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26th June 2019

The Energy Institute (EI) welcomes the opportunity to make the following submission to the All Party Parliamentary Group for Carbon Capture and Storage on the **'Greening Britain through CCUS'** inquiry.

In August 2018, the EI responded to a BEIS Commons Select Committee inquiry on carbon capture, usage and storage (CCUS). Due to the overlap in subject matter between the BEIS inquiry and the APPG inquiry, the EI's response to the original BEIS consultation addresses many of the questions asked in this consultation. It has been attached for reference[1].

In the months following the BEIS inquiry, the Government published the UK CCUS Deployment Pathway[2] and the Committee on Climate Change (CCC) released its Net Zero report[3]. The Government is set to amend the Climate Change Act 2008 accordingly to update the UK's greenhouse gas (GHG) emissions target to net-zero by 2050[4]. Additionally, the EI has released its findings from the 2019 edition of the Energy Barometer survey[5]. In light of this new information, this document acts as a supplement to the original consultation response.

1. The Committee on Climate Change sees a role for CCUS in decarbonising a) power b) transport and c) heavy industry. Which of these do you see as delivering a) the biggest environmental benefits and b) the biggest economic benefits to the UK?

1.1 Significant progress has been made in decarbonising power generation, thanks to improvements in efficiency, switching from coal to natural gas, and an increase in the share of renewable electricity sources. In 2018, the proportion of low-carbon electricity generated (including nuclear power) reached a record 52.8%[6].

1.2 As a greater proportion of variable generation sources are added to the UK's energy mix, the work of the ESO to balance the grid becomes more complex and time-consuming. Until electricity storage costs come down, it is likely that some proportion of firm baseload generation will be provided by natural gas-fired plants. To reach net-zero targets, CCUS will

[1] https://knowledge.energyinst.org/__data/assets/pdf_file/0009/558576/Energy-Institute-response-to-the-the-BEIS-Committees-inquiry-on-carbon-capture,-usage-and-storage-CCUS.pdf
[2] https://www.gov.uk/government/publications/the-uk-carbon-capture-usage-and-storage-ccus-deployment-pathway-an-action-plan
[3] https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/
[4] https://www.gov.uk/government/speeches/law-for-net-zero-emissions-begins-passage-through-parliament
[5] https://www.energyinst.org/barometer/2019
[6] https://www.gov.uk/government/news/uk-energy-statistics-statistical-press-release-march-2019

be needed to minimise emissions from this type of power generation. The combination of natural gas-fired generation coupled with CCUS may be a less-costly option than solely relying on electricity storage and demand-side response as balancing measures. This view is echoed in Energy UK's *The Future of Energy* report,[7] which details how CCUS has a place in future large-scale low carbon projects, particularly if alternative funding is found. It is expected that the first large-scale trial of CCUS will be launched in the mid-2020s, with the first CCUS cluster operational by 2030.

1.3 The development and deployment of CCUS technologies are of crucial importance outside of power generation. In fact, the case for CCUS is arguably stronger for heavy industries such as iron and steel, chemicals, refining, cement or aluminium, which account for around 17% of the UK's GHG emissions.[8] In contrast to power generation, there are limited alternatives for reducing emissions, due to the integral role of hydrocarbons in these industrial processes and emissions inherent to processes such as cement production. Currently, most of the energy needed in such processes is in the form of heat – usually from combustion of natural gas or coal - which cannot be easily replaced by low-carbon fuel sources. Decarbonisation of industries therefore requires policies to look beyond renewables or energy efficiency and to focus on CCUS as the best available option.

1.4 When questioned about development of CCUS, 54% of EI members believe the Government should **support pilot projects in energy intensive industry clusters**, and half call on the Government to commit to and communicate a long-term vision of support for CCUS. Just 13% of respondents to the 2019 Energy Barometer think the Government should not support CCUS at all. EI members in the natural gas and oil sector were the most supportive of CCUS, but there was **broad support across the board for pilot projects.** It should also be noted that various industrial processes produce concentrated streams of carbon dioxide, which may be particularly well-suited for capture and therefore for pilot CCUS projects.

