and be damaging to the UK economy*'. UKOOG agree that the UK oil and gas industry should not be 'offshored' and it is our view that stronger incentives should be put in place to ensure that the use of long distance pipelines and LNG tankers are not given 'carbon priority' when lower carbon natural gas and oil can be produced domestically. For example, given the need to retain high value industry and the lack of alternative solutions to fossil oil as a feedstock for industry, there is a very good case for positive special consideration of UK onshore oil and gas activities. In addition, incentives given to the importation of electricity which, regardless of provenance, is treated as zero-emission, should be removed immediately.

Significantly more recognition also needs to be given to the damaging economic and environmental impacts that offshoring is already having in the UK. All efforts should be made to ensure that existing issues are not exacerbated.

We are not complacent, and the oil and gas industry also needs to continue to play its part by reducing fugitive and other emissions using best available techniques as part of hydrocarbon production. There is a strong desire to do so with strict onshore regulation already in place.

Moving to a low carbon energy and industrial economy makes sense, however importing the required feedstocks from higher carbon sources to deliver Net Zero does not. Our energy transition must be approached with environmental, moral and economic consideration.

Yours,

The Sixth Carbon Budget and Welsh emissions targets – Call for Evidence

UKOOG's key points:

- There is a significant recognised need for oil and gas throughout the transition to and conclusion of net zero.
- Failure to develop and increase indigenous onshore oil and gas production as well as maximising economic recovery in the UK offshore sector will lead to a greater proportion of UK oil and gas demand being met by more carbon intensive overseas sources.
- The shortfall between gas supply and demand under net zero conditions from 2020 to 2050 (600 twh of annual gas demand in 2050) is in excess of 1400 billion cubic metres. That is the available space for UK shale to develop, as stated in test 2 of the CCC 2016 report on onshore petroleum.
- When accounting for feedstock oil demand (those uses that do not involve combustion, which were excluded from the CCC 2050 demand projection) – the shortfall between domestic oil supply and domestic demand is around 3.4 billion barrels again providing a lowest carbon space for the production of onshore oil close to demand.
- Failure to develop UK onshore oil and gas will result in the UK sending almost £½ trillion overseas to meet net zero-compliant oil and gas demand from 2020 to 2050.
- Given the capital costs required to meet net zero in the UK, increasing domestic production of oil and gas to raise taxation revenue offers significant benefits when compared to imported oil and gas (for example, imported oil and gas produces no Corporation Tax gains within the UK).
- The pre-combustion footprint of UK shale gas has been forecast to be between a quarter and half of that of liquified natural gas. Assuming 50% of 2050 natural gas demand (300 twh) comes from onshore sources, UK shale would offer an emissions saving of between 9 and 13 million tonnes CO_2e in the year 2050. For context, that is an emission savings equivalent to the entire upstream emissions from UK oil and gas production in 2019.
- Cumulative emissions savings through the development of UK shale gas total around 223 million tonnes CO_2e by 2050, which is around a half of UK annual emissions.
- Through the current carbon accounting regime, there is a perverse incentive to import oil and gas, among other goods, into the UK. In their net zero report, the CCC concluded that '*"The design of the policy framework to reduce UK industry emissions must ensure it does not drive industry overseas, which would not help to reduce global emissions, and be damaging to the UK economy."* UKOOG fully agree with this statement and given that domestic oil and gas production falls within the 'industry' definition, our strong view is that the UK should be prioritising onshore oil and gas production.
- If policies are applied to domestic oil and gas production, but not imported oil and gas, the policy framework **would drive industry overseas,** which would not help reduce global emissions and be simultaneously damaging to the UK economy.
- Failure to develop onshore oil and gas in the UK would be an offshoring of the country's environmental responsibility and economic opportunity.

- Given our extensive experience of working directly with local communities it is clear that one of the major barriers will be ensuring consumers are on board with the degree of intervention into their homes and potential levels of carbon taxation theorised to incentivise the switch away from current fuels. As a first step there needs to be an improvement in energy literacy across the UK. Many of the decisions we need to make in the next decade need to be made on the basis of knowledge and understanding of where energy currently comes from and what the possibilities are in the future. The demonisation of one sector will not help ongoing discussions.

Question and answer form

When responding, please provide answers that are as specific and evidence-based as possible, providing data and references to the extent possible.

Please limit your answers to 400 words per question and provide supporting evidence (e.g. academic literature, market assessments, policy reports, etc.) along with your responses.

A. Climate science and international circumstances

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

ANSWER: UKOOG have no specific comment on this question

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: UKOOG have no specific comment on this question

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: International effort is required to meet the Paris Agreement, given that the UK represents only around 1% of global emissions. Natural gas clearly has a role to play in decarbonising countries, especially developing ones. In UKOOG's view it makes no sense for LNG to go to countries such as the UK where a lower carbon natural gas source is available – instead the

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?

LNG should be prioritised to nations heavily reliant on coal power, such as India and China, given that the life cycle emissions from coal are double that of natural gas.

It would also be of interest to understand what global decarbonising impact the estimated £1 trillion cost to the UK could have if spent at least partially overseas instead of the UK. For example, if over the next 30 years it is forecast to cost £1 trillion to get the UK from 465 million tonnes per year to net zero, suggesting a per tonne price of £2061.85.

It would be interesting to understand the potential positive carbon reductions which would result from that capital being invested overseas?

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: The UK is leading the world in terms of emissions reductions, with territorial emissions declining by 42% since 1990. In that period, GDP has increased by 67%.

We do however have two major concerns:

1. What action should the UK take if the revised and strengthened UK NDC is not mirrored internationally? It would be unreasonable to expect the UK to strengthen its targets but for the rest of the world not to.
2. While territorial emissions have declined by 42% since 1990, consumption emissions have only declined by around 10%. Failure to address this disconnect between these methods and the issues with international carbon accounting will not achieve the highest levels of ambition as called for under Article 4 of the Paris Agreement – it will simply move emissions from one country (or region) to another.

