Building a zero-carbon economy – Call for Evidence

Background

On 15 October 2018 the governments of the UK, Scotland and Wales asked the Committee on Climate Change (CCC) to provide advice on the UK and Devolved Administrations' long-term targets for greenhouse gas emissions and the UK's transition to a net zero-carbon economy. Specifically: when the UK should reach net zero emissions of carbon dioxide and/or greenhouse gases as a contribution to global ambition under the Paris Agreement; if that target should be set now; the implications for emissions in 2050; how such reductions can be achieved; and the costs and benefits involved in comparison to existing targets.

The advice has been requested by the end of March 2019.

The UK's long-term emissions target is currently for at least an 80% reduction in greenhouse gas emissions from 1990 to 2050. It covers all sectors, including international aviation and shipping and is measured on a 'territorial' basis (i.e. based on emissions arising in the UK). On a comparable basis, emissions in 2017 were estimated to be 38% below 1990 levels.

The current target was set in 2008 based on advice from the Committee. That advice considered that to avoid the worst impacts of climate change, the central expectation of global temperature rise should be limited "to, or close to, 2°C", while the probability of crossing "the extreme danger threshold of 4°C" should be reduced to an extremely low level. That meant global emissions would roughly have to halve by 2050. The 2008 advice made the assumption that the UK should not plan to have a higher level of per capita emissions in 2050 than the global average.

The long-term target guides the setting of carbon budgets (sequential five-year caps on emissions that currently extend to 2032 and require a reduction in emissions of 57% from 1990 to 2030). 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).

Any change to the long-term targets would therefore be expected to have significant implications, not just in the long-term but on current policies to drive the transition.

The CCC will advise based on a thorough consideration of the relevant evidence. We expect that to cover:

- The latest climate science, including as contained in the IPCC Special Report on 1.5°C.
- The terms of the Paris Agreement.
- Global pathways (including those reported by the IPCC) consistent with limiting global average temperature rise in line with the goals of the Paris Agreement.

- International circumstances, including existing plans and commitments to cut emissions in other countries, actions to deliver on those plans and opportunities for going further.
- An updated assessment of the current and potential options for deep emissions reductions in the UK and emissions removals from the atmosphere, including options for going beyond the current 80% target towards net zero.
- An appraisal of the costs, risks and opportunities from setting a tighter long-term target.
- The actions needed in the near term that would be consistent with achieving the long-term targets.

This Call for Evidence will contribute to that advice.

Responding to the Call for Evidence
We encourage responses that are brief and to the point (i.e. a maximum of 400 words per question, plus links to supporting evidence, answering only those questions where you have particular expertise), and may follow up for more detail where appropriate.

You do not need to answer all the questions, please answer only those questions where you have specific expertise and evidence to share. It would be useful if you could use the question and response form below and then e-mail your response to: communications@theccc.gsi.gov.uk using the subject line: 'Zero carbon economy – Call for evidence'. Alternatively, you can complete the question and answer form on the CCC website, available here.

If you would prefer to post your response, please send it to:

The Committee on Climate Change – Call for Evidence
7 Holbein Place
London
SW1W 8NR

The deadline for responses is 12 noon on Friday 7 December 2018.

Confidentiality and data protection
Responses will be published on our website after the response deadline, along with a list of names or organisations that responded to the Call for Evidence.

If you want information that you provide to be treated as confidential (and not automatically published) please say so clearly in writing when you send your response to the consultation. It would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded by us as a confidentiality request.

All information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the access to information

legislation (primarily the Freedom of Information Act 2000, the Data Protection Act 1998 and the Environmental Information Regulations 2004).

Question and response 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 response to a maximum of 400 words per question.

Part 1: Climate Science

Question 1 (Climate Science): The IPCC's Fifth Assessment Report and the Special Report on 1.5°C will form an important part of the Committee's assessment of climate risks and global emissions pathways consistent with climate objectives. What further evidence should the Committee consider in this area?

ANSWER: SGN has no specific comments

Question 2 (CO_2 and GHGs): Carbon dioxide and other greenhouse gas gases have different effects and lifetimes in the atmosphere, which may become more important as emissions approach net-zero. In setting a net-zero target, how should the different gases be treated?

ANSWER: SGN has no specific comments

Part 2: International Action

Question 3 (Effort share): What evidence should be considered in assessing the UK's appropriate contribution to global temperature goals? Within this, how should this contribution reflect the UK's broader carbon footprint (i.e. 'consumption' emissions accounting, including emissions embodied in imports to the UK) alongside 'territorial' emissions arising in the UK?

