Written evidence from the Carbon Capture and Storage Association

The Carbon Capture and Storage Association (CCSA) is pleased to provide a response to the Environmental Audit Committee inquiry: Net zero aviation and shipping. The CCSA brings together a wide range of specialist companies across the spectrum of Carbon Capture, Utilisation and Storage (CCUS) technology, as well as a variety of support services to the energy sector. The CCSA exists to represent the interests of its members in promoting the business of CCUS and to assist policy developments in the UK, EU and internationally to support the commercial deployment of CCUS.

2. How close are zero carbon fuels to commercialisation for aviation / shipping? How effective will the Jet Zero Council be in catalysing zero emissions technologies? What role should transitional fuels such as alternative hydrocarbon fuels play?

The deployment of CCUS and hydrogen in the UK will be a critical enabler for the commercialisation of zero carbon fuels, through hydrogen production for ammonia based maritime fuel, fuels from waste (with CCS), and production of SAF using biogenic and atmospheric carbon with hydrogen. The technologies are well understood, however, to reach full commercialisation a route to market through early markets enabled by investable business models and clear policy direction is required from Government.

The CCSA supports the overall approach the Jet Zero Council and Government have taken on technology such as Sustainable Aviation Fuel (SAF) but highlight the need for policy commitments to be addressed in more detail, in order to drive action and create confidence in the emergence of this new sector.

Commercialisation of CCUS enabled fuels: For projects in the early stages of development to deploy, urgent consideration is still required for near term revenue mechanisms which can enable projects to have certainty on revenues as the early market is established. A more comprehensive financial model and timeline would build investor confidence enabling projects to move through FEED to FID stages, helping to develop the SAF sector.

The governments SAF proposal assumes that critical technology required to deliver SAF policies (CCUS and GGR technologies) would be sufficiently deployed and available for utilisation by the SAF sector. In order for this to take place several items need to be addressed:

- Deep cross departmental collaboration between BEIS and DfT is needed on the development of GGR policy mechanisms
- Business models for Direct Air Capture (DAC) and SAF need to be accelerated to develop on timelines that co-inside with those of the CCUS clusters
- Support for the development of projects in the 2020s to ensure scale up of the sector can occur from 2030

3. What new technologies are there to reduce emissions from aircraft / shipping vessels and how close to commercialisation are they?

Technologies available to reduce or offset emissions from aircraft include:

- Sustainable aviation fuels, including; fuels from waste (with CCS) using the Fischer-Tropsch process and; synthetic fuels using carbon captured from the biosphere combined with low-carbon hydrogen.
- Verifiable offsets using Direct Air Carbon Capture and Storage (DACCS) or Bioenergy with Carbon Capture and Storage (BECCS)

The above technologies are preparing to deploy as part of the UK CCUS cluster deployment programme, with the intention to be operating in the 2020s. It is vital that Government support can grow early markets for SAF and carbon removal technologies in the 2020s, to ensure scale up of markets can occur from the 2030s, as the technologies reach full commercialisation.

Technologies available to reduce emissions from shipping include:

- Hydrogen/ammonia fuelled ships: Ammonia and hydrogen-based solutions are being explored for the maritime shipping sector. The IEA predicts that ammonia will become a key shipping fuel in the future[1]. In the UK the deployment of an ammonia shipping sector is linked to the successful deployment of reliable volumes of low-carbon hydrogen.
- Carbon capture onboard vessels: Demonstration projects and trials are underway for carbon capture onboard marine vessels[2], whereby a modular 'container' capture solution is fitted to large oceangoing vessels, which captures CO2 from the exhaust of the engines. The captured CO2 can then be unloaded at port for permanent storage at local CO2 storage facilities. If this fuel feedstock can be biofuels (or blends) it has the potential to become a carbon negative fuel.

These technologies are somewhat reliant on the deployment of CCUS clusters and storage opportunities, to enable the production of large volumes of low-carbon hydrogen and to provide storage locations for CO2 captured on marine vessels. The UK has several CCUS clusters looking to be fully operational in the 2020s which can accelerate the commercialisation of the above technologies.

4. How should the Government's net zero aviation strategy support UK industry in the development and uptake of technologies, fuels and infrastructure to deliver net zero shipping and aviation?

Net zero aviation:

There are three main areas where the UK net zero aviation strategy should be more explicit to ensure the sector can develop and grow to achieve net zero ambitions:

Clear and investable business models: The introduction of net zero aviation policy mechanisms which can provide short term, as well as long term certainty on revenue are needed. For example, the use of a contracts for difference for SAF production supported by capital grants. The CfD mechanism is well understood through its use in the power CfD and provides revenue certainty as shown by the CfD contacts used to accelerate the deployment of offshore wind. A CfD type model could be a highly complementary SAF business model, providing potential schemes to incentivise CCUS applications, including engineered GGRs. The certainty of revenue which contractual instruments such as the CfDs can give both in the near-term and over the lifetime of the project, is vital to unlock interest from private sector investors.

