FOREST LITIGATION COLLABORATIVE

The Case Against Negative Emissions

Forest Litigation Collaborative
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This document lays out the science case for why the treatment of biomass as "low carbon" and BECCS as delivering negative emissions is unfounded.

Contents

A. Biomass and BECCS are climate frauds

1. Biomass and BECCS (biomass energy with carbon capture and storage) are at the core of climate mitigation plans around the globe. New information is rapidly emerging about the risks of CCS,[1] but few are calling out the fact that just as burning forest biomass isn't carbon neutral, BECCS won't deliver the negative emissions if it relies on burning forest biomass (EASAC is a notable exception[2]).
2. Burning wood for energy is the largest source of renewable energy in the UK (Figure 1).[3]
3. But although renewable energy is supposed to reduce CO_2 emissions, burning wood for heat and electricity emits more CO_2 than coal per unit energy, and logging forests for fuel destroys ecosystems and increases climate-warming CO_2 emissions. Research commissioned by the UK government in 2014[4] shows net CO_2 emissions from burning wood can exceed those from fossil fuels for decades, and the EU's 2016 impact assessment on forest biomass[5] concluded that carbon lost from logging for bioenergy might never be restored. In reality, burning forest biomass for renewable energy is undermining our ability to reduce emissions.

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[1] https://www.ciel.org/reports/deep-trouble-the-risks-of-offshore-carbon-capture-and-storage-november-2023/

[2] https://easac.eu/news/details/look-before-you-leap-european-science-academies-caution-against-subsidies-for-bioenergy-with-carbon-capture-and-storage-beccs

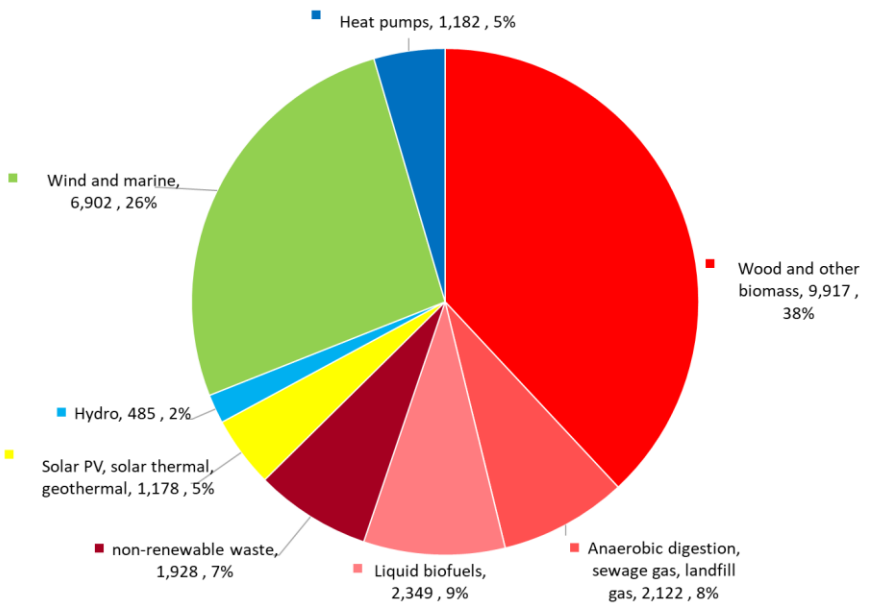
[3] DUKES Table 6.1 at https://www.gov.uk/government/statistics/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes

[4] https://www.gov.uk/government/publications/life-cycle-impacts-of-biomass-electricity-in-2020

[5] https://eur-lex.europa.eu/resource.html?uri=cellar:1bdc63bd-b7e9-11e6-9e3c-01aa75ed71a1.0001.02/DOC_1&format=PDF

4. In the UK, the government has been largely passive in the face of an abundance of evidence submitted to show that Drax, the largest wood-burning power plant in Europe and now a major manufacturer of wood pellets, is increasing CO_2 emissions and destroying forests. The government has received evidence from the U.S.[6] showing that the wood pellet industry is logging wetland hardwood forests in the US Southeast, and a BBC investigation[7] has shown that Drax wood pellet manufacturing operations are using wood from ancient and biodiverse forests in Canada. Such forest destruction is a major driver of climate change.

Figure 1: 2022 UK renewables on energy input basis, kilotonnes oil equivalent



5. Drax's own annual report[8] shows it got more than £3 million pounds per day in publicly funded renewable energy payments in 2022. Now Drax claims[9] it's going to use carbon capture and storage with biomass to deliver "negative emissions" that will cost billions in public funding – and still policymakers seem credulous.

6. This is reflected in UK's long-awaited Biomass Strategy,[10] published in August 2023, which signals that not only does the government intend to continue supporting biomass as providing "low carbon" energy, but they are doubling down by promoting biomass energy with carbon capture and storage – BECCS – for removing CO_2 from the atmosphere (often referred to as "negative emissions.").

