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Drax Response to IRS Proposed Rule Making Docket # REG-117631-23: 45V Tax Credit for Production of Clean Hydrogen

Introduction to Drax

Drax Group is a UK-headquartered, vertically integrated, renewable energy company with over 3,400 employees globally, with one third of those employees located in the US. Drax's purpose is to enable a zero-carbon, lower-cost energy future using Bioenergy with Carbon Capture and Storage (BECCS) – the *only* carbon removal technology which removes carbon dioxide from the atmosphere at scale while simultaneously delivering dispatchable renewable electricity.

Drax is one of the world's largest producers and generators of sustainable biomass. Drax owns and operates a portfolio of flexible, low-carbon and renewable electricity generation in the UK, and has wood pellet manufacturing operations in Alabama, Arkansas, Louisiana, and Mississippi, as well as Alberta and British Columbia. Drax's manufacturing operations contribute $1 billion to the US economy, and $1.1 billion to the Canadian economy annually.

At the Drax Power Station in North Yorkshire, Drax has successfully trialed BECCS to produce carbon negative electricity following the conversion of four units at the power station to operate using sustainably sourced biomass in place of coal. It is there that Drax successfully proved it can capture carbon dioxide emissions from electricity generation using a sustainable woody biomass feedstock.

Now Drax is ready to go further by using BECCS at scale to permanently remove millions of tons of CO_2 each year from the atmosphere. Drax intends to deliver at least 6 million tonnes of carbon removals from new-build BECCS projects internationally, with a focus on the US. America is an ideal location for these new facilities given its access to one of the world's greatest wood fiber baskets, well-established sustainable forestry sector, and suitable geology for CO_2 storage. A Drax BECCS project in the US is anticipated to produce around 250MWh of firm, baseload power while simultaneously removing up to 3Mt of carbon per year. Each project will represent a $2 billion investment, hundreds of jobs in the supply chain, and thousands of jobs during construction. Drax's aim is to create an American-grown, American-made supply chain – working with local landowners and using plentiful US forest resources to produce carbon negative power for American homes and businesses and create jobs for rural Americans.

US forests currently provide 20% of America's renewable power. Working forests across the US South, which are largely privately-owned, are sustainably managed to provide wood for construction, paper, and other uses. Forest cover in the US South has increased over the last century, despite increased pressure from population expansion and development, and Southern forests have an average growth-to-drain ratio of almost 2 – over 3 in some places. The forest sector currently supports over 800,000 American jobs and represents almost 4% of the nation's GDP. According to DOE's Billion Ton Study, there is an opportunity to mobilize 1 billion additional tonnes of forestry and agriculture residues to create a robust bioeconomy in the US. Residues and by-products from sustainable working US forests present an incredible opportunity for both the energy and hydrogen sectors.

DOE has already realized the significant role that BECCS can play in decarbonizing the US electricity sector. A recent report from the National Renewable Energy Lab indicates that a scale up to between 7 and 14 GW of installed BECCS capacity will be needed by 2035 to achieve 100% clean electricity – this estimate represents removal of 55-102 million tons of CO_2 per year via new BECCS installations. The report also recognizes BECCS as a negative emissions technology, defining it as producing 'net negative emissions of approx. -1.2MtCO_2eq/MWh.' It goes on to say that 'BECCS results in a net negative emissions rate because carbon from the atmosphere is captured during photosynthesis and then sequestered after combustion'.

There is significant opportunity for BECCS to play a role in clean hydrogen production, both as sustainable feedstock and as a carbon negative power source. In order to take advantage of this opportunity, Drax offers the recommendations included here.

Drax welcomes the request for additional information on accounting for emissions from biomass power generation and has also provided comments on this below.

Further, Drax is supportive of the robust requirements in the guidance for the 45V Clean Hydrogen Tax Credit Program. Drax is well-placed to meet these standards, specifically the 24/7 hourly matching and the location matching. To increase flexibility and carbon negative opportunities, we recommend:

1. Development of additional incentives for going beyond carbon *zero* to carbon *negative.*
2. Extension of additionality timelines, and allowance for mixing of legacy renewables.
3. Modifications to the 45VNH2-GREET Model to develop pathways for carbon negative power and improved considerations for the use of electricity sourced with carbon capture.

Considerations for Accounting for GHG Emissions from Biomass Power Generation and BECCS

Drax appreciates the opportunity to comment on accounting for GHG emissions from biomass power generation. Drax is pleased to provide its expertise in this area and offer the following comments.

Sustainable woody 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 lower-grade wood used for bioenergy are replanted, and these growing trees absorb yet more carbon. This cycle, as defined by the Intergovernmental Panel on Climate Change (IPCC), is carbon zero.

