Key Points

1. BECCS is promoted as a technology that can help meet energy demand and deliver so-called "negative emissions." However, because bioenergy from forest wood is not inherently carbon neutral, BECCS is not inherently carbon negative.
2. UK biomass carbon accounting rules are not aligned with scientific recommendations, which has resulted in millions of tonnes of "missing emissions" and a false sense of progress towards decarbonising the UK power sector.
3. UK biomass supply chains are highly emissive. A large fraction of total emissions occur offsite rather than at the power station and are thus *uncapturable* by the addition of CCS.
4. The leading approach to BECCS in the UK will not deliver negative emissions and in fact risks increasing atmospheric CO_2 concentrations within timeframes relevant for climate action under the Paris Agreement.
5. Government climate plans reliant on this technology should be viewed with skepticism as they risk perverse outcomes for the climate, amongst other environmental priorities.
6. The UK's existing biomass electricity subsidies should be reassessed and, where possible, reinvested in wind and solar, which guarantee real emissions savings at a fraction of the cost.
7. Any programme to subsidise BECCS at Drax Power Station will be ineffective in drawing down emissions and will divert public resources better invested elsewhere. Instead, public money should be spent on protecting and restoring biodiverse ecosystems and carbon sinks; energy saving measures, such as retrofitting homes; and genuinely clean and renewable energy.

Introduction

The following response is submitted on behalf of NRDC (Natural Resources Defense Council), the Southern Environmental Law Center (SELC), Dogwood Alliance, Biofuelwatch, and Stand.earth.

Our response summarises several recent reports on the climate impacts of large scale forest biomass burning for energy: the predominant type of biomass used in UK supply chains and globally today. They conclude that the leading approach to bioenergy in the UK is not carbon neutral; thus bioenergy with carbon capture and storage (BECCS) will not be carbon negative and, perversely, risks exacerbating climate change. This new evidence adds to years of established science highlighting the harmful impacts of forest bioenergy.[1]

Our comments here are specific to BECCS for three reasons. First, BECCS is virtually the only technological CO_2 removal option explicitly included in the Intergovernmental Panel on Climate Change's (IPCC) 2018 models.[2] While the IPCC packaged a variety of solutions into four modeled scenarios, each meant to *illustrate* a different pathway for staying below 1.5 degrees, the biomass industry has seized upon the report to claim, erroneously, that the IPCC is *recommending* large scale reliance on BECCS to meet global climate goals. Second, BECCS is a particularly hot topic in the UK,

[1] Searchable library of resources on (wood) biomass for heat and power: https://www.biofuelwatch.org.uk/2015/biomass-resources/

[2] The integrated assessment models used in the IPCC's most recent pathways report relied almost exclusively on afforestation, reforestation, and BECCS. (See Chapter 2.3.4.) Only 2 of the 21 IAMs also explicitly modeled direct air capture of C02. (See Table 2.SM.6.) The report notes that while other forms of CO_2 removal have been added to IAMs since the AR5, BECCS is still heavily favored by the models despite BECCS being deployed beyond the world's capacity and other options offering a range of co-benefits. Intergovernmental Panel on Climate Change, Global Warming of 1.5 °C, Chapter 2, October 2018, https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_Chapter2_Low_Res.pdf and https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_Chapter2_SM_High_Res.pdf.

with Government officials embracing it as key to net zero plans,[3] prejudging the results of critical inquiries on its effectiveness. Third, the Government is being lobbied to grant potentially tens of billions in additional financial support to the UK biomass industry to deploy BECCS.

We focus on the climate impacts of BECCS because the technology could receive Government support under energy and/or climate policy frameworks.[4] However, BECCS deployment carries major risks to land use, social justice, food security, biodiversity, and water resources. We draw your attention to prior and significant concerns raised by a large number of UK environmental groups,[5,6] as well as scientists and economists.[7] These joint statements highlight that biomass and BECCS makes climate change worse over Paris Agreement-relevant timescales; diverts public investment to a false climate solution; and should not be subsidised.

