Written evidence from Storegga Geotechnologies Ltd

What contribution could NETs (through DACCS, BECCS, and/or other NETs) make to achieving net zero by 2050?

- Storegga believes the targets for greenhouse gas removals set out in UK government's Net Zero Strategy are realistic proxies for the contribution that NETs can make to 2050 net zero: ~5MTPA by 2030, ~23MTPA by 2035, and finally ~75-81MTPA by 2050.

- The ~80MTPA by 2050 will be required in order for the hardest to decarbonise sectors to reach net zero. The interim targets for 2030 and 2035 are required to incentivise the development of the new infrastructure before 2050 and ensure the industry is of the required magnitude by 2050.

Which 'hard to decarbonise' sectors could benefit most from NETs, and which should be prioritised*?*

- Long-range transport such as aviation and shipping who cannot capture emissions at source
- Construction and other sectors that use significant quantities of cement
- Any organisations that count long-range transport and building as major parts of their supply chain emissions e.g. professional services, banking
- Also an attractive offer for those sectors, who can achieve 95% effective point capture at competitive prices e.g. fertilizer, power generation, petrochemicals, etc. but still require a solution for the remaining 5% of their emissions

At what technological stage are current NETs, and what is the likely timeframe that will allow NETs to be operational at scale in the UK?

- DAC is currently at TRL 8, as evidenced by the recently opened Climeworks facility in Iceland and the 1PointFive facility in US (currently in FEED, opening in 2024)

- Large-scale DAC (based on existing technology as already being developed in Iceland and the US) can be operational at scale as soon as large-scale permanent geological sequestration is available i.e. from 2026 onwards

What are, and have been, the barriers to further development of NETs? How can such barriers be overcome?

- The voluntary market for engineered carbon removal is new, and still at small scale. It is challenging to attract private sector financing solely on the back of this small and new market and its lack of long-term revenue certainty.

- This barrier could be overcome by creating: a) a liquid market for carbon removal credits; and b) ensuring emitters have a strong financial incentive to buy those credits. Both these points are explicitly highlighted in the UK Government's net zero strategy.

- There are multiple possible support mechanisms to overcome this barrier: inclusion in a UK emissions trading scheme (ETS), and award of contracts for difference (CfD).

- In addition to this revenue risk, the First of a Kind (FOAK) plants will also face the additional barrier of allowing future developers to profit from their learnings (thus driving down future costs), while having locked in the initial FOAK costs during their own lifetime. To overcome this FOAK investment barrier, capex support through the UK Infrastructure Bank would be a fitting mechanism

What, if any, are the links and co-benefits to other technological innovations, such as sustainable aviation fuel or sustainability in the energy sector?

- DAC facilities based on Carbon Engineering's (CE) technology require thermal energy to release the air-captured carbon. Research done by Storegga, CE (and others) in Project Dreamcatcher (as part of the BEIS GGR innovation competition) suggests this thermal energy can also be provided by hydrogen (instead of natural gas). This means that DAC facilities could become early, large scale clients of UK hydrogen producers. The research has also considered the potential role of renewable electricity.

What are the trade-offs between availability of land and availability of sustainable biomass to make NETs a viable option in and beyond the UK? N/A

What are the options for the storage of captured carbon, whether onshore or offshore?

- Storegga believes that the optimum model for the storage of captured CO_2 is in secure and permanent deep geological storage. In the UK, this will be offshore. Thirty per cent of the UK's known offshore CO2 storage resource (23.8Gt) lies within 50km of the offshore pipeline corridors at St Fergus. This resource could store the equivalent of 65 years of the UK's 2018 emissions to enable the UK's transition into a net zero future and also support our international neighbours to do the same. Given the higher cost of capture that DAC has compared to industrial capture applications, it is likely that DAC systems will be located close to where there is significant excess capacity for offshore transport and storage such that CO2 captured from DAC applications did not displace CO2 from industrial capture from limited pipeline and storage capacity.