7. In the EU, policymakers are similarly taking a big gamble on BECCS for climate mitigation. In addition to the Carbon Removals Legislation, which is laying the groundwork for more BECCS projects, modelling shows[11] the EU climate plan is counting on BECCS delivering 250 million tonnes of CO_2 removals *per year* by 2050. As discussed further below (section I), the EU is already funnelling hundreds of millions of euros into BECCS projects that like the "unabated" biomass projects before them, will deliver climate mitigation only on paper, and not in reality.[12]

8. Policymakers holding up biomass energy as low carbon or carbon neutral and BECCS as delivering negative emissions variously rely on two flawed and repeated arguments:

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[6] https://www.nrdc.org/sites/default/files/global-markets-biomass-energy-06172019.pdf

[7] https://vimeo.com/795555785/c6e9420ff6

[8] Page 192 at https://www.drax.com/wp-content/uploads/2023/03/Drax_AR2022_single_pages.final_.pdf

[9] https://www.drax.com/about-us/our-projects/bioenergy-carbon-capture-use-and-storage-beccs/

[10] https://www.gov.uk/government/publications/biomass-strategy

[11] https://www.pfpi.net/wp-content/uploads/2023/01/PFPI-EU-Land-Sink-Target-report-Nov-23-2021.pdf

[12] See https://forestdefenders.eu/wp-content/uploads/2022/11/PFPI-Burning-up-the-carbon-sink-Nov-7-2022.pdf

- The use of "sustainability criteria" will ensure that forest biomass burned for energy produces carbon neutral or low carbon energy (see e.g. the UK Biomass Strategy or the criteria in Article 28 of the Renewable Energy Directive), being the foundation for creative "negative emissions" via BECCS; and/or
- The zero-rating of burning biomass in the energy sector under IPCC carbon reporting mechanisms.

In the rest of this briefing, we explain why these two approaches are flawed.

B. Background on how the IPCC counts emissions from bioenergy and BECCS

9. First, it's helpful to discuss the basic concepts of carbon neutrality, negative emissions, and how to properly account for bioenergy emissions.

10. Carbon neutrality is not well-defined. The Intergovernmental Panel on Climate Change (IPCC) [13] defines carbon neutrality as "Condition in which anthropogenic carbon dioxide (CO_2) emissions associated with a subject are balanced by anthropogenic CO_2 removals." The term is seen as analogous to "net zero" emissions in many contexts.

11. The simplest conception of a carbon neutral process is that it has no net impact on the amount of CO_2 in the atmosphere. In the case of biomass, this generally implies that CO_2 emitted by burning wood or other plants and organic material is so quickly offset by some other process – usually assumed to be regrowth – that there is no net impact on the concentration of CO_2 in the atmosphere. Importantly, simply regrowing the biomass isn't sufficient. Leaving aside achieving full carbon neutrality, for a biomass project to even reduce net emissions compared to other ways of generating energy, net emissions in the biomass scenario (taking into account forest carbon uptake) must be less than the net emissions in the counterfactual scenario where an alternative energy source is used and the source forest continues to be managed for other uses or is left unmanaged. Such an assessment requires assessing forest carbon dynamics.

12. Negative emissions, which constitute removing CO_2 from the atmosphere and thus, in theory, reducing its concentration, requires some way to pull CO_2 from the atmosphere. For BECCS, plant growth is the means by which CO_2 is collected from the atmosphere. The CCS component concentrates smokestack emissions of CO_2, then stores the concentrated CO_2 belowground in geological formations that, in theory, lock it up in perpetuity.

13. It is important to note that simply reducing the amount of CO_2 entering the atmosphere does not constitute "negative" emissions. The key distinction between using CCS with coal and using it with biomass is that with coal, CCS is simply preventing smokestack emissions from entering the atmosphere. Using CCS with biomass does the same thing – but then, *in theory*, biomass regrowth occurs, capturing more CO_2 via photosynthesis, and drawing down the concentration of CO_2 in the atmosphere. The timing of biomass regrowth is thus obviously important.

14. Countries that have signed the Paris Agreement are bound by its provisions, which include Article 4(1)(a) requiring GHG emissions reporting using the protocols set by the United Nations Framework Convention on Climate Change (UNFCCC).

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[13] IPCC WG III report, page 1797 at https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_FullReport.pdf

