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Final Report

Scientific support for the design of a certification framework for Carbon Dioxide Removals in the EU

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Abstract: Scientific support for the design of a certification framework for Carbon Dioxide Removals in the EU

This report summarizes the results of the research project “Scientific support for the design of an EU Carbon Removal Certification Framework” (CRCF) that provided support to national policy makers during the negotiation process and pursued the following objectives. Seven publications were produced in the course of the project. These include the typology of carbon dioxide removal (CDR) and storage processes, a discussion of what details of the CRCF could be dealt with in a delegated act, and requirements for sustainability criteria. The project produced a summary of the European Commission's communication on sustainable carbon cycles and the legislative proposal for the proposed certification framework. Moreover, an analysis of the Commission's assumptions on the potential of CDR for natural processes was carried out as well as a discussion of requirements for robust certification based on existing methodologies. Another publication discusses the concrete design of the certification framework with regard to the use of certificates as well as suitable funding and financing instruments.

Kurzbeschreibung: Wissenschaftliche Begleitung zur Ausgestaltung des Zertifizierungsrahmens für Kohlenstoffbindungen in der EU

Dieser Bericht fasst die Ergebnisse des Forschungsprojekts "Scientific support for the design of an EU Carbon Removal Certification Framework" (CRCF) zusammen, das nationale politische Entscheidungsträger und -trägerinnen während des Verhandlungsprozesses unterstützte und die folgenden Ziele verfolgte. Im Rahmen des Projekts wurden sieben Veröffentlichungen erstellt. Dazu gehören eine Typologie der Verfahren zur Entfernung und Speicherung von Kohlendioxid (CDR), eine Diskussion darüber, welche Details des CRCF in einem delegierten Rechtsakt behandelt werden könnten, sowie Anforderungen an Nachhaltigkeitskriterien. Im Rahmen des Projekts wurde eine Zusammenfassung der Mitteilung der Europäischen Kommission über nachhaltige Kohlenstoffkreisläufe und des Legislativvorschlags für den Zertifizierungsrahmen erstellt. Darüber hinaus wurde eine Analyse der Annahmen der Kommission zum Potenzial von CDR für natürliche Prozesse durchgeführt sowie eine Diskussion der Anforderungen an eine robuste Zertifizierung auf der Grundlage bestehender Methodologien. Eine weitere Publikation erörtert die konkrete Ausgestaltung des Zertifizierungsrahmens im Hinblick auf die Verwendung von Zertifikaten sowie geeignete Förder- und Finanzierungsinstrumente.

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1 Introduction

1.1 Background

To limit the average global temperature rise to well below 2°C or 1.5°C compared to pre-industrial times, drastic and immediate reductions in greenhouse gas (GHG) emissions are essential but are unlikely to be sufficient. To keep temperature rises below the targets of the Paris Agreement, all emission reduction pathways effectively assume that CO_2 must be removed from the atmosphere (IPCC 2021). The IPCC calls carbon dioxide removal (CDR) "unavoidable" (IPCC 2021).

Although CDR is unavoidable, the potential of natural CDR that can be expected from activities in the sector of Land Use, Land Use Change and Forestry (LULUCF) and the required extent and timing of technical CDR varies widely. While some scenarios assume that "Bioenergy with Carbon Capture and Storage" (BECCS) approaches will remove about 30 Gt CO_2 between 2020 and 2100, others estimate up to 780 Gt CO_2 - a difference by a factor of 26. Estimates for CDR through "Direct Air Carbon Capture and Storage" (DACCS) vary even more: estimates assume a removal potential of DACCS of 0-310 Gt CO_2 between 2020 and 2100. Currently, the quantities of CO_2 removed are far below the pathways that limit global warming to 1.5 °C or 2 °C (IPCC 2018).

EU law recognises the importance of CDRs in different ways:

- **Climate target 2050:** the European Climate Law stipulates in a legally binding manner that the EU must become climate neutral by 2050 (Article 2.1). This means that residual emissions must be offset by CDR by this date. According to Article 15.4 of the Governance Regulation, the climate strategies of the EU and the Member States are also geared towards the 2050 climate neutrality target.
- **Net GHG target for 2030:** The European Climate Law sets an EU net GHG emissions target for 2030. According to this, emissions must be at least 55% below the 1990 level. Up to -225 Mt CO_2eq of natural sinks reported under the LULUCF sector can be counted towards achieving the target.
- **Negative emissions after 2050:** According to Article 2.2 of the European Climate Law, the EU should remove more GHGs from the atmosphere after 2050 than it emits, i.e. after 2050 CDR will become the central field of action of climate policy.
- **LULUCF Regulation:** The LULUCF Regulation sets out the so-called "no debit" rule. According to this rule, the emissions accounted for under the Regulation may not exceed the removals in the LULUCF sector (Article 4). The LULUCF Regulation has recently been revised. The Regulation sets new CDR rules for the period after 2030, including a removal target for the EU of -310 Mt CO_2 by 2030 and individual targets for Member States.

