

Response to Supplementary Evidence from Drax Group plc (published 6 Jan. 2022)

21 January 2022

The following is submitted in response to supplementary evidence published by Drax Group plc as part of the Environmental Audit Committee's inquiry into Negative Emissions Technologies. The below is supported by the undersigned organisations.

Crucially, we reassert that BECCS¹ may not deliver negative emissions at all and in some cases, especially the use of wood harvested from forests, may result in a net increase in atmospheric carbon for years or decades.² The claim that BECCS is “carbon negative” is based on the erroneous notion that bioenergy on its own is “carbon neutral.” The IPCC itself has stated that it is inaccurate to “automatically consider or assume biomass used for energy [is] ‘carbon neutral,’ even in cases where the biomass is thought to be produced sustainably.”³ Over 500 scientists have written to world leaders warning that bioenergy is making climate change worse,⁴ while studies have also found that in some cases BECCS will increase emissions, not reduce them.⁵ The letter to world leaders from scientists said that “numerous studies have shown, [that] burning of wood will increase warming for decades to centuries. That is true even when the wood replaces coal, oil or natural gas.”⁶

1. Rationale for Drax no Longer Being a Member of S&P Global Clean Energy Index

We submit that Drax was removed from the S&P Global Clean Energy Index due to “doubts over the sustainability of the company’s wood-burning power,” as reported by *The Guardian* newspaper,⁷ despite the company’s claim that it was due to legacy thermal generation (gas and coal). Indeed, the move by Standard and Poors came shortly after a decision by financial services firm Jeffries to inform its clients that bioenergy is “unlikely to make a positive contribution” to

¹ For purposes of this submission we use “BECCS” to refer to carbon capture from biomass combustion.

² Mathilde Fajardy & Niall Mac Dowell, *Can BECCS Deliver Sustainable and Resource Efficient Negative Emissions?*, *Energy & Environmental Science* 10: 1389-1426 (Apr. 2017), <https://pubs.rsc.org/en/content/articlelanding/2017/ee/c7ee00465f>.

³ Intergovernmental Panel on Climate Change, *Task Force on National Greenhouse Gas Inventories: Frequently Asked Questions* (accessed Sept. 23, 2021), <https://www.ipcc-nggip.iges.or.jp/faq/faq.html>.

⁴ Letter Regarding Use of Forests for Bioenergy (Feb. 11, 2021), <https://www.dropbox.com/s/hdmmcnd0d1d2lq5/Scientist%20Letter%20to%20Biden%2C%20von%20der%20Leyen%2C%20Michel%2C%20Suga%20%26%20Moon%20%20Re.%20Forest%20Biomass%20%28February%2011%2C%202021%29.pdf?dl=0>.

⁵ See *UK: Joint NGO Statement on Biomass for Net Zero* (June 15, 2021), <https://elc-insight.org/uk-joint-ngo-statement-on-biomass-for-net-zero/>.

⁶ Letter Regarding Use of Forests for Bioenergy, *supra* note 4.

⁷ Jillian Ambrose, *Drax Dropped from Index of Green Energy Firms Amid Biomass Doubts*, *The Guardian* (Oct. 19, 2021), <https://www.theguardian.com/business/2021/oct/19/drax-dropped-from-index-of-green-energy-firms-amid-biomass-doubts>.

tackling climate change.⁸ Moreover, Citi also downgraded Drax's stock due to concerns over bioenergy: "While sentiment could continue to support *what's perceived* as a green growth stock . . . we do not fundamentally see biomass as a sustainable source of energy."⁹

2. Efficiency of Drax Power Station with and without BECCS:

Low current efficiency due to this being an electricity-only power plant:

Based on figures published in Drax's 2020 Annual Report, Drax's biomass units have a net efficiency of around 39%. We can find no example worldwide of any other electricity-only power station combusting wood that has ever achieved a higher efficiency.¹⁰ We therefore believe that there is little or no margin for efficiency improvement left in the absence of heat pipes and a significant customer (not a realistic option given Drax's location).

