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Re: Net Zero Energy and Transport Committee Evidence session on CCUS

This response has been prepared by Dr Clair Gough and Dr Sarah Mander, informed by their research on carbon capture, utilisation and storage over the past two decades.

This research is rooted in social scientific analysis involving stakeholder assessment and public engagement with CCUS, typically within wider interdisciplinary studies. The views reflected herein are attributed to the authors, and do not represent the collective view of the Tyndall Centre for Climate Change Research, or the University of Manchester. This responds to the following questions from the Committee:

Q1. Whether CCUS has a role to play in helping the planet, and the UK and Scotland in particular, achieve net zero (with specific reference to Scotland's 2045 target):

- **Carbon budgets depend on CO_2 trajectory**. Current policy goals for climate change mitigation at the global (Paris Agreement), UK (net zero by 2050) and Scottish (net zero by 2045) scales are ambitious in scale and urgency. The efficacy of these targets depends on the trajectory along which emissions are reduced as much as the final target year. There is huge inertia in current economic systems which are predicated on fossil fuel use, associated with extensive infrastructure and skills. We consider that CCUS does have role to play in reaching these targets. Although CCS technologies will not bring emissions down to zero, it brings the potential for significant reduction in emissions, particularly in certain sectors – notably energy intensive industry

- **CCS can provide significant emissions reduction this decade**. Deploying CCS in existing high emitting industrial applications will enable drastic reduction in emissions during this decade. Without deploying CCS in these sectors, emissions will be higher in the UK, unless production ceases or relocates overseas to areas with less stringent emissions standards – with an associated impact on global emissions. However, it is important to recognise that CCS and CCUS describe a wide variety of technologies and possible supply chains which may be used in a variety of applications and locations. The specific impacts across different metrics (including CO_2 emissions) are highly context specific, so it is essential that CCS deployment is evaluated on a case-by-case basis (e.g. Freer e al, 2022).

- **Oil and gas industry can play a critical role in establishing CCS infrastructure**. In the context of the oil and gas industry which is currently so important to, and

embedded in, the Scottish economy, CCS is not an alternative to the transition to renewable energy sources. However, the oil and gas industry can play a critical role in establishing the CCS sector in Scotland. Developing CCS infrastructure and know-how across a variety of applications in the near term will enable those industries to start decarbonising in the short term, and that infrastructure will be available for more novel or less established applications as they become available, with the potential to support a variety of services over the longer term, including low carbon hydrogen, transport, industry and greenhouse gas removal, all of which may be necessary to deliver net zero across Scotland.

- **Building enough renewable capacity to reach net zero**. With increasing demand for renewable electricity to extend beyond current uses to heat, transport, industry, hydrogen and potentially greenhouse gas removal, a massive expansion in renewable capacity will be required. CCS can support the decarbonisation of these services over the coming decade and beyond in the context of the scale required to deliver significant emissions reduction

- **UK as world leader in CCS**. The UK is exceptionally well-placed to provide global leadership in CCS - with extensive offshore geological storage, existing infrastructure and assets which may be repurposed as well as the skills, knowledge and actor networks necessary to deliver CCS deployment. Early progress in developing low carbon and net zero industrial clusters in the UK has the potential to contribute to the acceleration of similar initiatives in other countries – by demonstrating successful commercial scale industrial decarbonisation in a variety of applications, developing the networks and learning necessary to support wider deployment as well as providing the infrastructure which could be used to store CO2 from regions with more limited storage resource.

- **Blue hydrogen has a role**. Many industries are exploring the use of hydrogen - there is not sufficient renewable energy to produce enough green hydrogen in the near term. Blue hydrogen may support the transition to establishing end-uses and hydrogen infrastructure before green hydrogen becomes available at scale. Industrial users of hydrogen are technology agnostic in terms of where the hydrogen comes from. Hydrogen may also have a role in decarbonising road freight, rail. Our understanding is that its role in domestic heating is less clear.