ANSWER: SGN has no specific comments

Question 4 (International collaboration): Beyond setting and meeting its own targets, how can the UK best support efforts to cut emissions elsewhere in the world through international collaboration (e.g. emissions trading schemes and other initiatives with partner countries, technology transfer, capacity building, climate finance)? What efforts are effective currently?

ANSWER:

The UK has a major opportunity to be a global leader in terms of delivering a decarbonised gas grid, provided further innovation and demonstration projects are approved and funded in this country to develop our export potential. Key to these developments is also the enabling changes to move gas quality standards from the Gas Safety (Management) Regulations legislation to an IGEM standard to allow a wider range of low carbon gases in the UK network and more than 0.1% hydrogen.

Question 4 (International collaboration): Beyond setting and meeting its own targets, how can the UK best support efforts to cut emissions elsewhere in the world through international collaboration (e.g. emissions trading schemes and other initiatives with partner countries, technology transfer, capacity building, climate finance)? What efforts are effective currently?

A study by Vivid Economics and Imperial College for BEIS highlighted many countries are like the UK and have many homes, businesses and industry on a gas grid as a result of the low cost and high satisfaction with gas heating. The study showed no country has successfully achieved a large move away from heating delivered via a gas network despite substantial efforts. This illustrates the scale of the opportunity to support emissions reductions elsewhere.

SGN and the other UK gas networks, are developing a pathway to demonstrate how the gas network will underpin decarbonisation.[1] A study by KPMG showed this would be a third of the cost of an all-electric pathway and less disruptive for customers as it would make the most of infrastructure already connected to 85% of UK homes.[2]

Poyry estimate that for Europe to reduce emissions by 95%, a zero-carbon gas pathway, which includes biomethane, hydrogen from electrolysis and natural gas with CCS would cost €1.15tn less than an all-electric pathway.[3]

The UK has become a global leader in terms of projects to support the decarbonisation of gas like SGN's H100 project which is looking to demonstrate a 100% hydrogen network in Scotland.[4] This would be the first of its kind in the world. Countries including Australia, Japan and Holland are now looking at conversion of the gas grid to hydrogen to meet climate change obligations.

The £25m BEIS Hy4heat programme and the £20m hydrogen supply competition need to be backed up by further funding for low carbon gas demonstration projects to 1) gather the evidence to inform a UK heat policy decision before 2025 and 2) maintain our position as a global leader in developing decarbonised gas solutions.

Question 5 (Carbon credits): Is an effective global market in carbon credits likely to develop that can support action in developing countries? Subject to these developments, should credit purchase be required/expected/allowed in the UK's long-term targets?

ANSWER: SGN has no specific comments

[1] Assessing Decarbonisation Pathways for the Gas Networks http://www.energynetworks.org/assets/files/gas/futures/181116%20Scope%20of%20Services%20-%20Decarbonisation%20Pathway.docx

[2] KPMG, 2050 Energy Scenarios : The UK Gas Networks role in a 2050 whole energy system https://www.energynetworks.org/assets/files/gas/futures/KPMG%20Future%20of%20Gas%20Main%20report%20plus%20appendices%20FINAL.pdf

[3] Poyry, Fully decarbonising Europe's energy system by 2050, May 2018 http://www.poyry.com/sites/default/files/media/related_material/poyrypointofview_fullydecarbonisingeuropesenergysystemby2050_printerfriendly.pdf

[4] https://www.sgn.co.uk/Hydrogen-100/

Part 3: Reducing emissions

Question 6 (Hard-to-reduce sectors): Previous CCC analysis has identified aviation, agriculture and industry as sectors where it will be particularly hard to reduce emissions to close to zero, potentially alongside some hard-to-treat buildings. Through both low-carbon technologies and behaviour change, how can emissions be reduced to close to zero in these sectors? What risks are there that broader technological developments or social trends act to increase emissions that are hard to eliminate?

ANSWER:

Getting emissions from industry and heat to zero is very challenging. However, CCUS could play a pivotal role in developing a hydrogen economy to help meet the challenge.

For industry, we believe there is a need to focus on clusters, where significant emissions reductions could be achieved using shared infrastructure. One cluster is in North East Scotland where we are involved in the Aberdeen Vision project looking at capturing the carbon from hydrogen production from natural gas at the St Fergus Terminal.[5] This is looking to blend 2% hydrogen into the gas transmission system and 20-100% into our local Aberdeen network.

35% of UK natural gas comes onshore at St Fergus which is the third largest CO_2 emissions location in Scotland. The project provides a great opportunity for early adoption of CCUS technology in the UK due to the infrastructure the Acorn project has shown is capable of dealing with the emissions.[6] The scheme could expand via an existing pipeline to Grangemouth, which has the largest cluster of industrial emissions in Scotland.

