23 June 2022

Drax Group Comments on California Air Resources Board DRAFT 2022 SCOPING PLAN UPDATE

Drax is a UK-headquartered global, vertically integrated, renewable energy company with over 3,400 employees in North America and the UK. Enabling a zero-carbon, lower-cost energy future is Drax Group's purpose. To that end, we announced in 2019 a world-leading ambition to be carbon negative by 2030, using Bioenergy with Carbon Capture and Storage (BECCS) technology to remove carbon dioxide (CO_2) from the atmosphere at scale while delivering reliable renewable electricity.

We are pleased to provide comments to the California Air Resources Board to inform its Scoping Plan for California to have a net-zero energy system by 2035 or 2045. The deployment of carbon removals will be highly reliant on favorable government policy frameworks to enable investment in first-of-a-kind projects such as BECCS by Drax, and to ensure scale-up of these technologies in line with net-zero objectives. In particular, we would like to highlight the following points in our comments:

- **Drax supports CARB's inclusion of BECCS in its scoping plan.** Drax supports BECCS as a mechanical carbon dioxide removal technology along with direct air capture as outlined in the scoping plan. Drax also affirms the need to accelerate deployment of BECCS to aid California in achieving its carbon-neutral ambitions.
- **BECCS will accelerate CARB's electricity sector GHG reduction goals.** BECCS has the ability play a key role for California in meeting its carbon-neutral objectives and solving many of California's challenges associated with operation of intermittent resources.
- **BECCS by Drax in the U.S.** Drax is developing a project to build the first at-scale negative emissions power plant in the U.S. Drax's development plans rely on U.S policymakers developing an accommodating policy framework for BECCS.
- **BECCS offers multiple benefits**. Improved forest health, air quality and reductions in fossil fuel use are all benefits of BECCS.
- **CDR technologies – including BECCS – need government support.** CDR technologies are going to be delivered with government support or government-backed incentives to help give investors confidence and ensure that the widest range of negative emissions solutions are brought to market. Existing policy mechanisms – such as the LCFS, cap-and-trade system and 45Q tax credit - need to be reformed to reflect the scale of the challenge and enable low carbon technologies like BECCS to be deployed at scale.
- **Drax stands ready to support the Government develop the right frameworks to scale up CDR technologies.**

We value the opportunity to help inform California's approach to integrating carbon removal technologies into the Scoping Plan—including the development of policy mechanisms to support deployment. Please find detailed answers to individual questions

relevant to Drax appended to this letter. We would welcome the opportunity to discuss the points raised in the Draft Scoping Plan in further detail with CARB.

Yours sincerely,

Ross McKenzie
Senior Vice President of International Affairs

Introduction

Drax Group plc (Drax) owns and operates a portfolio of flexible, low-carbon and renewable electricity generation. Drax is the world's largest producer and generator of sustainable bioenergy. We have operations in Arkansas, Louisiana, Mississippi and Alabama and power generating facilities across the UK. At the Drax Power Station in North Yorkshire, we have been trialling Bioenergy with Carbon Capture and Storage (BECCS) to produce carbon negative electricity following the conversion two units at the power station to operate using sustainably-sourced biomass in place of coal. It is here that we successfully proved we can capture carbon dioxide emissions from electricity generation using a 100% sustainable biomass feedstock. Now we are ready to go further by using BECCS at scale to permanently remove millions of tonnes of CO_2 each year from the atmosphere and become a carbon negative company. Drax will deliver 8MMtCO_2 of negative emissions as part of the first phase of the BECCS programme at Drax Power Station in the 2020's.

We recently announced our ambition to deploy our BECCS technology globally. Drax has set a target to deliver 12MMt of negative CO_2 emissions annually – including 4MMt of negative CO_2 from new BECCS projects internationally by 2030. We believe the U.S. is an ideal location to deploy our first BECCS project outside the UK given its access to one of the world's greatest fiber baskets, well-established sustainable forestry sector and suitable geology for CO_2 storage.

