

Overview of the Carbon Removals and Carbon Farming Certification process

In December 2024, the EU launched its certification framework for permanent carbon removals, carbon farming and carbon storage in products, commonly known as the Carbon Removals and Carbon Farming (CRCF) certification [Framework](#).

As its name suggests, the CRCF aims to certify a variety of practices or processes, namely: permanent carbon removals, carbon farming, and carbon storage in products. Each practice involves specific activities for which tailored methodologies are currently being developed. The methodologies will be published as [Delegated Acts](#), taking on the force of law. Note that the Regulation only offers guidance on the basic rules for developing the methodologies (Articles 4 till 8) and the elements they should contain (Annex I).

Overall, the activities involve:

1. **Permanent removals:** direct air capture and storage (DACCS), biomass with carbon capture and storage (BioCCS) and biochar. Biochar is currently classified as a permanent removal activity - yet uncertainty persists on its storage length. Therefore, a key aspect of the methodology is determining how much of a given biochar batch will be stored for at least several centuries.
2. **Carbon farming emissions reductions**, namely via peatland restoration through rewetting and, in the near future, reduced fertiliser use.
3. **Carbon farming sequestration**, specifically the planting of trees on unused and severely degraded land, soil carbon sequestration in mineral (or agricultural) soils and agro-forestry.
4. **Carbon storage in products**, mainly wooden construction elements.

Note that the list of activities is likely to expand.

As established in Articles 4 to 7 of the CRCF, the methodologies will follow the so-called Q.U.A.L.I.T.Y criteria. These are the quantification of climate impacts (against a baseline), the additionality of the activity, its long-term storage and liability for early release into the atmosphere, and sustainability. The methodologies should set out robust conditions, tests and safeguards that eligible activities need to comply with to be certified under the scheme. However, as a voluntary framework, the decision on whether to participate in the scheme or not rests with the operators and certification schemes.

While the European Commission and its consultants are developing the methodologies, these are also being discussed within the EU Carbon Removals Expert Group ([CREG](#)) of which CMW is a member. Note that, in addition to CREG meetings, numerous online workshops, discussing particular sections of (at times specific) methodologies, e.g. quantification in forestry, are held throughout the year.

Unfortunately, the CREG is largely dominated by industry lobbyists, which skews the balance during discussions and diminishes vital voices from independent experts, researchers, and civil society. As an active member of the CREG and the CRCF process in general, CMW has sought to rectify this imbalance by hiring its own consultants to thoroughly review the methodologies and flag pertinent issues. This document sets out the feedback received for the biochar methodology by Öko-Institut. By sharing this information, we hope to contribute to the debate and shed further light on the numerous issues affecting the methodologies.

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Assessment of the draft technical specifications for certification under the EU CRCF

Biochar

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Summary of key findings and recommendations

This document provides an assessment of the proposed draft technical specifications for the certification of permanent carbon removals through biochar, dated 10 November 2024. In its current form, the methodology may lead to substantial overestimation of removals. In some instances, no removals may occur at all. The methodology should be improved in many aspects, in particular with regard to the following issues:

- **Only new mitigation activities should be eligible:** The methodology allows rewarding past climate action. The methodology should include provisions to ensure that mitigation activities are only eligible if they are newly implemented and if they have considered the incentives from CRCF units when deciding to proceed with the implementation of the mitigation activities (see our textual proposal in our [cross-cutting findings](#)).
- **Accounting for biomass use:** The methodology does not appropriately account for the GHG impact of increasing the use of biomass. In some instances, the use of biomass for biochar production may merely shift carbon from one pool to another, or from one use to another, not resulting in any enhancement of removals relative to the baseline scenario. Biomass should only be eligible to be used under the methodology where it stems from biomass residues that are not commonly used (i.e. it would decay in the baseline scenario) or newly established sources. The methodology should include provisions to identify such biomass sources (see our detailed comments and explanations on this matter in the section on accounting for biomass use in our [cross-cutting findings](#)).
- **No consideration of cascade principles in defining eligible biomass types:** A circular bioeconomy is part of the EU's Circular Economy Action Plan and the EU has developed guidance on cascading use of biomass. These principles inter alia require keeping carbon-storing biomass in its material form for as long as possible, take sustainable mobilized biomass as a starting point and promoting the highest economic added value. These

principles should be reflected in the methodology by determining which type of biomass sources should be eligible for use towards biochar production.

