

Written evidence submitted by the Coalition for Negative Emissions

The mission of the Coalition for Negative Emissions Limited is to instil confidence in nature based and technology-based negative emissions and enable the scaling of a negative emissions sector to fulfil climate mitigation requirements.

We are made up of a diverse range of companies across industries, from landowners and environmental stewards, large users and generators of energy, to technology start-ups and large manufacturers. Many members support the development of technologies or solutions that deliver negative emissions as a tool for climate mitigation through their commercial, regulatory, academic, policy or other activity.

The Coalition's members work across differing sectors of global economies, but we share a common vision: to develop and deploy negative emissions at a scale that will create genuine impact across the world.

We welcome the opportunity provided by this inquiry to reaffirm the essential role that negative emissions technologies will play, in addition to emissions reductions, to help the UK reach Net Zero. Negative emissions will be essential to decarbonise hard to abate sectors and are the only route to remove historical emissions from the atmosphere, by capturing CO₂ and storing it permanently.

Please find detailed answers to individual questions appended to this letter. We have also provided the executive summary of the Coalition's recent report, the case for negative emissions, which outline the global role that negative emissions solutions can play, their sustainable potential, and key actions required to accelerate their global deployment.

Yours sincerely,
By email

Catriona Reynolds

On behalf of the Coalition for Negative Emissions

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

It is widely acknowledged by the Climate Change Committee in the advice on the Sixth Carbon Budget, by the UN Intergovernmental Panel on Climate Change in the 2018 Special Report on Global Warming of 1.5°C and by the UK government in the Net Zero Strategy that alongside emissions reductions, negative emissions technologies will be essential to meeting climate targets. Negative emissions technologies that combine the removal of CO₂ from the atmosphere with permanent CO₂ storage are the only way to permanently reduce the concentration of CO₂ in the atmosphere, mitigating residual emissions from hard to decarbonise sectors and removing historic CO₂ emissions.

Globally, the IPCC estimates that approximately 10Gt of negative emissions will be needed by 2050. In the UK, depending on how quickly sectors decarbonise and the range of technologies available, the CCC estimate that by 2050, the UK will require 45 to 112Mt of CO₂ removal per year from engineered solutions (BECCS, DACCS and wood in construction). Similarly, National Grid ESO estimate in the 2021 Future

of Energy Scenarios that 78 to 93 Mt of CO₂ removal per year in 2050 from negative emissions solutions. The recent Net Zero Strategy also anticipates that by 2050 52 to 58 Mt of negative emissions per year from BECCS and 18 to 29 Mt of negative emissions per year from DACS.

Beyond direct reductions to atmospheric CO₂ concentration, the deployment of NETs in the UK will make an important socioeconomic contribution by delivering a 'just transition'. Delivering NETs will require the creation of new industries, skills, and green growth in industrial regions of the UK in support of the government's levelling up agenda. By supporting a new NET sector on comparable timescales to the government's CCUS Cluster Sequencing process and enabling deployment in the 2020s, the UK has a genuine opportunity to lead the world in the development of negative emissions technologies. This will enable the UK to benefit from export opportunities through the development of BECCS and DACS technology, IP, supply chains and a skilled workforce.

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

Hard to decarbonise sectors are high emitting sectors in which decarbonisation solutions are prohibitively expensive, or where no decarbonisation solution currently exists. While all sectors should continue to seek methods to reduce emissions, negative emissions provide a cross-cutting solution to 'neutralise' the residual emission from multiple sectors such as agriculture, aviation, cement and concrete, chemicals, heavy industry and steel.

However, NETs can also be applied to other sectors. There is increasing interest from the tech and finance sectors to use negative emissions to neutralise their historical emissions. For example, Microsoft has an ambition to be carbon negative by 2030 and to remove all the CO₂ emitted since the company was founded by 2050. As a first step towards this goal, in 2021 Microsoft procured 1.3 Mt of negative emissions in a world first carbon removal RFP¹. Corporates looking to neutralise historical emissions or demonstrate leadership through their ESG commitments and by making use of the voluntary carbon market could also be important enablers to scale up the NET sector.

3. 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?

There are a broad range of BECCS, DACS and other negative emissions technologies at varying stages of readiness. BECCS power, energy from waste with CCS and liquid sorbent DACS projects are all part of priority or reserve clusters which are on track to become operational in the mid-2020s, and which are at current TRLs of 7-8.