B. The path to the 2050 target

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

ANSWER: The change in individual household/consumer behaviour is critical to ensure the UK meets its net zero target. There are three good examples of how consumers through Government intervention have engaged with significant changes to the energy system:

1. Starting in the late 1960's the UK began the transition from town gas to natural gas, a process that took less than a decade but required at least one visit to each home in the UK.
2. In the 1990s the UK government mandated that new gas boilers must be condensing, improving efficiency for heat provision in the home and offering savings to the consumer. Almost three decades on, condensing boilers now represent around 60% of the domestic

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?

boiler population and there has been a 20% reduction in domestic gas use (since 2000) and therefore domestic gas-fired emissions.

3. In the 2010s, the UK government encouraged the rollout of smart meters to improve data collection on home energy use and reduce costs to consumers. Even with potential cost savings, it has been challenging to encourage smart meter take up in UK homes.

Under net zero proposals – there are significant upfront costs required to make the housing stock net zero compliant – and it is still unclear who will meet these costs. For example, the costs to achieve 'passivhaus' standards are around £30,000 per household. For the 80% of UK households currently on the gas grid – the total costs in this scenario are £780 billion. Given the cost even with some form of subsidy and disruption this would be extremely difficult to achieve. The OFGEM decarbonisation action plan noted that '*Historically, there have been assumptions that consumers will behave in an economically rational way, for instance switching tariffs if there are savings to be made. However, a large body of research, including work done by Ofgem's behavioural insights team, shows that most consumers do not make active energy tariff choices even when prompted to do so'*[1]

Given the success of the condensing boiler roll out, a potential solution would be for the government to mandate that new boilers fitted are 'hydrogen ready', with minimal cost differentiation between a standard new natural gas boiler. UKOOG would support such a policy direction and would suggest a good way of engaging with the public as a first step in terms of awareness about where energy comes from. Even if further down the line hydrogen was not the complete solution to home heating, the cost differential between a gas and hydrogen boiler makes this a low regrets option.

It is also very clear that there needs to be greater public understanding of energy demand and provenance, including issues such as land use and sourcing of materials. The education of the public is very important to ensure net zero is met as cost effectively as possible. For example, at present the most cost and environmentally effective way of producing hydrogen is through steam reformation of methane. It would make no sense to purchase that methane from the highest carbon emitting sources.

One point which is unclear is the extent of carbon pricing to be applied on domestic home heating, and the rate at which it would increase. Government policy which incentivises people to shift away from their current reliable and cost-effective natural gas-based heating system without direct taxation on natural gas usage would need to be made clear to the public, who already feel that their energy bills are too high.

Domestic heating carbon pricing applied bluntly would be regressive, for example, if a £50/tonne CO_2 was applied to home heating it would increase annual bills by around £150 per year per household, but this is unlikely to be sufficient. Based on work conducted by Element Energy as part of the CCC net zero work package[2], a carbon price of >£250/tonne would have to be applied to incentivise a switch away from natural gas boilers to heat pumps (assuming no space constraints) in 50% of the on-gas grid household population. That equates to an average increase in home

[1] https://www.ofgem.gov.uk/system/files/docs/2020/02/ofg1190_decarbonisation_action_plan_web_0.pdf

[2] https://www.theccc.org.uk/wp-content/uploads/2019/08/Analysis-on-abating-direct-emissions-from-%E2%80%98hard-to-decarbonise%E2%80%99-homes-Element-Energy-UCL.pdf

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?

heating of £750 per year per household. **In UKOOG's view it should be made clear to consumers whether or not carbon taxation at this level will be applied, and at what rate.**

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: In UKOOG's view there are three key uncertainties that policy needs to take into account:

1. One of the clear results of the current debate in the UK is the demonisation of hydrocarbons. As indicated by yourselves and in our foreword there is a clear need for both oil and gas now and through the transition to net zero. For this to happen clear signals need to be given to the investment community that it is still acceptable to invest in production. If the demonisation of the hydrocarbon industry continues, the achievability of net zero will be impossible, given the requirement for both oil and gas out to 2050. Government should be encouraged to open an honest discussion with the general public as part of an overall education programme.
2. As above, the rate of consumer change: The degree of change needed to reduce the UK's annual emissions by around 15 million tonnes CO_2e per year is enormous. Even when there have been significant cost savings associated with change, consumers have not rapidly engaged with the process. It is unclear how readily consumers will be on board with the degree of intervention into their homes, or accept the level of carbon taxation theorised to incentivise the switch away from current fuels.
3. The planning system: Whichever pathways are used to achieve net zero, there will be a need to build, replace or improve infrastructure such as local grid networks, onshore wind farms or other renewable plants. Planning permission is also required for tree planting if the development exceeds 2 hectares[3] .The local planning system process makes it extremely challenging to progress applications for development in a reasonable timeframe, even when planning applications are recommended for approval by the planning officer. For example, since 2000 – 75% of onshore oil and gas applications have been recommended for approval by the respective planning officer, however 73% of all applications since 2000 have been rejected at a local councillor committee level[4]. The issue is not restricted to onshore oil and gas. Since 2000, around 60% of onshore wind applications have been rejected by local authorities[5]. In essence, the point is that in order to achieve net zero targets – there is a need for rapid decision-making in low carbon

[3] https://www.woodlandtrust.org.uk/plant-trees/advice/where/

[4] http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/housing-communities-and-local-government-committee/planning-guidance-on-fracking/written/80149.html

[5] http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/housing-communities-and-local-government-committee/planning-guidance-on-fracking/written/80149.html

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infrastructure out to 2050 – and the local planning route is unlikely to be sympathetic to such a need. It is highly likely that net zero infrastructure will require some form of permitted development legislation or to be passed through NSIP (Nationally Significant Infrastructure Projects). It is also our view that onshore oil and gas should also be able to utilise these national planning options to prevent the UK importing greater volumes of more carbon-intensive oil and gas, offshoring our environmental responsibility and economic opportunity.

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: While UKOOG have no specific comment on the merits of revisiting these targets – it will likely be extremely challenging to implement changes for the fifth carbon budget (due to start in 3 years time) to make it compatible with net zero. We understand that a shallower decline in the fourth carbon budget may require an even steeper decline in the fifth carbon budget.

Similarly, given that the UK is already off track from the 5th carbon budget-compatible pathway, the priority should be design and policy implementation.