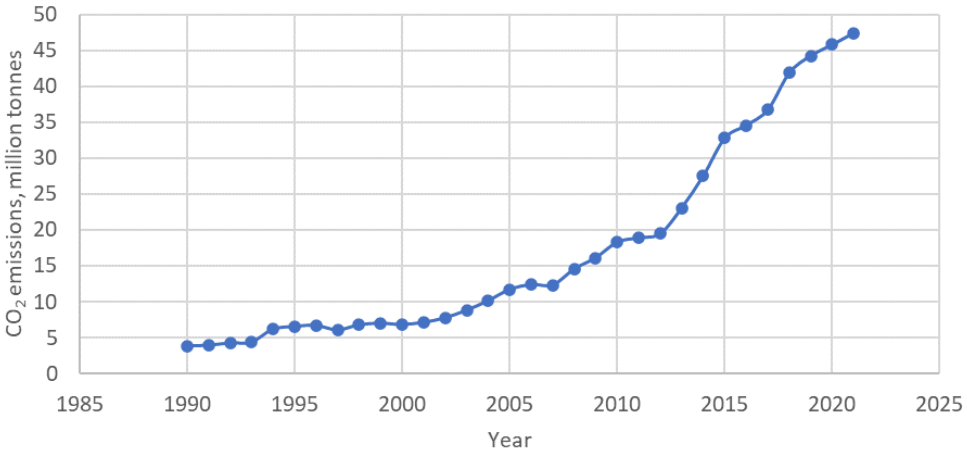
15. The IPCC sets the rules for GHG emissions reporting in Guidelines that were published in 2006 and partially updated in 2019. If countries want to claim they are reducing emissions, their emissions reporting needs to comply with the IPCC guidelines.

16. The IPCC guidelines count all carbon stock changes on land in the Agriculture, Forestry, Other Land Use ("AFOLU") sector. Another name for this sector is Land Use, Land Use Change, and Forestry ("LULUCF"). Here it's just referred to as the "land sector".

17. Forests are the biggest sink for CO_2 in the land sector, but they are also emissions sources. Changes in forest carbon stocks include the growth of vegetation as well as carbon loss, including from harvesting.

18. To avoid double-counting of this carbon loss in a national inventory, CO_2 emissions from biomass use in the rest of the economy (e.g., consumption of food/feed, use of biomass for energy) are not counted. Due to their importance and magnitude, emissions from the burning of biomass are reported as a "memo" item in the energy sector. However, they are not added to the total, to avoid double-counting, under the assumption that the full impact it reflected in the land sector of the inventory of the country of production. As Figure 2 shows, bioenergy emissions in the UK in 2021 were more than 47 million tonnes.[14]

Figure 2: CO_2 emissions from biomass in the UK, million tonnes



19. As the 2019 update to the IPCC Inventory Guidelines explains,
"Carbon dioxide (CO_2) emissions from the combustion of biomass or biomass-based products are captured within the CO_2 emissions in the AFOLU sector through the estimated changes in carbon stocks from biomass harvest, even in cases where the emissions physically take place in other sectors (e.g., energy). This approach to estimate and report all CO_2 emissions from biomass or biomass-based products in the AFOLU sector was introduced in the first IPCC guidelines for national greenhouse gas emissions (IPCC 1995), reflecting close linkages with data on biomass harvesting, and for the pragmatic reason to avoid double counting."[15]

20. The approach means that the land CO_2 impact of biomass traded (produced in one country but used in another) is supposed to be counted only in the land sector of the country where it was produced. E.g., CO_2 emissions from using palm oil (e.g., for food) or imported wood pellets for bioenergy are not

[14] https://di.unfccc.int/detailed_data_by_party
[15] https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/2_Volume2/19R_V2_2_Ch02_Stationary_Combustion.pdf

counted in the country of use, as all the resulting biogenic emissions (including any deforestation or peat fire of clearcuts) are supposed to be reported and accounted for by the country of origin.

C. A simple example of forest carbon flux calculations

21. The mechanics of how emissions from the land sector are counted are relevant for understanding how to calculate the carbon impact of bioenergy. The inventory reporting methods for the land sector do not measure actual emissions and removals of CO_2 from the atmosphere (fluxes of gases), but instead estimate these based on changes of carbon stocks on land.

22. Carbon enters ecosystems as CO_2 fixed by photosynthesis, and leaves ecosystems mostly as CO_2 when biomass is oxidized (burns or decomposes), or in the form of harvested biomass (crops and wood cut and removed).

23. In most countries, the basis for estimating stock changes in forest is the national forest inventory of the country, which estimates the standing stock and growth of the country's forests periodically. Changes in forest carbon stocks measured by forest inventories are converted to the forest carbon flux (emissions and removals), which is the difference between stocks year-to-year. The underlying equation is:
Forest carbon flux in year x = (carbon stock in year x-1) – (carbon stock in year x)

24. This approach means that when carbon is sequestered in the forest (removed from the atmosphere) this is counted as a negative number. When net carbon is emitted to the atmosphere, it is shown as a positive number.

25. So, for example, if a forest had a carbon stock of 1,000 tonnes in 2019, 1,030 tonnes in 2020, and 1,040 tonnes in 2021, the flux for 2020 would be -30, and the flux in 2021 would be -10. The sink is lower (less negative) in 2021 than 2020, meaning there is less atmospheric CO_2 embodied in the newly added forest carbon stocks that year, and thus more CO_2 left in the atmosphere.

26. Adapting this example to illustrate how logging and burning forest wood for energy could change the flux, if the forest under the management regime of 2019 – 2020 removed 30 tonnes of carbon from the atmosphere, and then logging was intensified in 2021 so that an additional 20 tonnes of carbon was logged and taken out of the forest to be burned for energy, the reduction in the forest carbon sink (from -30 in 2020 to -10 in 2021) would reflect the carbon removed from the forest by logging.