- **Permanent greenhouse gas removal requires CCS**. Delivering net zero depends on an ambitious approach to reducing all emissions from across the whole economy as close to zero as possible; however, to reach net zero greenhouse gas removals will be necessary to balance any ‘residual’ emissions that cannot be avoided through changes in practices, technology, materials and fuels. Scotland has an earlier net zero target than the rest of the UK. Depending on their management and implementation, so-called natural climate solutions (NCS) may bring multiple benefits (flood protection, improved biodiversity etc) as well as carbon storage. However, carbon stored in forests is both less secure (vulnerable to fire, disease, and dependent on management practices and does not provide the very long-term removals (thousands of years versus decades) that geologic storage can. NCS should be pursued for a broader set of motives, and can delay carbon emissions but cannot be compared like for like with permanent removals from geological storage of CO_2. So if GGR is needed to achieve a net balance of zero emissions to the

atmosphere, CCUS will have a role to play through BECCS and potentially DACS – both of which will require investment in CO_2 transport and storage infrastructure now. While BECCS and DACCS both have the potential to provide permanent removals at scale, they will need careful attention to full supply chain performance and wider sustainability impacts (as with all technologies) and robust regulatory frameworks (e.g. Röder et al (2019); Garcia Freites et al (2021); Welfle et al (2020)).

Q2. Whether CCUS will help achieve a just transition:

CCUS is a suite of technologies that can be applied to different sectors. Process emissions of CO2 can be captured from existing industries, along with emissions from combustion of fossil fuels from these industries. Although there are multiple decarbonisation options that can be used across diverse industries, to achieve net zero, energy intensive industries must either be decarbonised, or cease to exist with products sourced from elsewhere; this sector is therefore an important application for CCUS. CCUS also has a role to play to provide CO2 removal through engineered greenhouse gas removals (BECCS and/or DACS); these are important in the Scottish Government's plans. CCUS is necessary for the production of 'blue hydrogen', which the modular approach outlined in Scotland's Net Zero Infrastructure Programme anticipates could be used for decarbonisation of heating; however there is yet to be a clear winner in terms of approach for the decarbonisation of heating.

- **CCUS is a chain of technologies.** Distinct technologies for capture, transport and storage mean that there are multiple and diverse spatial contexts to CCUS.

- **A 'just transition' is rooted in concepts of social justice.** Whilst a 'just transition' is frequently focused on the energy sector and the impacts on workers of a move away from fossil fuels, at its heart it is a broader concept which should ensure social justice across a range of settings and over different timeframes. This includes at least three forms of 'justice' (Carley and Konisky, 2020): distributional justice, namely the 'distribution of benefits and burdens across populations'; procedural justice, namely seeking 'to ensure that … procedures are fair, equitable and inclusive of all who choose to participate'; and recognition justice, or understanding and acknowledging 'historic and ongoing inequalities'

- **Employment is most commonly equated with a 'just transition' in a CCUS context.** Plans for industrial decarbonisation often take a narrow conceptualisation of a 'just transition' and most frequently emphasise the importance of CCUS for protecting existing jobs and generating new jobs within the CCUS industry. Clearly employment is an important element of a 'just transition', however a holistic view must be taken such that for decarbonisation of a particular sector, CCUS related jobs are placed in the context of jobs that could be created if an alternative approach was taken to decarbonising a particular sector.

- **A 'just transition' needs to be considered in a broad context.** The work of the Just Transition Commission takes a broad view of a 'just transition' emphasising that the transition needs to be strategically managed at a national scale within Scotland. This requires the shaping of the transition by citizens (procedural justice), co-production between government, industry and other stakeholders, skills and education, and ensuring that financial burdens are shared and based on the ability to pay. These broader elements of the 'just transition' need to be incorporated into any

future deployment of CCUS, and considered for specific CCUS applications and elements of the CCUS chain, within a broader context than for only the CCUS industry.

- **Key to a 'just transition' is it where when, to whom and how justice is enacted.** Thus, CCUS in some contexts could help achieve a 'just transition', however this is not a given.

Q3. Whether CCUS may, if anything, prolong fossil fuel dependence and, if so, whether there is any argument that this could be an acceptable short-term trade-off (for instance in pursuit of a just transition);

Q4. Views if any, on whether the October 2021 decision to prioritise two other projects over the Scottish cluster appears to be a robust one, justified by the underlying scientific, logistical and engineering considerations, given the relevant information we have in the public domain about the different projects.

We are not in position to respond to Q3 and Q4 in detail but would like to reiterate the importance of recognising that CCS and CCUS describe a wide variety of technologies and possible supply chains which may be used in a verity of applications and locations. The specific impacts across a variety of metrics (including CO_2 emissions) are highly context specific, so it is essential that CCS deployment is evaluated on a case-by-case basis. That said, technology-wise, for industrial applications in particular, CCS is ready now and can start to contribute to decarbonising these sectors within 3-4 years. Decarbonisation across all of the UK industrial clusters will be required and track 2 funding aims to bring two further clusters online by 2027.

References

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