With the Commission's Communication on Carbon Cycles of December 2021, the political CDR debate in the EU had gained additional momentum. With this communication, the Commission makes it clear that climate neutrality must be achieved primarily through emission reductions. In this context, the communication contains a general reference to the EU long-term strategy, according to which the EU must reduce its emissions by 95% by 2050 to achieve climate neutrality. CO_2 removals should have a supplementary effect where residual emissions can no longer be reduced at reasonable cost.

The Commission communication also states that certification, accounting and verification of CO_2 removals must become central components of the EU removal architecture. The Commission

also promised land users access to verified emissions and removal data by 2028. As announced in its communication, the Commission tabled a proposal for a framework for standardised and robust certification of carbon removals in the EU (EC 2022). The aim of the carbon removal certification framework (CRCF) was to develop legislation for the generation and trade of permanent high quality carbon removals, carbon farming and carbon storage in products. High-quality removals are referred to as removals that meet minimum criteria regarding their quantification, ensuring additionality, guaranteeing long-term storage, and environmental sustainability. Such certified units may underpin different end-uses, such as, the proof of climate-related and other environmental corporate claims (including on biodiversity), or the exchange of certified units through voluntary carbon markets.

On 20 February 2024, the European Parliament and the Council of the EU reached a provisional agreement on the CRCF Regulation, establishing the first EU-wide voluntary framework for certifying carbon removals, carbon farming and carbon storage in products generated in Europe. The European Parliament has adopted the CRCF Regulation in April 2024.

The negotiations before the adoption centred around a number of controversial questions regarding the generation and use of carbon removal certificates. These included:

- **Equivalence between withdrawals and reductions:** Are removals and reductions comparable or inherently different and could they be used to offset emissions?
- **Use of CDR certificates:** May CDR certificates be counted towards the fulfilment of reduction targets or are they merely used as a standard to which climate protection policies and instruments as well as voluntary climate protection efforts are applied?
- **How CO_2 should be extracted:** The type of CDR makes a big difference for biodiversity, soil protection and the climate resilience of ecosystems whether CO_2 is removed through afforestation in monocultures or through the restoration of damaged ecosystems. Whether carbon is stored in living biomass, wood products, plastics or geological formations is significant for the long-term storage of carbon. It therefore remains unclear how it can be ensured that measures have a positive effect on biodiversity conservation and other environmental goals in addition to the climate protection effect and how this could be measured and taken into account in certification.
- **Design of regulatory systems:** Can natural and technical processes for carbon capture, removal and storage be effectively addressed in one and the same EU-wide regulatory system?
- **Liability:** Who is liable under what conditions if extracted CO_2 escapes back into the atmosphere? Liability rules are a central component of a robust removal and storage regime.
- **Positioning in the EU climate target architecture:** How should the certification framework be integrated into the EU climate target architecture? This raises the question of whether or not certification should serve to underpin the EU's own removal target - analogous to the existing target for 2030.

1.2 Aim of the project

This report summarizes the results of the research project “Scientific support for the design of an EU Carbon Removal Certification Framework” (FKZ 3722 42 515 0) that provided support to national policy makers during the negotiation process and pursued the following objectives:

- Creation of a clear typology of carbon sequestration or CO_2 removal and storage processes, which serves as a basis for further scientific work;
- To summarize and analyze the EU Commission's communication on sustainable carbon cycles and the legislative proposal for a certification framework in order to identify any need for improvements;
- Analyzing and assessing the EU Commission's assumptions on the potential of carbon sequestration for natural processes and the requirements for certification;
- Developing of requirements for a transparent, robust and applicable monitoring system as well as methods for avoiding double counting, ensuring additionality and ensuring positive contributions to other environmental goals as a basis for certification;
- Discussing the concrete design of the certification framework with regard to the use of certificates, suitable funding and financing instruments, a suitable mix of instruments for the long-term promotion of interventions for carbon sequestration, including regulatory support, and embedding in the EU target architecture in order to promote the long-term transformation of land use management.

The results of the research project were to be used for the further science-based development and implementation of the legal framework.