27. The IPCC rules treat reductions in forest carbon stocks as if the forest carbon was instantaneously emitted to the atmosphere ("instantaneous oxidation"). However, this is an accounting convention, since harvesting forests reduces the biomass stock on land but does not translate to instantaneous emissions there and then.

28. Just as the IPCC's accounting convention of treating forest carbon loss as "instantaneously oxidized" in the land sector does not reflect physical reality, the accounting convention of counting wood as having "zero" emissions in the energy sector also does not reflect physical reality. Nevertheless, it is this categorisation of emissions as "zero" that has led many policymakers to treat biomass as a carbon-neutral energy source.

29. Carbon dioxide is a global pollutant, so the convention of treating biomass as having zero emissions when burned has no significance regarding its actual impact on the atmosphere. As the IPCC notes in its FAQ [ref] at Question Q2-10[16]:

30. "The overall IPCC approach to estimating and reporting bioenergy greenhouse gas emissions at the national level requires complete coverage of all IPCC sectors, including the AFOLU and Energy sectors. All CO2 emissions and removals associated with biomass are reported in the AFOLU sector. Therefore, CO2 emissions from biomass combustion used for energy are only recorded as a memo item in the Energy sector; these emissions are not included in the Energy sector total to avoid double counting. The approach of not including these emissions in the Energy Sector total should not be interpreted as a conclusion about the sustainability, or carbon neutrality of bioenergy." [Emphasis added]

31. The 2019 refinement of the IPCC guidelines is even more explicit, stating[17] the need to consider wood energy use emissions as reported in both the land sector and the energy sectors: "*The CO_2 emissions from wood biomass burnt are not reported in either the Energy sector (burnt for energy purposes) or Waste sector (burnt or lost without energy recovery). This is to avoid the possibility of double counting these emissions in two or more GHG inventory sectors because they are already included in the AFOLU sector. When using inventory estimates to assess the CO_2 emissions arising from energy use, including wood for energy purposes, it is necessary to consider relevant emissions estimated in the Energy and AFOLU sectors.*"

D. The need for counterfactual modelling to assess the net carbon impact of bioenergy

32. The IPCC approach for reporting emissions from the land sector only considers recent years. It is not forward-looking. The loss of forest carbon from harvesting may be offset over time, but forests don't regrow instantaneously. This means that if carbon reporting is being done properly, it is generally not possible to conclude that forest biomass is "carbon neutral" in its year of use, using IPCC reporting.

33. Assessing the net carbon impact of bioenergy requires counterfactual accounting that projects the impact into the future. In fact, predicting the carbon impact of *any* energy project, not just bioenergy, requires modelling the impacts of a scenario where the project is executed, versus one in which it is not – i.e., contrasting the project scenario with a counterfactual scenario. This is true for coal – for example, we ask, how much will carbon emissions increase over a business-as-usual scenario if we build a coal plant? – and it is likewise true for a biomass power plant.

34. Smokestack and other direct emissions of biogenic CO_2 warm the atmosphere as effectively as fossil fuel CO_2. But, unlike coal, because biomass has the potential to grow back over time and take up CO_2 from the atmosphere, its emissions are often evaluated in the context of a lifecycle modelling approach that considers regrowth of the fuel, which is taken as offsetting some of the previous CO_2 emissions from burning the fuel.

35. The convention is to assign biomass regrowth to offsetting the emissions from bioenergy, although in fact there is no reason to assign this benefit specifically to the operator of the power plant burning the biomass, or to the country where the power plant is located. They generally don't own the land from which the biomass is sourced, and if the fuel is sourced from a different country (e.g., the US or Canada, like the pellets that Drax imports), that other country gets to claim the forest carbon sink benefit of regrowing forests under the IPCC's carbon reporting protocol.

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[16] https://www.ipcc-nggip.iges.or.jp/faq/faq.html

[17] Page 12.33 at https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4_Volume4/19R_V4_Ch12_HarvestedWoodProducts.pdf

36. In biogenic carbon accounting models that seek to determine the future carbon impact of bioenergy projects, the net carbon emissions impact of bioenergy is generally calculated as the total CO_2 emissions from fuel sourcing and burning, *minus* CO_2 that the model assumes will be sequestered as biomass regrows.

37. However, as explained above, a counterfactual is also required. The correct way to analyse the impact of the bioenergy project is to assess the emissions of the bioenergy scenario against a scenario where the forest is *not* logged to provide fuel but instead undergoes some other fate, and energy is generated in some other way (this could include solar or wind, it doesn't have to be fossil fuels). Many bioenergy scenarios simply involve intensifying harvesting in a forest that is already being logged for other products, so the counterfactual scenario is not "let the forest grow" but instead, "continue logging at the present intensity."

38. The *difference* between the bioenergy and no-bioenergy scenarios represents the net carbon impact of the bioenergy scenario.