In fact, we are progressing our plans to build the first at-scale carbon negative power plant in the U.S. We are aiming to build a new facility of around 300 megawatts (MW), with the capacity to generate over 2MMt of CO_2 emissions removal each year. Through the provision of dispatchable renewable power and negative emissions, this facility will play an important role in meeting the Biden Administration's 2035 clean grid target – and, if located in California, the state's 2035 and 2045 targets. The project will also create a unique end-to-end U.S. supply chain, protecting and establishing around 1,000 jobs in clean energy. Two regions in particular are well suited for Drax to deploy its first BECCS plant: California and the Southeast US.

BECCS is unique in its ability to deliver 24/7, dispatchable renewable power and remove carbon from the atmosphere simultaneously. It is one of only two engineered solutions that removes carbon from the atmosphere and the only solution that produces, rather than consumes, renewable power.

As the draft scoping plan recognises, CDR technologies such as BECCS are vital to achieve the state's emission targets. The Draft Scoping Plan correctly identifies the benefits of deploying these technologies at scale. One BECCS by Drax project alone can deliver around 70% of the CDRs needed to achieve net zero. However, the Draft Scoping Plan also highlights the importance of starting to develop policies now that enable the construction of the new infrastructure needed to support CDR technologies. Drax stands ready to support the Government to develop the right policy framework, permitting and construction to incentivise the deployment of CDR technologies in California.

Drax supports CARB's inclusion of BECCS as a mechanical carbon dioxide removal technology.

Drax supports CARB's inclusion of BECCS as a carbon dioxide removal (CDR) technology but encourages CARB to place more emphasis on modelling and including BECCS and CDR technologies in its final Scoping Plan. BECCS can deliver significant CO_2 removals and contribute to a net negative grid. As pointed out in the Scoping Plan, California cannot achieve its carbon neutral goals without CDR, but there is little discussion in the draft outlining policies to support and deploy CDR technologies.

Traditionally, policy development and associated funding streams for CDR projects have been open only to Direct Air Capture (DAC) projects. No pathway exists for BECCS within existing funding streams or project support mechanisms to deploy BECCS in the U.S. Drax is pleased to see that CARB's Draft Scoping Plan includes BECCS as a form of CDR and encourages California to consider policies that will incentivize deployment of BECCS in order to achieve its carbon neutral objectives.

BECCS will support CARB's electricity sector GHG emissions objectives.

Drax encourages CARB to model and include BECCS in its Scoping Plan to achieve its electricity generation sector GHG target of 38 $MMTCO_2e$ in 2030 and $MMTCO_2e$ in 2045. A single BECCS by Drax facility will produce 2MMt of CO_2 removals annually and is scalable in the near term, enabling California to achieve its 2030 carbon reduction target. The potential for BECCS to support this goal is extremely high, given the available fuel from closely sourced sustainably managed U.S forests, geological storage, and demand for renewable power to scale up BECCS.

BECCS will also enable California to reduce its reliance on fossil gas generation to support grid reliability, as it can serve as a clean, dispatchable alternative. Early deployment of BECCS will also reduce the pressure for California to increase rates of deployment of solar and battery storage under its Proposed Scenario while delivering carbon negative electricity for the grid. Carbon negative grid electricity will allow California to support electrification of certain industries earlier than proposed while complimenting the growth of renewables.

BECCS offers important benefits beyond climate change mitigation and baseload power generation.

Improved Forestry Management and Health

A build-up of forest residuals and fuel load is recognized by state and federal forest managers as a significant threat to forest health because of the associated increased risk of pests, disease, and forest fires.

In California, a build-up of residuals and lack of forest management has exacerbated forest fires, while a significant volume of residual material is being burned at roadside with resulting poor air quality in communities. BECCS can support the State of California in addressing this issue through the collection and utilization of forest residuals, reducing the risk of forest fires and the subsequent air quality issues and risk to life and livelihood that are affecting communities.

BECCS provides not only an outlet for these residuals, sawmill residuals and thinnings, but also a new market for these products. The market demand created by BECCS both prevents this material from being burned at roadside or left to rot, reducing carbon that would otherwise have been emitted directly to atmosphere, and provides a market for their use.

Growth of Clean Energy Jobs

During the construction phase of a new BECCS facility we estimate 10,000 jobs will be created. The 20+ year operation of a BECCS facility will support 1,000 direct and indirect jobs across the supply chain. BECCS will create an end-to-end supply chain that stretches from the forestry sector to power station operation and CO_2 capture and storage. The 'catchment area' of a BECCS plant, from biomass sourcing to carbon sequestration, will be 60 miles, potentially concentrating jobs in rural communities while bolstering California's efforts to decarbonize using California technology and labor.