- **Important emission sources are not considered:** The methodology does not consider important emission sources, such as emissions associated with the production and transportation of biomass feedstocks to the biochar production plant, or emissions from any waste products. The methodology should be amended to comprehensively consider emission sources unless their omission results in a more conservative estimate of removals.
- **Operating conditions of biochar plants should be defined more clearly:** Newbuilt biochar plants that may operate for decades should reflect state-of-the-art and not lead to lock-in GHG intensive practices which could undermine achieving the EU's climate targets. The methodology should specify that venting of methane is prohibited, that no fossil fuels shall be used in the biochar production plants and specify that biochar shall be produced based on pyrolysis, as other processes have too low temperatures. Biomass should only be sourced from within the EU.
- **Quantification of removals needs improvement in many areas:** The methodological approaches for quantifying removals should be improved in several areas, including specification of measurement approaches and reporting frequency, and the documentation of measurement outcomes. The priming effect of biochar is not mentioned and should be addressed.
- **No consideration of public funding:** The eligible mitigation activities may also be funded through public funding. If mitigation activities receive both public subsidies and CRCF units, this could artificially lower CRCF unit prices and implicitly subsidise continued fossil fuel use by the buyers of the units. The methodology should either exclude mitigation activities that receive public funding or proportionally attribute the removals or emission reductions to the financial support provided (see our [cross-cutting findings](#)).

More detailed and further comments are provided below.

Detailed comments

Section 1: Definitions

- **Definition of biochar:** Biochar has a growing number of uses in agriculture, industry or construction. These uses require certain biochar qualities, e.g. use as resource in construction requires compliance with EU REACH regulation, biochar as feeding supplement in agriculture or on soils requires compliance with EU feed regulation or fertilizer regulation. The current definition does not recognize that different types of uses of the biochar require compliance with additional EU legislation. At the end of the CFCR method, these differences are addressed in sections 4, 5 and 7, but it is recommended that the definition separates between different biochar uses and as these different products have to comply with different parts of EU legislation.

It would also be useful to add that biochar shall be produced by pyrolysis and exclude torrefaction and hydrothermal carbonization. These processes have lower temperatures than 350° C and are excluded indirectly through the current temperature ranges in the definition. The addition would add clarity for the users.

- **Definition of greenhouse gases:** The draft methodology defines greenhouse gases as follows: 'greenhouse gas (GHG)' refers to any greenhouse gas listed in Annex II to Directive 2003/87/EC.
 - The list of GHGs in that Annex to the ETS Directive is both incomplete and unclear with respect to fluorinated GHGs covered under the EU NDC: NF_3 (nitrogen trifluoride) is missing and the gas groups HFC (hydrofluorocarbons) and PFCs (perfluorocarbons) are not defined.
 - Instead of Annex II of the ETS Directive, the methodology should better refer to Part 2 of Annex V of the Regulation (EU) 2018/1999 (the Governance Regulation) for defining GHGs (see also our [cross-cutting findings](#)).
- **Global warming potential (GWP) values:** The draft methodology defines CO_2e with a reference to 'global warming potentials' without further specification in section 1: In section 4, a reference to the GWP100 of 5th IPCC Assessment report is made.
 - The reference to AR5 is ambiguous with respect to methane: in the AR5 two different GWPs for methane are given, with and without climate-carbon feedbacks.
 - In EU law, AR5 based GWP100 values are defined in Annex I of Commission Delegated Regulation (EU) 2020/1044 (in that Delegated Regulation under the EU Governance Regulation targeted for the use in the GHG inventory & projection reporting context). For methane, the GWP without climate-carbon feedback was chosen.

- For future NDCs, the EU may possibly move to AR6 and in that event Annex I of Commission Delegated Regulation (EU) 2020/1044 would be changed.
- Instead of the general and vague reference to the AR5, the CRCF methodology could
 - either refer to Annex I of Commission Delegated Regulation (EU) 2020/1044;
 - or copy the values given in the present AR5-based version of that Annex (for future NDCs, the EU may possibly move to AR6 and in that event Commission Delegated Regulation (EU) 2020/1044 would be updated).
- Both approaches have precedents under EU law, both under the EU-ETS:
 - The definition of GWPs applied for ETS emissions in maritime transport activities is managed in in Regulation (EU) 2015/757 via a link to of Commission Delegated Regulation (EU) 2020/1044.
 - The definition of GWPs applied for ETS emissions in stationary installations (certain activities in chemical industry and metal production) is managed in Commission Implementing Regulation (EU) 2018/2066 by means of copying the relevant GWP values into Annex VI section 3 Table 6 of that Implementing Regulation (and the values in that Table were updated from an AR4 basis into an AR5 basis by means of an amendment of that implementing Regulation in 2020, coming into effect 1 January 2021 (see also our [cross-cutting findings](#)).
- Minor: In the definition of ‘associated CO₂’ use ‘process chain’ rather than ‘lifecycle’ (with permanent removals we don’t want cycle).