39. The net carbon impacts of bioenergy scenarios change over time. Because burning wood usually emits more CO_2 per unit energy generated than burning fossil fuels, emissions in the bioenergy scenario typically exceed those of the alternative scenario in the first period, but can be slowly drawn down, under the assumption that the forest would grow faster due to the bioenergy-driven harvest than it would otherwise do. **If** this condition is met, this reduces the relative net carbon impact of the bioenergy scenario over time and, if maintained long enough, it *may* reduce the net impact to zero. However, this takes decades to centuries (even theoretically), and may not happen at all. There are many forests where increased harvest cannot expect to increase subsequent growth, or more likely to reduce it. In such cases, wood-based bioenergy will *permanently* have a higher CO_2 intensity than fossil alternatives, with no compensation.

40. In fact, the assumption that forest carbon stocks fully recover after harvest is increasingly unlikely to be met. Changes in species composition, soil carbon loss from harvesting, other disturbances, shortened rotation periods, climate change, and a host of other factors conspire to ensure that forests regenerating after cutting hold less carbon than previously. These uncertainties are meaningful for the ability of models to predict actual bioenergy carbon impacts. In all cases, such uncertainties, if realised, worsen the carbon impact.

41. Under this approach, many studies show that net emissions from burning forest biomass can exceed those from the no-bioenergy scenario for decades to centuries– even when the no-bioenergy scenario relies on coal-burning to provide energy.

42. For example, biomass sourcing scenarios for the US Southeast were found to have emissions significantly greater than zero at year 40 in a UK government-commissioned study from 2014. The study analysed net carbon emissions of wood pellets manufactured in the US Southeast using the Biomass Emissions and Counterfactual (BEAC) model, which characterises the carbon impact of burning various types of forest biomass by comparing their lifecycle emissions to emissions of counterfactual scenarios. This model and the summary report are still available on the government's website.[18]

[18] https://www.gov.uk/government/publications/life-cycle-impacts-of-biomass-electricity-in-2020

E. The misuse of IPCC rules to justify treatment of bioenergy as "low carbon"

43. By relying on the IPCC rules to justify treatment of bioenergy as "low carbon", policymakers are doing the very thing that the IPCC has warned against, using the bookkeeping convention of treating imported wood as if it has zero emissions as if it represents physical reality.

44. But given that emissions occur and are counted under national inventories, if one wishes to argue that biomass energy has "low" emissions or is "carbon neutral," this requires evaluating the projected impact over time using counterfactual modelling that counts all lifecycle GHG emissions associated with growing, harvesting, producing, transporting, and burning the biomass, and makes projections about how regrowth over time may offset some of these emissions, comparing this to an alternative scenario. National GHG inventories created under IPCC rules are not a substitute for such forward-looking modelling.

45. Since the IPCC reporting framework is intended to provide full accounting of all sectoral emissions and sinks at the national level, or potentially at lower geographic levels, it is an inappropriate tool for assessing the GHG impact(s) of particular projects such as biomass power plants. This is supported by the answer to the IPCC FAQ Q2-10 which states that:

46. "While individual methodologies and emission factors provided in the IPCC Guidelines may be relevant for estimating CO2 emissions from the use of bioenergy at an individual facility or industry, the IPCC Guidelines as an overall framework for a national GHG inventory do not provide an analytical approach for assessing the full bioenergy emissions at sub-national entities such as industry sectors. A complete coverage of bioenergy emissions at the sub-national level – for example for an industry sector – may require additional analytical work and assumptions beyond the scope of the 2006 IPCC Guidelines to attribute all relevant bioenergy emissions (e.g. those associated with growing bioenergy crop, land-use change, fertilization, transportation, etc.) to the sub-national entities of interest." [Emphasis added].

47. Any reference to the IPCC inventory accounting convention of counting biomass emissions as zero in the energy sector is thus wrong in at least two ways: it violates the IPCC's own warning to not treat the convention as representing reality, and it inappropriately applies a framework intended for national-level reporting to the biomass energy sector, violating the IPCC's instructions here, as well.

F. The misuse of IPCC protocols to falsely claim that BECCS will deliver "negative emissions"

48. BECCS can only deliver "negative emissions" if biomass burning is truly carbon neutral. The premise of carbon neutrality is that plant regrowth sequesters equivalent carbon as was released by burning the fuel, offsetting those emissions so that ultimately there is no addition of CO_2 to the atmosphere. The premise of negative emissions from BECCS is that because the emissions have been captured and stored belowground using CCS, they no longer need offsetting, so carbon sequestration by plant regrowth now represents a net removal of CO_2 from the atmosphere.

49. Regarding use of forest biomass as fuel, one issue is immediately apparent: regrowth does not occur quickly, so there no net removal of CO_2 from the atmosphere during the regrowth phase for decades or longer. Thus, while adding CCS to an existing biomass plant would theoretically reduce the amount of CO_2 entering the atmosphere at the smokestack, just like adding CCS to a coal plant would, it can not deliver "negative emissions," at least not in timeframes relevant for meeting legislated emission reduction targets. As is true for unabated bioenergy (i.e. without CCS), determining the potential future impact of BECCS projects requires counterfactual modelling.