1.5 Hydrogen gas can contribute to decarbonisation of heat and transport as a low-carbon fuel[9] for heating homes, as well as a possible alternative fuel for HGVs, trains and planes. Creating hydrogen via electrolysis of water is expensive and energy intensive; to produce hydrogen at scale would require steam reformation of methane. CCUS therefore can play a further role in decarbonising the economy by capturing the CO_2 from this process.

[7] https://www.energy-uk.org.uk/our-work/future-of-energy.html

[8] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/679334/2016_Final_Emissions_Statistics_one_page_summary.pdf

[9] CCC Report: Hydrogen in a low-carbon economy https://www.theccc.org.uk/publication/hydrogen-in-a-low-carbon-economy/

2. How essential is CCUS for the UK to meet net zero emissions by 2050?

2.1 Energy professionals are realistic that, although the energy system is undergoing a long-term transition to low carbon, our dependence on fossil fuels is not yet over. Global consumption of coal (+1.4%) and oil (+1.5%) rose in 2018 and it is expected that natural gas consumption will grow even more strongly, supported by broad-based demand and the continuing expansion of liquefied natural gas (LNG)[10]. For example, the IEA's *Natural Gas Information 2018*[11] shows that global natural gas demand grew 3.2% from 2016 to 2017 and is increasing at an even faster pace in non-OECD[12] countries. Another industry outlook foresees that oil and gas will be still crucial components of the world's energy future, accounting for 44% of world energy supply in 2050, compared to 53% today[13].

2.2 EI members believe that CCUS deployed at the point of combustion has the greatest potential of any of the major technologies to reduce emissions in the natural gas lifecycle. The more cleanly gas is produced (via reducing fugitive methane emissions) and used (via efficient processes and CCUS), the bigger the benefit in tackling climate change. In common with major industry forecasts, EI members believe that natural gas can retain a significant long-term role in the UK and global electricity and industrial supply mix, given its global abundance and flexibility which complements the variable nature of renewables. The long-term role of gas could be significantly greater given greater efforts to reduce fugitive methane emissions and the right policy environment to encourage cost reduction and implementation of CCUS technologies.

2.3 In successive Energy Barometer surveys, CCUS has been identified as one of the technologies with the greatest potential for decarbonising and transforming the energy system. Reflecting the view in other high-profile assessments from the CCC[14], International Energy Agency[15] and University College London[16], EI members have repeatedly stressed the key role that the technology needs to play in meeting the UK's emission reduction targets.

[10] https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html
[11] https://webstore.iea.org/natural-gas-information-2018
[12] OECD refers to the Organisation for Economic Co-operation and Development, http://www.oecd.org/
[13] https://eto.dnvgl.com/2017/oilgas
[14] https://www.theccc.org.uk/wp-content/uploads/2018/01/CCC-Independent-Assessment-of-UKs-Clean-GrowthStrategy-2018.pdf
[15] http://www.iea.org/publications/freepublications/publication/20YearsofCarbonCaptureandStorage_WEB.pdf
[16] http://hub.globalccsinstitute.com/sites/default/files/publications/201833/report-role-ccs-meeting-climate.pdf

4. What opportunities are there for the UK to play a world-leading role in the development and export of CCUS e.g. technology, equipment, green industrial products, and policy and regulatory frameworks?

4.1 The CCC Net Zero report describes CCUS as "crucial to the delivery of net-zero GHG emissions and strategically important to the UK economy."[17] Despite this, of the 43 large-scale projects operating or in development around the world, none are in the UK. Consideration of CCUS should also be made in the context of its likely role as a crucial technology globally, particularly as action is progressed towards meeting the Paris Agreement goals.