This means that even without BECCS, all of the energy contained in >6 out of 10 of trees from which pellets are sourced are being wasted entirely as uncaptured heat.¹¹

No real-world evidence about the prospective efficiency of running Drax's biomass units with carbon capture:

A written response from Drax in December 2021¹² confirms that their very small carbon capture trial of the Mitsubishi Heavy Industries ("MHI") amine solvent now chosen for their proposed BECCS project was not designed to establish the amount of energy required for capturing a given amount of CO₂. It was only designed to provide data "*on the interaction of the carbon capture solvent with Drax flue gas.*" Furthermore, Drax admitted in their responses that "*a pilot plant is not representative of a large-scale process.*" Drax, in the same answer, referred to commercially confidential data from the vendor, i.e. Mitsubishi Heavy Industries. The solvent chosen (KS-21™) has never yet been used in a commercial-scale carbon capture facility of any type. Results from tests in a pilot natural gas plant in Japan, suggest its efficiency is comparable to that of a previous MHI amine solvent that was used to capture carbon from the Petra Nova coal power station in Texas. That coal-CCS unit was closed in 2020. According to a report by the

⁸ *Id.*

⁹ Michele Maatouk, *Citi Downgrades Drax on Less Attractive Risk/Reward*, ShareCast News (Dec. 2, 2021), <https://www.sharecast.com/news/broker-recommendations/citi-downgrades-drax-on-less-attractive-riskreward--8748996.html> (emphasis added).

¹⁰ In theory, a super-critical or ultra super-critical coal power station converted to biomass might achieve slightly higher efficiencies, however, this is not relevant to Drax, who operate a subcritical power plant.

¹¹ Biofuelwatch & Friends of the Earth Scotland Briefing, *BioEnergy with Carbon Capture and Storage (BECCS): A Dangerous Distraction from Meaningful Climate Action* (June 2020), <https://foe.scot/wp-content/uploads/2020/07/BECCS-Briefing-from-Biofuelwatch-and-Friends-of-the-Earth-Scotland.pdf>.

¹² Biofuelwatch, *Drax Admits Lack of Data About its Own BECCS Proposal: Written Responses from Drax Consultation Team* (Dec. 2021), biofuelwatch.org.uk/2021/drax-beccs-response-november/.

Institute for Energy Economics and Financial Analysis (IEEFA),¹³ there were “serious questions about the performance at Petra Nova” and a “serious lack of transparency surrounding the plant and its operations.” The plant fell significantly short of the developers’ carbon capture goals, but neither the reasons for those shortfalls nor the cost of carbon capture have been disclosed. Nor, it appears, has the figure for the energy penalty been disclosed.

Drax’s proposed BECCS project would be a first-of-its kind worldwide, so there are no comparable BECCS plants from which to derive a likely energy penalty figure.

No credible basis for Drax’s suggestion that their energy penalty could be as low as 11%:

We can find no basis in peer-reviewed literature for Drax’s suggestion that an energy penalty as low as 11% could be feasible.

The authors of a 2016 peer-reviewed article¹⁴ suggest that the lowest theoretically achievable energy penalty for post-combustion carbon capture from coal combustion is around 18% (Table 3). There is no evidence that this has ever been achieved in practice. Moreover, the authors of a 2020 review article published in *Frontiers in Energy Research*¹⁵ cite from literature (focusing on post-combustion carbon capture) to state: “*Aqueous amine scrubbing is the benchmark carbon capture technology currently commercially available in industry. . . . It is predicted that the required parasitic loads or the so-called energy penalty for CO₂ removal is around 0.2–0.5 MWh/ton-CO₂, which is equivalent to 20–30% of power plant output.*”

Conclusion regarding energy efficiency:

As an electricity-only power station, Drax is highly unlikely to increase its power station’s efficiency beyond the ~39% achieved at present, without carbon capture. With carbon capture, efficiency would be significantly reduced. For post-combustion carbon capture from coal combustion, the energy penalty is between 20 and 30%, however, there is no real-world data about the energy penalty from capturing carbon from a biomass plant such as Drax’s.

