Biofuelwatch fundamentally rejects the certification of any carbon dioxide removals (CDR) for the purpose of offsetting ongoing greenhouse gas (ghg) emissions, whether through the voluntary carbon markets or via inclusion in the EU Emissions Trading Scheme. As the 2022 IPCC Assessment Report 6 highlighted, "CDR is not a substitute for deep emissions reductions".[1] Yet the CRCF framework allows CDR to be used as offsets for ongoing ghg emissions which could and should be avoided.

Biofuelwatch has been undertaking research, campaigning and advocacy related to large-scale bioenergy since 2006, and we have published reports on biochar on BioCCS. In this response, we look at all of the methodologies and requirements proposed in the Annex, i.e. those for DACCS, BioCCS and biochar. ***In the case of the BioCCS and biochar proposals, we believe that they will, if adopted, in the best-case scenario move carbon currently stored in forests from the LULUCF sector into the so-called "technical removals" sector, with no benefit to the climate. Even worse, both biochar and BioCCS have a significant potential to cause real harm to climate and biodiversity.***

<u>DACCS</u>

1) Permanence of geological assurance is assumed whenever national authorities are responsible for monitoring storage sites. However, while leakage would hopefully be detected, it cannot be reliably predicted. This is evident for example from the experiences at the Norwegian Sleipner and Snøhvit storage sites. At Sleipner, it was discovered after three years of CO_2 injections that the CO_2 was leaking into a shallower, previously unidentified layer. Despite extensive studies, that layer had not been identified. At Snøhvit, it became clear after around 18 months of CO_2 injections that pressure was rising faster than anticipated, and less than 6 months of further injections would be possible without leakage . A new injection well had to be drilled and the storage potential is far smaller than anticipated. According to the Institute for Energy Economics and Financial Analysis (IEEFA), "*unproven is whether CO_2 will remain sequestered with 100% reliability such that none of those sites leak what is supposed to be permanently buried CO_2 back into an already strained environment. What is unknown is the long-term viability of any subsurface storage formation*".[2]

2) Although ghg emissions from the energy used to power DAC plants are to be accounted for, the proposed methodology does not prevent DAC projects from using electricity from existing renewable energy schemes and therefore cause existing users of that energy to rely on fossil fuels or high-carbon biomass energy instead. Given the high energy requirements for DAC, such indirect impacts are a major concern.

<u>Bio-CCS</u>

1) Concern (1) set out in relation to DACCS above equally applies to BioCCS.

2) The proposed methodology does nothing to guarantee BioCCS projects result in negative carbon emissions – nor even in carbon neutral biomass combustion. It adopts the RED3 carbon accounting methodology which ignores:

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[1] ipcc.ch/report/ar6/wg3/downloads/outreach/IPCC_AR6_WGIII_Factsheet_CDR.pdf
[2] ieefa.org/sites/default/files/2023-06/Norway%E2%80%99s%20Sleipner%20and%20Sn%C3%B8hvit%20CCS-%20Industry%20models%20or%20cautionary%20tales.pdf

1. Upfront CO_2 emissions from biomass combustion: According to research by IEEFA,[3] "*no existing project has consistently captured more than 80% of carbon*", so even in a BioCCS project, there will still be substantial CO_2 emissions.
2. Reductions in forest (including forest soil) carbon stores and sinks due to increased logging caused by the growing demand for biomass energy.
   Impacts of increased logging driven by demand for biomass energy on forest carbon stores and sinks (see below for more details).

3) According to the proposal, "*the process [for BioCCS] shall not be adjusted in a way that increases the generation of CO_2 per unit of output if that adjustment is made solely to increase the quantity of CO_2 that is available to be captured.*" This addresses an entirely fictitious risk – one of companies deliberately reducing a biomass plant's efficiency beyond the drop in efficiency caused by the carbon capture energy penalty. That energy penalty is likely very high: The Boundary Dam coal power power station in Canada uses 30 to 31% of the energy output to capture and compress CO_2.[4] It is also proposed that no CRCF offsets/credits should go to new biomass plants which would not be economically viable without such support for CCS. This is not enforceable, because neither governments nor certifiers will be privy to sensitive business information and thus be able to make any credible judgement on that matter. The real concern is that operators of large biomass power generators, such as RWE in the Netherlands, are proposing to instal carbon capture equipment to significantly extend the lifespan of those plants once their subsidies for biomass electricity run out. If successful, RWE would burn up to 7.5 million tonnes of imported wood pellets a year for the foreseeable future, solely based on support for BioCCS.[5] Yet this very real scenario is not addressed by the proposal at all.