4.2 There is room for optimism, as the global CCUS market is one in which UK companies are well-placed to compete. CCUS projects will require the right blend of gas processing technology, large-scale infrastructure and engineering design, financing, and project management that have been the hallmarks of the success of UK oil and gas companies in supporting global supply chains. The UK has several active industrial clusters (Teesside Collective[18], Grangemouth, Yorkshire[19] etc.) which would be well-suited to piloting this technology, where a storage or potential use exists, and the necessary concentrated CO_2 is available.

4.3 Additionally, the North Sea is well suited for long-term storage of captured carbon and the UK already has substantial infrastructure (platforms, wells, pipelines and subsea structures) which could be repurposed to that effect. The location of the aforementioned industrial clusters on the east cost of the UK is proximal to the North Sea which would allow for easier transportation of captured carbon. There is precedent for this – for example, the ports of Rotterdam, Antwerp and Ghent recently announced that they will bury 10mn tonnes of CO2 emissions in empty North Sea gas fields.[20]

8. Can you comment on the effectiveness of existing CCUS funding commitments?

8.1 Although CCUS is widely viewed as necessary for tackling climate change, a minority of respondents to the 2019 Energy Barometer view it as cost-effective, potentially due to the absence of clear revenue streams and the current lack of incentive structures to bring it forward. This is reflected in the fact that just 23% of EI members believe that by 2030, the cost of CCUS will have reduced by 25% or more.

8.2 There are mixed views regarding approaches to support policy on CCUS. Since 2016, EI members have viewed UK policy for the development of CCUS as growing in effectiveness

[17] Page 175 https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf
[18] http://www.teessidecollective.co.uk/
[19] https://www.drax.com/press_release/drax-to-pilot-europes-first-carbon-capture-storage-project-beccs/
[20] https://www.theguardian.com/environment/2019/may/09/empty-north-sea-gas-fields-bury-10m-tonnes-c02-eu-ports

each year. However, perceived investment risk due to policy uncertainty has remained consistently very high, likely due to the widely-varying financial support for the technology and lack of concrete progress over the past few years.

8.3 Funding for CCUS advancement is welcome, particularly in the area of demonstration or pilot projects. This includes the Carbon Capture and Utilisation Demonstration (CCUD) programme[21]. However, re-purposing CO_2 is unlikely to remove the large amounts needed to avert the worst impacts of climate change; storage will be required. In addition, most of the technologies for capturing and storing carbon already exist, they merely have yet to be rolled out on a wider scale. Intermediate-scale pilots to demonstrate storage, similar to those incentivised by the CCUD programme, are therefore seen as at least as important, if not more so, than the CCUD programme. The funding landscape could therefore benefit significantly from a programme to demonstrate storage of CO_2.

8.4 As evidenced by our research with energy professionals, the biggest barrier for rolling out CCUS at large, industrial scale is the **lack of an economic driver to incentivise it**. Given the UK's leading role in climate action and regulation, and its strong background in the finance industry, it is particularly well-placed to **explore financing or regulatory mechanisms** that would enable this technology to be rolled out at scale.

Most climate models, including those of the CCC in the UK and IPCC internationally, rely heavily on the use of CCUS to meet emissions targets and indicate that meeting the targets without CCUS comes at a significantly higher total cost. The Global CCS Institute's 2017 report on *The role of CCS in meeting climate policy targets* stated that "Policy makers' decisions as to whether to pursue CCS should be based on a judgement as to whether the risks and uncertainties associated with attempting to deploy CCS outweigh the risks of not having it available as part of a future portfolio of mitigation options, in future years."[22]

The development of CCUS requires close cooperation between industry, government and academia in the UK and internationally. The EI urges discussion about the relative roles of each in CCUS development and deployment and would be very happy to coordinate any such discussions.

[21] https://www.gov.uk/government/publications/carbon-capture-and-utilisation-demonstration-ccud-innovation-programme

[22] http://hub.globalccsinstitute.com/sites/default/files/publications/201833/report-role-ccs-meeting-climate.pdf