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Bioenergy is promoted as "carbon neutral" and BECCS as "carbon negative," but evidence shows neither is true.

The UK today is heavily reliant on bioenergy, which is its single biggest source of renewable energy.[8] The Government's policy of maintaining billions of pounds in existing subsidies to keep large biomass power stations operating until at least 2027 appears driven in part by the desire for them to remain operational so they are an option in the period 2030-2050 as a negative emissions technology.

The basic premise of BECCS is that adding CCS to UK biomass plants will create a "carbon negative" power station (i.e., resulting in a net removal of CO_2 from the atmosphere). "Carbon negative" power generation would both help to meet energy demand and to offset emissions from hard-to-decarbonise sectors, helping to deliver the Government's commitment to reaching net zero economy-wide emissions by 2050.

The claim that BECCS is "carbon negative" is based on the erroneous notion that bioenergy on its own is "carbon neutral." Scientists are clear that this simplistic picture of bioenergy and BECCS is flawed. In particular, bioenergy generated from forest biomass is rarely, if ever, "carbon neutral." **According to the IPCC, it is inaccurate to "automatically consider or assume biomass used for**

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[3] Daisy Dunne, "Boris Johnson to laud green credentials of firm that runs 'UK's largest carbon emitter,' Independent, 18 October 2021, https://www.independent.co.uk/climate-change/news/boris-johnson-drax-power-plant-b1939189.html; Clean Growth Minister Kwasi Kwarteng visits the C-Capture pilot project at Drax Power Station, February 2020, https://www.c-capture.co.uk/clean-growth-minister-kwasi-kwarteng-visits-the-c-capture-pilot-project-at-drax-power-station/; HM Government, Net Zero Strategy: Build Back Greener, October 2021, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1028157/net-zero-strategy.pdf

[4] "Investable commercial frameworks for Power BECCS," June 2021, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1026637/investable-commercial-framework-power-beccs.pdf

[5] UK Joint NGO Statement on Biomass for Net Zero, June 15, 2021, https://elc-insight.org/forest-bioenergy/ngos/

[6] UK: Joint NGO Statement on BECCS, March 23, 2021, https://elc-insight.org/forest-bioenergy/uk-ngos-beccs/

[7] A Statement by Scientists and Economists on BECCS from Forest Biomass, February 26, 2021, https://www.cutcarbonnotforests.org/wp-content/uploads/2021/04/scientist-statement-beccs-for-submission-ggr-call-for-evidence-20210226.pdf

[8] Office of National Statistics, "A burning issue: biomass is the biggest source of renewable energy consumed in the UK," 30 August 2019, https://www.ons.gov.uk/economy/environmentalaccounts/articles/aburningissuebiomassisthebiggestsourceofrenewableenergyconsumedintheuk/2019-08-30

energy [is] 'carbon neutral,' even in cases where the biomass is thought to be produced sustainably."[9] Since bioenergy is not inherently "carbon neutral," BECCS is not inherently "carbon negative."[10]

The vast majority of biomass feedstock burned for electricity in the UK is woody material. While some of it is in the form of sawmill residues, much is in the form of whole trees harvested from forests.

In 2020 Drax sourced over 7 million tonnes of wood pellets from overseas. Most came from the U.S., where an area of woodland roughly the size of the New Forest (just over 50,000 hectares) was harvested to supply just a portion of this demand. (It is worth noting that 50,000 hectares is the top end of the Climate Change Committee's recommended level of annual domestic woodland creation in the UK, meaning one would simply be offsetting the other rather than creating any additional climate or biodiversity benefit).[11] Drax also imported wood pellets from Canada, Estonia, Latvia, Portugal, Brazil, Russia and Belarus. According to Drax's 2020 investor report, over half of its imported pellets were made from whole standing trees harvested directly from forests.[12]