Impacts of wood bioenergy on forest carbon stores and sinks:

The EU's forest and thereby LULUCF carbon sink declined by almost one third between the periods 2010-14 and 2020-22.[6] In some countries, including Finland[7] and Germany[8], the entire LULUCF sector has already become a net source of CO_2 emissions. According to the authors of a 2024 study published in *Nature Communications*, satellite imaging from the period 1986 to 2020 reveals that logging was responsible for 82% of canopy openings, i.e. tree cover loss.[9]

A recent study by researchers from the Joint Research Committee (JRC), published in *Nature* in July 2025, further confirms that the intensification of logging has been a key reason for the decline in the EU's LULUCF carbon sink. The authors state: "*The increase in forest harvest may be attributed to a growing demand for wood consumption, especially for energy*".[10]

Another peer-reviewed article, published in February 2025, shows the close causal link between increased wood burning for energy in the EU on the one hand and the declining LULUCF carbon

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[3] ieefa.org/ccs
[4] eefa.org/wp-content/uploads/2018/11/Holy-Grail-of-Carbon-Capture-Continues-to-Elude-Coal-Industry_November-2018.pdf
[5] banktrack.org/project/dodgy_deal_rwe_biomass_conversion_project_the_netherlands
[6] Scaling up carbon dioxide removals, Recommendations for navigating opportunities and risks in the EU, European Scientific Advisory Board on Climate Change, February 2025 , climate-advisory-board.europa.eu/reports-and-publications/scaling-up-carbon-dioxide-removals-recommendations-for-navigating-opportunities-and-risks-in-the-eu
[7] icos-cp.eu/news-and-events/news/finlands-forests-have-become-source-carbon
[8] bmleh.de/SharedDocs/Downloads/DE/Broschueren/vierte-bundeswaldinventur.html
[9] Changes in planned and unplanned canopy openings are linked in Europe's forests, Rupert Seidl and Cornelius Senf, Nature Communications, June 2024, nature.com/articles/s41467-024-49116-0
[10] Securing the forest carbon sink for the European Union's climate ambition, Mirco Migliavacca et.al., Nature, July 2025 , nature.com/articles/s41586-025-08967-3

sink on the other hand. [11] The authors highlight the position of the International Panel on Climate Change (IPCC), which states: "*IPCC Guidelines do not automatically consider or assume biomass used for energy as 'carbon neutral', even in cases where the biomass is thought to be produced sustainably.*"[12]

In February 2025, the European Scientific Advisory Council on Climate Change looked at the recent decline in the EU's LULUCF carbon sink, writing "*The EU's land sink is declining rapidly, driven by climate impacts and competing demands for land use, such as food production, bioenergy production or ecosystem restoration*" and "*the decrease in the LULUCF sink is partly linked to increasing bioenergy use in the EU*".[13]

Finally, the authors of a peer-reviewed study published in July 2025 conclude "*that burning forest biomass, including logging residues, increases atmospheric CO2 concentration; land sector reporting using net greenhouse gas inventories obscures the impact of forest harvesting on ecosystem carbon stocks; and biomass energy will most likely displace other renewable energy, rather than fossil fuels. We also found that the use of bioenergy results in major negative cascading impacts for forest ecosystem integrity and consequently a reduction in the resilience and natural adaptive capacity of species in the face of climate change impacts*".[14]

Missing minimum safeguards:

Although we fundamentally disagree with carbon offsets and credits for BioCCS and other CDR approaches, we would particularly highlight the fact that the proposed BioCCS methodology and rules do not prevent biomass sourcing from countries where the LULUCF sector has been declining in recent years, nor from countries that have not ratified or are withdrawing from the Paris Climate Agreement (namely the USA, which supplies wood pellets to the Netherlands and Denmark). There are no biodiversity measures that ensure the protection and restoration of ecosystems. Finally, voluntary certification schemes accredited under the Renewable Energy Directive have been shown to be entirely ineffective.[15] The Sustainable Biomass Program, certifies even wood pellets made from whole logs from the clearcutting of oldgrowth forests as meeting current EU sustainability criteria.[16]

<u>Biochar</u>

Here we would like to set out our concerns about serious flaws in the proposed methodology and regulations:

1) It is proposed that only wastes and co-products as defined by Article 2 of the Renewable Energy Directive can be used as biochar feedstock for the purpose of CRCF certification, provided that "biochar accounts for at least 50% of the total energy outputs in the co-products". We consider this to be meaningless because it is very rare for pyrolysis to yield at least 50% char and thus no more than 50% syngas and pyrolysis oil. According to a study that looks at biochar production methods, published in 2022, slow, intermediate and fast

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[11] Burning Up the Carbon Sink: How the EU's Forest Biomass Policy Undermines Climate Mitigation, M.S. Booth and J. Giuntoli, GCB Bioenergy, February 2025, onlinelibrary.wiley.com/doi/epdf/10.1111/gcbb.70035
[12] IPCC Task Force on National Greenhouse Gas Inventories 2024, ipcc-nggip.iges.or.jp/faq/faq.html
[13] climate-advisory-board.europa.eu/reports-and-publications/scaling-up-carbon-dioxide-removals-recommendations-for-navigating-opportunities-and-risks-in-the-eu
[14] Burning Forest Biomass Is Not an Effective Climate Mitigation Response and Conflicts With Biodiversity Adaptation, Policy Paper, B. G. Mackey et.al., Climate Resilience and Sustainability, July 2025
[15] fern.org/publications-insight/mass-imbalance/
[16] forourclimate.org/research/596

pyrolysis result in biochar containing 35%, 25% and 12% of the carbon in the feedstock.[17] with all of those pyrolysis methods, the majority of carbon ends up in syngas and pyrolysis oil combined. The only pyrolysis process that in which more than 50% of biomass carbon ends up in char is torrefaction, according to the authors of the article. However, torrefaction temperatures are below the minimum temperature level for pyrolysis required under the proposed methodology and rules (based, no doubt, on the fact that char produced at low temperatures will have a higher content of toxic Polycyclic Aromatic Hydrocarbons).