- Storegga is the lead developer of the Acorn carbon capture and storage offshore project at St Fergus in north east Scotland which will used depleted and well-understood gas fields and saline aquifers to store CO_2 securely and permanently. Storegga is planning on developing Europe's first large scale direct air capture plant in Scotland and to dispose of the captured CO_2 in the Acorn store.

- Storegga is not considering the use of onshore CO_2 storage because of the availability of offshore geological storage and the current regulatory constraints around onshore Co2 storage.

What other drawbacks for the environment and society would need to be overcome to make NETs operational?

- Storegga believes that the use of direct air capture technology, combined with permanent geological storage, is a technology that can deliver significant reductions in CO_2 emissions with a limited environmental footprint acceptable to society.

- As with all carbon capture technologies, DAC requires energy to operate. It is essential that the energy used is itself fully decarbonised, and the embedded emissions in the plant itself are also eliminated during the earliest operation.

Given the proposed role of NETs in climate change modelling, is there a danger of over-reliance on these technologies in net zero strategies?

- Storegga believes that NETs is a valuable technology in the net zero toolbox. Over-reliance will not become an issue if limited to hardest to abate volumes that remain after emission reductions. This can be achieved by appropriate pricing mechanisms.
- Any "early" development of NETs before 2050 is not (and should not) be aimed at avoiding required emissions reductions – but done to ensure that by 2050 the industry exists at the required scale to achieve UK wide net zero targets.

How should the UK Government support the further development of NETs?

- Create a policy support mechanism to give long-term revenue certainty e.g. through inclusion in ETS or through CfD

- CAPEX support, e.g. through UK Infrastructure bank, to minimize risk of a FOAK asset becoming a "stranded asset" (could happen once the initial CFD expires and second or third generation plants come online)

- Better link strategies between carbon storage development and NET development. The large volumes of NETs required by 2035 and 2050 require early consideration in the build-out plans of the respective carbon T&S systems

What policy changes, if any, are needed to ensure the UK gains a competitive advantage and remains at the cutting edge of this sector?

- With access to a significant proportion of Europe's geological carbon storage, the UK has the potential to build competitive advantage and provide negative emission credits to all of Europe.

- In addition to all the policy supports outlined above, it is necessary to ensure that UK DAC negative emission credits are recognised under the *carbon removal certifi*cation currently being developed by the EU. Achieving this would open up a large market of EU-based emitters to sell UK-generated negative emission credits.

The Government has indicated it will publish a Biomass Strategy in 2022, including the role of BECCS. What should be included in this strategy?

- It is vital that for any form of carbon removal, including BECCS, that government strategies are based on carbon accounting that covers the full life cycle (including the supply chain of all energy sources). Such an analysis of the full life cycle must also be included in any BECCS strategy.

Details of Respondent

Name of respondent	Storegga Geotechnolgies Ltd
Information about organisation	Storegga is a British business fully focussed upon the development of net zero infrastructure to support and drive industrial decarbonisation in the UK and elsewhere in the world. Storegga, in partnership with Carbon Engineering, the leading Canadian pioneer of commercial scale direct air capture technology (DAC), is in pre-FEED to build a first of its kind 1MPTA direct air capture facility in North East Scotland. This facility will be connected by direct pipeline to the Acorn permanent storage facility. Storegga owns Pale Blue Dot Energy Limited, the Lead Developer for the Acorn Project. The Acorn Project is a collaborative joint venture among Storegga, Shell UK and Harbour Energy (the Acorn Participants). Storegga, along with partners is developing infrastructure across the entire carbon ecosystem – power and industrial carbon capture, hydrogen, transport, Direct Air Capture, CO2 shipping services and permanent deep geological storage.
Contact name and email	**Alan James**
Happy for response to be published?	Please contact the above before any publication for approval

Storegga Geotechnologies Ltd

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