Dear Sir/Madam,

Thank you for the opportunity to comment on the Supervisory Body report about Removal activities under the Article 6.4 mechanism.

Biofuelwatch is deeply concerned about the inclusion of carbon dioxide removals into carbon market mechanisms in general. We believe that this would further delay vital efforts to reduce greenhouse gas emissions at source. One example of this happening already is the announcement by Microsoft about its pathway for becoming "carbon negative by 2030", a pathway which shows continued high carbon emissions, especially from supply chains, supposedly offset by "negative emission" including BECCS and Direct Air Capture. And oil companies such as Eni are using investments in afforestation and reforestation, i.e. industrial tree plantations, to claim that they are offsetting their actual carbon emissions from fossil oil and gas. This includes an Eni announcement to acquire 8.1 million hectares of land for tree plantations in Africa, with no mention of the communities living on and using that land for their livelihoods, nor of the biodiversity impacts of converting land to industrial plantations. Also, no mention is made of the susceptibility of industrial tree plantations to wildfires, which is increasing as temperatures rise.

However, below we will focus specifically on Bioenergy with Carbon Capture and Storage and biochar, because we have undertaken extensive desktop research into those two technologies.

We fully agree with the observation in Table 3 of the report that "e*ngineering-based removal activities are technologically and economically unproven, especially at scale, and pose unknown environmental and social risks*" and that "t*hese activities do not contribute to sustainable development, are not suitable for implementation in the developing countries and do not contribute to reducing the global mitigation costs*."

We would, however, add that both BECCS and biochar risk worsening climate change, too, because procuring biomass for large-scale applications of those technologies will most likely result in direct and/or indirect land use change and/or in more intensive or extensive logging of forest ecosystems.

BECCS:

In November 2022, we published a report based on desktop research and information requests to companies with projects involving carbon capture from bioenergy and from waste incineration. The findings presented in our report confirm the fact that carbon capture from bioenergy is a wholly unproven technology, with ***no examples of successful carbon capture from biomass combustion or gasification at scale***. The only examples of so-called BECCS deployment relate to carbon capture from ethanol fermentation, especially in the USA.

However, this is not simply a theoretical question as to whether BECCS might one day become technically viable. As can be seen from the large unsuccessful attempts to capture CO_2 from coal combustion at scale, serious efforts to develop such technologies require many billions of Euros or dollars in subsidies. Given the constraints to public finance worldwide, such funding directly competes with support for proven and highly effective mitigations strategies, such as better insulating homes or scaling up electric heating via heat pumps using non-emissive renewable electricity.

Ethanol fermentation releases a pure CO_2 stream, which is relatively cheap and easy to capture compared with CO_2 capture from other forms of bioenergy generation. Nonetheless, the largest of those projects to date, the Illinois Industrial CCS project at Decatur, captured only 12% of the plant's overall CO_2 emissions, according to a report by the Institute for Energy Economics and Financial Analysis (IEEFA).The project stopped at the end of 2021. Thus, even if only fossil fuel emissions related to such a typical corn ethanol refinery are accounted for, such a project is far from carbon-neutral, let alone carbon negative.

The IEEFA figure does not account for direct and indirect land use change emissions associated with corn ethanol production. A peer-reviwed study, published by PNAS in February 2022, concluded that emissions from ethanol are up to 24% higher than those from burning petrol, once emissions from land use change and fertiliser use associated with the expanded demand for corn are accounted for.

The assumption that BECCS is carbon negative is based on the fact that carbon emissions from bioenergy are not accounted for in the energy or transport sectors where they occur. However, this is based on UNFCCC accounting rules according to which emissions associated with logging and with land use change are shown in the LULUCF sector of the country from which the biomass feedstock is sourced. Accordingly the IPCC states: "*The IPCC approach of not including bioenergy emissions in the Energy Sector total should not be interpreted as a conclusion about the sustainability or carbon neutrality of bioenergy*".

CCS from biomass combustion would result in significant quantities of additional biomass being burned for the same amount of energy generated:

The only technology for carbon capture from combustion plants that has been used at scale is post-combustion carbon capture using amine solvents.

There is only one example of such a plant worldwide, and that is at the Boundary Dam coal power station in Saskatchewan. According to figures obtained by IEEFA, carbon capture and compression at that plant requires 30-31% of the plant's energy generation. The impact of sourcing 30-31% more biomass feedstock, or reducing the commonly very low efficiency of biomass

power plants even further, must be taken into account in any discussion about the potential for future BECCS.

Potential future BECCS involving crops and trees grown for bioenergy:

It is widely recognised, especially in relation to biofuels, that converting land to energy crop and tree plantations results in indirect as well as direct land use change which, in turn, can lead to very high emissions of CO_2 emissions. Land conversion to crop and tree plantations also commonly results in habitat loss, thus putting species at greater risk of extinction, in land-grabbing especially in the global South, and in competition with food production, causing more hunger and food insecurity. It will also increase water use and competition for water, at a time when water scarcity and drought affect an ever greater proportion of the world's population.