The UK gas networks are developing a pathway for the gas networks to 100% low carbon.[7] In the short-term by blending green gas such as biomethane and bioSNG into the network. In the medium-term adding hydrogen to that blend. In the longer term the potential to move towards 100% hydrogen networks.

Producing hydrogen from natural gas using auto-thermal reforming would reduce emissions by over 92% compared with natural gas. The savings implied by the H21 North of England report are higher than the 60-85% in the CCC's hydrogen report. Emissions from production and combustion of hydrogen would be 14.47g CO_2e/kWh.[8] This is lower than analysis for lifecycle emissions of electricity of solar (85g CO_2e/kWh) and wind (26g CO_2e/kWh).[9]

[5] https://pale-blu.com/2018/10/10/sgn-and-pale-blue-dot-collaborate-on-aberdeen-hydrogen-vision/

[6] Pale Blue Dot: Acorn CCS Project https://pale-blu.com/acorn/

[7] Assessing Decarbonisation Pathways for the Gas Networks http://www.energynetworks.org/assets/files/gas/futures/181116%20Scope%20of%20Services%20-%20Decarbonisation%20Pathway.docx

[8] H21 North of England, November 2018, https://northerngasnetworks.co.uk/h21-noe/H21-NoE-23Nov18-v1.0.pdf

Question 6 (Hard-to-reduce sectors): Previous CCC analysis has identified aviation, agriculture and industry as sectors where it will be particularly hard to reduce emissions to close to zero, potentially alongside some hard-to-treat buildings. Through both low-carbon technologies and behaviour change, how can emissions be reduced to close to zero in these sectors? What risks are there that broader technological developments or social trends act to increase emissions that are hard to eliminate?

Developing a comprehensive evidence base on how different decarbonised heat solutions work in practice by funding large scale trials is the priority in the short term. Key to these developments are timely changes to move gas quality requirements from UK legislation (Gas Safety (Management) Regulations) to an IGEM standard to enable us to move along the pathway to 100% low carbon gas – a fully integrated approach with dedicated hydrogen networks in some areas and low carbon gas across the system.

Question 7 (Greenhouse gas removals): Not all sources of emissions can be reduced to zero. How far can greenhouse gas removal from the atmosphere, in the UK or internationally, be used to offset any remaining emissions, both prior to 2050 and beyond?

ANSWER:

We believe the combination of bioenergy with CCS can provide the negative greenhouse gas emissions that are essential to offset emissions that are difficult to reduce from sectors such as agriculture and aviation. This includes capturing the emissions from the production of BioSNG which can be produced through the gasification of black bag waste and other organic material. The BioSNG process produces a high-purity stream of carbon dioxide which could be sequestered in carbon storage infrastructure to increase carbon savings to 190% compared to fossil natural gas.[10] If the impact of diverting waste from landfill is also taken into account the saving could be as high as 264%.

Converting the gasification of biomass from producing bioSNG to biohydrogen produces even greater carbon savings. BioSNG facilities can produce gas with the low levels of hydrogen required to meet the current grid specification but are able to increase hydrogen levels and shift to very high levels of hydrogen if networks move to 100% hydrogen. This flexibility means that BioSNG can play an important part in the conversion of gas networks to hydrogen and deliver negative emissions.[11] The BioSNG demonstration plant built in Swindon has illustrated the costs of converting a BioSNG plant to Biohydrogen production or the production of a BioSNG/Biohydrogen blend are also relatively low.

[9] World Nuclear Association, Comparison of Lifecycle Greenhouse Gas Emissions of Various Electricity Generation Sources http://www.world-nuclear.org/uploadedFiles/org/WNA/Publications/Working_Group_Reports/comparison_of_lifecycle.pdf

[10] BioSNG Demonstration Plant Project Close-Down Report http://gogreengas.com/wp-content/uploads/2015/11/BioSNG-170223-1-Project-Close-Out-Report.pdf

[11] BioSNG Demonstration Plant Project Close-Down Report http://gogreengas.com/wp-content/uploads/2015/11/BioSNG-170223-1-Project-Close-Out-Report.pdf

Question 7 (Greenhouse gas removals): Not all sources of emissions can be reduced to zero. How far can greenhouse gas removal from the atmosphere, in the UK or internationally, be used to offset any remaining emissions, both prior to 2050 and beyond?