3. If BECCS is to Capture Meaningful Amounts of Carbon it Will Require Unsustainable Amounts of Land

¹³ Hiroshi Tanaka et al., *Advanced KM CDR Process Using New Solvent* (Rev. Oct. 27, 2020), papers.ssrn.com/sol3/papers.cfm?abstract_id=3366174.

¹⁴ Suraj Vasudevan et al., *Energy Penalty Estimates for CO₂ Capture: Comparison Between Fuel Types and Capture-combustion Modes*, 103 *Energy* 709-714 (May 2016), <https://www.sciencedirect.com/science/article/abs/pii/S036054421630216X>.

¹⁵ Xiaoxing Wang & Chunshan Son, *Carbon Capture From Flue Gas and the Atmosphere: A Perspective*, *Frontiers in Energy Research* (Dec. 15, 2020), [frontiersin.org/articles/10.3389/fenrg.2020.560849/full#h1](https://www.frontiersin.org/articles/10.3389/fenrg.2020.560849/full#h1).

What matters more than the precise numbers cited by Dr Quiggin is the fundamental trade-off (acknowledged by Drax in this Supplementary Evidence) between power station efficiency and some of this being diverted into capturing emissions. Any BECCS plant has to, in effect, make a trade-off between power efficiency or capture efficiency, but cannot achieve both.¹⁶

When wood from forests is used for BECCS a significant proportion of biomass emissions occur away from the power station—the lost absorption of felled trees in a forest, the processing and transport of wood pellets. BECCS plants do not represent a good investment of energy nor of public subsidy. These uncaptured emissions are around 80% of those that are released and then captured at the power plant. They will not deliver the negative emissions that companies such as Drax promise.

The greater the ambition to capture emissions, the larger the quantity of feedstock that would be required. The Climate Change Committee estimates that UK energy crops may need to cover up to 6% of all the UK's land in order to supply BECCS. Moreover, BECCS deployment carries major risks to land use, social justice, food security, biodiversity, and water resources.

4. The Forests Drax Sources Wood from are Declining in Acreage and Health

The state of the forests in the United States—and especially in the U.S. Southeast, where Drax obtains most of its feedstock—is not nearly as positive as Drax portrays. Instead, natural forests are declining in both acreage and forest health. This has serious negative impacts for nature and the climate.

Forest acreage has grown less than 2% in the last 64 years, and acres of “forest” in the U.S. South are increasingly likely to be pine plantations, not natural forests.¹⁷ The forest products industry celebrates this growth as a “victory” because it values profits and standing tree farms. If those forests had grown at the same rate that they had grown between 1953-1964, the first recording period, there would be 25 million more acres of forests in the U.S. South than there are currently.

This finding is also supported by a new report by researchers at Clark University, commissioned by the Southern Environmental Law Center, which concludes that Enviva's pellet mills in North Carolina and Virginia (which supply pellets to Drax) are likely contributing to an overall decline

¹⁶ Dan Quiggin, Chatham House, *BECCS Deployment: The Risks of Policies Forging Ahead of the Evidence* (Oct. 2021), <https://www.chathamhouse.org/sites/default/files/2021-09/2021-10-01-beccs-deployment-quiggin.pdf>.