Acceleration of California's Transition Away from Fossil Fuels

Sustainable biomass is a renewable energy source because of the closed carbon cycle created when trees grow and take CO_2 from the atmosphere, and then reabsorb the carbon in the process of regrowth. Whether the wood is used for bioenergy or these trees naturally decompose, the same amount of CO_2 is released into the atmosphere. The cycle remains in balance because the working forests that supply the low-grade wood used for biomass are replanted, and these growing trees absorb yet more carbon. By adding carbon capture technology, we effectively break that carbon cycle. Therefore, BECCS produces two useful products: carbon removals and power in the form of renewable, low-carbon firm electricity.

Implementing BECCS will provide additional carbon abatement, on top of the carbon removals from the BECCS project, by displacing the fossil fuel use for electricity generation in existing fossil facilities. BECCS is the only non-fossil technology to offer the full suite of system services – providing grid support and the integration of intermittent renewables while flexible fossil plant use diminishes.

Additional power plant emission abatement

Drax's experience shows that our technology works and it's ready to be deployed at scale. BECCS in a power generation application is a highly advanced technology with biomass combustion proven at large commercial scale, the largest being each of Drax's 670MW thermal power generation units. Post-combustion CCS has also been proven at large commercial scale at Petra Nova in the U.S. where 1.4MMT/year of CO_2 was captured from a coal- fired power generation unit. Biomass flue gas is very beneficial for post-combustion CCS in comparison to coal. Whilst the CO_2 volume is similar at 11-13% and the O2 volume is also similar at 6%, biomass flue gas is advantageous in that it contains minimal to zero levels of sulphur contaminants, and nitrogen-based emissions are much lower than coal which is beneficial for capture projects. The process of carbon capture with BECCS strips out a host of other criteria pollutants, including SO_2, NOx and particulate matter.

Drax Criteria for US Project Host Site

Drax has identified the U.S. as an optimal location to deploy BECCS. Two critical workstreams underpin Drax project development and delivery in the U.S. For BECCS developers such as Drax, the following criteria must – to the maximum possible extent – overlap to identify a specific location:

1. **Fiber availability** – The availability of sustainably sourced biomass within a radius of approximately 100 miles around the location of the plant.
2. **Carbon storage** – CO_2 storage characterization, injection rates, and permitting. The site needs to be located near a well characterized and understood storage facility with the capacity to store 2 million tonnes of CO_2 per year throughout the life of the project (approx. 20-25 years). In addition, states that are in the process of or interested in applying for primacy over Class VI permits to adopt a more risk- and performance-based approach are more desirable to deploy BECCS.

These criteria make California an ideal site given the significant volumes of forestry waste biomass available to support a BECCS generation facility, as well as ideal geology suitable for permanent geologic storage in the Central Valley.

Barriers to Deploying BECCS

There are several barriers that currently prevent CDR technologies from being deployed at scale. It is worth noting that almost all the barriers are policy or commercial barriers rather than technical barriers to deployment. As explained in the Appendix to these comments, Drax has proven the technical capabilities of BECCS through the operation of pilot facilities at its Drax Power Station in the UK.

The primary barrier to deploying CDR technologies at scale is that high quality carbon removals are not properly accounted for within frameworks for decarbonization. Carbon markets are not mature, are unable to provide a revenue stream for permanent high quality carbon removals or cannot provide price certainty to make most CDR projects investable. Carbon removals are not rewarded equally through schemes like the federal 45Q tax credit or state Low Carbon Fuel Standard program, and, while voluntary markets are beginning to develop, these are currently immature markets. In order to support the deployment of mechanical CDR technologies at the scale required to meet net-zero and decarbonization ambitions, Drax encourages CARB to include a policy framework in its final Scoping Plant to support early CDR deployment in order to achieves the state's carbon-neutral goals and to encourage the development of a carbon market that supports high quality carbon removals over time.