2) Therefore, all of the concerns related to the climate and biodiversity impacts of biomass set out above in relation to BioCCS also apply to biochar.

3) Adding biochar, or for that matter any other source of carbon, to soils can result in positive or negative priming. Positive priming means stimulating soil microbes to mineralise existing soil organic carbon and turning that carbon into CO_2 emissions. Negative priming means reducing the amount of soil carbon mineralisation and thereby stabilising soil carbon. According to the proposal: "*Where biochar is applied to agricultural soils, operators shall demonstrate that the local agricultural context has been considered and that it is reasonable to expect no overall negative effect on agricultural production or soil health and no significant reductions in the storage of other soil organic carbon through positive priming effects from the application of biochar. Where significant loss of other soil organic carbon...are considered likely by the certification body, no carbon removal units shall be issued.*" We consider this akin to asking operators to seek out a fortune-teller. According to the authors of a 2022 peer-reviewed study, "*The complex interplay among various BC [black carbon] traits (feedstock, pyrolysis temperature, incubation time, rate of application, structural properties) and soil properties has a range of effects on BC-induced PEs [priming effects. In addition, SOC [soil organic carbon]-poor soils, low clay contents, low moisture, low temperature, and high pH soils stimulate the SOM [soil organic matter] mineralization. All these prescribed factors affect C sequestration in primed soil*".[18]
It is absurd to suggest that biochar producers should predict the priming effect of their biochar when there is no scientific method for making credible predictions of this type, when operators of pyrolysis plants are not likely to be soil scientists, and when there is not even a requirement for testing soil qualitites.

4) The proposed methodology is based on the assumption that most of the carbon contained in biochar will remain stable in soils for thousands of years. In reality, few studies have looked at the fate of soil carbon for as long as ten years following biochar application, let alone longer. According to the authors of a 2015 scientific review of large-scale biochar field trials, "*the stability of added biochar in soil remains a contentious topic*".[19] In 2017, another study was published, showing that, under field conditions, the residence time of black or pyrogenic carbon is far shorter than widely assumed: "*soil PyOC [pyrogenic organic carbon] contents decreased more rapidly than expected from current concepts, the mean residence time (MRT) of native PyOC being just 1.6 times longer than that of SOC. At the oldest experimental site, 55% of the initial PyOC remained after 80 years of bare fallow*". A more recent finding, published in a 2023 study, is that "*complex polymeric carbon in subsoil is vulnerable to decomposition and propose that molecular structure alone may not protect*

[17] Biochar production techniques utilizing biomass waste-derived materials and environmental applications – A review, Farah Amalina et.al., Journal of Hazardous Materials Advances, August 2022, sciencedirect.com/science/article/pii/S2772416622000900?via%3Dihub, Table 2

[18] Biochar-induced priming effects in soil via modifying the status of soil organic matter and microflora: A review, Maria Rasul et.al., September 2022, sciencedirect.com/science/article/abs/pii/S004896972105381X

[19] J. Wang et al.,2016. Biochar stability in soil: meta-analysis of decomposition and priming effects,Jinyang Wang et.al., April 2015, onlinelibrary.wiley.com/doi/10.1111/gcbb.12266

compounds from degradation under future warming".[20] This refers to pyrogenic or black carbon, including carbon in biochar.

5) According to the proposal in the Annex: "*Operators are not subject to further monitoring requirements after the end of the monitoring period as the risk of reversals is characterised through the assessment of the permanence fraction of the biochar and it is not practically possible to directly identify reversals after the point of application or incorporation*". As shown above (4) if the future fate of black carbon cannot be reliably ascertained through molecular analysis of biochar. On the other hand, soil carbon testing is very much "practically possible". It would at least show changes of soil carbon following biochar addition over a number of years, even if the longer-term fate remains unpredictable. It is the overall amount of soil carbon over time that matters in the context of the CRCF, not the fate of specific black carbon molecules. ***Without mandatory period soil carbon testing, there can be no evidence of even medium-term net increases in soil carbon following biochar application. Even with such carbon testing, however, it cannot be assumed that soil carbon increases (classed as negative emissions under CRCF) will remain until 2100 or beyond.***

[20] Rapid loss of complex polymers and pyrogenic carbon in subsoils under whole-soil warming, Cyril U. Zosso et.al., Nature Geoscience, February 2023, nature.com/articles/s41561-023-01142-1