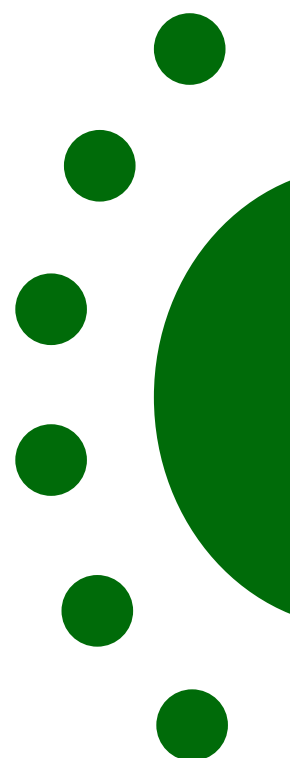


The operationalization of engineering-based removals under the Article 6.4 mechanism

Authors

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1 Introduction: the role of engineering-based removals in balancing emissions

All global modelled pathways that limit warming to either 1.5°C or 2°C assume some Carbon Dioxide Removal (CDR) methods, including direct air carbon capture and storage (DACCS) and bioenergy with carbon capture and storage (BECCS), to counterbalance residual GHG emissions. Such pathways are well described and discussed by prominent international institutions such as the IPCC and the IEA, but also by private companies and NGOs such as bp and the Energy Transition Commission.

It is also important to recall the negotiations in Paris, during which it was said that Article 6 and carbon removals have to and are meant to play a critical role and substantially contribute to the achievement of global climate neutrality.

This understanding can neither be neglected nor forgotten during the operationalisation of the Article 6 mechanisms and in subsequent negotiations.

On the experience from the Kyoto Protocol, the Paris Agreement's basic building block is the nationally determined approach. This translates into giving freedom to countries to choose how to achieve net-zero emissions, following their national endowments, capabilities and responsibilities.

The Paris Agreement adopts a technology neutrality approach as well: indeed, it does not refer or give preference to any technology. The use of any technology should not be restricted in any way, but rather leave the Parties to choose the option best suited according to their circumstances.

To implement the principle of technology neutrality, all options should be given the same technological and political support in debates taking place in international institutions such as the United Nations and the UNFCCC Secretariat.

2 Peculiarities of removal activities

Recently, questions have been raised on the functions that the actors of the Article 6.4 mechanism, such as the activity proponents, the Article 6.4 mechanism Supervisory Body (6.4BS), the 6.4 mechanism registry administrator, and the host Party, should have concerning the implementation of activities delivering engineering-based removals.

Activities delivering engineering-based removals are no different than any other activities in terms of administration and operationalization. Peculiarities of engineering-based removal activities lay at the level of the product that is delivered – that is, a carbon removal, instead of a stream of reductions from a counterfactual scenario.

By thinking in these terms, three main features of carbon removal activities can be outlined: the absence of additionality of carbon removal activities (what would have

happened in the absence of), the permanence aspect of carbon removals, and the risk of reversals. Each one of these features is addressed in the following subchapters.

2.1 *The absence of additionality*

First, additionality refers to the concept that, when a project is implemented, it should show and guarantee that the emissions reductions achieved through this project would not have occurred without the implementation of the project through the carbon market. Such a concept was already applied in the Clean Development Mechanism (CDM)¹, and countries are now discussing its application in Article 6.4 methodologies.

We see technological removals as different from reductions that may or may not happen in the absence of a project (CDM/Article 6.4). In the case of removal activities, such counterfactual does not exist, as the CO₂ can (or cannot) be captured and stored. The impact of CO₂ in the atmosphere is not dependent on alternatives, it is not counterfactual.

2.2 *Operationalizing the concept of permanence and the risk of reversals*

The other important elements that are usually linked to removals are permanence and the risk of reversals for accountability purposes. While engineering-based removals are meant to store CO₂ permanently, it is very difficult to put such a concept into reality and make it fit into the market concepts governing the Article 6.4 mechanism. From this perspective, the durability (or permanence) of removals needs to be defined to make the concept usable and applicable.

Looking forward, an option can be to generate credits which guarantee that the CO₂ is permanently stored for the entire crediting period, including renewals, and associate the credit with the probability of future reversals within the first 1,000 years² of CO₂ storage. Such an approach can be valid for any type of removal, regardless of the actual permanence of the CO₂ removed: removals with a low probability of reversals will have higher quality credits generated from a project. Otherwise, this concept can also be operationalized by adding a discount rate not only related to the storage period, as it is now proposed in the UNFCCC's Information note³, but also by differentiating discount rates based

¹ UNFCCC (2009). CDM-EB07-A04-GLOS, Glossary: CDM terms, Version 11.0. Available at https://cdm.unfccc.int/Reference/Guidclarif/glos_CDM.pdf

² This is how long the biggest share of CO₂ (between 15% and 40%) stays in the atmosphere, as stated by the IPCC in "IPCC, 2021: Annex VII: Glossary [Matthews, J.B.R., V. Möller, R. van Diemen, J.S. Fuglestvedt, V. Masson-Delmotte, C. Méndez, S. Semenov, A. Reisinger (eds.)]. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 2215–2256, doi:10.1017/9781009157896.022".

³ UNFCCC (2023). Information note: Removal activities under the Article 6.4 mechanism (A6.4-SB005-AA-A09). Available at: <https://unfccc.int/sites/default/files/resource/a64-sb005-aa-a09.pdf>

on the technology that is used and the geographical location where the storage takes place.