Per unit of electricity, all biomass power plants emit at least as much CO_2 from their stacks as coal plants do, whether they burn biomass in the form of whole trees or harvest residues. However, UK rules require accounting only for peripheral emissions associated with the biomass supply chain; they do not require accounting for emissions at the smokestack, treating the fuel itself as 'zero-carbon' at the point of combustion. While Drax reports emitting over 13 million tonnes of CO_2 into the atmosphere from combusting biomass in 2020, it states in a footnote that these emissions are counted as zero in official reporting to UK authorities.[13] **In turn, the UK Government is permitted to count these emissions as zero when compiling national emissions accounts to meet legally binding carbon targets and the targets it has signed up to under the UN.**

Multiple studies released in Q3 of 2021 warn that treating biomass from forests as a 'zero-carbon' fuel risks undermining the Paris Agreement. The first, a new analysis from NRDC, disaggregates and quantifies all sources of lifecycle emissions in a BECCS scenario representative of the most common supply chain for UK biomass electricity: pellets made of wood from pine plantations in the southeastern U.S.[14] These emissions sources include drying the wood and processing the pellets; transporting the wood supply and finished pellets; and the foregone sequestration in the forest after logging. Adding CCS to a power plant also requires additional energy to install and operate -- and ultimately no CCS technology captures all of the CO_2 at the smokestack. The analysis also accounts for these emissions.

The results reveal that a large fraction of the lifecycle CO_2 emissions occur offsite—away from the biomass plant—and are thus uncapturable by the addition of CCS. These offsite and uncapturable

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[9] Intergovernmental Panel on Climate Change, "Task Force on National Greenhouse Gas Inventories: Frequently Asked Questions" (Q2–10, accessed September 23, 2021, https://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf.
[10] "500+ scientists tell EU to end tree burning for energy, 11 February 2021, https://www.wwf.eu/?uNewsID=2128466
[11] Climate Change Committee, 2020, "Land Use: Policies for a Net Zero UK," https://www.theccc.org.uk/publication/land-use-policies-for-a-net-zero-uk/
[12] Drax Group plc Annual report and accounts 2020, see table titled, Drax Power Station biomass pellet feedstock sources in 2020, pg. 54. https://www.drax.com/wp-content/uploads/2021/03/Drax_AR2020.pdf
[13] Drax Group plc Annual report and accounts 2020, https://www.drax.com/wp-content/uploads/2021/03/Drax_AR2020.pdf
[14] NRDC Issue Brief, "A Bad Biomass Bet; Why The Leading Approach To Biomass Energy With Carbon Capture And Storage Isn't Carbon Negative," October 21, 2021, https://www.nrdc.org/sites/default/files/bad-biomass-bet-beccs-ib.pdf

emissions equal approximately 60% of the stack emissions at the plant. **Far from being carbon negative, the analysis indicates that the emissions from BECCS, while relying on biomass supply chains typical of UK biopower today, would be higher than the current average grid intensity of UK electricity, and almost equivalent to those of a coal power station**, even after accounting for subsequent forest regrowth and on-site carbon capture at the power plant.

Importantly, the report highlights the common fallacy when talking about large scale energy generation using forest biomass: that because the trees absorbed their carbon from the atmosphere and can be replanted and grow back, over a long enough period of time cutting and burning forests won't change the balance of carbon stored on the land versus in the atmosphere. However, even if this were true, simply maintaining the current amount of sequestered carbon in the world's forests is not enough to avert the worst impacts of climate change. All pathways identified by the IPCC to address the climate crisis involve not just maintaining but enhancing forest carbon sinks. Meanwhile, the model used in the NRDC report shows that bioenergy does not even maintain carbon sequestration levels; cutting and burning forests in the southeastern U.S. leads to a net shift of carbon from the land to the air that lasts for decades, far beyond the point when the world needs to have brought emissions to zero.

It may be possible to transition to domestic sources of biomass, as suggested by the UK Climate Change Committee's Sixth Carbon Budget.[15] However, under the CCC's plans meeting biomass demand for BECCS would require converting up to 700,000 hectares of UK land (more than four times the size of Greater London, or 3% of all the UK's land) to grow energy crops, *in addition to imports*. Reducing the land available for food production risks either greater intensification of agriculture or a reduction in food security. It is also important to remember that the science on biomass carbon impacts, whether biomass from forests or energy crops, applies equally to feedstocks sourced from all regions, including the UK.