¹⁷ Oswald SN, et al., U.S. Dep't of Agriculture, *Forest Resources of the United States, 2017* (2019), https://www.fs.fed.us/research/publications/gtr/gtr_wo97.pdf; Duden AS, et al., *Impact of Increased Wood Pellet Demand on Biodiversity in the South-eastern United States*, *GCB Bioenergy*, 10: 841–860 (2018), <https://onlinelibrary.wiley.com/doi/full/10.1111/gcbb.12554>.

in carbon stocks in the area's hardwood forests.¹⁸ The report utilized the best-available satellite image data to map the harvesting of forests over time in the sourcing region of Enviva's three pellet mills in northeastern North Carolina and southeastern Virginia—which are located in Ahoskie, North Carolina; Northampton, North Carolina; and Southampton, Virginia, and started operating in 2011, 2012, and 2013, respectively. Researchers analyzed satellite images of forests in the sourcing area of these pellet mills (roughly 100 km radius) to evaluate forest loss (i.e., harvesting or clearing) over time and by forest type.

The main results of this analysis reached by the expert researchers are as follows:

- Harvesting of hardwood forests in the sourcing area of Enviva's three pellet mills, which have relied primarily on hardwood feedstocks, increased after those pellet mills started operating. In fact, harvesting of the area's hardwood forests not only returned to the harvesting rates experienced prior to the 2008-2010 recession, but they actually exceeded those levels by 2016.
- From 2011-2016, in the years immediately after Enviva's pellet mills started operating hardwood forest harvests actually exceeded growth, resulting in a net loss of hardwood forest cover in the area around Enviva's pellet mills.
- From 2016-2018, Enviva's three pellet mills consumed nearly half (41-47%) of all wood from hardwood forest clearings in the relevant sourcing area.

This new evidence, together with years of on-the-ground photographic evidence directly contradicts and otherwise highlights the deceptive nature of many of the industry's main arguments. The wood pellet/biomass industry often attempts to mask its impact on forests by focusing on national or regional trends in forest growth. This satellite image analysis instead highlights the localized impacts in the forests actually being sourced for wood pellet mills, demonstrating the true impacts of the industry.

Moreover, the findings from this analysis and the relationship between forest harvesting levels and wood pellet demand is further supported by the U.S. Forest Service's Timber Product Outputs ("TPO") data, which is compiled as part of the Forest Service's Forest Inventory and Analysis ("FIA") program.¹⁹ An internal analysis of the TPO data, conducted by geospatial

¹⁸ Dr. Christopher A. Williams, *Forest Clearing Rates in the Sourcing Region for Enviva Pellet Mills in Virginia and North Carolina, U.S.A.* (Dec. 7, 2021), <https://southernenvironment.sharefile.com/home/myfile>.

¹⁹ The TPO data can be downloaded from the U.S. Forest Service's website at <https://usfs-public.app.box.com/s/y4ziirdb9v7zardus0cuajh7ziy9b2id>. Any analysis of this data, along with the results of the satellite image report, are being compiled into a report by the Southern Environmental Law Center. The Southern Environmental Law Center would be happy to provide a copy of this report to the Environmental Audit Committee in the coming weeks.

analysts at the Southern Environmental Law Center, shows that harvesting for bioenergy/fuelwood (which is primarily wood for pellet mills) in the area around Enviva’s Ahoskie, Northampton, and Southampton mills increased from just over 500,000 green tons (U.S. short tons) in 2011, when the Ahoskie facility was just coming online, to 4.8 million green tons in 2019. Similarly, harvesting for bioenergy/fuelwood in the area around Enviva’s pellet mill in Sampson, North Carolina—which opened in 2016 in the southeastern part of the state—increased from 155,000 green tons in 2011 to 1.8 million green tons in 2019, with a marked increase after the Sampson mill started operating. Finally, the TPO data demonstrates that approximately 84% of hardwood harvesting for bioenergy/fuelwood in the area around the three Enviva mills comes from larger diameter whole trees that qualify as sawtimber. Given the share of this material going to Enviva’s Ahoskie, Northampton, and Southampton mills, this data slams the door firmly shut on industry claims that pellet mills rely predominantly on wastes, residues, and low-value roundwood that has no other use. Sawtimber trees are defined by the U.S. Forest Service as live trees with a diameter outside of bark of at least 11 inches for hardwood and larger than poletimber trees.²⁰

The use of whole trees to make wood pellets in Drax’s supply chain has been well documented by on-the-ground investigations dating back as far as 2013.²¹ Use of whole trees from a mature was demonstrated once again in February 2020. The following images show a clearcut harvest of a mature natural forests in eastern North Carolina, located close to the Moccasin Creek in the Tar-Pamlico River basin. Hardwood trees from this harvest site were traced back to Enviva’s pellet mill in Northampton, North Carolina.

