Annex A: Submission by the Department for Business Energy and Industrial Strategy to the Scottish Parliament Net Zero, Energy and Transport Committee regarding Carbon Capture Usage and Storage

Q1. It is clear that both the UK and Scottish Governments believe that CCUS technology has a role to play in achieving net zero by way of a just transition. Is there further information that can be put in the public domain to provide reassurance that proper risk analyses have been carried out and that the technology is viable, offers good value for money (to the extent that it is supported by public investment), and rests on a robust evidence base?

CCUS was first deployed in 1972 in the USA and Norway, which geologically has many similarities to the UK, has been successfully storing Co2 for more than twenty years. Both countries, and elsewhere, are expanding their CCUS plans, and assess them to be a viable solution to Net Zero. UK industry, and public sectors have examined the work in other countries and assess them as viable for the UK. The department's CCUS Energy Innovation Needs Assessment shows that the UK could potentially store more than 78 billion tonnes of CO_2.

Our ongoing approach to deployment of CCUS technology is designed to drive value for money for taxpayers and consumers. Our business models are intended to provide a long-term revenue stream, providing a sufficient level of confidence to investors and helping to lower the cost of capital. As we have seen with other technologies, such as renewables from wind, the cost of provision can be lowered dramatically over time with a consistent policy framework. As such, we will announce a funding envelope in 2022 that will enable us to award the first contracts to CCUS-enabled hydrogen and industrial carbon capture facilities from 2023 through the Cluster Sequencing process.

That said, CCUS is a significant undertaking, and any decision to award support at any stage of this process is only expected to be made subject to government being comfortable with: the application of subsidy control requirements, any balance sheet implications, the status of any relevant statutory consents, and that the project represents value for money for the consumer and the taxpayer. Any negotiation would only conclude successfully once government has satisfied itself of the desirability of the project through a robust and extensive value for money analysis. Further details on the business models for power and industrial carbon capture, and the transport and storage of CO2, were provided in the publication of 'Carbon Capture, Usage and Storage: an update on business models' published in December 2020, with a further update published in January 2022.

Q2. How do you respond to evidence and views that the viability of CCUS technology has never been satisfactorily proven and that it remains highly speculative as an effective method for achieving net carbon reduction?

As of September 2021, there are 27 operational CCUS facilities around the world that can capture over 36 million tonnes of CO2 a year. From a European storage perspective, the operation of Sleipner and Snøhvit in Norway have been geologically storing CO2 since 1996 and 2008. These two projects have demonstrated how CO2 can be monitored, measured and verified (MMV), to give confidence that the CO2 will remain safely geologically stored for thousands of years.

The Science and Innovation for Climate and Energy (SICE) team in BEIS are investigating many options for industrial decarbonisation and funding the Carbon Capture, Usage and Storage Innovation 2.0 programme under the £1 billion Net Zero Innovation Portfolio. The aim of this programme is to develop novel CCUS technologies and processes that have the potential to reduce the cost of deployment in those industrial sectors that have emissions that are hard to abate by other means. It is through this programme that SICE seeks to explore the viability of technology solutions and fully explore the potential of CCUS as part of the totality of the industrial decarbonisation options for deployment to contribute to the UK achieving its Net Zero targets for 2050.

Q3. How do you respond to views that large-scale adopting of CCUS may risk prolonging continuation of fossil fuel use?

The Climate Change Committee (CCC) has described CCUS as a 'necessity, not an option' for the transition to Net Zero. There is no pathway to reach net zero without the continued use of some fossil fuels, so abating emissions from the use of fossil fuels is critical.

In order to decarbonise the power sector whilst maintaining security of supply and keeping costs low, we will need to balance renewable variability against demand. Gas-fired generation with CCUS can provide flexible, non-weather dependent low-carbon capacity to complement high levels of renewables. Low carbon hydrogen can provide flexible energy deployment across heat, power and transport, and is critical to decarbonising "hard to electrify" UK industrial sectors.

Our exposure to volatile global gas prices underscores the importance of our plan to build a strong, home-grown low-carbon energy sector to further reduce our reliance on fossil fuels. Furthermore, carbon dioxide will need to be removed from the atmosphere through greenhouse gas removal technologies. Developing CCUS at scale provides the platform for these negative emissions technologies via Bioenergy Carbon Capture and Storage (BECCS) and Direct Air Carbon Dioxide Capture and Storage (DACCS) - which are also likely to be essential for reaching net zero.

