From: Harald Bier EBI <Harald.Bier@biochar-industry.com>
Sent: Tuesday, 11 October, 2022 18:12
To: Supervisory-Body <Supervisory-Body@unfccc.int>
Cc: EBI Office <info@biochar-industry.com>
Subject: Call for input 2022 - activities involving removals under the Article 6.4 Mechanism of the Paris Agreement

Dear all,

Please find attached the comment of European Biochar Association (EBI).
Thank you for this initiative, we are more than happy to respond to any questions you might have and/or provide peer-reviewed literature.

All the best,

Harald Bier

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EBI response to the UNFCCC – Call for input 2022 – Activities involving removals under the Article 6.4 Mechanism of the Paris Agreement

The European Biochar Industry (EBI) Consortium welcomes the UNFCCC initiative to elaborate on removal activities under the article 6.4 mechanism and requirements for the development and assessment of mechanism methodologies pertaining to activities involving removals. The EBI is a trade and business association representing **over 70 members** across the entire value-chain of biochar, located across **more than 14 countries**.

Transparent, accurate and practical report frameworks for removals are key to achieving climate targets.

We are pleased that **biochar is already an integral part** of the UNFCCC draft, following the reports of the IPCC. Biochar, respectively the technological process of transforming residual biomass into a stable, safe, and functional form of carbon, is developing very fast. As an example, the number of scientific papers containing the word "biochar" increased form less than 50 per year at the beginning of the 2000s to more than 5000 per year in 2020[1][2].

Today, **Pyrogenic Carbon Capture and Storage (PyCCS) represents the most relevant technical carbon sink.** PyCCS is the technical process of transforming biogenic carbon (mainly forest, agricultural or urban residues) into a valuable, stable form of carbon (biochar) and the subsequent long-term storage by use in materials or soils. Due to the **mature technical readiness level (TRL) of 8+,** a developed voluntary market for biochar-based carbon sink certificates and added value through marketable products like renewable energy and biochar, the industry is growing rapidly (CAGR 2019 2022: 67%). Hence, in **2022 alone, EU wide PyCCS installations will sequester 100.000 tons of CO_{2e}**. In 2036, **255 million tons of CO_{2e}** annually can be stored if PyCCS is supported by policy as a key means to carbon sequestration[3]. In short term: PyCCS is a key technology for the creation of carbon sinks and thus for mitigating climate change.

Scaling this industry further leads to **job creation within different sectors,** e.g. energy, forestry and agriculture, energy independence and climate resilience in the course of biochar applications[4]. Therefore, we are glad to share state of the art knowledge with all relevant stakeholders, especially the UNFCCC, to build the needed suitable, transparent and practical framework to scale carbon removals, to mitigate climate change and maintain a human friendly environment.

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1 Conte, P.; Bertani, R.;Sgarbossa, P.; Bambina, P.; Schmidt,H.-P.; Raga, R.; Lo Papa, G.; ChilluraMartino, D.F.; Lo Meo, P. Recent Developments in Understanding Biochar's Physical–Chemistry. Agronomy 2021, 11, 615. https:// doi.org/10.3390/agronomy11040615

2 Islam, T.; Li, Y.; Cheng, H. Biochars and Engineered Biochars for Water and Soil Remediation: A Review. Sustainability 2021, 13, 9932.https://doi.org/10.3390/su13179932

3 European Biochar Market Report (2021/2022): https://www.biochar-industry.com/wp-content/uploads/2022/03/EU-Biochar-Market-Report_2022-03-09.pdf

4 Schmidt, H.- P., Kammann, C., Hagemann, N., Leifeld, J., Bucheli, T. D., Sánchez Monedero, M. A., & Cayuela, M. L. (2021). Biochar in agriculture – A systematic review of 26 global meta- analyses. GCB Bioenergy, 13, 1708– 1730. https://doi.org/10.1111/gcbb.12889

Therefore, please find below our proposals for adjustments of the drafts.

Document: A6.4-SB002-AA-A06

2.1 Terms defined in the IPCC glossary

10. Carbon dioxide capture and storage (CCS), we suggest using the definition by the IPCC special report on Carbon Capture and Storage instead of the existing definition[5]. The definition is as followed:

CCS is a process consisting of the separation of CO2 from industrial and energy-related sources, transport to a storage location and long-term isolation from the atmosphere.

Alternatively, from our perspective another improvement, without narrowing the purpose of carbon capture and storage:

CCS is a technical process where carbon dioxide is captured and if needed conditioned, transported, and stored for long-term isolation from the atmosphere.

This definition is more open for a diversity of technologies, still the core sense is met, regarding carbon dioxide capturing and further mitigating climate change.

11. CCU should explicitly exclude enhanced oil recovery, as this could trigger a rebound effect, where more carbon dioxide is captured but emissions are still rising.