Section 2: Scope

- **Biomass should only be sourced from within the EU:** We welcome that the biochar production facility and storage must take place in the EU but we strongly recommend extending this requirement to the biomass feedstock for the biochar production. Thus, also the production of the biomass feedstock has to occur in the EU. Such extension to the biomass feedstock may also help prevent carbon leakage. The text (p. 6) should read: *“The biomass feedstocks, the biochar production facility and the storage location for the biochar shall be located in the European Union.”*

There are already reports of deforestation activities in African countries occurring for exports for biochar production. Without the proposed amendment that the biomass feedstocks must be produced in the EU, the EU would be responsible for triggering such detrimental developments.

- **Upstream emissions associated with biomass feedstocks:** The carbon removal process chain has to include the upstream emissions for the biomass

feedstocks, e.g. the transport of the biomass feedstocks from the location where it is produced to the biochar facility. These emissions are currently not included, nor any other relevant upstream emissions. This transport process clearly has to be attributed to the biochar production and would not take place without the biochar production. Thus, the current accounting of biochar emissions in the draft methodology is incomplete. If the biomass feedstock is produced for the purposes of biochar production, all upstream emissions from the productions shall be included in the carbon removal process chain.

The text should read as following: *“The operator applying for the certification is required to take on the responsibility for the entire carbon removal ~~value~~ **process chain**, either by providing all the required services (**production and transport of biomass feedstocks**, operation of a biochar facility, transport to market and storage by application to soils or incorporation in a product) themselves or by engaging with partners or subcontractors.”*

- **Only new mitigation activities should be eligible:** The methodology does not include any provisions that prevent rewarding past climate action. The methodology should include provisions to ensure that mitigation activities are only eligible if they are newly implemented and if they have considered the incentives from CRCF units when deciding to proceed with the implementation of the mitigation activities (see our textual proposal in our [cross-cutting findings](#)).

Section 4: Requirements for quantification

Quantification of permanent net carbon removal benefit

- **Editorial:** The description of the key first equation [1] (p. 8) is not user-friendly and misleading as it does not explain the use of “minus” or “plus” in the equations. The presentation of the equations should be improved and better explained.
- **No consideration of emissions associated with generation of the biomass resources used as feedstock:** The definitions of $\text{GHG}_{\text{associated}}$ in equation [1] and [3] and the procedures in the relevant further sections of the methodology do not consider the upstream emissions associated with the generation of biomass residues. In particular, emissions from the production of biomass for the purpose of biochar production and emissions from transport of the biomass feedstocks to the biochar production facility are missing. These upstream emissions would not take place in the absence of biochar production and should therefore be addressed as part of the associated GHG emissions. These upstream emissions are covered in the CRCF DACC/BECCs methodology. The exclusion in this methodology would provide an unfair advantage to biochar compared to other methodologies under the framework.
- **Waste disposal from biochar production not considered:** The term $\text{GHG}_{\text{associated}}$ also misses emissions associated with the waste disposal of any waste remaining from the biochar production facility, including waste from any biomass used for energy consumed by the facilities, emissions from wastewater and exhaust gases generated in the biochar facility. This inclusion of waste treatment is

also inconsistent with CRCF DAC and BECCS methodology where such emissions are included.

- **Use of non-biogenic sources of carbon in the feedstock:** The use of non-biogenic materials in the biochar production process such as plastics, as referred to in describing the term Q_{biochar} on page 12, should be generally excluded (as for example in the World Certificate Biochar Guidelines). Unavoidable biomass contamination by plastic, rubber waste, and/or other fossil carbon-based products/polymers must not exceed 1% (m/m). Producing biochar from fossil materials is not sustainable and not a carbon removal technology that should be supported. The inclusion of non-biogenic materials is significantly reducing the quality of the biochar and will disincentivize the biochar application on soils and for other uses and prevent the establishment of value chains for the biochar. The guidelines have to be more specific about contamination by pollutants. It is not sufficient to address them in general terms as non-biogenic carbon.

The methodology is also not sufficiently clear how the non-biogenic carbon is determined (how frequently has the carbon 14 (C14) testing to be done, which exact method for testing has to be used, clear references are needed. But this addition would not be needed if non-biogenic materials are excluded.