We would also caution that changes in previous budgets may have the unintended consequence of driving the offshoring of emissions up. For example, a very simple way of reducing our emissions would be to reduce North Sea oil and gas production, reduce steel manufacturing or reduce the number of cattle and sheep in animal agriculture. This would inevitably lead to further imports of higher carbon alternatives.

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:

There are clearly potential co-benefits of net zero – the creation of jobs to provide new technology being the most obvious. However there also needs to be an acknowledgement of some of the serious implications for the Treasury. Today the Treasury takes in significant taxation from the sale of road fuel and the oil and gas industry pays the highest corporation tax in the country. UKOOG believes as North Sea production declines the tax benefits will not be fully replaced by other sector jobs unless onshore oil and gas is further developed. The alternative as stated elsewhere is the offshoring on not only emissions but the current economic benefits.

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: UKOOG agree that carbon targets are only credible if they are accompanied by policy action. UKOOG envision several points which we believe are important out to the period 2030/2035:

- Greater recognition of the role for oil and gas in meeting net zero targets in the context of a diverse and secure energy mix, together with the need to move from combustion to utilisation
- The retaining of high value industry in the UK through the implementation of carbon leakage prevention policies
- Greater recognition of the issues around production and consumption emissions domestically and internationally
- Improvement in the UK energy security through the increased production of domestic energy (including oil and gas, renewables and nuclear)
- Development of low carbon industrial clusters across the UK
- Government decision on the future of heating in the UK
- Joined up regulation – in order to ensure cost effective net zero transition and delay minimisation every effort should be made to ensure regulatory bodies operate in an efficient way, with little-to-no overlap of responsibilities
- Improved energy literacy in the UK, along with that of climate change (for example, there is still misinterpretation of what 'electricity' demand is compared to 'energy' demand)

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: As mentioned in question 6, there can be issues through the overreliance on local authorities – including on their expertise and capacity to make decisions in the interests of achieving net zero without offshoring industry.

It is of some concern that local authorities may simply focus on emissions reductions in their territory and not give weight to material national and or international considerations. For example, a local council may come to the conclusion that the development of an onshore oil and gas site within its boundary increases the regional emissions when compared to not developing the energy source. This is only the case because the exploration and production emissions occur within the geographical boundaries of that council, whereas the pre-combustion emissions associated with imported oil and gas occur within the country of export. Some local authorities have stated that they will only consider the emissions within their boundary – which ignores the recommendation in the CCC Net Zero document that policy should not incentivise the offshoring of industry.

Similarly, in the Scottish government's Strategic Environmental Assessment for Hydraulic Fracturing, they state that 'it is considered appropriate that the scope and focus of this SEA is on the '*effects that would occur within Scotland*'. In essence, the SEA disregards emissions considerations outside of the borders of Scotland, which is again in conflict with the recommendations of the CCC Net Zero report.

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?

To give an example of heterogenous views on how to manage climate change locally, Surrey County Council declared a climate emergency[6], however neighbouring West Sussex County Council did not. UKOOG has seen differing degrees in the understanding of oil and gas, energy and climate change policy more widely in local authorities. In general, the local authorities which have had the greatest onshore oil and gas development over the last 150 years (with over 2,100 wells drilled) have demonstrated greater understanding.

In UKOOG's view – it would be preferable for the CCC to encourage MHCLG to provide guidance to local authorities on how they should consider climate change in the context of planning applications, however, climate change targets should be regulated centrally by BEIS or another appropriate Government department.

This issue does not only impact the onshore oil and gas industry – there will be some areas of the UK that have more sites with higher wind speeds, more hours of daylight for solar, or more agriculture-based development and therefore better suited to certain land uses than other areas.

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: Improper policy will lead to UK industry becoming less competitive, the fiscal balance worsening, fuel poverty becoming more severe and energy imports increasing. These outcomes would be totally undesirable from an environmental and economic perspective. UKOOG understands that there is a very fine balance between retaining high value industry and reducing industrial emissions.

UKOOG's view is simply that where there is the potential for domestic industries to flourish – they should be allowed to do so. The UK does not need to have to have a natural gas import dependency of 50% today and of 86% in 2050. If UK industry is offshored as a result of UK policies over the next 30 years the impact on Treasury funds will be pronounced. For example, the INEOS Grangemouth refinery represents 4% of Scottish GDP – if this refinery was to close the economic impact on Scotland, and the town of Grangemouth, would be very serious.

Similarly, given that the annual fuel duty receipts of around £28 billion per year will decline as the direct use of petrol and diesel in road vehicles declines, there will have to be steps taken to ensure the shortfall is managed to reduce the annual expenditure deficit.

Fuel poverty in the UK stands at around 10% of households, with the issue being more pronounced for those not connected to the natural gas grid (those not on the gas grid are 50% more likely to be in fuel poverty). In order to prevent the exacerbation of fuel poverty in the UK, the full costs of decarbonisation cannot fully fall on consumers – meaning that there will have to be an increase in taxation or increased Government borrowing. If the increased taxation was to fall on industry, competitiveness would be affected, meaning industry may simply be offshored.

[6] https://www.surreycc.gov.uk/people-and-community/climate-change/what-are-we-doing

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?

Increasing energy imports has a big impact on the country's balance of payments which in the absence of UK economic growth will need to be funded by increased borrowing and therefore will have a restriction on future growth. We estimate that by 2050 the UK could be spending in excess of £12bn per year just on gas imports.

The critical elements of policy design should include:

- Incentivisation policy levers to ensure more domestic businesses produce more revenue for the exchequer
- Appropriate consideration of the environmental impacts of imported goods into the UK
- Greater focus on the relationship and trade-offs in respect to financial burdens on industry and consumers

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:

UKOOG understand that achieving a just transition is an extremely challenging task, however failure to do so will ensure consumers and industries do not properly engage with the ambitious target of achieving net zero.

It is as yet still unclear where the costs of the just transition should fall. The capital will only be available through borrowing or increased taxation revenue. Pernicious taxation regimes should not be applied to industry as this will simply disincentivise domestic industrial development.

The UK should avoid merely thinking of this as a cost but ensure that it is enshrined in legislation that a fixed percentage of everything used in the transition is built or provided for in the UK. For example, the onshore oil and gas industry already has a commitment which has been successfully demonstrated to ensure a significant proportion of day-to-day spending is spent within the confines of the local community. This sort of initiative should be rolled out to other sectors. If the solutions to Net Zero are merely imported from overseas then there would be an economic, as well as environmental, cost.