However, it will be essential to continue to support NETs that are at lower levels of technological readiness to ensure that a broad portfolio of NETs can be advanced ready for large scale deployment in the 2020s, 2030s and beyond. No single NET can meet the negative emissions requirements set out in Q1, so supporting the development of all NETs should remain a priority.

¹ <https://blogs.microsoft.com/blog/2021/01/28/one-year-later-the-path-to-carbon-negative-a-progress-report-on-our-climate-moonshot/>

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

The Coalition for Negative Emissions published a report in July 2021², outlining the case for negative emissions and setting out both the key barriers and potential enablers to scaling a NET industry. Today the market faces a ‘chicken and egg’ situation where supply, demand and intermediation cannot grow individually until they grow collectively. Key challenges identified in the report include:

- In supply, there is limited public consensus on what constitutes quality negative emissions, and how to best intervene to scale.
- In intermediation, limited activity is both a cause and a symptom of a nascent and fragmented market.
- In demand, not all companies and governments are sure of the benefits negative emissions hold for them, how to navigate nuances and what role they should play in driving them if they do.

There are five key areas of action which could help to unlock growth:

- I. Define what constitutes high quality negative emissions
- II. Shape robust, liquid and transparent markets for trading negative emissions credits, and provide supply-side financing for individual projects
- III. Ensure sufficient national commitments to negative emissions (in addition to commitments to emissions reductions) by effective government orchestration and intervention to incentivise supply and obligate demand.
- IV. Agree on a method for transparently tracking and celebrating corporate claims, supported by clear accounting principles and a narrative that highlights the distinct value proposition of negative emissions in addition to emissions reduction. This would enable other companies to follow Microsoft’s example
- V. Enable multilateral collaboration and trade that solves the negative emissions challenge globally.

The UK government is taking action to unlock development of NETs by:

- ensuring there is sufficient CO₂ transport and storage infrastructure that NETs can access, through the Cluster Sequencing process;
- making essential funding available for early stage or lower TRL level NETs through innovation funding and partnerships with academia and industry;
- developing business models which value negative emissions, such as the BECCS power business models published in October 2021 and the expected consultation on other GGR business models in Spring 2022;
- exploring market-based options for supporting NETs, such as inclusion in the UK ETS; and
- providing demand incentives through setting ambitions for deployment, e.g. the ambition for 5Mt of negative emissions by 2030 in the Net Zero Strategy.

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

BECCS and DACS are broad technologies which have many potential co-benefits

² <https://coalitionfornegativeemissions.org/wp-content/uploads/2021/06/The-Case-for-Negative-Emissions-Coalition-for-Negative-Emissions-report-FINAL-2021-06-30.pdf>

and links to other technological innovations.

- Both BECCS and DACS can help support the scale-up of sustainable aviation fuel production in the UK by providing feedstocks for SAF production
- BECCS power can be used to deliver carbon negative baseload power.
- Energy from waste with CCS can be used to decarbonise the waste sector
- As discussed in Q2, NETs can be used to neutralise emissions from any hard to abate sector, and can be applied to remove historical emissions from any sector.

6. 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?

Combining bioenergy with CCS provides an opportunity to maximise the climate benefit of biomass by creating negative emissions as well as other useful by-products including, electricity, hydrogen and fuels, as outlined in the CCC's advice on the Sixth Carbon Budget.

The CCC has set out ambitious targets for deployment of UK biomass, which will require multiple stakeholders to work together to realise. Partnerships across industries will be critical to delivering workable solutions, such as the recently announced partnership between Drax and the National Farmers Union to explore the scale up of UK energy crops³. The forthcoming Interim Bioenergy Strategy from BEIS will outline some of the key considerations policy and industry stakeholders to take forwards.

It is critical that the solutions used to produce negative emissions are environmentally and economically sustainable. As noted in the Government's Net Zero Strategy, the UK's biomass sustainability criteria is among the most stringent in the world. It ensures all biomass feedstock, regardless of where it is sourced from, is in compliance with the UK Timber Regulation, Forest Europe sustainable forest management criteria, and other environmental and climate regulations. This includes assurance of replanting after harvest, maintenance of overall forest health and productivity, maintenance of biodiversity and wildlife habitat, protection of soil and water quality, and more. Further, the criteria ensures strict limits on supply chain emissions.