- **Certification audit.** If the certification body is not satisfied with the quantification, it has to withhold certification. Otherwise, the certification is useless, if there are no consequences at all, if the requirements are not fulfilled. The methodology should be rephrased in the following way: *“If a certification body is not satisfied that the estimated values represent a reasonable characterisation of the project, then it **shall may** withhold certification.”* (p. 9)
- **Re-certification:** The guidance should be more specific related to the measured values required. What type of measurements, how frequently etc.
- **The proposed materiality threshold is inconsistent with the principle of conservative quantification.** The methodology should be revised to include all emission sources or sinks, except where the exclusion is conservative (see our [cross-cutting findings](#) for more details). Note also that the materiality threshold of 2% refers to ‘gross carbon removals’ without defining what ‘gross carbon removals’ are, which presumably refers to CR_{total} .

Baseline

- **Inappropriate standardised baseline:** The standardised baseline should not be 0 tCO₂/year for biochar activities. This does not correctly reflect the mitigation effects of producing biochar. In some instances, the use of biomass for biochar production may merely shift carbon from one pool to another, or from one use to another, not resulting in any enhancement of removals relative to the baseline scenario. Biomass should only be eligible to be used under the methodology where it stems from biomass residues that are not commonly used (i.e. it would decay in the baseline scenario) or newly established sources. The methodology should include provisions to identify such biomass sources (see our detailed comments and explanations on this matter in the section on accounting for biomass use in our [cross-cutting findings](#)).

Installations producing biochar

- **Allocation of emissions to the biochar:** There is no explanation why no emissions should be allocated to the production process if the biochar is containing 10% of the total chemical energy. Moreover, while an allocation based on energy content may be appropriate for situations where different fuels are produced, this allocation is not appropriate for the context of biochar production where biochar is not produced for the purpose of being used as a fuel. Given that the plants should be mainly constructed for the purpose of producing biochar and the plant would not operate in the baseline scenario – noting that if the plant would be constructed anyways for energy generation purposes and the biochar is a by-product, then the mitigation activity may not be additional – a conservative and robust approach would be allocating all emissions to the biochar.

Similar considerations apply to the allocation to co-products. The allocation of emissions to other products should only be applied, if the facility proves that these products are sold and the energy content is used by other facilities. If the other products including their energy contents are wasted and released in the atmosphere, all emissions have to be allocated to the biochar produced. Otherwise, large amounts of emissions produced are excluded from the accounting. However, if the main purpose of the facility is energy generation, the facility may also be constructed in the baseline scenario.

Lastly, the emissions impact also depends on what kind of fuels the co-products are replacing if they are being used. If these co-products substitute the adoption of low emission technologies such as heat pumps, then the allocation would also underestimate the emissions impact of the construction of the plant.

Overall, the rules for allocation need revision. A conservative default approach should be to allocate all emissions to the biochar production (assuming that the plant is additional and would not be constructed anyways).

- **E_{co-products}:** the facility should continuously monitor and prove that the quantity of E_{co-products} subtracted is consistent with the electricity and heat sold to a grid outside the system boundary.
- **Biomass sources and principles of cascade use:** The RED III and its Annexes are not properly referred to which makes it impossible to understand the draft methodology. In addition, the references to Annex V seem to be too complicated for the purposes of biochar facilities and the relevant provisions should be extracted and added to this methodology. For any user of the method it is very difficult to understand which parts of the complex RED III provisions in Annex V and VI are relevant, because biochar facilities will mostly not use biomass fuels, but other solid biomass feedstocks. Annex VI of the RED Directive lists different types of biomass inputs that could also be inputs to biochar plants, but the percentage GHG savings for heat and electricity in this Annex is not what is required for the biochar methodology. The table would need to show GHG emissions related to the biomass sources, not emission savings.

Instead of complicated references to the RED Directive, for user-friendliness of the biochar methodology it is preferred to implement a positive list with permissible biomass feedstocks for the production of biochar. This positive list shall only

include biomass residues and residual biomass (Harvest residues from agricultural crops, prunings from perennial cultures, residues from landscape management, residues from wood processing, organic residues and waste, manure, residues from anaerobic digestion) and shall exclude wood and wood chips and annual crops only produced for the purposes of biochar production. The positive list can use elements from the RED Directive but, it is preferable to add an Annex with a respective list to the biochar methodology as this is considerably more user-friendly and would promote the use by private entities (see our detailed comments and explanations on this matter in the section on accounting for biomass use in our [cross-cutting findings](#)).