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: UKOOG have no specific comment on this question

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: UKOOG have no specific comment on this question

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: UKOOG have no specific comment on this question

Question 16: Do you have any evidence on the appropriate level of Scotland's interim emissions reduction targets in 2030 and 2040?

ANSWER: UKOOG have no specific comment on this question

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: There is an absolute need for consistency across devolved and Westminster policy to prevent perverse incentives but also across departments and other European countries. There are two key examples of this:

1. Carbon pricing: Imported power is accounted as zero carbon even when it may not be - as well as its exemption from UK transmission costs – there is clearly a perverse incentive to import potentially higher carbon emitting electricity into the UK. As part of the Net Zero package for the CCC, a document on carbon pricing was produced which detailed how California applies carbon border tariffs for power generation to prevent the importation of 'zero carbon accounted' fossil power. This could readily be applied in the UK.
2. Global Warming Potential (GWP): There should not be divergence in the global warming potentials assigned to different greenhouse gases. It should be agreed across all of the devolved nations, and internationally, that a consistent timeframe and value will be agreed to. Doing so, again prevents perverse incentives to locate development in one area over another. The CCC concluded in the net zero report that '*throughout this report, emissions of different greenhouse gases are combined using the GWP100 metric, in line with international convention'* and repeated in the progress report to Parliament: '*At COP24 in December 2018 the international community decided to standardise reporting under the Paris Agreement transparency framework using the GWP100 metric*'. This type of consistency should also be communicated to local authorities and Government departments.

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: UKOOG have no specific comment on this question

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

ANSWER: UKOOG have no specific comment on this question

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: UKOOG have no specific comment on this question

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: The decision process for transport logistics to achieve a shift away from diesel fuel to zero emission HGVs will be dependent on two key variables; cost and logistics.

The UK already has an extensive natural gas grid network, and this could easily be repurposed to transport hydrogen gas. Hydrogen depots could feasibly replace the current petrol stations for HGVs and enable the decarbonisation of a disproportionately large transport emission source.

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:

c)

UK Onshore Oil and Gas (UKOOG), as the representative body for the onshore petroleum production industry, is supportive of the ambitions of net zero, and we see a critical role for onshore oil and gas in meeting the strict targets. The UK already applies the best available techniques (BAT) for gas management, which, for example, disincentivises venting and encourages the utilisation or flaring of waste gases for oil and gas early stage exploration sites only.

Firstly, fossil fuel combustion in the UK has the same carbon footprint regardless of source (given the strict Wobbe number requirements set by the regulators). Combusting UK oil and gas instead of imported oil and gas offers no emissions savings. The potential savings are in the upstream or 'pre-combustion footprint'. These values are detailed in question 23.

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

In terms of onshore we believe the CCC recommendations of 2016 are still relevant

Industry comment on the three tests set out in the report

Test 1: "Well development, production and decommissioning emissions must be strictly limited. Emissions must be tightly regulated and closely monitored in order to ensure rapid action to address leaks."

The four parts of Test 1 are already covered by the existing regulatory regime in the UK.

• "A range of technologies and techniques to limit methane emissions should be required, including 'reduced emissions completions' (also known as 'green completions') and liquid unloading mitigation technologies (e.g. plunger lift system) should these be needed"

The Environment Agency (EA) has already stated that it considers green completions to be a 'best available technique'. Best available techniques will evolve as the industry moves to production. The report recognises that the CCC's view of the current UK situation does not include further techniques and technologies that are likely to be required by the EA. The industry will continue to work proactively with regulators to minimise fugitive emissions from our operations.

• "A monitoring regime that catches potentially significant methane leaks early is essential in order to limit the impact of 'super-emitters'"

Environmental permits will include the need to monitor emissions to air to demonstrate compliance with the permit. In addition, Section 50 of the Infrastructure Act 2015 states that hydraulic fracturing cannot take place unless appropriate arrangements have been made for monitoring emissions of methane into the air.

• "Production should not be allowed in areas where it would entail significant CO2 emissions resulting from the change in land use (e.g. areas with deep peat soils)"

CO2 emissions resulting from a change in land use will be taken into account in the planning process.

• "The regulatory regime must require proper decommissioning of wells at the end of their lives. It must also ensure that the liability for emissions at this stage rests with the producer."

It is the responsibility of the licence holder to decommission the well in accordance with regulations, and the HSE will ensure that the well is properly decommissioned. In addition, the environmental permits can only be relinquished once the EA is satisfied that environmental risks

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

are no longer present or are sufficiently low. Finally, provision for decommissioning and restoration may be required as a condition of the planning permission.

Test 2: "Consumption – gas consumption must remain in line with carbon budgets requirements. UK unabated fossil energy consumption must be reduced over time within levels we have previously advised to be consistent with the carbon budgets. This means that UK shale gas production must displace imported gas rather than increasing domestic consumption."

We agree with this and note that under the higher shale gas production scenario and the lowest gas consumption scenario in the CCC report, the UK is still a small net importer of gas. With North Sea production declining, there is considerable room for shale gas to replace imported gas. The National Grid, in its UK Future Energy Scenarios report, stated this week that the UK could be importing 93% of its gas by 2040. If domestic development stalls. The report also states that the cheapest way to create low-carbon hydrogen is from gas with Carbon Capture and Storage (CCS), and we fully support efforts to develop this technology.

Test 3: "Accommodating shale gas production emissions within carbon budgets. Additional production emissions from shale gas wells will need to be offset through reductions elsewhere in the UK economy, such that the overall effort to reduce emissions is sufficient to meet carbon budgets."

The report states that with a high level of shale gas production, fugitive methane emissions would be around 11 million tonnes of CO2-equivalent per annum in 2030. This is around 3% of the average annual allowance in the Fifth Carbon Budget period (the Fifth Carbon Budget recommends a level of 1,765 million tonnes of CO2-equivalent for 2028-32, an average of 353 million tonnes a year). The Government has confirmed its commitment to meeting the Fifth Carbon Budget, and at up to 3% of the total, shale gas emissions can be accommodated.