Question 8 (Technology and Innovation): How will global deployment of low-carbon technologies drive innovation and cost reduction? Could a tighter long-term emissions target for the UK, supported by targeted innovation policies, drive significantly increased innovation in technologies to reduce or remove emissions?

ANSWER:

The potential global market for low carbon industrial goods and services could be considerable. The Hydrogen Council roadmap presents a 2050 vision where the global annual sales of hydrogen technology and services reach £1.94 trillion and create jobs for 30 million people. The roadmap estimates that global demand for hydrogen could increase tenfold between 2015 and 2050.

The UK has important strengths, which means it stands to benefit from exports and tax revenues. Firstly, it has one of the most extensive gas networks in the world, which supplies around 300TWh of gas each year to business and industry, alongside around 300TWh for domestic consumers and 300TWh to power stations, and which is already being upgraded through the Iron Mains Replacement Programme, which will make it more suitable for transporting hydrogen. The gas network industry has developed detailed plans for deep decarbonisation such as our H100 project which is looking to build a 'world first' of its kind 100% hydrogen network.[12]

Policies to support innovation and deployment are essential to reduce costs and ensure that the UK is well placed to compete in global markets. The UK has a relatively good track record on supporting innovation in energy utilities through Ofgem's RIIO framework. This has supported flagship decarbonisation projects such as H21, Hydeploy, Freedom and H100, which are helping to provide policymakers with evidence around future options. Continued mechanisms to support and drive innovation are needed in RIIO-2 from 2021, as economic regulation otherwise tends to focus on minimising short-term costs.

Government and regulators should also consider how price controls incentivise larger scale transition using the learning from innovation projects, such as work to deliver a gas network capable of carrying a wider range of decarbonised gasses.

Question 9 (Behaviour change): How far can people's behaviours and decisions change over time in a way that will reduce emissions, within a supportive policy environment and sustained global effort to tackle climate change?

ANSWER:

[12] SGN, Hydrogen 100 Project https://www.sgn.co.uk/Hydrogen-100/

Question 9 (Behaviour change): How far can people's behaviours and decisions change over time in a way that will reduce emissions, within a supportive policy environment and sustained global effort to tackle climate change?

It is crucial to design policies that work for consumers, whether domestic or industrial. Domestic consumers continue to choose gas over electricity for heating. We continue to connect 50,000 homes a year to our gas network across Scotland and the south of England as gas heating remains a selling point in new homes.

In 2017, 22,000 heat pumps were sold, but 1.6 million gas boilers were installed. This suggests customers are comfortable with the way heat is currently provided by gas, and that future low carbon heating systems will need to work with the grain of consumer behaviour. The domestic RHI, for example, has not been a success, with less than 18,000 properties on the gas grid making a switch in the four years of the scheme's operation. At this rate, it would take around 5,000 years to switch all properties on the gas grid to heat pumps.

Fuel poverty is already too high, and a low-carbon transition should be looking to reduce, not increase it. Electricity (around 16-18p/kWh) costs consumers at least three times more per kWh than gas (4-5p/kWh), and households off the gas grid are far more likely to be in fuel poverty. The CCC also need to focus on the performance of heat pumps during the coldest weather which based on recent work needs to assume a coefficient of performance of no more than 1.5.[13]

Awareness of low-carbon heating systems is low, as evidenced in recent opinion research carried out for the CCC, and so there is a need for sustained communication. The relative low uptake of the smart meter programme is an example of the scale of the challenge. It also reiterates the importance of any change being the least disruptive one for customers.

The least disruptive change for industrial consumers is also important. BEIS figures show industrial gas prices are less than one third of industrial electricity prices, and the second lowest in the EU 15. Many energy intensive industries that rely on high temperature heat provided by gas operate in highly competitive global markets with small margins. Competitive fuels are therefore essential in a post Brexit world. The switch from natural gas to hydrogen in industry can allow us to maintain our industrial strengths and reduce emissions by over 92%.[14]

Question 10 (Policy): Including the role for government policy, how can the required changes be delivered to meet a net-zero target (or tightened 2050 targets) in the UK?

ANSWER:

[13] ETI, Local Area Energy Planning: Insights from three pilot local areas https://drive.google.com/file/d/1c3g2p2KSjuk_n_85k6-7yxKLB79xfRYL/view

[14] H21 North of England, November 2018, https://northerngasnetworks.co.uk/h21-noe/H21-NoE-23Nov18-v1.0.pdf

Question 10 (Policy): Including the role for government policy, how can the required changes be delivered to meet a net-zero target (or tightened 2050 targets) in the UK?