A circular bioeconomy is part of the EU's Circular Economy Action Plan and the EU has developed guidance on cascading use of biomass¹. These principles inter alia require keeping carbon-storing biomass in its material form for as long as possible, take sustainable mobilized biomass as a starting point and promoting the highest economic added value. We currently do not see the cascading principles for circular biomass reflected in the methodology and these principles should be reflected with additional guidance related to different biomass feedstocks that can potentially be used for biochar production. For biomass feedstocks such as wood other long-term uses are preferable (e.g. construction, furniture, replacement of fossil-based products) compared to a direct production of biochar from wood. There are not sufficient biomass sources in the EU to comply with current needs for the different purposes and biochar may add to this competition. Therefore, it is essential to incorporate elements in the methodology that safeguard cascading use of biomass as foreseen in the EU's circular economy strategy. Agricultural crops should primarily be used for food supply and not for energy production or biochar production.

Emissions from the biochar facility

- **CH₄ vented:** CH₄ emissions from venting in the pyrolysis process shall be prohibited as this is technically possible (other biochar certification standards such as World biochar Certificate clearly prohibit CH₄ venting). These plants do not yet exist at large scale and will be mostly newbuilt and should therefore be state-of-the-art technology. Thus, they should not emit any CH₄. Please check whether the release of CH₄ from newbuilt production facilities would be in line with EU requirements for permitting new production facilities. If the CH₄ venting is not prohibited, there should at least be the requirement of continuous measurement of CH₄ venting and flaring. Two measurements during the certification period are certainly not sufficient. It is also not clear what twice during a certification period means. Twice for 5 minutes, twice during a day, twice a week? Venting could vary considerably over time and two measurements will not capture the released CH₄. If venting occurs, the results of the continuous measurement results have to be transferred annually from the certified projects to the institutions responsible for national GHG inventories for the national reporting, as these will be additional sources of GHG emissions in the EU and MS will not be able to track these emissions. This

¹ European Commission: Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Guidance on cascading use of biomass with selected good practice examples on woody biomass, Publications Office, 2018, <https://data.europa.eu/doi/10.2873/68553>

provision to allow and even promote new CH₄ sources from venting at installations is not in line with the EU's methane strategy.

- **GHG_{bio-storage}**: The methodology uses the term “**batch**”, but does not define what a batch is. “Batch” should be defined. Other biochar certification methodologies provide such definitions, e.g. World Biochar Certificate, defines that a production batch lasts a maximum of one calendar day, including all possible interruptions and requires a unique ID number and QR code to ensure traceability of the biomass feedstock, the conditions of production and the quality of biochar.
- The exceptions that CH₄ emissions from biomass storage for less than four weeks and with a maximum of 30% residual moisture shall be set to zero shall be deleted. On these four weeks CH₄ emissions are likely to occur and should be accounted.
- No scientific sources of the parameter 0.0013 for the assumed monthly fractional loss of biomass is provided. This needs to be clearly justified based on available scientific evidence. The emissions will depend on the type of biomass, moisture content and temperature which is not taken into account. CH₄ emissions should be measured if storage of biomass with moisture contents of >30% is used.
- The methodology does not cover the situation that insufficient water content can cause dust formation and spontaneous combustion and the provisions related to low water content increase these risks. This should be added.
- **GHG_{combustion}**: The combustion of fossil fuels at the biochar production facility should generally be prohibited in the certification framework. Biochar facilities are not yet widespread facilities. The EU should not allow that new facilities that consume fossil fuels for decades are built for the purposes of carbon sequestration with biomass. If this is implemented, the storage of fossil CO₂ is not necessary in equation.
- **GHG_{Heat}**: The combustion of fossil fuels for heat produced outside the system boundary and consumed by the biochar production process should generally be prohibited in the certification framework.

Emissions from inputs

- Examples of relevant inputs and related GHG emissions should be provided in the methodology.