It should also be stressed that emission from UK production of shale gas are included within the carbon budgets, whereas emissions from the production and transportation of imported gas are not. Therefore, shale gas does not add to the UK's overall carbon footprint – indeed the report confirms that lifecycle emissions from shale gas are slightly lower than from imported LNG.

The report confirms that: "If these conditions are met, then shale gas could make a useful contribution to UK energy supplies, including providing some energy security benefits." It is clear that the three tests are met by existing UK regulations and policy.

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

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:

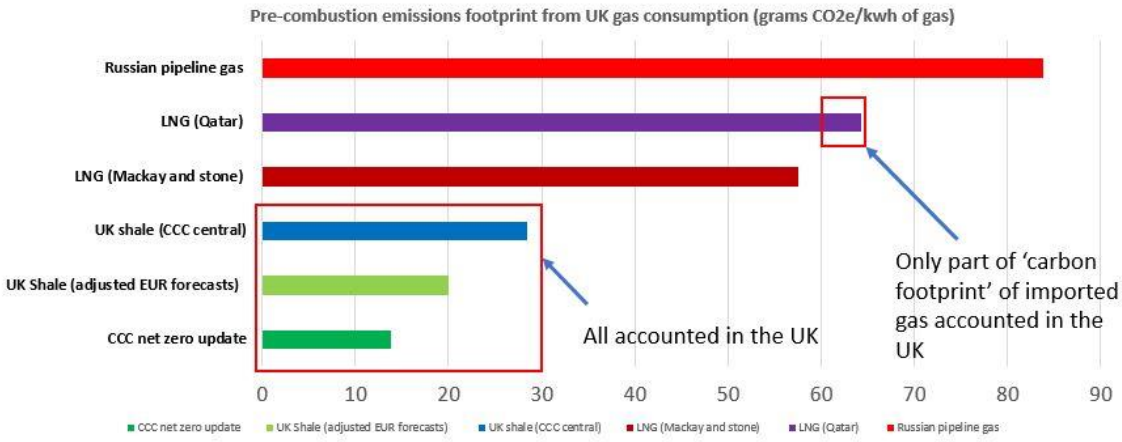
First and foremost, UKOOG see the prime opportunity for reduction in fossil fuel supply emissions through the displacement of carbon intensive imports, such as LNG and long distance pipeline, with UK shale gas. The relative carbon footprints of each source is shown below:

GHG emissions per unit of thermal energy gCO2e/kWh(th)	**LNG (source Mackay and Stone analysis)**	**Long Distance Pipeline (LDP) (source Mackay and Stone analysis)**	**United Kingdom Continental Shelf (North Sea) (Mackay and Stone Analysis)**	**UK Shale Gas (forecast – Source CCC report on compatibility of onshore petroleum)**
High	89	80	15	53 (71 if venting and very low EUR)
Central	57	68.5	13	28
Low	38	42	8	13.8

The pre-combustion footprint of UK shale gas has been forecast to be between a quarter and a half of that of liquified natural gas. Assuming a 50% of 2050 natural gas supply comparison (300 twh) and based on CCC data, UK shale would offer an emissions saving of between 9 and 13 million tonnes CO_2e in the year 2050. The 2016 CCC analysis concluded that UK shale would have a pre-combustion footprint of around 28 g CO_2/kwh, however the updated analysis as part of the Net Zero package concluded that UK shale would have a pre-combustion footprint of 13.8 g CO2/kwh. UKOOG feel the latter number is more realistic as the Estimated Ultimate Recovery (EUR) value used in the CCC's 2016 report is too low and out of date.

However, there is a glaring issue to address. The pre-combustion footprint of imported natural gas is not accounted for within the UK – this is shown graphically below:

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?



The UKCS has one of the lowest carbon footprints of any source, however if the UK was to shut down the UKCS and displace it all with LNG and imported heavy crude oil – the UK would see emissions reductions of around 13 million tonnes CO_2e, simply because the upstream emissions occur in another country. UKOOG believe that to achieve a **real** reduction in fossil fuel supply emissions, UK shale gas should be developed to achieve net zero.

It is also our firm view that there is a very good case for special consideration for UK onshore oil and gas development, with recognition of the role it can play in achieving net zero.

Good practice of emissions reductions in the UK onshore oil and gas sector include:

- Surface gas management infrastructure (e.g. phase separator) to minimise fugitive gas releases at surface
- Disallowing of 'open flowback lagoons' at sites by collecting flowback fluids and produced water in tanks
- Frequent leak detection and repair surveys of onsite infrastructure
- High efficiency shrouded ground flares
- Zero bleed pneumatic controllers (valves operated with inert gases, e.g. nitrogen, instead of well gas)

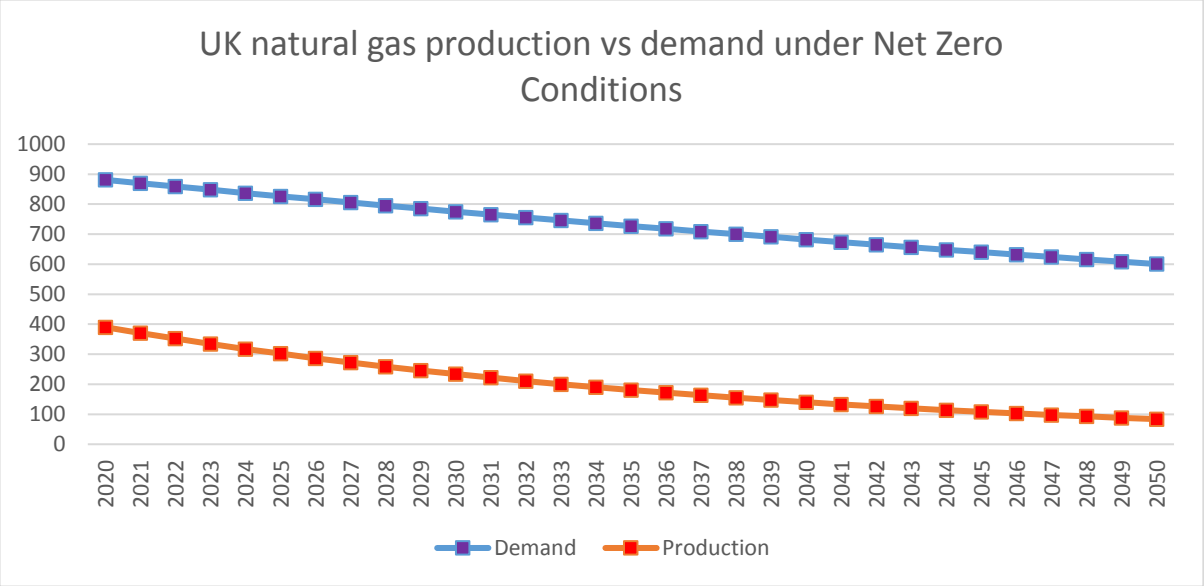
Question 24 (Industry): How can the UK achieve a just transition in the fossil fuel supply sectors?