Drax regularly monitors and reports end-to-end supply chain emissions (production, transport, etc) to UK government regulators. With these emissions included, biomass can result in upwards of 90% GHG emissions reduction when compared to coal, and 70% when compared to natural gas, when used to produce electricity.

By adding carbon capture technology alongside the use of sustainable woody biomass, a Drax BECCS operation can achieve negative emissions. Therefore, BECCS produces two useful products: 1) carbon removals and 2) power in the form of baseload renewable electricity. BECCS can supply this carbon negative electricity for hydrogen production, supporting large-scale hydrogen hubs and making the entire process carbon negative, as well as for other technologies, such as DAC, that need carbon negative power to operate.

Drax supports the use of a lifecycle analysis (LCA), as defined in the Inflation Reduction Act (IRA), which has common and consistent boundaries. The assumptions and parameters of a biomass/BECCS LCA are very important, as the forest sector is very complex and thus it is critical that the realities of the market are taken into account. Drax recommends the following parameters for a biomass/BECCS LCA, and have outlined each in more detail below:

1. Use of risk-based chain of custody assessment to verify origin and sustainability of biomass feedstock.
2. Use of attributional LCA for calculating the carbon intensity of biomass value chains, considered alongside consequential LCA to identify appropriate mitigation measures where counterfactual risk is identified.
3. Use of landscape level carbon accounting.
4. Use of historical baseline data for determining actual impact (direct and indirect) on forest and carbon resources.
5. Use of robust sustainability criteria to mitigate leakage.

1. Use of risk-based chain of custody assessment to verify origin and sustainability of biomass feedstock.

The climate impact of biomass to energy generation is highly dependent upon both what type of biomass is sourced and the potential for biomass demand to change land use and land management in the sourcing region. This is true both when biomass is combusted for use in power generation and when it is gasified to produce hydrogen directly. Biomass sustainability is key for all biomass to energy pathways.

Therefore, to evaluate the climate impact of biomass power generation, it is necessary to be able to trace biomass back to the sourcing region through verifiable chain of custody processes and systems. Associated Energy Attribute Certificate (EAC) instruments should rely on the principles of mass balance, allowing for mixing along the value chain, but ensuring end-to-end physical traceability.

As an example, traceability can be achieved through applying internationally recognized forest supply chain certifications, such as the Sustainable Biomass Program (SBP) Chain of Custody Standard. SBP is an accredited risk-based supply chain certification scheme which provides assurances that woody biomass is sourced both legally and sustainably. Risk assessments are performed of the region and/or the specific biomass supply base, mitigation measures are put in place to address any identified risk, and then an independent, third-party audit is performed of the assessment and the mitigation measures. This audit report is publicly available.

SBP verifies, among other requirements, that lands from which biomass has been sourced are replanted, levels of biodiversity are not negatively impacted, the long-term viability of the forest is not impaired, that carbon stocks are stable or increasing across the region, and that economic sawlog-quality timber is not used to produce biomass.

2. Use of attributional LCA for calculating the carbon intensity of biomass value chains, used alongside consequential LCA to identify appropriate mitigation measures where counterfactual risk is identified.

There are two distinct lifecycle assessment accounting methodologies: ‘attributional’ accounting and ‘consequential’ accounting. They are each used for an important but different objective.

Attributional accounting is widely used across regulatory environments - for national and corporate GHG inventory reporting. It quantifies physical GHG emissions from a system or value chain and allocates these to the output product(s). It can rely on fully verifiable data and is valuable for continuous measurement of performance. However, attributional accounting does not capture indirect system impacts. It is therefore important that attributional accounting is considered alongside consequential analysis in order to identify necessary sustainability provisions that mitigate the risk of carbon leakage.

Consequential accounting is used for quantifying the impact of an action or intervention; and includes indirect (normally market-linked) impacts outside the primary system boundary (leakage). Consequential LCA provides an important and valuable decision-support tool that can be used to identify and quantify climate risks and to inform effective mitigative policy and asset development. The possible consequential (indirect) impacts associated with biomass power generation are wide-ranging, complex and unpredictable, and quantifying them requires making assumptions about how systems will respond to a particular action or intervention. Therefore, it is important to test a wide range of possible counterfactual scenarios to inform decision-making.

Given the uncertain and variable potential outcomes, as noted previously, it is recommended for policy and regulation to emphasize mitigation against indirect/consequential impacts, rather than focus on trying to accurately quantify all possible consequential impacts.

Counterfactuals to biomass uses may include:

- Waste/residues which would otherwise decompose or be combusted without energy recovery.
- Alternative non-wood product substitutes are used in competing markets to satisfy market demand, such as more concrete or steel used in construction.