13. Suggestion to change the definition of biochar to:

Biochar - Porous, carbonaceous material produced by pyrolytic carbonisation of biomass feedstock. Biochar can be used to reduce greenhouse gas emissions from biomass, improve soil functions and as carbon storage. Furthermore, it can be used for the production of low-carbon materials, e.g. as additive for concrete, to improve product qualities and reach climate neutrality for hard-to-abate processes.

Suggestion to add number 14 under 2.1

Pyrogenic carbon dioxide capture and storage (PyCCS): PyCCS is the technical process of transforming biogenic carbon (biomass, mainly forest-, agricultural- or urban residues) into a stable form of carbon (biochar) and the successive long-term storage by use in materials or soils.

3. Type of removal activities

[5] IPCC, 2005: IPCC Special Report on Carbon Dioxide Capture and Storage. Prepared by Working Group III of the Intergovernmental Panel on Climate Change [Metz, B., O. Davidson, H. C. de Coninck, M. Loos, and L. A. Meyer (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 442 pp.

24. (b) adding: (v) Pyrogenic carbon capture and storage (PyCCS); Because it is the technical process of PyCCS which leads to a stable material from biogenic carbon and carbon sequestration through its long-term use (agriculture or long-lasting products).

25. (b) (II) Biochar used, and thus stored, over long-term in materials or soils.

223. Comment: For PyCCS there are already methods available (EBC C-Sink). We would be glad to support in defining the methodologies or connect to other experts in this field.

5. Methodological issues related to engineering-based removal activities

5.3. Accounting for removals

5.3.1 Baselines

244. Suggestion: Baseline for PyCCS should be the local commonly applied path for biomass treatment, e.g. for waste wood or sewage sludge in Germany: combustion.

5.3.2 Activity boundaries

247. Suggestion, addition: inclusion of necessary infrastructure and transport into system boundaries.

5.3.3 Additionality

249. Comment: To meet the goals of the Paris Agreement, the rapid scaling of carbon dioxide removal with positive socio-economic impacts and co-benefits of climate change adaption is key. This is independent from mere financial additionality. Therefore, environmental and social impacts should be included in a baseline for additionality. Furthermore, it is difficult to monitor real costs due to common market behaviour and corporate disclosures. In the case of biochar, certain activities might be cost-efficient, but only the carbon market helped to grow the industry by 70 to 80+% annually in recent years.

5.5 Addressing reversal

264. Comment: The activity participants should periodically monitor the storage facility independently of the type of storage.

5.7 Avoidance of other negative environmental and social impacts

Comment: The avoidance of negative impacts is of high importance. Nevertheless, positive environmental and social impacts should also be highlighted in order to draw a better future for the people instead of merely raising fears of possible threats. Certain technologies, e.g. the application of biochar to soils, can help adapting agriculture to a changing climate and secure (or even increase) yields.

5.8 Long-term carbon storage methods in removal activities

283. (b) Suggestion: Store the carbon in a certified storage site.

Appendix: Summary descriptions of engineering-based removal activities

Comment: Add PyCCS as engineering-based removal activities, following our suggestions:

Pyrogenic Carbon Capture and Storage (PyCCS)

Description

Plant biomass consists of approximately 50% carbon that is removed from the atmosphere in form of CO_2 and then used to build organic molecules such as glucose, cellulose, or lignin. When plant biomass decomposes or burns, the assimilated carbon is released back into the atmosphere, mainly in the form of CO_2 and CH_4. If, on the other hand, the plant biomass is pyrolyzed, only about half of the bound carbon becomes volatile. The resulting gas[6] is combustible and generally used for energy production - according to the European Biochar Certificate (EBC), biomass pyrolysis must be conducted in an energy efficient manner. The second half of the plant carbon is transformed into a highly persistent, solid form: biochar. Under natural conditions (in soils or water bodies), biochar degrades extremely slowly. Furthermore, it can be permanently stored in a broad range of materials, e.g. concrete. In these materials, the carbon remains incorporated in a stable matrix, even after recycling or final storage. Unless the biochar is burned, the largest portion of its carbon is permanently bound. Biochar therefore represents a permanent carbon sink (C sink).

Status

TRL 8+

Potentials

Biochar and PYCCS' potential sequestration capacity strongly depends on assumptions about the availability of biomass and its allocation. It is therefore not surprising that a broad spectrum of potentials has been mentioned in the literature. While some publications show a worldwide annual potential of at least 3 - 6 Gt CO_{2e} (Werner et al, 2018; Smith, 2016; Lee & Day, 2013; Woolf et al, 2010; Lenton, 2010) other authors (including the IPCC) consider the achievable potential to be higher. If other biomass sources such as sewage sludge and maritime biomass are included, the potential is considerably higher (Bates & Draper, 2019)[7].

In addition to the question of which biomasses should be converted via pyrolysis processes, there is another aspect which is increasingly being taken into account when considering their potential: the fact that pyrolysis can be used to produce not only biochar, but also pyrolysis-oils and process gas. Process gas can be used by the chemical industry or for energy purposes, while pyrolysis-oil can be used for carbon sequestration - either through material use or through geological storage (Schmidt et al., 2018). This means that carbon efficiency can be increased from today's level of 30-60% to up to 70%. If used in combination with CO_2 capture technologies like the ones used in BECCS or fossil CCS technology, even higher efficiency could be achieved[8].