The Coalition has assessed the global sustainable potential of BECCS, DACS and natural climate solutions using strict sustainability filters to minimise impacts on biodiversity, water supplies and other sensitive natural capital, and ensure no land use change. Our conservative estimate using this stringent sustainability filter, is that BECCS can provide 2 to 4 Gt of CO₂ removals per year⁴, using agricultural residues, woody residues and energy crops grown on unused degraded land.

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

The UK Storage Appraisal Project estimated the UK's CO₂ storage capacity at 78 Gt in over 500 potential storage sites located offshore around the UK, mainly in the Southern North Sea, the Central and Northern North Sea, and the East Irish Sea.

³ https://www.drax.com/press_release/drax-and-nfu-partner-to-boost-uk-energy-crop-market/

⁴ <https://coalitionfornegativeemissions.org/wp-content/uploads/2021/06/The-Case-for-Negative-Emissions-Coalition-for-Negative-Emissions-report-FINAL-2021-06-30.pdf>

Storage sites have been identified offshore, predominantly in saline aquifers, but some depleted oil and gas fields may also be suitable. The geology, rock and fluid characteristics, and structures that are suitable for CO₂ storage are well understood from decades of subsurface characterisation and exploration in the oil and gas sector. CCUS clusters currently under development as part of the government's Cluster Sequencing Process plan on using both saline aquifer and depleted fields for CO₂ storage. Information on potential storage sites is available on a public database, CO₂Stored⁵, supported by the British Geological Survey and the Crown Estate. The UK has one of the largest storage potentials in Europe, meaning the UK could provide CO₂ storage as a service to near neighbours with insufficient storage potential. Onshore storage is not being pursued in the UK, as the large storage capacity offshore and long-standing experience of offshore developments from the oil and gas industry make it unlikely onshore resource would need to be utilised.

8. **What other drawbacks for the environment and society would need to be overcome to make NETs operational?**
9. **Given the proposed role of NETs in climate change modelling, is there a danger of over-reliance on these technologies in net zero strategies?**

The Coalition fully agrees that to limit global warming to 1.5 degrees, it is critical that government and industry prioritise policy interventions and investment in technologies that can deliver emissions reduction over the coming decades. Negative emissions solutions should not be seen as a substitute for these measures.

However, as outlined previously independent analysis from the world's leading climate science bodies, such as the IPCC and CCC, clearly indicates there are a number of industries that are unlikely to achieve the technological breakthroughs required to achieve full decarbonisation by 2050. As a result, we have a high level of confidence that a significant volume of negative emissions solutions will be required to mitigate these emissions.

Therefore, to ensure the scale-up of the UK negative emissions sector occurs at a pace that is both sustainable but also capitalises on the UK's capabilities to be a world-leader in this sector, early intervention from government working with industry to bring forward early projects in the 2020s is essential.

To mitigate concerns around the scope for negative emissions to 'push out' reduction efforts, the Coalition are supportive of having a clearly defined target for deployment of negative emissions in UK, distinct from its broader emissions reduction targets. The UK Government has already taken steps in this regard through its ambition in the Net Zero Strategy to have *at least* 5 million tonnes per year of engineered negative emissions capability (i.e., BECCS and DACS) deployed in the UK by 2030.

10. **How should the UK Government support the further development of NETs?**

Targeted interventions the UK could make to realise the opportunities associated with scaling the negative emissions industry in the UK and build a global leadership position include:

- Accelerating the deployment of First of a Kind BECCS and DACS projects in the UK through the provision of bespoke government support packages, subject to

⁵ http://www.co2stored.co.uk/home/about_faq

demonstrating value for money and sustainability credentials. These could take the form of long-term contracts providing a guaranteed price for abatement, which would reward every tonne of CO₂ removed from the atmosphere, similar to the support mechanisms currently being considered for other carbon capture technologies.

- Additional innovation funding focused on bringing through cutting-edge negative emissions technologies and solutions, building on the Government's existing £100m 'Direct Air Capture and other Greenhouse Gas Removal technologies' competition.
- Establishing 'low regrets' targets for negative emissions deployment in the UK over the medium to long-term, building on the ambition in the Net Zero Strategy to have *at least* 5 million tonnes of engineered negative emissions deployed in the UK by 2030.
- Accelerating the maturation of the industry in the UK by consulting with industry and stakeholders on the appropriate mechanism to create a large-scale, liquid market for negative emissions that connects producers with organisations in hard-to-abate sectors and minimises intervention from government. As a first step, the Government should publish the call for evidence on including negative emissions in the UK Emissions Trading Scheme, committed to in the Net Zero Strategy, no later than spring 2022.