Counterfactuals to land uses may include:

- Forest expansion does/does not occur (e.g. where new forest is grown to satisfy market demand).
- Harvest intensification does/does not occur (e.g. where lands are managed more intensively to satisfy market demand).
- Thinning of forest does/does not occur (e.g. where increased thinning occurs to satisfy market demand).
- Increased natural disturbances does/does not occur (e.g. because thinning does/does not occur, making forests more/less susceptible to e.g. wildfire or wind damage).
- Forest biodiversity increases/decreases (e.g. because thinning does/does not occur, increasing plant and animal species biodiversity e.g. more sunlight penetrating the forest canopy).

When sourcing biomass at scale, even within a relatively homogenous landscape, it is likely that a broad combination of these counterfactuals occur simultaneously. It is therefore difficult to choose any one of these counterfactuals as a representative counterfactual for a given biomass source. Instead, it is recommended to consider *a range* of counterfactuals to capture the broad scope of possible landowner behavior and forest product markets in the region. Implementation of appropriate provisions to mitigate counterfactual risk for forest biomass is discussed further in point 5 below.

3. Use of landscape level carbon accounting.

It is important to evaluate land use impacts of forest biomass sourcing at a landscape scale, rather than at an individual forest stand level, for several reasons:

- Landscape-level accounting captures both direct land use change impacts and indirect land use change impacts (leakage) to surrounding forests that might occur as a result of biomass sourcing.
- Landscape-level accounting captures the whole forest system that is supplying biomass over the life of a facility, not just a forest stand that is supplying a particular year of operation.
- Landscape-level accounting captures carbon impacts at a scale relevant to climate change.
- Landscape-level accounting can encourage biomass sourcing that enhances forest productivity and increased forest carbon stocks at scale.

Stand-level analysis is not appropriate for the reverse of all reasons provided above. It also introduces contention around the arbitrary carbon accounting decision of whether planting and growth occurs before harvesting, or whether harvesting occurs before planting and regrowth. This decision has no real impact on forest carbon fluxes but it has a material impact on a project's apparent net carbon impact. Assuming growth occurs first will typically over-estimate climate benefit, whereas assuming harvesting first will underestimate climate benefit.

4. Use of historical baseline data for determining actual impact (direct and indirect) on forest and carbon resources.

Prospective modeling is valuable for guiding decision-making but will always have high levels of associated uncertainty. Therefore, it is important that historical forest inventory data is relied upon in policy and regulation for quantifying the actual impacts that the atmosphere 'sees' following the implementation of an intervention.

To evaluate counterfactual scenarios, it is necessary to compare them to a 'baseline' scenario that is aligned to the purpose of the study. This is normally what would occur in the absence of an action or intervention, such as a policy implementation. Temporal and spatial system boundaries must be appropriately defined to capture the direct and indirect impacts of the intervention. In the case of a new woody biomass power/BECCS project, it should account for the longer growth cycles of forests (as compared to agriculture crops etc).

Baselines also need to appropriately account for any other important drivers of forest management in the region, such as urbanization. Markets have a significant influence on landowner behavior, and thus economic factors such as supply and demand elasticities must be factored in.

It is important to recognize that managed forests are rarely an idealized 'normal' forest with an even-distribution of tree ages and linear carbon stock over time. In reality, carbon stocks rise and fall depending on where the majority of trees are in their growth cycle. This growth pattern is impacted by historic planting rates as well as natural disturbance patterns (fire, storm damage, pests and disease etc) and harvesting trends. An appropriate forest baseline scenario needs to be dynamic to account for forest growth cycles, un-even mix of tree ages and varying growth rates across the landscape.

5. Use of robust sustainability criteria to mitigate leakage.

Indirect GHG emissions (leakage) may occur as a result of biomass sourcing and power generation. Leakage, which is normally market driven, can include indirect land use change (iLUC). For example, forest expansion could displace agriculture production to some other location. Or increased biomass demand in one area could cause a demand 'ripple effect' and lead to increased harvesting elsewhere, outside the sourcing area. These impacts could lead to shifts in land carbon stocks.

However, indirect impacts are difficult to causally associate with a particular project or to quantify with any confidence due to the complexity of forest ecosystems, forest product markets, and other land use systems. For this reason, consequential LCA can be used to put appropriate mitigations in place.

The following are important indicators that biomass sourcing is unlikely to cause negative indirect impacts due to iLUC and product value chain displacement:

- Biomass is not the primary commodity driving land use in the sourcing region.
- Biomass has no alternative local market that achieves higher environmental benefit, considering both carbon storage and product substitution impacts.
- Forests in the region are healthy and managed well within 'sustainable yield management' limits.
- Land carbon stocks in the sourcing region are continuously monitored and are not being depleted.