Photo credits: Dogwood Alliance, February 2020.

²⁰ U.S. Forest Service, Forest Inventory and Analysis Glossary, <https://www.nrs.fs.fed.us/fia/data-tools/state-reports/glossary/>.

²¹ See, e.g., Dogwood Alliance, NRDC, Southern Environmental Law Center, *Global Marks for Biomass Energy are Devastating U.S. Forests* (2019), <https://www.nrdc.org/sites/default/files/global-markets-biomass-energy-06172019.pdf>.



At the same time acreage of natural forests has stagnated, other measures of forest health have also declined. In the last sixty years, there have been increases in natural forest replacement with plantations, increases in exotic pests,²² decreases in biodiversity,²³ and sharply increased forest fragmentation.²⁴ All of these measures point to declines in forest health. In some cases, forest health declines are directly due to the impacts of increased extraction from Southern forests. The U.S. Fish & Wildlife Service acknowledged in their last “Status & Trends” report that silviculture was the dominant cause of forested wetland loss in the United States, also accounting for over half of all wetland losses from 2004 to 2009.²⁵ Another study found that around half of tree cover loss in North America was driven by forestry activities, and that particular tree cover loss was predominantly in the United States.²⁶

In conclusion, the reduction in forest health and acreage means they are no longer acting as carbon sinks to the same extent they were and that their value for biodiversity is severely compromised.

5. The Cost of BECCS Could be High and is Uncertain

The cost of BECCS is highly uncertain and likely to be very high. The cost of capturing one tonne of carbon using BECCS could be up to twelve times higher than that of a healthy peatland, for example and far higher per MWh than the cost of new nuclear power.

Alongside its Net Zero Strategy the UK Government released an analysis of the investable commercial frameworks for BECCS power. If BECCS were to be supported by a conventional Contract for Difference for electricity then the Government analysis shows that this would need to be at £179/MWh (far higher than the figures Drax cite in their Supplementary Evidence).

The Government says that securing a Final Investment Decision for First Of A Kind BECCS may be challenging given uncertainty over revenue and the internal rate of return. While

²² David Pimentel et al., *Update on the Environmental and Economic Costs Associated with Alien-invasive Species in the United States*, 52 *Ecological Economics* 273–288 (2005), <https://www.sciencedirect.com/science/article/abs/pii/S0921800904003027>.

²³ Kyle Eyvindson et al., *Mitigating Forest Biodiversity and Ecosystem Service Losses in the Era of Bio-based Economy*, 92 *Forest Policy Economics* 92: 119–127 (2018), <https://www.sciencedirect.com/science/article/abs/pii/S1389934117303210>.

²⁴ Gerald E. Heilman et al., *Forest Fragmentation of the Conterminous United States: Assessing Forest Intactness through Road Density and Spatial Characteristics*, 52 *Bioscience* 411–422 (2002), <http://bioscience.oxfordjournals.org/content/52/5/411.extract>.

²⁵ U.S. Fish & Wildlife Service, *Status and Trends of Wetlands in the Conterminous United States 2004 to 2009* (2011), <https://www.fws.gov/wetlands/documents/status-and-trends-of-wetlands-in-the-conterminous-united-states-2004-to-2009.pdf>.

²⁶ PG Curtis PG, et al., *Classifying Drivers of Global Forest Loss*, 361 *Science* 1108–1111 (2018), <https://www.science.org/doi/10.1126/science.aau3445>.

retrofitting CCS to an existing plant or industrial facility may reduce the cost, there nonetheless remains significant uncertainty over the cost and financial feasibility of this technology.