If engineering-based removals are to be used for storing GHGs other than CO₂, their different properties associated with their global warming potential and the process of storing must be taken into account by approved methodology(ies) and properly accounted for when crediting such units.

2.3 Managing the risks of reversals

Given their peculiarities, a new institution that takes the liability of the risks associated with carbon removal activities can be created, such as a carbon central bank. This idea has been first proposed for managing carbon removals within the EU framework, in which the European Carbon Central Bank is thought to operate under EU ETS by taking over different roles, ranging from issuing emissions allowances to facilitating the auctions and providing technical assistance to the regulators⁴.

In the Article 6.4 mechanism, instead, a carbon central bank should be responsible for issuing insurance over the risks that carbon removals entail and being held responsible for implementing measures to address reversals upon agreement with the host countries. This new role can be overtaken by an already-existing institution which has a significant balance sheet, credibility, and stability, such as the World Bank, or by a newly established international institution.

In this framework, the role of the host Party is defined and critical if the Article 6.4 units are authorised for international transfers, but it should not be deemed different from the role it covers in other activities undertaken under the mechanism. It should rather take over additional duties. Indeed, in case of removal activities, the host Party, which has also authorised such activity, should be held responsible for the application of mitigation measures in case of any reversals, particularly when the project developer fails to address the due diligence. This can be done by either having the host Parties implement their measures, or it can be delegated to the newly established central carbon bank upon agreement between the two.

3 Issues linked to monitoring & crediting periods and addressing reversals for removal activities

3.1 Monitoring period for removal activities

⁴ Edenhofer, O., Franks, M., Kalkuhl, M., Runge-Metzger, A. (2023). On the Governance of Carbon Dioxide Removal – A Public Economics Perspective. CESifo Working Paper No. 10370 (April 2023), Available at <http://dx.doi.org/10.2139/ssrn.4422845>

In engineering-based removals, the CO₂ is supposed to be stored for a long period and is perceived as more durable than traditional nature-based solutions until an external influence/factor leads to leakage of CO₂ from the storage site.

It is strongly believed that monitoring technologies are comprehensive and cover all relevant phases (pre-injection, injection and post-injection) and geographical structures (geosphere, wells, marine environment, etc.).

In general, measuring CO₂ in the case of removals is via measuring the flow of the CO₂ stream in the storage site and the CO₂ stored compared to a baseline. While there are various methods to measure the sequestered carbon, it is important to determine an appropriate baseline to enable further operation of the technology i.e. CO₂ injection at the site.

While there are different tools continuously advancing to ensure that storage is safe, the cost of setting up and operating these tools also increases significantly and so for operationalisation and maintenance, adding up to the energy costs related to capturing the CO₂ and to its transport. In addition to this, these tools provide time-lapse data and not real-time data to drive in-time effective decision-making.

3.2 Crediting period

The engineering-based removals should engage in longer periods between the registration and crediting to effectively monitor real outcomes and for ex-post crediting. The crediting should be based on the baseline emission of the CO₂ from the moment that it is stored.

It is also important to recall that engineering-based removals can also have a long crediting period of up to 25-year⁵, longer than the current crediting period that has been now set up at 15 years by the UNFCCC, as the activity can be carried over until the storage site is full. Taking this into account, the crediting period of removal projects could be project-based, instead, as it can vary based on project- and storage site-specific characteristics.

3.3 Timeframe for addressing reversals

The re-release of stored CO₂ can be referenced as “reversal”. Ideally, to address the risk of reversals it is important to guarantee long-term storage or permanence and prompt detection of any potential reversals and therefore, it is important to keep monitoring periods at higher frequency to avoid severe damage. For instance, under removal

⁵ M. Krey (2023). How carbon credits can incentivize CCS projects (PowerPoint presentation). METI-JOGMEC-IETA joint workshop: Global Carbon Markets and CCS. Tokyo, 26th January 2023. Available at <https://www.jogmec.go.jp/content/300382143.pdf>

projects, carbon must be stored for 100 years for offsetting purposes. In addition to this, the measures for addressing reversals should be shaped accordingly and proportionately to the probability of reversals associated with the removal activity.

However, what also holds credibility is to have a proper system to manage and address the reversals such as lapse of credits, buffer pools, performance guarantees/bonds or insurance.

Credit Lapse: creation of a financial buffer → keeping aside a portion of carbon credits or revenues → this can be referred to as reverse funds → compensation from the reverse funds can be used in case of reversal

Buffer Pools: Creation of excess capacity or margin within the CCS system (this can be in the form of reduced capacity estimates, extra storage capacity etc) → this creates a safety net/buffer to compensate for failures/leakages

Performance Guarantees and Bonds: set targets/goals/performance standards and financial commitment by the developer/ third party to achieve the targets in the form of bonds/guarantees → Bond can be used towards compensation for failure to achieve the targets

Insurance and risk transfer: Develop appropriate insurance coverage → that mitigates financial risks

4 Way forward

As modelled in many global scenarios, carbon removals are expected and are called to play an increasingly crucial role to meet the climate targets set by the Paris Agreement. Because of this reason, the A6.4SB should not delay inclusions of these activities in international carbon markets. By doing so, it will limit options that countries can rely on to achieve climate targets and ambitious NDCs, which, by nature, are based on countries' national circumstances.

Even if removal projects do not present any differences from any other projects in their implementation phases, the product that they deliver – a removal – is peculiar. It has characteristics that projects delivering emissions reductions do not have. Therefore, such characteristics need to be considered when designing an international carbon market which is robust and fit for purpose.