Regardless, under all scenarios, the CCC still assumes heavy reliance on imported biomass. Additionally, there is no real-world evidence that the UK is moving away from reliance on wood pellet biomass imports. On the contrary, there is significant evidence that Drax is locking in its import-based supply chains. The company recently purchased Pinnacle Renewable Energy in Canada, the second-largest producer of industrial wood pellets in the world, and now owns or has interests in 17 other pellet plants and development projects across North America.[16]

Another report from Chatham House and the Woodwell Climate Research Center examines emissions from the consumption of U.S.-sourced biomass in the EU and UK under three headings: emissions from pellet combustion; emissions from energy use in the supply chain; and foregone removals of CO_2 from the atmosphere by trees, and emissions from the decay of roots and unused logging residues. Across these categories, the analysis shows that emissions from burning U.S. wood pellets in power stations in the EU28 increased from 9–11 million tonnes of CO_2 in 2014 to 16–19 million tonnes in 2019. **Most of this was accounted for by the UK, where emissions increased from 7–8 million tonnes of CO_2 in 2014 to 13–16 million tonnes in 2019, making it less likely that the UK**

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[15] Committee on Climate Change, "Sixth Carbon Budget," 9 December 2020, https://www.theccc.org.uk/publication/sixth-carbon-budget/

[16] "Drax Completes Acquisition of Pinnacle Renewable Energy Inc," GlobeNewswire, April 13, 2021, https://www.globenewswire.com/news-release/2021/04/13/2209296/0/en/Drax-Completes-Acquisition-of-Pinnacle-Renewable-Energy-Inc.html; "Drax Begins Construction of the First of Three New Pellet Plants in Arkansas," Lesprom, May 7, 2021, https://www.lesprom.com/en/news/Drax_begins_construction_the_first_of_three_new_pellet_plants_in_Arkansas_98713/

will achieve its climate targets. Almost all of this increase in UK emissions was associated with biomass burnt at Drax.[17]

This echoes the findings of an earlier analysis by climate think tank Ember, which found that, when accurately accounting for all emissions, Drax is the UK's largest single source of CO_2 emissions, and beginning in 2019, carbon emissions from burning biomass in the UK electricity sector exceeded those from coal and were second only to emissions from burning fossil gas.[18]

Alarmingly, both Ember and Chatham House/Woodwell underscore that almost all of these emissions are not included in the UK's national GHG inventory. If they were, this would have added between 22 and 27% to the emissions from total UK electricity generation, or up to 3.6% of total UK GHG emissions in 2019 – equivalent to the annual emissions of 6-7 million passenger vehicles missing from the UK's balance sheet. If these emissions weren't ignored due to loopholes in biomass accounting rules, the UK would be even further off course for meeting its carbon budgets than it already is.

According to Chatham House/Woodwell, the driver of these missing emissions is the treatment of biomass as 'zero-carbon' in policy frameworks, which has led the UK and other governments to provide enormous subsidies and regulatory support to biomass electricity producers. Since emissions take time to be reabsorbed by forest growth, burning forest biomass from the U.S. increases CO_2 emissions in the atmosphere for decades or even centuries, and any eventual emissions savings (if and when trees are replaced) are likely to come well outside of timeframes relevant to climate action under the Paris Agreement. **The authors warn that classifying biomass as 'zero carbon' in the country where it is combusted for energy gives policymakers false confidence about emissions cuts being achieved, and underscore that UK sustainability criteria do not take account of the real impacts of different biomass feedstocks on the climate and thus cannot limit the impact of bioenergy on the climate.**

Per the analysis, by 2025 biomass emissions in the UK are expected to rise due to increased use, constituting roughly 5% of the GHG emissions target in the UK's fourth carbon budget, making it more difficult to hit climate targets. This is a key finding as failing to achieve earlier carbon budget targets will increase the cost and difficulty of cutting emissions later for other sectors of the economy. Perversely, this risks ever-greater Government reliance on unproven technologies like BECCS to deliver on climate commitments.