50. The inability of BECCS to deliver negative emissions is apparent from the IPCC 2006 Guidelines approach to calculating BECCS impacts. The approach is designated as a "Tier III" protocol.[19] Chapter 2, Equation 2.7, "Treatment of CO_2 capture," states that for a source category, "s", $Emissions_s = Production_s - Capture_s$

EQUATION 2.7
TREATMENT OF CO_2 CAPTURE

$$Emissions_s = Production_s - Capture_s$$

Where:

s = source category or subcategory where capture takes place

Captures	= Amount captured.
Productions	= Estimated emissions, using these guidelines assuming no capture
$Emissions_s$	= Reported emission for the source category or sub-category

51. If the source category is taken to be the energy sector, bioenergy emissions are counted as zero. However, for a complete picture of the GHG impact of BECCS at the national level, this convention is not a problem, because the land sector emissions are included, thus the full impact of BECCS can be assessed. Viewing equation 2.7 considering national all-sector reporting, the "production" term would be zero, the "capture" term would be non-zero, thus the resulting emissions would be "negative" *in the energy sector* – but over in the land sector, the loss of carbon from logging the trees burned for energy would be counted as an emission. Summing the "negative" energy sector emissions thus calculated under equation 2.7 with the emissions counted in the land sector produces a net impact at the whole system level of **zero *at best* – not "negative" emissions**.

52. "At best" because emissions from **BECCS will only be zero if production and capture of GHG's are equivalent** – in other words, if CCS captures 100% of the CO_2 that was produced in the land sector by logging the biomass. In practical terms this would require that the *only* carbon lost from the land sector due to logging is carbon embodied in wood removed from the forest (this never occurs – e.g., there is soil carbon loss from disturbance), *and* 100% of that wood is burned with no loss, *and* 100% of the CO_2 emissions from burning that wood are captured by CCS. In this case, the production and capture terms in equation 2.7 would be equivalent, making emissions zero. In all real-life cases, however, emissions from BECCS would be positive.

53. It is never appropriate to report energy sector GHG emissions of burning biomass in isolation, because of the impacts of bioenergy on land sector carbon. As the 2019 update to the IPCC Inventory Guidelines explains, "*Carbon dioxide (CO2) emissions from the combustion of biomass or biomass-based products are captured within the CO2 emissions in the AFOLU sector through the estimated changes in carbon stocks from biomass harvest, even in cases where the emissions physically take place in other sectors (e.g., energy).*"[20] In other words, you can't just ignore the emissions, even if they happen halfway around the world. This concept is well-understood for liquid biofuels and palm oil.

54. It is incorrect to count the storage of biomass carbon as a removal of CO_2 from the atmosphere. The majority of the carbon in a mature tree has already been captured and removed from the atmosphere and represents the carbon stock. Thus, the act of burning a tree and storing the CO_2 belowground

[19] https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf

[20] https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/2_Volume2/19R_V2_2_Ch02_Stationary_Combustion.pdf

using BECCS simply represents a **transfer** of carbon from one non-atmospheric pool (the tree) to another non-atmospheric pool (geological storage). **This transfer in no way constitutes "negative" emissions/removal of CO_2 from the atmosphere.**

G. Illustrating how transfers of forest carbon stock do not constitute "negative emissions"

55. The following section, which was provided by a colleague, illustrates the fallacy at the heart of claims that burning forest wood with BECCS will deliver "negative" emissions.

56. Some British Columbia trees burned in the UK can easily be older than the province as we know it. Claiming their cumulative removals as current GHG removal can only be through an accounting procedure and cannot reasonably be based on a narrative that these trees were grown from the outset to remove carbon in and for the UK in the 2020's to reduce climate change. But the same applies to plantations established for the paper industry 50 years ago: none of that was for the UK to claim.

57. On ownership of removals: It is clear that when the forest grows, the resulting removals (i.e., increase of carbon stock in the forest) is "owned" by the US or Canada. It is reported and claimed by those countries and may allow those countries to emit more fossil fuel CO_2.

58. It is also clear that once the forest is logged, the wood is burned and its carbon stored using CCS in the UK, the same removals would be claimed by the UK as theirs, and theirs only (as a removal happening in the year of CCS).

59. But this raises a question: exactly what element of the intervening chain of events would trigger the transfer of right/ownership/claim from the US to the UK?

60. The growth of the forest in the US was a real, physical removal of carbon (although it may or may not have been "anthropogenic"), taking place over an extended period of time (many decades if we just consider the trees cut, but possibly millennia if we consider the age of the "forest", since the time of the last glacial). Whatever the period, the cumulative removal of this long time in North America is claimed by the UK at the moment of storing it belowground somewhere. But what makes this possible?