2 Overview of project activities and publications

2.1 Project work packages

The project was divided into four Work Packages (WP):

- **WP 1 Typology of processes for the conservation, enhancement and development of carbon sinks.** The WP aimed to classify existing types of carbon removal processes in order to create a basis in terms of terminology and understanding of different processes for further work in the research project.
- **WP 2 Categorisation of the EU COM communication and the legislative proposal for an EU-wide certification system.** The WP summarized and evaluated the EU Commission proposal for a framework for carbon removal certification that was published on 30 November 2022. The proposal and the following negotiation process between Commission, Council and Parliament formed the core of the debate on carbon removals in the EU and also in the project.
- **WP 3 Assumptions on the potential for CDR and prerequisites for appropriate monitoring.** The WP analyzed and critically examined the EU Commission's assumptions on natural carbon sequestration potentials with regard to the objectives of the certification framework. It also discussed prerequisites for a transparent and robust monitoring system by looking at existing certification schemes and methodologies.
- **WP 4 Design and implementation of the EU certification framework.** The WP discussed proposals for the design and implementation of the certification framework. The focus was on the aim and purpose of certification and alternative options for the use of certificates. It discussed which issues are relevant for which type of use and which specific risks are associated with the use of certificates to offset emissions in the context of carbon markets. Moreover, the WP discussed the design and implementation of the certification framework with regard to possible forms of remuneration for certification. The WP also looked into financing and funding instruments for an incentive system and integration into the EU target architecture. Based on this, proposals for an incentive system for natural processes for carbon removals was derived.

2.2 Project publications

The project activities resulted in seven publications, three fact sheets and four reports, that are briefly introduced in the following.

2.2.1 Fact sheet: Short Typology of Carbon Dioxide Removals

The fact sheet was published in July 2023 (Siemons et al. 2023).

It addressed the question how to best differentiate methods and technologies for establishing and enhancing carbon sinks. The fact sheet presented a suggested typology of Carbon Dioxide Removals (CDR) that serves as a basis for introducing and defining key terminology around CDR, differentiating general methods of CDR regarding their effectiveness to remove CO_2, and characterising concrete CDR technologies for assessing the environmental impacts of their implementation.

The fact sheet first presented and compared different definitions of CDR that are available in the literature. Secondly, it briefly outlined activities for removing CO_2 from the atmosphere. In a

third step, it discussed characteristics that distinguish different CDR activities. Lastly, it proposed a schematic overview on the basis of the evaluation of existing literature and summarises implications implied in the typology proposed by the European Commission in its proposal on a CRCF.

2.2.2 Fact sheet: Commission Proposal for an EU Carbon Removal Certification Framework - Is the proposed delegation of power in line with Article 290 of the Treaty on the Functioning of the EU?

The fact sheet was published in June 2023 (Meyer-Ohlendorf and Siemons 2023).

The report examined whether the proposed provisions on delegation in the Commission's proposal for the CRCF were in line with Article 290 of the Treaty on the Functioning of the EU (TFEU). This Article governs the delegation of power to the Commission. According to this provision, delegated acts must not regulate the "essential elements" of a legislative act. The essential elements of an area must be "reserved for the legislative act and accordingly shall not be the subject of a delegation of power".

The process for adopting delegated acts is regulated by Article 16 of the CRCF proposal. This provision sets rules regarding the scope and duration of the delegation, consultation requirements, and the possibility for the European Parliament and Council to revoke the delegation and object to delegated acts.

The fact sheet found that the proposal does not regulate central aspects of liability, delegating them to the Commission. This is despite the fact that the liability aspects can be considered essential elements of the proposed regulation. They determine, for example, to what extent and for which time spans operators would be liable for a reversal or to what extent this risk would be externalized to societies.

The fact sheet concluded that by defining rules on appropriate liability mechanisms through a delegated act, the Commission would modify the material and temporal scope of the CRCF. Liability rules also impact on the operator's fundamental rights. The delegation of power to the Commission to regulate issues of liability – as proposed – is not compatible with Article 290 TFEU.

2.2.3 Fact sheet: Sustainability criteria for carbon dioxide removals - Requirements for sustainability criteria in the EU CRCF proposal and elements to be included in a delegated act

The fact sheet was published in December 2023 (Böttcher et al. 2024).

The report examined the robustness of the sustainability criteria included in the CRCF proposal and discussed different concepts for sustainability criteria. The EU Taxonomy rules include various provisions related to the Do-No-Significant-Harm (DNSH) Principle, but they do not cover important aspects regarding carbon removal activities, such as energy and resource consumption of technical removal methods. In the context of forestry, the DNSH Principle does not adequately consider emerging practices that promote biodiversity-friendly approaches, such as close-to-nature forestry.