Monitoring and reporting

- **Monitoring of carbon uptake in soils**: If the monitoring period stops with the application of biochar to land or the incorporation in products, there seems to be no process to evaluate whether the assumptions made mostly from laboratory experiments are correct and no checks are foreseen regarding the degradation of biochar and the carbon contents of soils. There should at least be regular assessments of the biochar degradation and the total soil carbon (for biochar added to soils) to:
 1. Confirm the assumptions made by biochar experts with regard to permanence; and

2. Provide the necessary data required for national GHG inventories to develop Tier 2, country-specific sequestration factors as required in the 2019 IPCC methodological supplement for biochar accounting in GHG inventories. This requires a continuous periodic measurement of the biochar degradation, but also the development of total soil carbon in the soils on which biochar is applied. If such monitoring is missing, Member States will not be able to consider the effects of biochar in the national GHG inventories and the biochar application cannot be accounted as carbon removals for the EU's GHG emission targets. This will result in a substantive disincentive to implement any incentive schemes for biochar for Member States.
- It seems incorrect that the monitoring shall occur on an annual basis. The reporting of the monitored information may be on an annual basis, but parameters such as the quantity of biomass consumed has to be monitored continuously.
 - The monitoring and reporting should not be limited to the GHG emissions, other parameters should be monitored and reported:
 - Results of analysis of PCB and PCDD/F
 - Results of analysis for polycyclic aromatic hydrocarbons (PAH)
 - Results of the analysis of heavy metals
 - There should also be certain key parameters and properties that shall be declared on the biochar product certified e.g.:
 - Organic carbon content of biochar
 - H/C_{org} ratio
 - Biochar nutrients at least for nitrogen, phosphorus, potassium, magnesium, calcium and iron.
 - Water holding capacity
 - pH, salt content, bulk density, water content
 - The analytical methods should be specified by the biochar methodology, see for example analytical methods for WBC-biochar that specify sample preparation, bulk density measurement, water content measurement, organic carbon content, H/C and O/C and many more parameters. They should not be a choice for the users of the methods. If standards such as ISO, DIN etc. exist for the measurements, they have to be used. This is a key part of any methodology and a key gap in the draft biochar methodology. Flexibility to choose between many different quantification approaches can lead to adverse selection, as has been observed with some methodologies in the voluntary carbon market.
 - The monitoring frequency should also be specified in the methodology (which is currently not the case), the reporting should only prove that the guidance has been followed.
 - **No consideration of public funding:** The eligible mitigation activities might already receive funding through public support schemes. If mitigation activities

receive both public subsidies and CRCF units, this could artificially lower CRCF unit prices and implicitly subsidise continued fossil fuel use by the buyers of the units. The methodology should either exclude mitigation activities that receive public funding or proportionally attribute the removals or emission reductions to the financial support provided (see our [cross-cutting findings](#)).

Transport of biochar

- Only one trip is allocated to the biochar, but empty trips are likely to occur which are not allocated to the biochar but increase general emissions for the country or the public. Therefore both trips should be allocated to the biochar.

Use of biochar

- This section – similar to other – misses all references to the methods specified. The methods used to determine permanence fraction should be part of standards such as ISO or DIN.
- In the workshop related to the biochar methodology it was mentioned that expertise to determine inertinite is very rare and not commonly available in qualified laboratories. This method should only be used if there are at least three certified laboratories operating in each Member State to perform the analysis. A certified standard for the inertinite assessment shall be provided. The availability of the analytical capacities should be analysed by the methodological developers prior to publishing draft methodologies and not asked as a question to the reviewers.
- It is preferable to use the decay function based on H/Corg ratio because this is the method already used in other biochar certification methods and there is a DIN/ISO standard available for the analysis. However, it is explained that the 200 year values are not directly presented in the paper and were derived by the project team. This approach has to be transparently included in an Annex to the methodology. It is not explained what type of temperature is indicated in table 4 (outside temperature, soil temperature?).
- GHG electricity is explained under the equation but not used in the equation.

Common principles for quantification

Section 6.2.2 Heat

- The combustion of fossil fuels for the generation of heat for pyrolysis should generally be prohibited in the certification framework. The EU should not build additional plants that consume fossil fuels for decades for the purposes of carbon sequestration with biomass. This could lead to a lock-in into carbon intensive technologies and practice that may undermine the achievement of the EU's climate targets. This should also apply to heat supplied from a heat network, if this is based on fossil fuels.

Section 6.2.4 Inputs

- The specifications or the calculation of emissions is not user-friendly at all. There should be additional tables in an annex indicating which part of the lifecycle emissions can be found in which of the documents quoted.

- For the use of the Ecoinvent database, a single license is related with costs of at least € 3,800 a year. It does not seem adequate that the EU legislation provides a permanent revenue stream for a single company that is monopolizing data for lifecycle assessments. Has it been checked whether this listing is in line with EU state aid and EU competition legislation? This also implies that only large companies with respective licenses will be able to implement the calculations. NGOs may not be able to cross-check any supplied documents. In addition, the Ecoinvent database is also not sufficiently transparent to be used for this purpose. All required parameters for the methods have to be published in an annex to the biochar method and the commercial Ecoinvent database should be deleted as a sources. The correct implementation of EU legislation cannot be dependent on the purchase of expensive licenses from companies.