The single biggest factor affecting the operating costs of BECCS plants (according to the same UK Government analysis) will be the cost of wood pellets. Separate analysis by the Climate Change Committee finds that the price of wood pellets could increase by up to 500% by 2050, and that pressures on land use may also apply upward cost pressures on operators.

Analysis by Ember finds that a BECCS unit at Drax could require £31 billion in subsidy over a 25-year lifetime,²⁷ while Drax estimates it would capture 8 million tonnes of carbon dioxide every year. This means a cost per tonne of CO₂ captured of £155, twelve times as expensive as the carbon capture achieved by healthy peatlands, for example.

Most importantly, BECCS would represent very poor value for money since it will not deliver the promised negative emissions and will cause significant harm to nature.

6. Former Drax Employee Dr Rebecca Heaton’s Membership on the Climate Change Committee (CCC) Constitutes a Conflict of Interest

Former Drax employee Dr. Rebecca Heaton’s membership on the Climate Change Committee (CCC), did constitute a conflict of interest, despite Drax’s claims to the contrary.

While the CCC’s rules required Dr. Heaton to recuse herself from any conversations regarding biomass—and Drax and CCC chief executive Chris Stark claims that she did so—the opposite is true. Instead, while Dr. Heaton excused herself for agenda items specifically entitled “bioenergy,” the CCC’s own minutes show that she was present at meetings which discussed bioenergy as well as the use and development of BECCS without recusing herself whilst also working for Drax Group plc.

Specifically, CCC meeting minutes from September 2018, January 2019, February 2019, June 2019, July 2020, September 2020, and April 2021 show that Dr. Heaton was present for CCC discussions of:

- UK land use policy (which in the CCC’s scenarios and analysis includes bioenergy crops);
- power sector decarbonisation;
- greenhouse gas removals, specifically including bioenergy with carbon capture and storage;

²⁷ Phil MacDonald & Tomos Harrison, Ember, *Understanding the Cost of the Drax BECCS Plant to UK Consumers* (May 2021), <https://ember-climate.org/wp-content/uploads/2021/05/2021-Drax-BECCS-subsidies-1.pdf>.

- fuel use, specifically including biomass;
- overall climate policies in which Drax Group would conceivably have a strong business interest;
- and areas potentially crucial to Drax’s future business operations, including the development of bioenergy policy, the bioenergy review, discussions around the future of the UK power sector, and perhaps most significant for Drax’s future business, CCC meetings on greenhouse gas removal technologies and the development of BECCS.

In some cases, BECCS and bioenergy are specifically mentioned in the minutes as subjects discussed in Dr. Heaton’s presence.²⁸ NRDC obtained screenshots of the CCC minutes in 2017 (no longer available on the CCC website but which we can provide if required). It is extremely concerning that a senior employee of the UK’s largest bioenergy company was present at key CCC discussions about the role the company’s technology would play in the UK’s net zero target and its power sector decarbonisation efforts.

The CCC’s annual report for 2019-2020 shows that the Government Internal Audit Agency (GIAA) audit of the CCC in 2019 found that its then governance and risk management mechanisms only provided “moderate assurance” against conflicts of interest. We understand that the Financial Times requested to see the report of this audit but its request was refused and we would therefore recommend that the Environmental Audit Committee request to see this report which could be of value in determining whether levels of governance were adequate at this time.

* * *

Thank you for the opportunity to submit this additional evidence in response to the supplemental evidence provided by Drax Group on January 6, 2022.

Sincerely,

Biofuelwatch
Dogwood Alliance.
Natural Resources Defense Council
Southern Environmental Law Center
Royal Society for the Protection of Birds

²⁸ UK CCC Meeting Minutes, <https://www.theccc.org.uk/about/transparency/minutes-of-meetings/>.