Finally, the authors warn that while biomass emissions are likely to fall by 2030, with the end of government subsidies for power stations converted from coal to biomass, they could rise again thereafter if BECCS plants are developed at scale. The authors echo skepticism about a transition to domestic biomass sourcing, stating that, "Each of the scenarios developed by the UK's Climate Change Committee to illustrate how the UK could meet its net zero emissions target by 2050 rely on BECCS to a greater or lesser extent, and in most cases rely on imports, even if ambitious targets for the expansion of UK forestry and energy crops are achieved." They also echo warnings from the CCC itself in its 2018 report, *"Biomass in a low carbon economy,"* which noted critical gaps in UK biomass rules and stated that these gaps must be addressed to avoid the risk of bioenergy resulting in worse

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[17] Duncan Brack, Richard Birdsey, and Wayne Walker, " Greenhouse gas emissions from burning US-sourced woody biomass in the EU and UK," Chatham House, October 2021, https://www.chathamhouse.org/sites/default/files/2021-10/2021-10-14-woody-biomass-us-eu-uk-research-paper_0.pdf

[18] Ember, "UK biomass emits more CO2 than coal," October 8, 2021, https://ember-climate.org/commentary/2021/10/08/uk-biomass-emits-more-co2-than-coal/

outcomes for the climate than fossil fuel use.[19] To date, these reforms have not been adopted and we have seen no evidence that such a reform effort is underway.

Separately, a second new report from Chatham House warns that policymakers are over-relying on theoretical models that achieve 'net zero' emissions through BECCS, and are turning these directly into policy without an understanding of the type of feedstock, land requirement, efficiency of the BECCS power plants, or capital expenditures required, resulting in a clear risk of policy and market support mechanisms developing ahead of resolving crucial scientific and engineering uncertainties.[20] Indeed, Drax is proposing post-combustion carbon capture, which requires a significant proportion of electricity generated by a power station to be used to capture and compress CO_2. In March 2021, the company admitted that they have no real-world data from any trials to ascertain how high that proportion would be for their power station.[21] No other company has carried out and published any trial data involving carbon capture from a wood-burning plant. What is certain, however, is that BECCS would reduce the net efficiency of biomass plants (already < 40% for Drax), resulting either in more biomass being burned for the same energy output, or in reduced energy output from the same amount of biomass burned without carbon capture.

Further, the second Chatham House report finds, the scale of BECCS envisaged by global and UK models would require orders of magnitude more feedstock than is used for bioenergy today. For example, if supplied solely by wood pellets, global levels of CO_2 removals via BECCS in IPCC modeled scenarios would require a 12,000% increase in biomass fuel compared to what Drax, the UK's largest bioenergy producer, currently combusts. For the UK alone, the CCC's scenarios would require a fourfold increase in biomass fuel.

Drax is currently lobbying the Government to grant it additional subsidies to add CCS technology to its plant. Ember estimates this project will require £31.7 billion in new subsidies.[22] Analysis provided for the Government alongside its Net Zero Strategy[23] finds that the first BECCS plants could need a price of £179/MWh guaranteed by public subsidy. This corroborates the findings by Ember, and is more than triple the price guaranteed to offshore wind. Such large government subsidies should guarantee large climate benefits. Yet, the evidence summarised here indicates the policy would be ineffective at drawing down emissions and, perversely, make climate change worse.