61. Thought experiments: Assume that Drax does not buy the harvested wood, but buys the forest (in its entirety, with standing timber). Could Drax (or the UK) claim the carbon in the standing trees as their own "removals" or "negative emissions", just because all that carbon has been removed from the atmosphere, and they now own it? It's doubtful. Even by the "standards" of the voluntary carbon markets, just owning a stock of carbon would not entitle one to claim the past removals that created that stock. So they bought all that carbon removed from the atmosphere, but cannot claim any of it as "removal" let alone theirs (if the asset is in another country).

62. Let's say Drax harvests that wood and ships it to the UK, where it is piled up in a neat heap. The forest carbon is now physically in the UK, but could the UK claim the "removals", just by transferring tons of wood (and having caused a corresponding reduction in the US forest carbon stock)? Hardly. Under some alternative IPCC approaches to harvested wood product accounting it could be claimed, but it is not straightforward and would not result in net removals. E.g., if both the US and UK follow the production approach, then the US could use the carbon in the stockpile to reduce the debit it took after the harvest of the forest itself (so part of the accounted emissions would be delayed as long as the C is in the stockpile, and the US would continue to "own" this benefit under the production approach). But this would not result in ANY removal: The US would only count lower emissions than would be the case if the wood had been "lost" (perhaps burned, or just unaccounted for). And even that relative benefit (emissions reduced compared to instantaneous oxidation) would accrue to the US (as producer), not the UK. The math would be different under other HWP approaches, but the

essence remains that there would be no net "removal" anywhere. Just sitting on the stockpile of imported wood would hardly be claimable as "negative emissions", even if in accounting terms it is deductible from the harvest emissions the US has to account for.

63. Then Drax decides to burn the stockpile, actually causing emissions. Again, no claims on "removals" can be made by anyone. Drax/UK don't count the emissions because the US has counted them (or so they assume), but no "removals".

64. Then Drax decides to pump the CO_2 into the ground (instead of releasing it as they would), and all of sudden "removals" appear in the UK. A miracle has happened.

65. It appears that owning the trees (with all the carbon intact) is not sufficient to claim any carbon benefit (let alone "negative emissions"). Even killing them and taking them home is not enough to make it claimable. You need to burn them. Unless you do this, they are nothing. This is the absurdity of assigning the carbon benefit of land to the energy sector: the act of burning entitles them to claim the removals that not even the owner of the forest can claim. Only burning the trees in a power plant can validate the removals that made them be.

H. Why "sustainability" is not a proxy for carbon neutrality

66. The UK's biomass sustainability criteria, and those of the EU's Renewable Energy Directive, do not ensure biomass is "low carbon" or carbon neutral. The EU's criteria were deconstructed in another report.[21] This brief section focuses on the UK's criteria.

67. The UK's Biomass Strategy[22] states that biomass will only be considered "low carbon" if it complies with the UK's sustainability criteria (see e.g. p.6 and p.19). However, there is no provision in these criteria that would ensure forest biomass that complies is thereby low carbon or carbon neutral, in the sense of ensuring that the net carbon impact of its combustion is low or zero.

68. There is no single uniform set of sustainability criteria in the UK; different Government support schemes (in particular, the Renewable Obligation ("RO") and Contract for Difference ("CfD") schemes) have different criteria, though they are broadly similar. The schemes are summarised in a Table 2.1 at pages 24-27 of the Biomass Strategy. However, the schemes do not ensure compliant forest biomass feedstocks are low carbon.

69. GHG emission criteria: as set out in Table 2.1, the various schemes each set their own specific threshold as to the percentage savings of GHG emissions that must be achieved for compliance. However, the formulas used to calculate the GHG emissions of bioenergy under the criteria for each scheme **only account for the fossil fuel-derived lifecycle emissions** from growing, harvesting, processing, and transporting biomass, as well as non-CO_2 GHG emissions from biomass combustion, without taking into account the biogenic CO_2 emissions from manufacturing and combusting the biomass.[23]

70. Direct land use change: As regards the land criteria, as set out in Table 2.1, sourcing biomass where there has been direct land use change (conversion of forest to some other kind of land use, like agriculture) is generally forbidden under the schemes. This is a necessary but not sufficient requirement

[21] https://forestdefenders.eu/wp-content/uploads/2021/05/RED-II-biomass-Paper-Tiger-July-6-2020.pdf

[22] https://www.gov.uk/government/publications/biomass-strategy

[23] See for example, the GHG emissions formula used in the Renewable Heat Incentive scheme: Schedule 3, The Renewable Heath Incentive Scheme Regulations 2018 (Statutory Instrument 2018, No. 611).

to avoid loss of forest carbon. It is important to note that clearcutting a forest of any kind, even a forest that has never previously been cut, does not constitute "land use change."

71. Protection of carbon stocks: as set out in Table 2.1, the relevant schemes are summarised as requiring "*No sourcing from high carbon stock areas. Source from permitted sourcing only*". "*High carbon stock areas*" is not defined, but it likely means areas such as old-growth and/or unmanaged forests. While biomass sourced from these areas would certainly not be low carbon, this is simply ruling out one worst-case scenario: again, it is a necessary but not a sufficient condition. This condition does not ensure that forest biomass is low carbon because it does not require assessing carbon flux from harvesting and burning biomass.