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

Negative emissions are a nascent but rapidly developing industry and there are already examples of early action being taken by other countries to build capability and accelerate scale-up. These include:

- The United States' federal 45Q tax incentive, which awards DAC facilities \$50 per tonne of CO₂ permanently stored under the ground.
- California's Low Carbon Fuel Standard, which currently awards DAC facilities over \$200 per tonne of CO₂ permanently stored under the ground.
- The New Zealand Emissions Trading System, which enables forest owners to receive credits for the CO₂ their forests sequester.

A number of early stage BECCS and DACS projects are also advancing across the globe. For example:

- Stockholm Exergi in Sweden are starting to apply BECCS to their Biomass-fired Värtan CHP. Once applied to the full plant, it is estimated to be able to capture 800,000 tonnes CO₂/year⁶.
- Mikawa Power Plant in Japan is retrofitting a 50MW unit power plant with 100% biomass with a CO₂ capture facility. At full scale it will capture over 180,000 tonnes CO₂/year⁷.
- Orsted in Denmark are exploring ways to support the development of carbon capture and storage at biomass-fired heat and power plants in Denmark⁸. The Amager Resource Center (ARC) is far ahead with an operational pilot plant that is

⁶ <https://www.stockholmexergi.se/om-stockholm-exergi/about-stockholm-exergi/negative-emissions/bio-ccs/>

⁷ <https://bioenergyinternational.com/heat-power/toshiba-ess-commission-japans-first-large-scale-beccs-plant>

⁸ <https://orsted.com/en/media/newsroom/news/2021/03/569767710474825>

planned to capture 500,000 tons of CO₂ in 2025⁹. The Danish Economic Council potential for negative emissions through BECCS is estimated at approximately 5 MtCO₂/year¹⁰.

- Swiss company Climeworks began operating the world's largest DACS plant, Orca, in Iceland in September this year¹¹. The plant is capable of capturing 4,000 tonnes CO₂/year. CO₂ is then stored permanently through a mineralisation process at Carbfix's CCS facility
- Carbon Engineering, in collaboration with Oxy Low Carbon Ventures, are developing a 1 Mt CO₂/year DACS project in the Permian Basin in Texas, US¹².

As outlined above, in the first instance it is critical that the Government works with industry to develop support schemes that bring forward early projects in the 2020s that are both value for money and sustainable. This would ensure that the UK is well positioned to capture the value associated with this nascent industry in terms of technology innovation, intellectual property rights and skills.

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

The Biomass Strategy represents a unique opportunity for the UK Government to set out a long-term vision for the sustainable deployment of BECCS in the UK and how it can support multiple policy objectives including decarbonisation, levelling up and global leadership. The Climate Change Committee's Net Zero Balanced Pathway illustrates the value of BECCS to the UK's decarbonisation efforts, with 53 Mts per year of BECCS forecast to be deployed by 2050 across power, energy-from waste, biofuels, hydrogen production and industrial fuel switching.

To realise the potential for sustainable BECCS in the UK and secure the buy-in from multiple stakeholders of the scope and scale of its deployment, the Government's final bioenergy strategy should:

- Include a firm commitment to deploying a First of a Kind BECCS project in the UK in the 2020s, which would generate a number of key learnings for future projects and support the scale-up of BECCS solutions in the 2030s.
- Reaffirm the UK's commitment to its world-leading biomass sustainability regime, and outline how it can use this foundation to deliver its Net Zero ambitions .
- Identify targeted interventions to facilitate the sustainable scale-up of domestically produced bioenergy feedstocks in the UK, working with critical stakeholders such as the farming community.

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⁹ <https://a-r-c.dk/klima-og-miljo/co2-fangst/>

¹⁰ https://dors.dk/files/media/rapporter/2020/m20/engelsk_summary/disk./m20_disk_summary_and_recommendations.pdf

¹¹ <https://climeworks.com/news/climeworks-launches-orca>

¹² <https://carbonengineering.com/news-updates/new-development-company-1pointfive-formed/>