The Government must not rely on speculative and damaging BECCS to deliver on its net zero climate commitment, or approve a new round of subsidies for bioenergy. Industrial scale bioenergy is already in receipt of significant government subsidy. From 2012-2019 Drax alone received over £4 billion in subsidy, with a further £5.8 billion expected until 2027.[24] Meanwhile, new economic analysis shows that continuing to subsidise large scale burning of imported wood pellets destroys significant economic value, particularly when compared against an alternative of generating an equivalent level

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[19] Committee on Climate Change, "Bioenergy in a low carbon economy," November 2018, https://www.theccc.org.uk/wp-content/uploads/2018/11/Biomass-in-a-low-carbon-economy-CCC-2018.pdf

[20] Dr. Daniel Quiggin, "BECCS deployment; The risks of policies forging ahead of the evidence," Chatham House Research Paper, October 2021, https://www.chathamhouse.org/sites/default/files/2021-09/2021-10-01-beccs-deployment-quiggin.pdf

[21] Written response from Drax consultation team, March 15, 2021, https://www.biofuelwatch.org.uk/2021/drax-beccs-response/

[22] Phil MacDonald, Tomos Harrison, Ember, "Understanding the cost of the Drax BECCS plant to UK consumers," May 25th, 2021, https://ember-climate.org/project/cost-drax-beccs-plant/

[23] Investable commercial frameworks for Power BECCS, June 2021, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1026637/investable-commercial-framework-power-beccs.pdf

[24] Ember, "The Burning Question: Should the UK end tax breaks on burning wood for power?," https://ember-climate.org/wp-content/uploads/2020/06/2020-Ember-Burning-question-FINAL.pdf

of additional power from offshore wind or similar technologies. The 2021 study, which used HM Treasury's own 'Green Book' methodology for economic appraisal of policies to evaluate the economic impact of UK biomass electricity subsidies, concluded that, by contrast, were the Government to reinvest this public money in wind and solar projects, it could create between £1.93 Bn and £2.49 Bn of additional economic value and more UK jobs.[25]

Rather than subsidise BECCS, the priority for billions in public resources should be scaling energy saving measures, such as retrofitting homes, and investing in genuinely renewable and non-emitting energy sources, such as wind and solar. Rapid deployment of these solutions at scale will deliver guaranteed emissions reductions and reduce the need for unproven and high-risk technologies like BECCS. The UK Government must also prioritise nature-based climate solutions, which can help to absorb and store carbon from the atmosphere, including protecting and restoring biodiverse ecosystems and carbon sinks in the UK. Analysis by WWF UK and RSPB suggests that in the UK protection and restoration of natural habitats could deliver up to 123MtCO_2e of sequestration by 2030,[26] as well as providing crucial protection from the impacts of climate change.[27]

We call on this Committee to recommend that the Government:

- Prioritise rapid economy-wide emissions reductions, the restoration of natural ecosystems, and the deployment of genuinely renewable and non-emitting energy sources to minimise the role of speculative BECCS technology and the risk of deterring investment in proven mitigation efforts.
- Conduct a full and transparent inquiry into the feasibility and impacts of scaling up BECCS on resource use and the environment, including impacts missed by current UK biomass accounting rules and sustainability criteria.
- Adjust UK energy policy to reflect all biomass emissions and avoid perverse outcomes, including removing the 'zero carbon' rating for biomass energy in the UK Emissions Trading Scheme.
- Avoid any new and costly public subsidies to support industrial scale biomass-burning with CCS until these reforms are in place.
- Redirect existing subsidies to large power stations burning biomass under the Renewables Obligation Certificates scheme to wind, solar and tidal energy.

[25] Trident Economics, "Briefing Note: The Economics of Wood Pellet based Power Generation in the United Kingdom, April 2021, available here: https://tinyurl.com/24t3jd28

[26] RSPB and WWF UK, "The Role of Nature in a UK NDC," https://www.rspb.org.uk/globalassets/downloads/Nature_Based_Solutions_NDC_ReportV2.pdf

[27] RSPB, WWF UK and University of Oxford, "Nature Based Solutions in UK Climate Adaptation Policy, https://community.rspb.org.uk/cfs-file/__key/telligent-evolution-components-attachments/01-248396-00-00-00-79-32-55/Download-the-nature-based-solutions-adaption-report-here.pdf