Section 6.2.5 Transport

- The methodology says that Table 6 is based in the JRC report “Solid and gaseous bioenergy pathways: input values and GHG emissions”. However, there is not proper reference to this source and the values presented in Table 6 could not be found in the reference quoted. The JRC report presents more disaggregated emissions per kilometer for different types of biomass feedstocks that typically have different transport distance. These disaggregate findings have been merged in an extremely intransparent way into three emission factors. The JRC report quoted indicated that this approach is incorrect and adds unnecessary uncertainty to the calculation as more detailed data is available for different types of biomass feedstocks. Thus, the table should be far more disaggregate using the same biomass categories and providing factors for different transport distances. From such table the users should select the adequate parameters for the biomass feedstock used. It is correct that operators do not need to calculate emissions specifically for vehicles and routes utilized, but they should use specific factors for biomass feedstock types and distance categories that are available in this document.

Section 6.3 Capital emissions

- Why should emissions associated with non-biomass renewable energy generation equipment be excluded if the equipment has been built to produce electricity for the biochar plant? This would lead to incomplete emissions and these emissions have been generated for the biochar plant and shall not be excluded.

Section 6.2 Biochar sampling

- The sampling shall occur for each production batch produced with the same parameters. The same is the case for retention samples. This is missing from the guidance. Please delete “Where biochar sampling is required”, at the beginning of the paragraph and replace with information that described when exactly sampling is required and how frequently.

6.5 Measured data and uncertainties

- Please add in all relevant parts of the methodology how uncertainty is estimated based on measurements or add default uncertainties to ensure that the described uncertainty calculation can be implemented. In particular for the emission factors provided, it is important to add uncertainties.

6.6 Monitoring and reporting

- The analytical methods have to be specified by the biochar methodology, see for example analytical methods for WBC-biochar that specify sample preparation, bulk density measurement, water content measurement, organic carbon content, H/C and O/C and many more parameters. They should not be a choice for the users of the methods. If standards such as ISO, DIN etc. exist for the measurements, they have to be used. This is a key part of any methodology and a key gap in the draft biochar methodology.
- The monitoring frequency should also be specified in the methodology (which is currently not the case), the reporting should only prove that the guidance has been followed.
- The reliability of the monitoring/ measurement methods should not be up to the user, but reliable methods should be selected and described in this methodology.
- The annual monitored GHG emissions and removals have to be transferred to national GHG inventory agencies to ensure that certified GHG removals can be reflected in national GHG inventories and the EU GHG inventory. The 2019 IPCC methodology requires a Tier 2 method with country-specific emission/ removal factors. Without such transmission, countries will not be able to report any sequestration effects of the biochar certification framework.

Section 5: Storage monitoring and liability

- Monitoring is only required until the biochar is applied to the land or incorporated into a product as defined in the methodology. Thereafter, no further monitoring is required, as the risk of reversal for the permanent fraction of the carbon into the biochar is considered low (except for high temperature cement recycling processes) (p. 31).
 - The priming effect of biochar is not mentioned and should be addressed. There should be onsite monitoring practices that analyse whether negative priming effects of the biochar applied occur that stimulate soil organic carbon mineralization in the soils on which biochar is applied. As the related research seems to indicate that the direction of the priming effect (enhancement or reduction of carbon mineralization) may depend on soil properties and biochar properties further onsite investigations have to be conducted to avoid unaccounted emissions from enhanced SOC mineralization. Thus, there has to be further monitoring after the biochar is applied to the land. The risk of reversal depends on the interaction of the biochar with the soil. This is not the task of the Commission, but the task under the certification method to ensure that the assumed carbon storage is not significantly reduced through interactions of the biochar with the soils on which it is applied. Representative measurement campaigns need to be conducted to gather further evidence related to priming.

Section 6: Sustainability requirements

Sustainability requirements for biomass feedstocks

- It also has to be specified which biochar parameters have to be declared when the product is sold.
- The biomass used must not contain any paint residues, solvents or other potentially toxic impurities.
- For the eight cancerogenic PAHs (The eight cancerogenic compounds within 16 EPA PAH = 8 EFSA PAH are Benzo[a]pyrene, Benzo[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Dibenzo[a,h]anthracene, Indeno[1,2,3-cd]pyrene, Benzo[ghi]perylene), and additional limit shall be set, The WBC limit value of 1 mg for the sum of EFSA PAHs kg⁻¹ shall be applied.