In a scenario characterized by these low-risk indicators, Drax would recommend the following mitigation actions to address leakage:

- Source from forests with carbon stocks that are stable or increasing, considering a historic time-average trend, using most recently available data.
    - Exceptions are allowed where stocks are decreasing due to natural disturbance and where harvesting is included within a long-term plan designed to reverse a decline in carbon stocks.
- Do not source biomass that diverts from long-lived wood products, such as economic sawtimber-quality wood.

Additional LCA Considerations

Biomass has established renewable energy credentials. In order to support efficient market operations biomass electricity generation should be treated on par with other renewable technologies with respect to incrementality, temporal matching, and deliverability requirements. The IRA supports using an LCA approach, and Drax agrees that this is the best way to create a pathway to validate various electricity resources (as outlined in our comments above). Requiring the same standards across renewable electricity resources allows the clean hydrogen sector to efficiently select the lowest cost energy solution. The LCA can also take into account rate of carbon capture and other attributes.

Drax's experience in biomass power production in the UK shows that policies that encourage generation of electricity from eligible renewable resources through the issuance of certificates can be very effective in both increasing development of new renewables production and setting standards for renewable technologies. The UK Renewables Obligation (RO) scheme issues certificates per MWh of electricity produced using biomass, as long as this biomass meets certain reporting criteria related to sourcing profiling, monthly GHG supply chain emissions, and development of an annual audit report. This reporting is supported through third-party certification schemes, such as SBP, which is outlined in further detail above.

Drax supports the use of EACs that rely upon approved LCA pathways within the GREET model. For biomass power generation, the key considerations for an LCA are outlined above.

Additional Policy Recommendations for Clean Hydrogen Production

Achieving Negative Emissions

Sustainable biogenic resources can be used in the hydrogen production process for zero-carbon production. Taking this one step further by adding carbon capture to biomass gasification would create a net-negative form of hydrogen production. BECCS can also provide dispatchable negative carbon electricity at scale to a hydrogen hub or large hydrogen production project, further creating opportunities for negative emissions. Current policy incentivizes *low- and zero-* carbon hydrogen production, but does not reward those technologies that can result in *negative* carbon.

The clean hydrogen production program should further incentivize those pathways that can create a net-negative form of hydrogen production, such as those using BECCS. This can be achieved through a higher $/kg benefit for hydrogen production with net-negative emissions.

Additionality

There are always risks of delays in permitting and construction, in particular for large-scale, first-of-its-kind projects. Current delays in project development related to interconnectivity, transmission approval, land use, and more make development timelines difficult to predict. The additionality requirement of 3 years prior to hydrogen production is not practical, does not reflect the current realities of new energy production in the US, and is not aligned with regional and state decarbonization plans and timelines. A timeline of 5 years or more would be more appropriate.

Further, the additionality rules prevent use of legacy renewables, such as nuclear and hydro. To enable market efficiencies, mixing of renewable resources should be allowed. This could be achieved by netting each of their carbon intensities, where those technologies have a carbon intensity pathway in the GREET model. BECCS can lower overall carbon intensity of the grid because it can achieve negative emissions. Allowing for a blended energy portfolio of new and legacy resources would support development of both intermittent and non-intermittent renewables, strengthen reliability, and create a more practical approach to securing power generation for a large-scale hydrogen project.

The 45VH2-GREET Model

Lifecycle analysis is key to the success of any clean hydrogen or renewable technology. The GREET model should continue to be used as the gold standard. The model should also be enhanced to define carbon intensities of hydrogen feedstock and include carbon negative pathways for hydrogen production. This would allow Treasury and DOE to support both of our recommendations above: 1) to identify carbon zero and carbon negative energy resources, so appropriate incentives could be applied, and 2) to calculate carbon intensity of a mixture of renewable resources. Utilizing the GREET model will ensure each pathway is robust, while also allowing for maximum efficiency, which will allow US hydrogen producers to remain cost-competitive globally.

Annual reviews of the GREET model pathways do insert uncertainty into potential project development. Updates for grid emissions factors are acceptable, and presumably these factors would continue to decrease over time. However, there is risk that the methodology could be reconsidered, which has potential to change the parameters after significant investments have already been made. To reduce this risk, Drax suggests that the *methodology* in the GREET model pathway that prevails at beginning of construction be the *methodology* that remains over the 10-year tax credit claiming period.

Thank you for your consideration of these comments. Please contact us for further questions or discussion: Jessica Marcus, VP Public Affairs North America – jessica.marcus@drax.com.