The reference to the EU Renewable Energy Directive (RED III) provides a more concrete set of criteria but fails to cover important aspects regarding impacts on biodiversity. The sustainability criteria of RED III do not follow the precautionary principle. This makes them unsuitable to prove compliance with the DNSH Principle under the CRCF proposal.

Furthermore, due to substantial differences in the proposals put forward by the co-legislators, the extent to which the DNSH Principle will be integrated into the CRCF remains uncertain. While the CRCF sets incentives for the certification of removals, there is the need for procedures for approving certification schemes. It is important to ensure that certification under the CRCF avoids trade-offs with environmental, agricultural, and other relevant law.

For more coherence of environmental policy certified activities should have positive impacts instead of neutral impacts on other environmental aspects. Therefore, the DNSH rules need to be further defined in the light of expected environmental impacts.

The fact sheet concluded that there is the need for a clear path for stakeholder involvement, transparent complaints procedures, and clear rules for adaptive management to address sustainability risks whenever they become apparent.

2.2.4 Report: Certification of Carbon Dioxide Removals - Evaluation of the Commission Proposal

The report was published in March 2022 (Meyer-Ohlendorf et al. 2023).

Based on the Commission's proposal for the CRCF of 30 November 2022, the report critically discusses crucial regulatory aspects that were found to imply significant risks regarding the quality of carbon removal units issued under the framework and their use. More concretely, the following issues were raised by the publication:

- Unlimited use of removal units: The proposal contained no explicit rules on the eligible uses of the removal units – one of the most significant regulatory issues of carbon certification. In consequence, the units' use remained unlimited; units can potentially be used for any possible purpose. It was stated that the CRCF should prohibit the use of removal units for complying with emission reduction obligations.
- Promoting carbon removals without a sense of direction: It was stated that it is risky to promote the use of removal units, potentially including the use for offsetting emissions. Without adequate safeguards that limit the use of carbon removal units and set high standards for their quality, it is conceivable that the CRCF helps put the EU on a dangerous track that allows it to substitute emission reductions with removal units. To avoid this risk, it is critical that the EU clarifies swiftly the contributions of carbon removals to its climate policies – for example through separate removal targets for removals through carbon farming as well as geological sequestration for 2040 and 2050.
- Definition of carbon removals: The Commission's proposal defined carbon removals – among others – as "the reduction of carbon release from a biogenic carbon pool to the atmosphere." Hence, the proposed definition covers both – emission reductions and carbon removals. This definition was found to be incompatible with the terminology under the UNFCCC and the IPCC's definition, which defines removals as the withdrawal of greenhouse gases from the atmosphere.
- Definition of permanence: The proposal defined "permanent carbon storage" as a carbon removal activity that […] "stores atmospheric or biogenic carbon for several centuries." As significant parts of emitted CO_2 stay in the atmosphere much longer than several centuries, the CRCF should define permanence at least as the time that CO2 is expected to remain in the atmosphere.
- Expiry and validity of removal units: The proposal made no provisions regarding expiry dates. If removal units could potentially be used to balance out emissions, temporary units

must be excluded from such use. Alternatively, the CRCF should explicitly require temporary units to be or constantly renewed for the time that carbon remains in the atmosphere. to this end.

- No legal obligation for long-term storage: The proposed rules on long-term storage were incomplete. The proposal contained no legal obligation on operators to ensure long-term storage. Operators were only obliged to demonstrate that the removal activity "aims" at ensuring long-term storage.
- Transfer of responsibility to state and externalisation of costs: Given the large amounts of carbon that could be stored in geological formations until 2050 and beyond, this transfer of responsibility could present a significant burden for future generations – in particular if leakages from geological formations are larger than currently anticipated.
- Quantification of removals through standardised baselines: The proposal's formula for the quantification of removals applied a standardised baseline. This provision, understood as the average performance in the sector, lacked ambition and could imply that action that is already being undertaken becomes certified, thus undermining the environmental integrity of the certification framework.
- Quantification of removals should be conservative, not accurate: The proposal did not mention the principle of conservativeness but stipulated the use of the most accurate estimates. This was found to be a major weakness of the proposal.
- Delegation of power: The proposal empowered the Commission to regulate the certification methodology through delegated acts, which included issues as important as permanence, or even the use of removal units. Because of the essential importance of the certification methodology to the CRCF, it was questioned whether the proposed delegation of power was compatible with Article 290 of the Treaty on the Functioning of the European Union.