[1] IEA, 2020. Energy Technologies Perspective 2020.
Available at https://www.iea.org/reports/energy-technology-perspectives-2020

[2] https://www.logisticsmiddleeast.com/transport/worlds-first-co2-capture-plant-is-installed-on-a-vessel (accessed August 2021)

Cross-departmental collaboration and engagement: Deployment of the SAF industry relies on GGR technologies, therefore it is crucial the governmental departments; BEIS and DfT actively collaborate on the framework policy and business models for GGR technologies. This will ensure SAF projects can deploy without delays in the early stages and can be scaled up by 2030. Without direct interaction and support these technologies may not be available to deploy from 2030, and as such the realisation of a net zero aviation sector may not be achieved by 2050. It is critical that DfT support BEIS directly to ensure the policy frameworks are developed and GGR projects can be deployed in the 2020s.

Early action in the 2020s supporting wider decarbonisation activities: Business models for SAF and GGR technologies (such as Direct Air Capture) need to be developed along similar timelines to the cluster deployment process to ensure companies can make investment decisions on projects with CCUS and SAF, which will need access to carbon networks. Pro-active participation from DfT will again be important to ensure there is cross departmental support for the deployment of CCS clusters related to net zero aviation.

Developing projects at speed now and to the CCUS cluster development timelines will help to ensure the SAF industry can deploy in the 2020s and provide a clear pathway to a scale-up the sector in the 2030s.

5. How effective will the global offsetting scheme for international airlines (ICAO's CORSIA) and the UK and EU ETS be at stimulating technology improvement and/ or behaviour change to reduce emissions from aviation / shipping?

Global offsetting schemes, and the UK / EU ETS schemes could provide frameworks which encourage the development policy mechanism to reduce emissions from the aviation and shipping sector. However, these systems alone will be insufficient to establish the sector, and bring nascent technologies to market.

To some extent this has been noted in the recent consultation on Jet Zero by DfT, and the CCSA welcomes the governments consideration and development of carbon markets and use of Greenhouse Gas Removal (GGR) methods to drive down CO2 emissions from the aviation sector. Whilst this looks to a future system, Government does not seem to consider what actions and support are required in the near to medium term:

- There is an assumption within the current aviation policy stance that the GGR sector will be developed and investible in terms of deploying projects.
- There is a heavy reliance on CORSIA which alone may not be able to provide sufficient incentives to scale up a GGR sector.
- CORSIA and UK ETS are the only carbon market mechanisms suggested that could help the deployment of a sustainable aviation sector. Other important mechanisms for short to medium term deployment could be considered.

The key to ensuring long term market mechanisms are successful is to establish the low-carbon technologies and sectors in the 2020s. This has been explored in more detail below.

<u>Establishing Green House Gas Removals sector:</u>
To ensure GGR technology can be used for SAF production, for aviation/shipping decarbonisation, and to drive down CO2 emissions and help the UK achieve net zero, the GGR industry needs to be developed and investible. As GGR technologies deploy and become widespread, government must move from a technology support to market support and finally

towards steady state role depending on the GGR technology. Bespoke support may be required for early projects in the early technology phases, after which more general market support can be given.

In order to develop a sector at scale, FOAK and early projects must be developed in earnest. Delaying early projects will delay the establishing of the GGR sector and in turn the SAF sector and may even shift early mover advantage to other jurisdictions. In addition, DfT must work with BEIS to:

- Release a Greenhouse Gas Removal Strategy
- Commit to minimum levels of deployment for CCS and GGR. Including updating the 10Mt CO2 storage per year in 2030, to a minimum 'at least 10Mt per year target' aiming for 22Mt of CO2 stored per year as recommended by the Climate Change Committee[3]
- Set clear early deployment targets and interim GGR milestones to help define a pathway to 2050
- Ensure GGR and SAF business models can integrate with wider CCUS business models. This will allow projects to be assessed by financiers as a whole system and provide long term certainty to investors. Ultimately enabling deployment and exposing removal technologies such as BECCS and DACCS to valuable early operational experience.
- Establish a longer-term market framework and indicate how early projects can move into the market over time
- Build public support for GGRs. The pathway to net zero will expose the public to many novel, innovative and often complex integrated solutions, which must be accepted if projects are to progress. Government must engage with the public on the value of CO2 removals outside of afforestation and the critical role they will play in achieving net zero.

It will be important for Government departments to collaborate and coordinate on the above recommendations to ensure they have input on policy development which will be critical to the net zero aviation and shipping sector going forward. Further recommendations by the CCSA for GGR technology can be found in our response to the BEIS February 2021 call for evidence on Green House Gas Removals[4], which we would be happy to discuss in more detail.

GGR enabling policy mechanisms:

The use of carbon markets such as the UK ETS scheme and CORSIA could be suitable mechanisms to drive down CO2 emissions, as well as create an enduring market for GGR technologies for sectors close to, or already covered by an ETS. This is complex and will require additional supportive policy and further consideration with industry to ensure a route to market.

Other mechanisms further to UK ETS or CORSIA which could be considered to help short to medium term project deployments are:

- Voluntary private sector investment
- Obligations
- Grants and loans (payment schemes) for early projects on a case-by-case basis
- Contractual schemes such as CfDs

[3] Climate Change Committee, 2020. The Sixth Carbon Budget – The UKs path to Net Zero. Available at: https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf

[4] CCSA. 2021. CCSA response to the BEIS call for evidence on Greenhouse Gas Removals. Available at: CCSA-Res===ponse-to-the-BEIS-Call-for-Evidence-on-Greenhouse-Gas-Removals.pdf

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