Here are some of the studies which we recommend taking into account:

- Delayed use of bioenergy crops might threaten climate and food security, Siqing Xu et.al., Nature, September 2022: The authors highlight the fact that further warming will lead to more crop failures and to lower yields, worsening the energy-versus-food competition for land and crops, and also reducing the yield of agricultural residues.
- Irrigation of Biomass Plantations May Globally Increase Water Stress More Than Climate Change, Fabian Stenzel et.al., Nature Communications, March 2021
- Considering sustainability thresholds for BECCS in IPCC and biodiversity assessments, Felix Creutzig et.al., Editorial Commentary, GCB-Bioenergy, February 2021
- Bioenergy with Carbon Capture and Sequestration (BECCS): The Distracting Injustice of an Infeasible and Unlikely Technofix, Rachel Smolker, Development, September 2019
- Land use emissions play a critical role in land-based mitigation for Paris climate targets, Anna B Harper et.al., Nature Communications, August 2018
- Expert assessment concludes negative emissions may not deliver, Naomi E. Vaughan and Claire Gough, Environmental Research Letters, August 2016
- Biophysical and economic limits to negative CO2 emissions, Pete Smith et.al., Nature Climate Change, December 2015
- Ecological limits to terrestrial carbon dioxide removal, Lydia J. Smith and Margaret S. Torn, Climatic Change (2013).

Potential future BECCS involving the use of forest wood:

The vast majority of biomass heat and power plants burn wood rather than energy crops or agricultural residues. Some of that wood comes from industrial tree plantations, but much of it comes from logging natural forest ecosystems, mostly secondary forests but also primary forests. Both secondary and primary forests are of vital importance for carbon sequestration and storage in their own rights as well as providing vital habitat for plants, animals and insects,

mitigating against regional climate change and water scarcity, and maintaining soil fertility.

Genuine logging residues and post-consumption waste wood can only meet a very small fraction of today's demand for biomass energy, and there is thus no possibility of expanding their use for BECCS in future.

Even if most smokestack CO_2 emissions from a biomass combustion plant could be captured and sequestered, CO_2 emissions related to the loss of forest carbon stores and ongoing sequestration, as well as the loss of forest soil carbon would remain very significant.

We would recommend taking the findings of the following studies and scientific opinions, amongst others, into account:

- Forest bioenergy update: BECCS and its role in integrated assessment models, European Academies Science Advisory Council (EASAC), February 2022
- Abrupt increase in harvested forest area over Europe after 2015, Guido Ceccherini et.al., Nature, July 2020 [Note: The article discusses the increase/intensification of logging across the EU since 2016.]
- Serious mismatches continue between science and policy in forest bioenergy, Michael Norton et.al., Global Change Biology Bioenergy, August 2019
- Reconsidering bioenergy given the urgency of climate protection, John M. DeCicco and William H. Schlesinger, PNAS, September 2018
- Europe's renewable energy directive poised to harm global forests, Timothy Searchinger et.al., Nature Communications, September 2018

Biochar:

We believe that biochar must be classified as an engineering-based activity in the same way as BECCS. Economically viable large-scale biochar production depends on the co-production of char with syngas and bio-oil, which is technically so challenging that, to our knowledge, no such pyrolysis plant is operational so far anywhere in the world.

In the absence of full utilisation of syngas and pyrolysis oil, biochar production relies on conventional charcoal making processes, during which a minimum of 50% of the carbon is lost to the atmosphere upfront.

If biochar use was scaled up, then all of the impacts related to energy crops and trees, or to forest wood discussed in relation to BECCS above would apply to biochar, as well.

However, in addition to the impacts related to biochar feedstock procurement, it remains impossible to predict with any credibility whether any specific type of biochar applied to any specific soil under specific climate conditions will result in long-term or even medium-term carbon storage at all.

A 2011 peer-reviewed study, called Persistence of soil organic matter as an ecosystem property, highlighted the fact that "*it remains largely unknown why some SOM [soil organic matter] persists for millennia whereas other SOM decomposes readily"*. Amongst other types of soil carbon, the authors looked at fire-derived, i.e. black or pyrolysed carbon, which is the type of carbon contained in biochar. They found that "*fire-derived carbon does undergo oxidation and transport, as we now know from archaeological settings and from breakdown products in river and ocean water. In a field experiment, fire-derived residues were even observed to decompose faster than the remaining bulk organic matter, with 25% lost over 100 years*."

Subsequent studies have confirmed this. For example, the authors of a peer-reviewed study published in 2016 found that: "*biochar degradation depends on the soil characteristics, but the details of these interactions still require specific mechanistic investigation*".

The authors of a study publisehd in 2017 conducted a meta analysis of greenhouse gas fluxes from soils based on 91 published studies. They found that biochar additions to soils "*significantly increased GWP [global warming potential] by 46.22%*" pointing out that results from laboratory studies differ from those of field studies. They also pointed to a "*lack of field-scale studies especially those lasting at least two successive seasons*."

One of the reasons why biochar application can result in an overall reduction of soil carbon is 'priming', i.e. the fact that soil amendments, including with black carbon, can stimulate microorganisms to metabolise soil organic matter more effectively, resulting in that carbon being emitted as CO_2 to the atmosphere.

To sum up, there is no scientific basis for assuming that application of a certain amount of biochar will result in any, let alone a quantifiable amount of carbon storage; it can even lead to net soil carbon losses.

Please see our review of scientific studies about biochar for more information and more links to different studies on this topic.

Conclusion:

We believe that neither BECCS nor biochar can be assumed to have a benign impact on the climate, nor on biodiversity, food security, freshwater, soils and communities. Both technologies could, if ever applied at scale, lead to a further acceleration of climate change, rather than to genuine carbon dioxide removals.

We further believe that UNFCCC should not support any carbon markets involving so-called negative emissions/carbon dioxide removals.

Yours faithfully,

Almuth Ernsting
Biofuelwatch Co-Director