UNFCCC ARTICLE 6.4 CALL FOR INPUT 2023 - ISSUES INCLUDED IN THE ANNOTATED AGENDA AND RELATED ANNEXES OF THE FIFTH MEETING OF THE ARTICLE 6.4 SUPERVISORY BODY: CARBON ENGINEERING RESPONSE

May 25, 2023

INCLUSION OF STAKEHOLDER INPUT

Carbon Engineering requests that the Supervisory Body reconsider the Information Note *"Removal activities under the Article 6.4 mechanism"* Version 04.0 provided by the UNFCCC Secretariat and ensure that stakeholder inputs are considered, where relevant. Doing so will achieve a more balanced representation of carbon removal solutions, based on objective assessment criteria that are rooted in science, technological readiness and market potential.

We draw your attention to our previous submissions regarding the development of Article 6.4 which provide relevant references and information on Direct Air Capture (DAC) including the commercial readiness and deployment potential of our technology:

- April 11, 2023: Methodology Requirements
- October 12, 2022: Activities involving removals
- October 11, 2022: Development of Mechanism

We request a re-evaluation of *"Removal activities under the Article 6.4 mechanism"* Version 04.0 in advance of COP28, with direct input from experts in the carbon dioxide removal community. Absent a re-evaluation and revision of this document, Article 6 risks becoming an impediment to carbon dioxide removal – and thus to overall climate progress – rather than a catalyst.

SCIENCE AND POLICY MAKING- TECHNOLOGY-BASED REMOVALS ARE REQUIRED

We are highly concerned that several statements about carbon dioxide removal made in the document are in direct contradiction with the scientific consensus expressed in the IPCC 1.5°C Report, and recommendations on accounting methods are in contradiction with the evolving consensus in multiple government-led and private sector-led initiatives.

The IPCC's *'Global Warming of 1.5°C'* Report, the IEA's *'Net Zero by 2050'* analysis, and now many other such studies, show unequivocally that to reach the targets of the Paris Agreement, we must aggressively reduce GHG emissions at source, and we must also deploy carbon dioxide removal[1]. In fact, IPCC and IEA projections show that somewhere between 2 to 15 billion tonnes of carbon dioxide removal (CDR) per year will be required by mid-century, even in scenarios which feature aggressive and successful mitigation. These findings have three important implications for both country-level climate policymaking and for the design of Article 6.

[1] https://www.ipcc.ch/sr15/, https://www.iea.org/reports/net-zero-by-2050

First, a complementary set of carbon removal approaches will be needed. While land-based CDR approaches offer many benefits and should be responsibly pursued, they have limitations. Land-based CDR approaches can have large footprints and face tradeoffs related to food production and biodiversity preservation. Many of them offer storage permanence of less than 100 years and may be subject to reversal from natural disasters and human activity. Engineering-based CDR approaches, on the other hand, offer nearly unlimited scale potential and can provide permanent storage with minimal risks of reversal, depending on the approach. Engineering-based CDR approaches produce relatively few removals today, but this is rapidly changing. Several approaches are building out commercial scale operations, as detailed below, while newer ones are developing and preparing to scale in the years to come.

Both land-based and engineering-based CDR approaches will be needed to reach the scale of CDR required to meet Paris Agreement goals, and therefore, the goals of the Article 6.4 mechanism.

Second, policymaking should incorporate carbon dioxide removal in a high-integrity manner that ensures environmental and social benefits are accomplished, and that potential harms or side effects are minimized. To this end, there are a number of government-led and private sector-led initiatives to accurately quantify the climate benefits generated by CDR activities, to specify the monitoring reporting and verification criteria necessary to substantiate removals and to maintain trust with the public, and to ensure that environmental health and safety as well as community goals are involved in decisions about where and how to deploy carbon removal projects.

Third, and finally, the time to deploy carbon removal is now. This will require both rapid technological improvements and unprecedented growth for industrial-scale climate solutions. A billion tonne per annum scale carbon removal industry cannot spring up overnight nor within a handful of years. Rather, efforts are needed this decade to establish the first megaton scale carbon removal facilities and to build the supply chains and networks needed to then deploy at the required gigatonne scale shown by the IPCC and IEA by 2050. The rate of CDR adoption from 2050 onward will strongly depend on what is achieved for the first half of the century, with early inaction or emissions overshoot requiring steep adoption after 2050[2].