CCUS is also fundamental to the deep decarbonisation of industries such as chemicals, oil refining and cement. Options for decarbonising industry are limited and, in some cases, fuel switching can only partially decarbonise industry, beyond which CCUS will be required to provide deep decarbonisation. The UK Government's Net Zero Strategy sets out our policy priorities over the next ten years to support deployment of key technologies, and the long-term framework that should drive decarbonisation out to 2050.

Q4. The Committee notes a higher degree of consensus and hopefulness in evidence that CCUS could form part of the pathway to net zero in relation to certain high-emission processes, such as cement production. There was less of a consensus on its role in relation to waste incineration. The Committee would welcome the UK Government setting out its thinking on the potential for future applications of CCUS technology in such areas and the extent to which this is being developed, in partnership with business or research bodies.

CCUS is the main decarbonisation option for many existing residual waste management technologies, including Energy from Waste (EfW) and gasification/pyrolysis processes. In their *Progress in reducing emissions: 2021 Report to Parliament,* the Climate Change Committee (CCC) identified the decarbonisation of EfW as a gap that needs to be addressed with urgency, recommending government provide support to enable existing EfW facilities to be retrofitted with CCUS from the late 2020s and to introduce policy to ensure that any new EfW facilities are built with CCUS, or are 'CCUS ready'.

In November 2021, we confirmed that certain waste management CCS projects are in scope of the Industrial Carbon Capture (ICC) business model for Phase-2 of the Cluster Sequencing process, subject to meeting detailed eligibility criteria. Government considers this to be the best way to support deployment of waste management sector CCS projects at this stage, given the commonalities between the current barriers for waste management CCS projects and industrial CCS projects, and the importance of CCS to the sector. This presents an opportunity to progress the decarbonisation of waste management facilities in the 2020s and demonstrate the feasibility of deploying CCS for such facilities in the UK, in line with the CCC's recommendations. However, decisions on eligibility of the sector for future rounds of funding have not been made.

Further work is being done to assess whether any modifications to the ICC business model are necessary for waste management CCS projects, with an update published on 12 April 2022. We are engaging closely with CCUS expert groups, industry and other interested stakeholders to develop the final business model.

Q5. The Committee notes that the price of natural gas has spiked since last autumn. Whilst future price fluctuations are impossible to predict with certainty, it appears we may have entered a prolonged era of higher fossil fuel prices. We would welcome your assessment as to what this may mean in terms of future policy on CCS/CCUS. Does it make its use in relation to blue hydrogen production appear less viable? Conversely does green hydrogen production now look more within reach as an economically viable process?

In the British Energy Security Strategy, the government announced a significant increase in the UK's hydrogen ambition to up to 10GW of low carbon hydrogen production capacity by 2030, subject to affordability and value for money. At least half of this will come from electrolytic hydrogen, drawing on the scale-up of offshore wind and other renewables and new nuclear. The government continues to support the twin track approach set out in the UK Hydrogen Strategy, supporting multiple production technologies including both electrolytic 'green' and CCUS-enabled 'blue' hydrogen production.

In principle, higher gas prices should make hydrogen production more economically viable. This is because higher natural gas prices increase end-users' incentive to switch from natural gas to hydrogen. While higher natural gas prices increase production costs for CCUS-enabled hydrogen producers, they could also increase electrolytic project's costs in the short term; essentially, until the electricity grid is fully decarbonised, electricity prices will be positively correlated with natural gas prices. Therefore, the extent to which higher natural gas prices make electrolytic projects more competitive relative to CCUS-enabled producers in the short run is uncertain. In the medium-term, the impact of current high gas prices might dissipate. The first CCUS-enabled projects are expected to come online in the mid-2020s and it is possible natural gas prices will decrease from the current peak until then.

Higher natural gas prices can decrease government's cost of supporting hydrogen producers. As most recently set out in the response to Hydrogen Business Model (HBM) consultation, the government's position is to link the reference price to the natural gas price (natural gas price floor) - this would mean that higher gas prices will decrease the subsidy amount This is subject to final HBM design policy decisions. HBM funding will be awarded subject to a value for money assessment.

Q6. We heard that stakeholders require clarity about what happens next on cluster sequencing, and more detail about what reserve status really means with respect to the procurement process. When will this be available?

