From: Friedel Pretorius <Friedel.Pretorius@climeworks.com>
Sent: Tuesday, 11 October, 2022 19:39
To: Supervisory-Body <Supervisory-Body@unfccc.int>
Cc: Louis Uzor <Louis.Uzor@climeworks.com>; Peter Freudenstein <Peter.Freudenstein@climeworks.com>
Subject: Call for input 2022 - activities involving removals under the Article 6.4 Mechanism of the Paris Agreement.

Dear Supervisory Body,
Thank you for the opportunity to respond to the documents regarding removals under Article 6.4. We appreciate the clear framework of the documents provided.

At Climeworks we permanently remove carbon dioxide from the atmosphere using our Direct Air Capture technology which our partner Carbfix stores safely and permanently through rapid in-situ mineralization.

Together with Carbfix, we released methodologies last month to monitor, report, and verify CDR using our technologies. This methodology meets ISO 14064-2 2019 standards and was validated by DNV who also verified production of CDR at our plant, Orca, in Iceland. Our methodologies are available online and we welcome you to read them and reach out to us for any insight we can help provide the Article 6.4 framework regarding DAC and mineralization storage.

We have reviewed the documents made available. Please see Climeworks' response to the three documents in the attached document.

Best Regards,
Friedel Pretorius

Friedel Pretorius
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1. General Comments

The recommendations made in the three documents for counting, monitoring, and reporting removals give an overall valid approach, but without the definition of key terms, it is unclear how these mechanisms will play out and encourage or suppress removal activities. The following observations were made where clarification can allow for a better evaluation of the framework:

1) Time Horizon and Permanence period:

The length of both of these terms dictates how CDR produced by two separate methods compare with one another. Shorter periods incentivise CDR with a shorter holding period and negate the additional holding period of permanent solutions. Furthermore the time horizon and permanence period need to be selected based on scientific indications for what accurately mitigates a ton of emissions.

Without a definition of a Time Horizon, it is difficult to assess the validity of Tonne-year vs Tonne-based crediting.

> 19. **Time horizon** The time period in years that delineates the temporal boundary within which the impact of a mitigation action or policy is assessed.
>
> 20. **Permanence period** Simplified and approximate holding period applied across all the achieved carbon stocks, that is long enough to approximately justify crediting of 1 credit per tCO2 of the achieved carbon stocks. Any permanence period of less than the time horizon is a non-conservative approximation that results in overcrediting.

- The documents mention time horizons and permanence periods of 40-100 years at times. How and why these thresholds are selected and how they interact with removal solutions with 1000 year holding period is key to understanding the overall concept of the proposal. Additionally, how would permanence periods of 40-100 years be used to mitigate a CO_2 emission with 300-1000 year durability. Clarity on these details will bring major definition to the concept.

2) Crediting Factor

- This concepts presented work in principle, but understanding the values that are being considered, the methodologies for deriving them, and the accuracy of the derived values is key to evaluating the approach.

3) Direct Air Capture (DAC)

- Throughout the document DAC is mentioned as Direct Air Capture, Direct Air Removal, Direct Air Carbon Capture and Storage. Being in the business of Direct Air Capture (DAC) we advocate that the various references be updated to reflect the DAC industry terminology of **Direct Air Capture (DAC).** DAC brings clarity in distinguishing the technology from others.
- In general DAC is categorized with difficulty as it is the only capture technology that can be paired with various storage solutions to create a removal. Sub dividing the engineered-based removal activities into 1) capture and 2) storage & utilization 3) Transport categories would allow for a modular approach and room for new capture, storage, and utilization solutions to be easily adopted in the future. Separate categories would currently help distinguish DAC+S and DAC+U activities without needing to define the DAC components separately. Lastly, the documents have no mention of transport methodologies for the cases where capture and storage do not occur at the same location.

- The summary description of Direct Air Capture in the Appendix of Annex 6 (pg. 59) appears outdated and incomplete. Updating this section with current information will better help inform stakeholders.

4) Geological storage

- Geological mineralization is missing from the geological storage options
- The definition of a suitable site should not be limited by depth of injection, cap rock, porosity, or other reservoir characteristics explicitly, but rather by data supported indication that no significant risks of seepage or risk to human or environmental health exists. The requirement of porosity and caprock may be limiting to innovations in geological storage. In situ mineralization in ultra mafic rock has been scientifically been shown to provide safe and permanent CO_2 storage.
- Injection of carbon oxides additional to carbon dioxide, and in various forms for solution should be considered safe for injection if all available evidence, such as data, analysis and history matching, indicates that the injected carbon dioxide will be completely and permanently stored such that, under the proposed or actual conditions of use, no significant risk of seepage or risk to human health or the environment exists.

5) Accounting Requirements

19. Mechanism methodologies shall require that net removals achieved by a removal activity are equal to carbon stock achieved by the activity minus the baseline carbon stocks, minus emissions attributable to implementation of the activity, minus any leakage emissions.

- The accounting requirements broadly states " minus emissions attributable to implementation of the activity". This should clearly be defined as based on a cradle to grave LCA and including embodied emissions. As the purpose of the activities is net negative emissions, all emissions from the activity should be considered to avoid over crediting.

2. Section Comments

2.1 Annex 5

Appendix 2 (b)	Geological Storage Definition: The Supervisory Body should consider the definition of a geological storage to also explicitly include mineralization in addition to "isolation from the atmosphere".
(a)	Geological Storage Site Definition: The definition of a suitable site should not be limited to porosity and cap rock, but be defined by the objective of said characteristics as stated in (c) (i) "All available evidence, such as data, analysis and history matching, indicates that the injected carbon dioxide will be completely and permanently stored such that, under the proposed or actual conditions of use, no significant risk of seepage or risk to human health or the environment exists;". The requirement of porosity and caprock may be limiting to innovations in geological storage.
	Furthermore it should be clarified that various states of carbon oxides (not just dioxides) can safely be injected and stored in geological reservoirs including liquid, in solution, in supercritical
1.4	*32. **Crediting period of 15 years renewable twice** (15))(twice) needs to be supported. Is this number fitting equally for all activities? Rather than stating the number, state the criteria for determining it for each activity.*

1.6	*Accounting should define cradle to grave emmission*
2. pg 9	***Land Based Reversals Permanence period 40,50, 60, 100*** *Clarification on how these permanence periods are used in comparison to solutions with 1000 year permanence. Is 100 years sufficient? How are these periods determined?*

2.2 Annex 6

2.1 Pg 6	Terms defined: DAC+S should be defined to distinguish it clearly from CCS
5.1 230 Pg. 53	Frequency of monitoring and verification: The Supervisory Body should consider the impacts the timing of verification might have on the financing of projects. Requirements for verification that may delay verification may also delay when a project receives compensation for CDR and impacts the financing of the project. The project proponent should have some ability to verify more frequently or earlier than recommended if they carry the cost of verification as the verification schedule heavily dictates the business model. This is especially true for emerging technologies that are still working through the hurdles of scaling where the production of carbon stock may initially be slower than expected.
3.b.i Pg 8	Typo in Reference to Direct Air Capture "Direct Air Removal (DAC)" should be Direct Air Capture (DAC)

2.3 In-meeting document

Option 3	Definition 3 for CDR seems more inclusive of various technologies and future innovations while being specific enough to uphold the integrity of CDR.