It is imperative that carbon dioxide removals are integrated into present carbon market design along-side emissions mitigations, with the necessary integrity guard-rails to ensure that only the highest quality removals[3] may participate and that markets delivery the cost-optimal mix of mitigation and removal and thus achieve the maximum amount of climate progress at lowest cost.

TECHNOLOGY-BASED REMOVALS – ROLE IN SUSTAINBLE DEVELOPMENT

Dismissing technology-based removal activities as unsuitable for implementation in developing countries fails to recognize their potential to bring about equitable and inclusive climate action. By leveraging advancements in technology and global collaboration, engineered removals can be deployed in a manner that benefits both developed and developing nations. It is essential to foster knowledge sharing, capacity

[2] https://www.wri.org/insights/unlock-potential-direct-air-capture-we-must-invest-now
[3] Unlocking the potential of direct air capture: Is scaling up through carbon markets possible? – Analysis - IEA

building, and financial support to enable developing countries to access and utilize these innovative solutions, thereby fostering sustainable development and creating opportunities for local communities. We believe that DAC facilities can contribute positively to the following sustainable development goals:

- **SDG 7 - Affordable and Clean Energy:** DAC can help advance SDG 7 by providing a sustainable source of carbon-neutral or carbon-negative energy. In addition to sequestration to produce carbon dioxide removal, captured CO2 from direct air capture facilities can be used as a feedstock – along with renewable electricity – to produce synthetic fuels with low life cycle GHG emissions and with zero sulphur, thus reducing dependence on fossil fuels and improving local air quality.
- **SDG 9 - Industry, Innovation, and Infrastructure:** DAC technologies require significant technological innovation and infrastructure development. Investments in DAC can drive research and development, foster innovation, and contribute to the growth of a sustainable, low-carbon industry.
- **SDG 13 - Climate Action:** The primary goal of DAC is to mitigate climate change by removing CO2 from the atmosphere. By contributing to negative emissions and reducing greenhouse gas concentrations, DAC aligns directly with SDG 13, which aims to combat climate change and its impacts.
- **SDG 14/15 - Life Below Water and Life on Land:** By helping to reduce CO2 concentrations, DAC indirectly supports SDGs 14 and 15. Lower CO2 levels can mitigate ocean acidification, which threatens marine ecosystems, and also help protect terrestrial ecosystems by reducing stress on land-based biodiversity. Further, when compared with alternatives, direct air capture can accomplish carbon dioxide removal with very low land and water use, thus leaving these finite resources available for other purposes or to simply remain in their natural state.

All climate mitigation activities, including DAC, can generate positive and negative local/regional impacts on various SDGs via physical, social, economic, and political channels. The scale of implementation of CDR and related impacts are highly dependent on policy design and national planning processes, and they must be carefully designed to drive positive SDG impacts while delivering much needed global carbon removal at a climate relevant scale.

Carbon Engineering outlined how responsible Direct Air Capture (DAC) deployment can play a role in sustainable development in our October 11, 2022, submission. To ensure that DAC contributes to sustainable development, factors such as the energy source used for powering DAC facilities (see Carbon Engineering's April 11, 2023, submission), and the overall lifecycle assessment of the technology (see Carbon Engineering's October 11, 2022, submission) must be considered and reflected in markets.

Responsibly deployed direct air capture facilities could offer a multitude of economic benefits to host countries while serving a key role in achieving our climate commitments. If appropriately incorporated in Article 6 for trans-boundary trading, carbon removal facilities could allow the countries most responsible for aggregate GHG emissions to finance removals in countries with low historical responsibility as a form of climate equity.

DIRECT AIR CAPTURE – TECHNICAL READINESS LEVEL (TRL)

Carbon Engineering has been developing DAC technology since 2009 and has characterized the mass and energy flows, feedstock requirements, and engineering cost assessment of this technology in open peer-reviewed literature[4]. Furthermore, we have developed and demonstrated our DAC technology with multiple generations of equipment prototypes, and two separate end-to-end pilot facilities[5]. We are now working with development partner 1PointFive to build the world's first million tonne per annum direct air capture facility[6]. Once fully operational, this facility will capture up to one million tonnes of CO2 directly from atmospheric air each year while occupying a land area of roughly 60 acres. This is equivalent to the CO2 captured by 40 million newly planted trees as they grow to maturity.