Requirements for the biochar production process

- For the pyrolysis of animal by-products such as manure and manure containing biogas digestates, pyrolysis conditions must exceed 500 °C for 3 minutes at minimum to eliminate biological hazards and micropollutants (European Biochar Certificate)
- During the pyrolysis process, aromatic carbon, carbonates, and a multitude of diverse volatile organic compounds are formed. The latter constitutes a large part of the pyrolysis gas that partially condensates on biochar surfaces and pores. These condensed pyrolysis gas compounds are substantial constituents of biochar materials, are essential for certain biochar functions and thus necessary for the characterization of biochar. However, a quantitative determination of VOCs cannot be carried out at a reasonable cost. For an independent estimation of the true pyrolysis temperature, which can deviate from the temperature measured at the reactor for various reasons, the weight loss of volatile compounds of biochar is determined by gradually increasing the temperature in the absence of air using the thermogravimetric analysis (TGA). The TGA diagram can thus be used to determine both the absolute VOC content and the maximum temperature to which the biochar was exposed during pyrolysis. The total VOC content and its temperature-dependent degassing are considered as a criterion for the evaluation of the pyrolysis process. For this reason, it is considered sufficient that the TGA analysis need only be carried out in the first control year of a pyrolysis unit and should be reported in the first control year. (European Biochar Certificate)
- The method should exclude additional GHG emissions from the biochar production process. The use of fossil fuels for the heating of the pyrolysis reactor has to be prohibited. If the pyrolysis reactor is electrically heated, electricity from renewable energy sources has to be used. The current requirement related to the energy conversion efficiency is far too complicated.
- The pyrolysis gases produced during pyrolysis must be recovered or burned. It should be prohibited that they escape into the atmosphere. This requirement should be added.

- Excess/ waste heat from the plant should be used to at least 70% (e.g. for drying biomass, district heating) and a solution for efficient waste heat recovery has to be implemented.
- **Further clarity needed on item (i):** In point (i), the methodology requires the activity to be compliant with the criteria set out in Appendix A to Annex 1 to Commission Delegated Regulation (EU) 2021/2139. However, this provision is not clear:
 - Commission Delegated Regulation (EU) 2021/2139 functions under the Taxonomy Regulation (EU) 2020/852
 - Commission Delegated Regulation (EU) 2021/2139 of 4 June 2021 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives.
 - Appendix A to Annex 1 does not list any criteria but rather lists a classification of climate-related hazards, relevant for adaptation-related DNSH (do no significant harm) criteria under the Taxonomy. We wonder whether the reference in the methodology was a drafting error and which reference was intended to be included.
- **Further clarity needed on item (vi):** Reference to Art. 29 of RED needs to be improved:
 - In point (vi), the methodology requires that all biomass used for eligible BECCS activities shall comply with the sustainability requirements detailed in Article 29. It further implies
 - that therefore (quote: “i.e.”) ‘*all biomass utilised as feedstock must meet the requirements to be eligible to receive Member State financial support if utilised in energy applications*’
 - and that this ‘*excludes the use as feedstock of saw logs, veneer logs, industrial grade roundwood, stumps and roots*’.
 - In our interpretation of the RED, Art 29 sustainability requirements (as laid out in paras (2) – (7) of Art 29) do apply as minimum requirement for biomass eligible for financial support (see RED Art 29 (1) point c). However, it's not the Art 29 sustainability criteria that exclude saw logs, veneer logs, industrial grade roundwood, stumps and roots from financial support. This exclusion is provided for under Art 3(3c) of RED III.
 - In order to safeguard the exclusion of those biomass feedstock types, the feedstock limitation in section 6 of the CRCF methodology should better refer to both, eligibility under RED Art 3 (3c) and compliance with sustainability criteria of RED Art 29 (2)-(7). A simple reference to Art 29 of the RED would be unclear and misleading.

- The authors of this note cannot yet judge whether it would make sense to link biomass sustainability criteria in the DACCS/BECCS methodology also to compliance with GHG emissions savings criteria of RED Art 29 (10). Such a judgement would require an in-depth analysis of energy savings calculations defined in subordinate legislation under the RED.

Section 7: Information to be included in the certificate of compliance

- **Information to be made available on CRCF units:** The information to be included in certificates and publicly available background information should be amended (see the specific proposals in our [cross-cutting findings](#)).

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