2.2.5 Report: Assumptions on potentials for Carbon Dioxide Removals - A review of recent European Commission impact assessments

The report will be published in the second half of 2024 (Böttcher and Fallasch forthcoming).

The aim of the report was to analyse and critically review assumptions on natural carbon removal and storage potentials with a view to the objectives of the EU LULUCF and CRCF legislation agreed until February 2024. It reviewed selected EU documents that were published over a period of eight years and extracted and analyse information on specific assumptions affecting the potential for natural CDR emerging from different options in the land sector in the EU.

The potential for natural CDR options is an important information for strategic decision making in the field of climate policy. The specific potential per unit area, the absolute potential but also associated costs vary for different types of natural carbon removal and storage processes and regions where these options are being implemented. This is due to biophysical and climatic but also economic and policy conditions.

The report presented an overview of estimated potentials for natural CDR in the European Commission's Impact Assessments. Considerable changes in the level of the potential over time were found that can be referred to differences in assumptions. Comparing these with estimates based on scientific literature showed that potentials from the impact assessments are rather at the lower end of the range. While highest CDR potentials for 2050 in studies underlying the EU

legislation assume -400 to -500 Mt CO_2eq, literature studies often operate in the range of -500 to -600 Mt CO_2eq, with one estimate reaching almost -800 Mt CO_2eq.

2.2.6 Report: How to measure and quantify biogenic carbon removals - Requirements for a transparent monitoring system

The report will be published in the second half of 2024 (Fallasch and Böttcher forthcoming).

Robust quantification of emission reductions and removals lies at the heart of any certification mechanism and is central for their functionality and environmental integrity. The objective of most certification mechanisms is to turn greenhouse gas emission reductions or removals into tradable commodities. To achieve this, each certificate issued by a mechanism must reliably represent the same amount of greenhouse gas reduced or removed from the atmosphere. The report compared selected standards to work out advantages and disadvantages of existing monitoring methods for an EU certification of carbon removals.

The paper scrutinised the reviewed crediting methodologies for biogenic removals with regard to central aspects that impact the environmental integrity of these methodologies. A focus was put on the rules and requirements of these methodologies for quantifying and monitoring biogenic carbon removals. Other essential design elements were also touched upon but not considered in detail.

Robust quantification methodologies are a key pillar for ensuring the environmental integrity of removals certified under the CRCF. The report showed that existing methodologies for quantifying removals used on the voluntary carbon markets have shortcomings that involve overestimating risks when determining the net-removal impacts of project activities.

2.2.7 Report: The EU Carbon Removal Certification Framework: Options for using certified removal units and funding mitigation activities

The report will be published in the second half of 2024 (Fallasch et al. forthcoming).

The report discusses the options for how certified removal units may be used and what policy options are available to complement funding for removals besides revenues generated through the CRCF. In its chapter 2, the paper discusses advantages and disadvantages of possible types of uses of certified removal units. Possible ways of using carbon removal units and certificates are compared, including the use of removals in the EU NDC as the overall GHG emission reduction target, compliance use under the EU regulations including ETS, ESD, and LULUCF Regulation, as well as other compliance uses. Chapter 3 provides an overview of available instruments for incentivizing carbon removals. In addition some key voluntary private sector initiatives are presented. The focus is on those instruments that have been piloted on national levels or use regulatory instruments. For each instrument a brief overview is provided on potential strengths and risks. Chapter 4 presents interlinkages between CRCF implementation and existing national funding instruments with Germany as a case study. The chapter first presents challenges for national funding instruments for carbon removals and presents then potential interlinkages between CRCF and national funding instruments. Existing relevant national funding instruments and their financial capacities are discussed. Finally, conclusions on the role of the German government are drawn.

2.3 Project workshop

An online workshop presenting the results of work package 4 was held on 28 February 2024. 77 participants registered for the event.

Following presentations from Susanne Dröge, UBA, Nils Meyer-Ohlendorf, Ecologic, and Felix Fallasch, Oeko-Institut, comments on the matter were presented by Fabien Ramos, European Commission, Samantha Tanzer, Delft University of Technology and Danny Cullenward, University of Pennsylvania.

Participants agreed in principle that reductions and removals should be kept separately, given their inherent differences. Concerns were raised that future EU climate policies could treat reductions and removals alike. This concern pertains to the integration of removals into the ETS in particular. Danny Cullenward concluded the workshop saying that the work of the EU on carbon removals matters tremendously as it is often a blueprint for other countries.

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