ANSWER:

<u>Natural Gas</u>

Based on the forecast 2050 oil and gas demand in the CCC Net Zero document, there is still a significant role for oil and gas production in the UK. The natural gas chart is shown below:

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



Based on the CCC assumption that the UK would require 600 Twh of natural gas in 2050, the cumulative shortfall between UK domestic supply and UK domestic demand is over 1400bcm from 2020 to 2050, with an 86% import dependency in 2050.

In the Net Zero assessment, the CCC concluded that a bioresource of 200 Twh is available in 2050, 173TWh of which will be for BECCS and 14TWh of which is for biogas. Assuming 100% of the 'biogas' falls into the 'biomethane' i.e. grid spec definition, 14TWh (1.3bcm) of biomethane consumption in 2050 does not materially improve the UK's natural gas import issue, and it is also less than 20% of the 2050 biomethane production modelled in the National Grid 'community renewables' scenario. When accounting for biomethane injection, the UK natural gas import dependency increased by on average 1 terawatt hour per year from 2020-2050.

Assuming a gas price of 50 pence per therm over 30 years, the UK would send £250 billion overseas to meet domestic natural gas demand.

Even if the shortfall between UK supply and demand was a half of that of this forecast – there is a significant opportunity for shale gas to develop.

Therefore, based on the above statistics, UKOOG have developed two scenarios for gas demand in the UK from 2020 to 2050. The statistics are taken from:

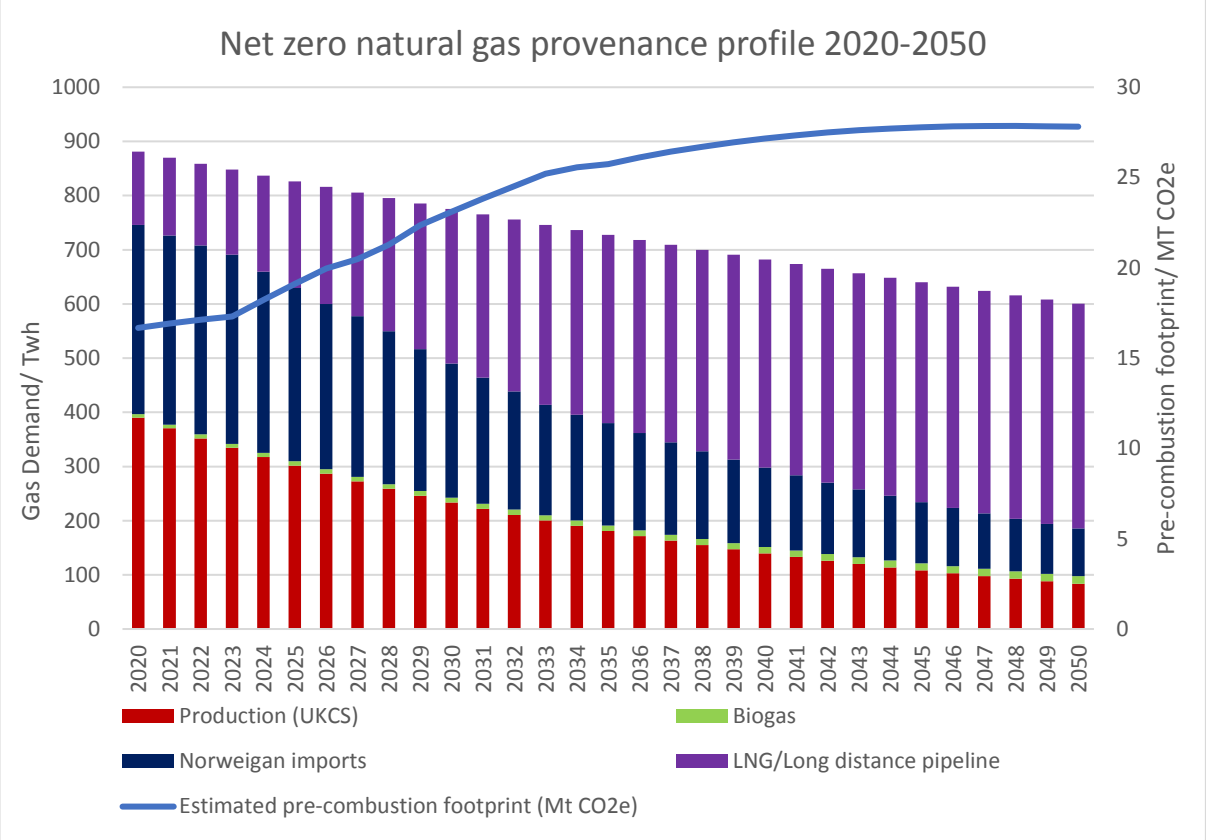
- OGA natural gas forecast production[7]
- National Grid Future of Energy Scenario[8]

[7] https://www.ogauthority.co.uk/media/5391/oga_projections_of_uk_oil_and_gas_production_and_expenditure.pdf

[8] https://www.ogauthority.co.uk/media/5391/oga_projections_of_uk_oil_and_gas_production_and_expenditure.pdf

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

- UKOOG updated production scenarios[9]