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Drax supports CARB's work on the Scoping Plan. We appreciate this opportunity to provide comment on the role that CDR technologies such as BECCS could play in helping the state achieve its climate targets. If you have any questions or need additional information on BECCS or Drax, please contact **Mariano Ruiz – Head of International Affairs – at Mariano.Ruiz@drax.com**

Appendix

Case study: Drax UK BECCS Project

As CARB considers how to integrate BECCS into the Scoping Plan, Drax's experience in Europe could be instructive. Drax UK implemented Europe's largest decarbonisation project by converting two-thirds of our Drax Power North Yorkshire coal-fired power station to use sustainable biomass. In 2020, 92% of the power produced by the station was from renewable sustainable biomass – helping us reduce Drax Group's carbon emissions by over 85% and making us the UK's largest renewable energy generator by output.

In October 2018, we began to pilot the first BECCS project of its kind in Europe at Drax Power Station. The first pilot project captured its first tonne of CO_2 at the UK's largest renewable power station in early 2019. The pilot is the first time that CO_2 has been captured from the combustion of a 100% biomass feedstock for power anywhere in the world. A second BECCS pilot facility within the power plant's carbon capture usage and storage (CCUS) incubation area in autumn 2020, enhanced Drax's technical understanding for delivering high quality carbon removals. We are now ready to deploy BECCS at scale.

In June 2021, Drax agreed to a long-term contract for Drax to put in place a licence agreement to deploy carbon capture technology in what will be the largest deployment of carbon removals in power generation anywhere in the world. The contract, which combines UK innovation and world-leading Japanese technology, will see Drax license carbon capture solvent to capture CO_2. In the first quarter of 2022, we will start the Front-End Engineering and Design (FEED) work and commence site preparation works for BECCS across the power station - including relocation and decommissioning work to make space for the project.

As BECCS at the North Yorkshire Drax Power Station is classified as a "Nationally Significant Infrastructure Project" under UK legislation, its construction and operation require planning permission known as a Development Consent Order (DCO). As part of the DCO process, the planning application is approved by the Government through the Planning Inspectorate. The Planning Inspectorate has six months to examine and prepare a report on the application to the relevant Secretary of State, including a recommendation. The Secretary of State then has three months to make a decision on the planning application. As part of this DCO process, we will hold both a non-statutory and statutory public consultation to share our plans with residents, community groups and stakeholders. We've already carried out the non-statutory consultation between March and December 2021, which was a great opportunity for us to share our plans with local communities and understand their views and feedback. This public consultation is the statutory consultation. Once finalised, we will submit the planning application in 2022.

With an effective negative emissions policy and investment framework from government, we could deploy BECCS on two of our biomass-generating units by 2030. BECCS at Drax Power Station will deliver at least 8MMt of negative emissions a year – around 40% of the negative emissions the UK's independent Climate Change Committee estimates are required from BECCS in 2050 to hit the UK net zero target. As well as providing large volumes of negative emissions, BECCS also delivers value for money. Analysis by Baringa for Drax shows that

meeting net zero with BECCS will save the UK £75bn (approximately US$92bn). Deploying BECCS at Drax Power Station specifically saves the UK £26bn (approximately US$32bn). By contrasty, every year of delay beyond our planned 2027 deployment date will cost the UK £500m (approximately US$614bn) per year.

BECCS timeline – UK project

- **2018**: Fourth coal unit converted fully to 100% biomass
- **2019**: Drax BECCS pilot started capturing CO_2 in world first with 100% biomass feedstock
- **2020**: Second Drax pilot to capture CO_2 from biomass feedstock installed in the autumn
- **2021**: Front end engineering design (FEED) study
    - Q1/Q2: Environmental scoping; non-statutory consultation; Incorporating feedback from non-statutory consultation; Liaising with local councils, landowners, and other statutory consultees
    - Q4: Statutory period of consultation including consultation on the Preliminary Environmental Information Report; Publication of Statement of Community Consultation
- **2022**: Submission of development consent order (DCO) application
- **2024**: BECCS construction starts at Drax Power Station
- **2027**: Carbon Capture Technology fully operational on first Drax unit – capturing around 4MMt of CO_2 a year
- **2030**: Second BECCS unity fully operational. Drax captures 8MMt of CO_2 per year, thereby becoming a carbon-negative company