72. Further details of what constitutes the land criteria can be found in individual pieces of legislation, but in all cases, the provisions do not ensure that biomass is "low carbon" because none of the provisions require an actual assessment of carbon flux.

73. For example, the RO requires that "at least 70% of the woody biomass was obtained from a sustainable source."[24] This is defined in the RO legislation[25] as including several criteria, but none of these consider the carbon dynamics of forest harvesting other than a requirement that "the productivity of the area is maintained, in particular by adopting plans to avoid significant negative impacts on productivity. There is also an optional requirement that woody biomass be grown in an area that was managed "consistent with" the Forest Europe Sustainable Forest Management Criteria. The only provision there relevant to carbon dynamics was the exhortation that "*Forest management practices should safeguard the quantity and quality of the forest resources in the medium and long term by balancing harvesting and growth rates, and by preferring techniques that minimise direct or indirect damage to forest, soil or water resources.*"[26]

74. The UK Timber Standard[27] also contains provisions that are invoked in some sustainability schemes. The only provision of the Timber Standard relevant to forest carbon dynamics is a requirement (provision S6(e)) that harvest levels should not exceed "the long-term production capacity of the forest based on adequate inventory and growth and yield data."

75. Whereas harvesting sustainability usually at a minimum means that logging should not remove more wood each year than the forest produces (thus allowing stocks to remain at least constant), this provision states that harvest levels should not exceed "long term production capacity" of the forest – a weaker provision because unlike the amount of wood grown each year, which can in theory be measured, the "long term production capacity" of the forest is undefined.

76. Under this provision, and also under similar provisions like that of the Forest Europe Sustainable management criteria requiring "balancing harvesting and growth rates," it would be possible to greatly reduce the carbon sink of a forest, and still meet the criteria. The example above at section C explains why.

77. Both scenarios preserve a net carbon sink (-30 and -10), meaning that harvest levels did not exceed production, and thus both scenarios would be treated as equally "sustainable" under the UK's criteria.

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[24] The Renewables Obligations Order 2015, Schedule 3 para 3 (Statutory Instrument 2015 No 1947)

[25] https://www.legislation.gov.uk/uksi/2015/1947/schedule/3

[26] Annex 2 of the Resolution L2, Pan-European Operational Level Guidelines for Sustainable Forest Management, available at: https://foresteurope.org/wp-content/uploads/2016/10/MC_lisbon_resolutionL2_with_annexes.pdf#page=18

[27] https://assets.publishing.service.gov.uk/media/5a7bfdafed915d01ba1ca71a/Timber_Standard_for_Heat_and_Electricity_under_RO_and_RHI_-_10-Feb-2014_for_pdf_-_FINAL_in_new_format.pdf

However, the forest sink would have removed less carbon from the atmosphere, and the atmosphere would contain more CO_2, for the year when logging was intensified.

78. From this it can be seen that a simple requirement to ensure harvesting does not exceed production is not sufficient to ensure that biomass from such harvesting is "low carbon."

I. Applying the reasoning here to a BECCS project in Europe, the Stockholm Exergi plant

79. The EU is already funding BECCS projects – but they suffer from the same misleading claims and inadequate analysis that DESNZ exhibits in the UK Biomass Strategy. For example, the EU has allocated €180 million in public funding to the Stockholm Exergi biomass plant[28] – without a single analysis showing the project can actually deliver negative emissions. The project writeup makes the extraordinary claim that it will "remove" 7 million tonnes of CO_2 from the atmosphere in the first ten years of operation.

80. This comes back to the old problem – that they want to treat biomass as *actually* having "zero" emissions, based solely on the accounting convention of *counting* biomass as zero in the energy sector.

81. The fact that burning one tonne of green wood emits slightly more than one tonne of CO_2 makes this easier to explain. What they will actually be doing at the Swedish plant is taking 7 million tonnes of green wood (over ten years) – which had *already* sequestered atmospheric CO_2, and *presumably was already counted as doing so in the national greenhouse gas inventory* – burning it, capturing the 7 million tonnes of CO_2, and storing that belowground, then claiming they have actually "removed" that CO_2 from the atmosphere, when in fact all they have done is prevented it from entering the atmosphere. There has been no net change. Previously, the carbon was embodied in the trees, and was thus not in the atmosphere. Now, the CO_2 is held belowground, so is still not in the atmosphere. **But there has been no new "removal" of CO_2 from the atmosphere.** They have simply taken stored carbon and moved it into a different kind of storage.

82. Thus, they are committing the first deadly sin of carbon inventories – **they are double-counting the removal of the carbon**. It was already counted as part of the carbon sink when it grew – now they want to count it again as a new "sink" just because they have burned it and stored the CO_2. This is a carbon accounting gimmick.

[28] https://climate.ec.europa.eu/system/files/2022-07/if_pf_2022_beccs_en.pdf