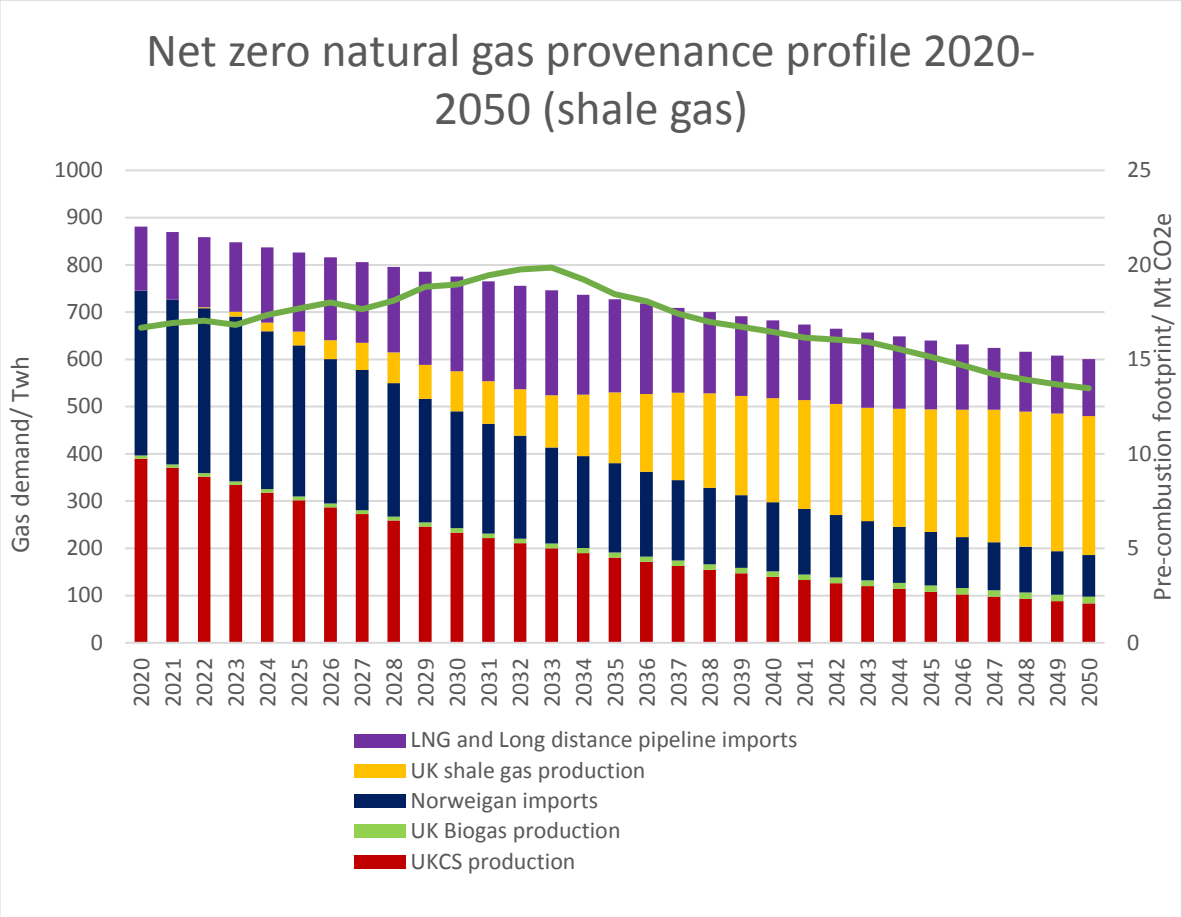


The above chart demonstrates that failure to develop UK shale gas results in greater volumes of LNG and long distance pipeline gas being imported into the UK, and the pre-combustion footprint of UK gas supply increases from around 16 million tonnes CO_2e today, to around 26 million tonnes CO_2e in 2050. The increase in the upstream emission footprint of UK oil and gas supply in this scenario, despite decreased supply itself, is the equivalent of adding around 40% of the annual emissions from Wales to the UK carbon footprint.

The overleaf chart demonstrates the emissions savings from the development of UK shale gas:

9 https://www.ogauthority.co.uk/media/5391/oga_projections_of_uk_oil_and_gas_production_and_expenditure.pdf

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



The development of shale gas in the UK, where natural gas imports are 50% less in 2050 than they would be in the no shale scenario, offers a cumulative emission saving of 223 million tonnes CO_2e over 30 years (2020-2050). By developing a lower carbon footprint domestic source, the UK is able to reduce its gas supply pre-combustion footprint by around 20% by 2050 (even with no technology improvements).

Oil

The case is similar for oil, with some minor clarifications. In the CCC net zero analysis, it was concluded that oil demand in 2050 would be 140 TWh (around 400,000 barrels of oil per day consumption, down from around 1.6 million barrels of oil per day in 2019) – **however this forecast does not include feedstock oil demand**. UKOOG assume that feedstock oil demand will remain at current levels for two key reasons:

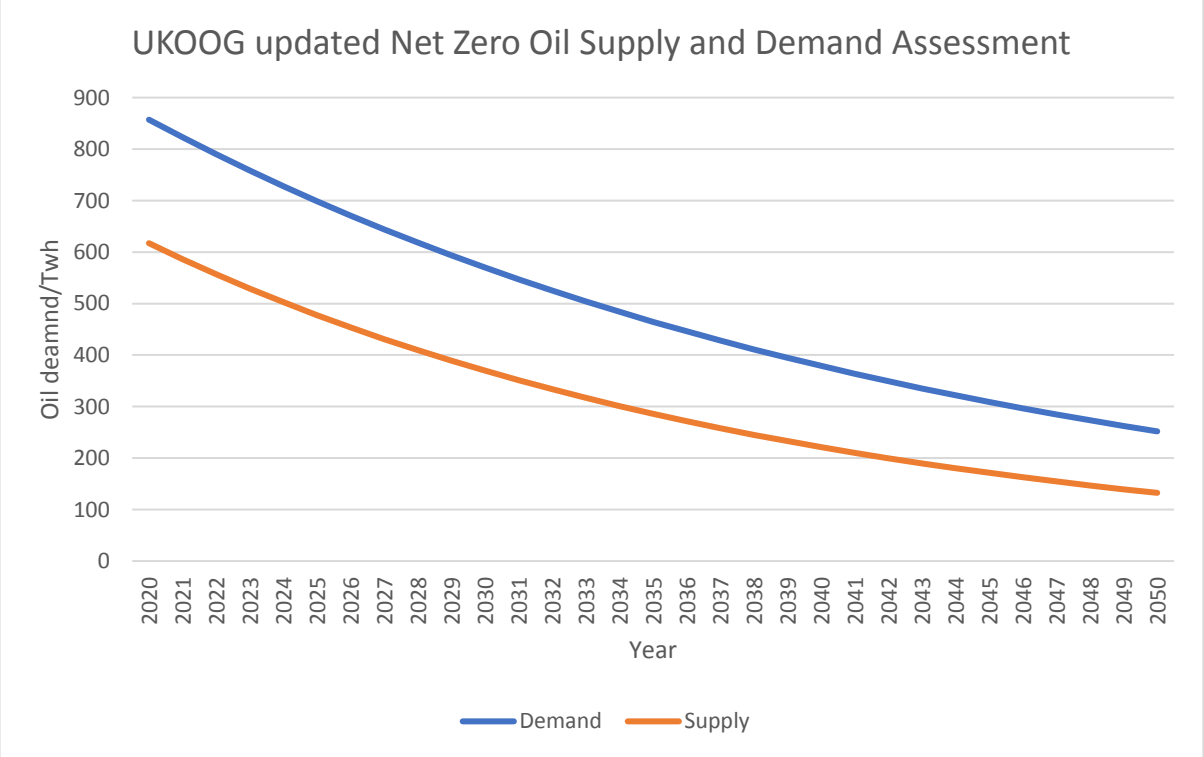
- The CCC Net Zero report concluded that industry cannot be offshored to achieve emissions targets. This therefore implies that industry should be retained and should be decarbonised, which UKOOG agrees with – but that does not remove the need for feedstock oil (which is not combusted). Feedstock oil will still be required to produce the key materials needed for a net zero economy, such as building and transport materials and chemicals.
- As part of the package of work for net zero, an assessment was undertaken of the potential for biofuels to displace fossil oil. The report concluded that '*The potential for the production and use of biopolymers as a climate change mitigation strategy in the UK is **limited**. Based*

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

upon the currently available LCA (life cycle assessment) data, there is ***no clear-cut case*** *for stating that there are benefits to be obtained by the substitution of a biopolymer for a functionally equivalent fossil derived material'.* Therefore, there is minimal justification to exclude feedstock oil on the grounds of recognised continued demand for industry and no viable alternative.

Accounting for feedstock oil, UKOOG propose the following updated 2050 oil demand division and production/demand profile

Petroleum products	TWh	Mtoe	Barrels per day
Aviation	114	9.81	191,386
Surface transport	12	1.03	20,145
Industry / agriculture	11	0.95	18,467
Industry feedstock	105	9.03	177,000
Total	**237**	**11.78**	**406,998**



Under this assessment the shortfall in supply is 3.41 billion barrels of oil (5555.19 Twh) over the period 2020-2050, or the equivalent of 311,585 barrels per day over 30 years. Oil import dependency in 2050 would be 48%.

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

Assuming an average Brent Crude Oil price of £50 per barrel – the cost of importing oil into the UK to meet net zero targets from 2020-2050 would be £170 billion.

It is also important to consider that 66% of natural gas supplied to the UK from the UKCS is associated gas. Failure to drill, complete and produce from oil wells in the UKCS therefore will likely have a knock-on effect on domestic gas supply.

Without increases in oil and gas production – the UK will be facing a combined oil and gas import dependency of 75% in 2050.

In regards to employment, assessments for the onshore oil and gas industry concluded that a UK shale gas industry would see the creation of 64,000 new jobs[10] and the further development of onshore oil would see up to 5,600 further jobs created[11]. UKOOG see the best way to ensure a 'just transition' for oil and gas workers in the UK is to maximise economic recovery of available lower carbon UK onshore oil and gas.

It would be very useful for further CCC analysis to include a profile (or profiles) of economy-wide oil and gas demand compatible with net zero (similar to the charts above), and to highlight the shortfall between supply and demand. These profiles were provided in the CCC 2016 assessment on the compatibility of onshore petroleum with UK carbon targets.

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: UKOOG have no specific comment on this question

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: In the 1990s the UK Government mandated that new gas boilers must be condensing, improving efficiency for heat provision in the home and offering savings to the consumer. Almost three decades on, condensing boilers now represent around 60% of the domestic boiler

[10] https://business-hive.co.uk/wp-content/uploads/2014/05/here.pdf

[11] https://www.ukogplc.com/ul/Kimmeridge%20Limestone%20Oil%20-%20The%20UK%20opportunity%20-%20Final%20Approved%20-%2015%20April%202016.pdf

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population and there has been a 20% reduction in domestic gas use (since 2000) and, therefore, domestic gas-fired emissions.

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: UKOOG have no specific comment on this question

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: In UKOOG's view there should be a co-ordinated and effective planning system which allows for the development of infrastructure required to meet Net-Zero at least cost, including renewables, storage infrastructure and onshore oil and gas development.

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: UKOOG have no specific comment on this question

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: As with our comments on previous questions, UKOOG are concerned about the perverse incentive to import electricity into the UK – primarily as a result of differentiation in carbon pricing in the UK and continental Europe – but also because imported power enjoys an exemption from UK transmission costs. This is an issue which equally impacts renewable generation as well as thermal power generation.

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: UKOOG fully supports the development of large-scale low carbon hydrogen production in the UK. UKOOG sees a key role for hydrogen in the decarbonisation of heavy industry, transport and home heating across the UK.

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: UKOOG have no specific comment on this question

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: UKOOG have no specific comment on this question

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: UKOOG have no specific comment on this question

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: UKOOG have no specific comment on this question

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: UKOOG have no specific comment on this question

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: Different technologies are likely to be deployed in different parts of the UK depending on demand, available infrastructure etc. The most important variable will be the central Government decision-making on which technology is deployed where, and at what rate.

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: CCUS is critical to achieve net zero in the UK, and UKOOG is fully supportive of its development. There is a great opportunity for the UK to utilise its onshore sequestration capacity, as well as the offshore. For example, there are a number of coal mine methane wells across the UK which could be suitable for CCUS. The storage of CO_2 in older coal mine methane wells is a proven technology, whereby flue gas is injected into the lattice, which adsorbs onto the coal seam. This process also offers the opportunity for enhanced coal seam gas recovery.