In April 2023, we announced the commercial groundbreaking of Stratos[7] with start-up due in late 2024 and commercial operations set to commence in 2025.

MARKET POTENTIAL - INTEGRITY AND DURABILITY MATTERS

The UN's High-Level Expert Group on the Net Zero Emissions Commitments of Non-State Entities has flagged the risks of weakening climate action related to voluntary purchases of carbon credits and highlighted the importance of long-duration removals to reduce these risks. The Expert Group advised in its November 2022[8] report that in cases where the use of credits is deemed appropriate, "A high-quality carbon credit should, at a minimum, fit the criteria of additionality and permanence."

The DAC technology we have partnered to deploy at a climate relevant scale will generate high-quality, tangible, and highly durable CDR when paired with safe and secure geologic storage. Direct air capture with secure geologic storage (DACCS) plays an important and growing role in potential net-zero pathways. Carbon markets currently allow for higher prices for high-quality CDR services such as DAC, and customers are willing to invest in this relatively expensive but attractive solution, because of its very high durability when combined with geological storage.

Contrary to the claim that engineered removals do not contribute to reducing global mitigation costs, these technologies have the potential to significantly lower the overall costs of achieving climate targets. As these technologies mature and scale up, their costs are expected to decrease, making them increasingly cost-competitive with traditional mitigation approaches. The deployment at a global scale, supported by investments in research, development, and deployment, can pave the way for cost-effective and efficient climate mitigation strategies.

Strong private sector demand for DAC credits demonstrates that UNFCCC has an opportunity to align investment flows with the 6.4 mechanism.

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[4] https://www.cell.com/joule/pdf/S2542-4351(18)30225-3.pdf
[5] https://carbonengineering.com/our-technology/
[6] https://www.1pointfive.com/1pointfive-holds-groundbreaking
[7] Explore STRATOS, our first Direct Air Capture facility - YouTube
[8] high-level_expert_group_n7b.pdf (un.org)

CONCLUSION

Carbon markets will need to continue to evolve to encourage investment not only in reducing emissions to move us towards net zero emissions, but also to support investment in carbon removals. Both land-based and engineering-based CDR approaches should be made eligible under the Article 6.4 mechanism.

Leaving engineered removals out of the scope of Article 6.4 would be a missed opportunity to establish robust, complete methodologies on a global level that align with IPCC climate.

ABOUT CARBON ENGINEERING

Carbon Engineering is a global leader in the development of Direct Air Capture (DAC) technology capable of removing CO_2 from atmospheric air and, through a series of chemical reactions, delivering it in a pure compressed stream suitable for storage or use.

Carbon Engineering was founded more than a decade ago with the mission to develop and commercialize affordable and highly scalable carbon removal technology. Carbon Engineering is a developer and licensor of direct air capture (DAC) technology. A standard commercial-scale CE DAC facility will annually capture over 1.0 MtCO_2 directly from the atmosphere. Carbon Engineering's DAC technology is a liquid-based DAC technology (L-DAC) that deploys an aqueous basic solution to pull CO2 directly from the atmosphere and, after a series of clever chemical looping processes, conditions the atmospheric CO2 into a dense phase that is optimized for transport and final end-use.

Carbon Engineering's DAC technology can provide highly durable CDR when combined with secure geologic storage. This rock-solid combination of DAC + secure geologic storage (DACCS) provides a highly scalable and verifiable CDR mechanism for safely storing CO_2 for 1,000+ years, all with relatively low land and water use. Today, leading commercial markets are ready and we're working with global partners to deploy large-scale commercial facilities in multiple locations around the world.

The first large-scale commercial facility to utilize our DAC technology is in active development with our partner, 1PointFive, and is expected to have an annual atmospheric capture capacity of 1.0 MtCO_2 when complete.[9] It's our goal to have this first plant ignite an industry by demonstrating that megaton-scale DAC technology is feasible, affordable, and available. We envision fleets of DAC facilities working alongside emissions-free electricity, energy efficiency, and clean innovations in all commercial and industrial sectors to fully tackle the climate challenge. Engineering has already commenced at a second site capable of supporting a capacity of 30 MtCO_2 per year. Additional information on Carbon Engineering's technology and commercial developments is provided at www.carbonengineering.com.

[9] Occidental, 1PointFive to Begin Construction of World's Largest Direct Air Capture Plant in the Texas Permian Basin