We have been clear that the role of the reserve cluster is to act as a fall-back option, should one of the named Track-1 clusters encounter significant delivery challenges. The Track-1 clusters are first-of-a-kind projects and accordingly carry non-trivial delivery risk; naming a reserve cluster recognises this fact, by ensuring that government has optionality if these delivery risks materialise.

We recognise that Acorn's continued engagement with the programme has resulted in their project partners continuing to devote resources to the project without any guarantee of further support beyond the £40 million in development funding already allocated; we are grateful for their ongoing cooperation in this regard.

We also recognise the corresponding need to provide Acorn – as well as other prospective clusters – with clarity on a further route to accessing support beyond Track-1. Accordingly, we will seek to provide a public update on a Track-2 allocation process in due course.

Q7. In the view of the UK Government, what can now be done to ensure that the Scottish Cluster goes ahead in Phase Two. What could be improved, and in what ways did the Scottish bid not have an advantage?

The Phase-1 assessment was conducted in an objective and transparent manner, in line with the criteria and method set out when we launched the process in May 2021. We have provided Acorn with direct feedback on their performance and explained the areas in which they scored less strongly than the named Track-1 clusters.

Looking forward, we will publish details of our proposed allocation process for Track-2 in due course and would encourage Acorn to consider how they can look to align their proposal to our stated criteria once these are available. More generally, we recognise the potential benefits of Acorn and are keen to see the project continue its development and planning; clusters which are more advanced and more credible are likely to be best-placed to perform well in any allocation process.

Q8. How does the UK Government respond to Professor Haszeldine's view that prioritising projects with similar underlying geology has introduced systemic risk and that more diverse sites should have been favoured? What consideration was given to the underlying geology during the appraisal process, and as to the "systemic risk" to which he refers?

The risk described by Professor Haszeldine relates to the performance and reliability of the clusters' respective CO_2 storage proposals. The viability of each cluster's proposed CO_2 storage solution was subject to scrutiny under the Deliverability assessment criterion, including in relation to the clusters' assessment of the geological characteristics of their proposed CO_2 stores. Whilst it is clear that *all* clusters are likely to carry some degree of residual geological risk, we are confident in the robustness of our technical assessment.

Furthermore, store geology is just one of several factors which can drive diversity in clusters' proposed CO_2 storage solutions. For example, the distinction between the use of depleted oil and gas fields and saline aquifers is likely to influence how CO_2 behaves once injected into the store and is tied to other key learning areas, such as around the use of new-build and re-use offshore assets. Our assessment noted that HyNet's primary proposed CO_2 store is a depleted oil and gas field, whilst the East Coast Cluster's proposed 'Endurance' store is a closed saline aquifer. This entails a fundamental difference in the technical learnings which will be derived from the two clusters' storage solutions.

Therefore, whilst we acknowledge that Acorn's proposed store has different geological characteristics to those of HyNet and the East Coast Cluster, we do not agree that the sequencing decision has, in itself, introduced additional systemic risk to the programme. The

UK CCUS sector will ultimately span a wide range of technologies and geologies across the full value chain, and it is not realistic to expect that these will all be demonstrated in Track-1. This is a key reason why we want to continue to pursue the deployment of a further two clusters by 2030 via Track-2.

Q9: What measures can the UK Government take to ensure that the north-east of Scotland, and Scotland more widely, can play a role in and benefit from the development of CO2 shipping?

The UK government recognises the importance of shipping as a mode of transportation of CO_2 for decarbonising the broader economy, allowing decarbonisation and meeting our carbon budget targets and net zero ambitions by 2050. As outlined in our latest CO_2 Transport and Storage (T&S) Business Model update, which was published in January 2022, we intend to develop the licence conditions and business model arrangements so that non-piped sources of CO_2 can be accommodated by the Transport and Storage Regulatory Investment (TRI) model.

Q10 *What measures are the UK Government taking to enable a transfer of existing skills from other industries into CCUS so as to enable a just transition?*

We are working with colleagues across government and externally to the examine the skills requirements for CCUS. As the CCUS sector develops, there will be opportunities for local people to take advantage of new jobs created across the value chain. The UK is well positioned for this in many regards, with multiple transferable capabilities from sectors such as offshore oil and gas and engineering, procurement, and construction services.