A decisive advantage in terms of rapid scaling is the modularity of the technology. In modern pyrolysis plants biochar can be produced economically using relatively small amounts of up to 1,000 t biomass (dry mass) annually or roughly 2 – 3 tonnes per day. The advantages of smaller scale production are the short distances involved in supplying the plant with biomass and the ability to use the residual heat produced locally, which is important for the economic efficiency of plant operation. Provided that suitable quantities of biomass are available locally, plant sizes of up to 100,000 t of annual biomass are also feasible, so the cost scaling effects for the production of biochar can be achieved. The more cost-effective its production, the more applications

6 EBC (2020), Certification of the carbon sink potential of biochar, Ithaka Institute, Arbaz, Switzerland. (http://European-biochar.org). Version 2.1E of 1st February 2021

7 Bier, Harald; Gerber, Herlmut; Huber, Marcel; Junginger, Hannes; Kray, Daniel; Lange, Jörg; Lerchenmüller, Hansjörg, Nilsen, Pal (2020): Biochar-based carbon sinks to mitigate climate change. EBI Whitepaper. Hg. v. European Biochar Industry Consortium.

can be developed using biochar. Under the current economic conditions, biochar is used at present primarily in high value agricultural crops, in animal feed and to extend the life and resilience of urban trees. As the volume of biochar production increases and the service to the climate in the form of removing and storing carbon is increasingly and separately remunified, so the price for biochar will decrease, enabling broader applications of biochar[8] and thus enabling higher volumes of carbon sinks.

Risks and impacts
In order to reduce any potentially negative effect, e.g. through the incorporation of contaminated biochars into soils, the European Biochar Certificate (EBC) Guidelines[8] have been developed. They define thresholds of possible contaminants according to national and international legislation as well as to most recent scientific knowledge.

Co-benefits
A detailed description of co-benefits can be found in “Biochar-based carbon sinks to mitigate climate change”. Nevertheless, here is short excerpt:

1 Biomass pyrolysis is a key technology for saving the climate (Werner et al, 2018; Woolf et al, 2010; Woolf et al, 2016)
2 The use of certified biochar has been proven to meet the highest environmental standards and, when used properly, is safe for soils, ecosystems and users (EBC, 2012; Lehmann & Joseph, 2015)
3 Pyrolysis can be used to close organic material cycles. This is a prerequisite for the principle of recycling in the bio-economy. (Woolf et al, 2016)
4 Biochar improves the water retention capacity of soils and, in combination with fertilizers, leads to yield increase and stabilization (Ye et al, 2020; Razzaghi et al, 2020)
5 Biochar helps to build up humus (Blanco-Canqui et al, 2020; Weng et al, 2018)
6 Biochar reduces GHG emissions from agriculture (Borchard et al, 2019; He et al, 2017; Liu et al, 2018)
7 Biochar reduces nitrate pollution of ground and surface water (Borchard et al, 2019)
8 Biochar shows multiple benefits in animal husbandry and im-proves animal health (Schmidt et al, 2019)
9 Biochar promotes tree growth and increases the stress resistance of urban trees (Embrén et al, 2016; FLL, 2017)
10 Biochar can be used as an additive in composting to improve compost quality and reduce nitrogen losses (Godlewska et al, 2017; Zhao et al, 2020)
11 Biochar can improve the properties of concrete and asphalt (Gupta & Kua, 2017)
12 Biochar enables the rehabilitation of contaminated soils (BMLFUW, 2017)

[8] EBC (2012-2022) 'European Biochar Certificate - Guidelines for a Sustainable Production of Biochar.' European Biochar Foundation (EBC), Arbaz, Switzerland. (http://european-biochar.org).

Trade-offs and spill over effects

Beside the specific comments and suggestions, the EBI would like to state following comments in general to the documents provided:

Activities for removals should abide by the principle of the separation of powers. The following should be separated and/ or performed by independent partners:

1. Carbon Dioxide Removal Project
2. Monitoring of the removal activities
3. Reporting of the activities

Without separating powers, many people could mistrust the processes of carbon removal. In order to build trust and achieve the required carbon removal power, we therefore urge to include, evaluate, and communicate positive co-benefits. Furthermore, we stress to only acknowledge removal activities that do not lead to further production of fossil fuels.

Timeframes for carbon storage should be either defined dynamically, according to the conservate storage out of the atmosphere or, when different timeframes are used, the minimum storage time should be at least 50 years. Furthermore, the concept of achieved carbon stocks, holding period, tonne-years, time horizon, permanence period, tonne-year crediting and tonne-based crediting is not clear at the actual draft and needs more clarification, through illustrations as well as calculation examples.

Nevertheless, the drafts are already promising, and we are glad to offer our support for further elaboration in the field of our expertise.

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