SGN, along with the other UK gas networks are developing a pathway for the gas networks to 100% low carbon.[15] In the short-term by blending biomethane and bioSNG into the network. In the medium-term adding hydrogen to that blend. In the longer term the potential for 100% hydrogen networks with areas not converted running on biomethane and bioSNG with hybrid heat pumps.

Key to these developments is the timely amendment of Chapter 3 of the Gas Safety (Management) Regulations legislation and the move of gas quality requirements to a new standard to be managed by IGEM.[16] This more flexible standard will allow a wider range of lower carbon gases in the network and allow for safe increases to the level of hydrogen allowed which is currently 0.1% by volume.

Amendments to The Gas (Calculation of Thermal Energy) Regulations are also required to ensure customers are accurately billed for the energy content of the gas they receive and remove the need to process gas to meet a target calorific value for each Local Distribution Zone (LDZ). These changes are needed to cater for gas now coming from a wider range of sources.

While the £25m BEIS Hy4heat programme and the £20m hydrogen supply competition are welcome further funding for low carbon gas innovation and demonstration projects is needed to 1) gather evidence to inform a UK heat policy decision and 2) maintain our position as a global leader in decarbonised gas solutions.

The gas networks have a strong track record of enabling change evidenced by the transition from town gas to natural gas between 1966 and 1977. A similar transition would be required for conversion to 100% hydrogen. The H21 project has outlined how this could be done for the North of England with the costs recovered through regulated network price control periods, in a similar way to the current Iron Mains Replacement Programme.

There needs to be greater co-ordination within BEIS and with the DfT to coordinate policy making to reduce emissions across heat, transport and power as part of a whole system approach to enable a least cost decarbonisation of the economy. In addition, Ofgem RIIO price-control periods need to align with forthcoming decisions on heat decarbonisation. Otherwise, we risk unnecessary delay to implementation.

Part 4: Costs, risks and opportunities

Question 11 (Costs, risks and opportunities): How would the costs, risks and economic opportunities associated with cutting emissions change should tighter UK targets be set, especially where these are set at the limits of known technological achievability?

[15] Assessing Decarbonisation Pathways for the Gas Networks http://www.energynetworks.org/assets/files/gas/futures/181116%20Scope%20of%20Services%20-%20Decarbonisation%20Pathway.docx

[16] IGEM Gas Quality Working Group https://www.igem.org.uk/technical-standards/working-groups/gas-quality.aspx

Question 11 (Costs, risks and opportunities): How would the costs, risks and economic opportunities associated with cutting emissions change should tighter UK targets be set, especially where these are set at the limits of known technological achievability?

ANSWER:
There are risks if the UK becomes an international outlier in reducing greenhouse gas more quickly than other nations as decarbonisation does come at a cost. However, there are opportunities from being a first-mover, as the UK has an opportunity to in terms of decarbonising gas.

Getting emissions from industry and heat to zero is very challenging and the work Imperial College did for the CCC in the summer of 2018 showed the costs of reducing these emissions increased significantly when the target was increase to net-zero. We believe it is crucial the impact on customers is at the heart of the CCC's recommendations given the difference between theoretical support for 'zero-carbon' and support when customers realise the changes they would have to make to their homes and in how they live their lives to meet it.

As we have shown above, the UK has strengths in a number of aspects of decarbonisation and has developed ambitious proposals to decarbonise gas in several regions that could provide a template for other countries. Global markets for technologies such as hydrogen and CCS could become very large indeed, and the UK would be well placed to compete if the right policy support is in place.

Question 12 (Avoided climate costs): What evidence is there of differences in climate impacts in the UK from holding the increase in global average temperature to well below 2°C or to 1.5°C?

ANSWER: SGN has no specific comments

Part 5: Devolved Administrations

Question 13 (Devolved Administrations): What differences in circumstances between England, Wales, Scotland and Northern Ireland should be reflected in the Committee's advice on long-term targets for the Devolved Administrations?

ANSWER:

Circumstances vary widely between the various nations of the UK, and any targets for the Devolved Administrations need to take these into account. Scotland has a far larger per capita renewable resource than England, as it enjoys higher average wind speeds and is far less densely populated. Therefore, it is "easier" to meet a net-zero target in Scotland. The target that is of most importance is the one for the UK as a whole given renewable power generated in Scotland will be increasingly used to help decarbonise electricity consumed in England. Separating out targets for England from the rest of the UK could make meeting long-term targets more difficult for each nation.

Part 6: CCC Work Plan

Question 14 (Work plan): The areas of evidence the Committee intend to cover are included in the 'Background' section. Are there any other important aspects that should be covered in the Committee's work plan?
ANSWER: SGN has no specific comments