The North Sea Transition Deal between the UK government and oil and gas industry will support workers, businesses, and the supply chain through this transition by harnessing the industry's existing capabilities, infrastructure and private investment potential to exploit new and emerging technologies such as hydrogen production, CCUS, offshore wind and decommissioning.

The North Sea Transition Deal's people and skills chapter commits industry to facilitate the reskilling of existing parts of the oil and gas workforce to ensure that people and skills are transferable across the energy sector. Furthermore, OPITO, the skills body for the offshore oil and gas sector, is driving the production of the integrated People and Skills Plan. This People and Skills Plan is due to be released in the next few months and will consider how the workforce's skills can be redeployed to benefit the UK's decarbonisation campaign.

Q11. Should the Scottish Cluster not proceed, what are the implications for Scotland's ability to achieve a just transition, especially in the north-east Scotland?

We continue to engage with Acorn to ensure they can be well-placed for future deployment of CCUS. In addition, the UK Hydrogen Strategy package, including green hydrogen, puts a strong focus on the economic opportunities that hydrogen offers across the length and breadth of the Union. The Hydrogen Sector Development Action Plan will develop the next level of detail on how government will support UK companies to secure supply chain opportunities, skills and jobs in low carbon hydrogen, and position themselves at the forefront of an exciting global growth market. We will continue to work closely with the devolved administrations and continue regular engagement in various Boards, such as the Hydrogen Advisory Council, as this work develops.

On 9 February 2022, the government announced its intention to run Contracts for Difference (CfD) allocation rounds annually, with the next allocation round (AR5) planned for March 2023. Increased CfD round frequency underlines the government's commitment to accelerating low-carbon electricity generation to achieve a fully decarbonised electricity system by 2035,

subject to security of supply, and provide greater confidence to investors and supply chain companies.

In March 2021, the government announced £27 million of funding for the Aberdeen Energy Transition Zone and £5 million for a 'Global Underwater Hub', which will help support the industry's transition to renewable and low carbon energy technologies. We will continue to engage with industry, the devolved administrations, and others to ensure we capitalise on UK strengths in existing skills and capabilities, and support the transition away from high-carbon jobs to support the hydrogen and CCUS economy .

Q12. Will the UK Emissions Trading Scheme (ETS) be set up so as to ensure that the price of emitting CO2 is less competitive than capturing and storing it?

The UK ETS Authority has recently published a consultation that considers how to set the UK ETS cap for the remainder of phase one of the scheme (2021-30) in a way that is aligned with the UK's Net Zero trajectory. This consultation also contains a call for evidence on the role of the UK ETS as a potential long-term market for greenhouse gas removals, and a consultation on expanding the current provisions to include a wider range of CO2 transportation options. CCS is currently recognised in the UK ETS and enables operators to avoid paying the carbon price for any captured and stored CO2. UK Government will soon consult on business models for engineered greenhouse gas removals and, where relevant, policy development on the UK ETS will take this into account to ensure that carbon emissions continue to be reduced.

Q13: What is the UK Government's view on whether or not to grant an economic license to the Scottish Cluster to allow it to advance its direct air captures capabilities?

Throughout the development of our CCUS programme, we have been clear that the Cluster Sequencing process constitutes the primary route to deployment for CCUS clusters in the medium term; by extension, the Sequencing process is currently the sole route to obtaining an economic license for Transport and Storage (T&S) operation. CCUS Clusters will require significant central government investment in order to be commercially viable; therefore it is appropriate for government to have a significant role in mapping a logical sequence for the technology's initial rollout over the coming years.

Whilst the role of government in this process may change over time, we do not currently consider it feasible or desirable to award economic licenses to T&S operators outside of the Cluster Sequencing process, particularly in cases where the network is only intended to support a single emitter project.

More broadly, however, it should be emphasised that government is supportive of greenhouse gas removal (GGR) technologies, including Direct Air Capture (DAC), and we are delivering £100 million in innovation support for these methods. BEIS analysis has clearly demonstrated that engineered GGRs will be necessary in net zero scenarios to balance residual emissions from the most hard-to-abate sectors, such as agriculture and aviation – this is in line with advice from independent bodies, including the Climate Change Committee. As such, in the Net Zero Strategy we set the target of deploying 5MtCO_2 of annual engineered removal capacity by 2030.