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Interim Report

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

With the Carbon Removal Certification Framework (CRCF), adopted in 2024, the EU established a voluntary framework for carbon removal certification, which includes criteria for the certification of removals, rules for the certification process and the recognition of certification schemes. This 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.

Kurzbeschreibung: Der EU-Zertifizierungsrahmen für den Kohlenstoffabbau: Optionen für die Verwendung von Zertifikaten und die Finanzierung von Minderungsmaßnahmen

Mit dem 2024 verabschiedeten Rahmen für die Zertifizierung des Kohlenstoffabbaus (Carbon Removal Certification Framework, CRCF) hat die EU einen freiwilligen Rahmen für die Zertifizierung des Kohlenstoffabbaus geschaffen, der Kriterien für die Zertifizierung des Abbaus, Regeln für den Zertifizierungsprozess und die Anerkennung von Zertifizierungssystemen umfasst. In diesem Bericht wird erörtert, wie Zertifikate aus diesem Rahmen verwendet werden könnten und welche Optionen zur Verfügung stehen, um die Finanzierung des Abbaus neben den durch die CRCF erzielten Einnahmen zu ergänzen. In Kapitel 2 des Berichts werden die Vor- und Nachteile möglicher Verwendungsarten von zertifizierten Entfernungseinheiten diskutiert. Mögliche Verwendungsmöglichkeiten von Kohlenstoffabbaueinheiten und Zertifikaten werden verglichen, einschließlich der Verwendung im EU NDC, der Verwendung zur Einhaltung von EU-Verordnungen, einschließlich ETS, ESD und LULUCF-Verordnung, sowie anderer Verwendungsmöglichkeiten zur Einhaltung von internationalen Vereinbarungen. Kapitel 3 gibt einen Überblick über die verfügbaren Instrumente zur Schaffung von Anreizen für Kohlenstoffsenken. Darüber hinaus werden einige wichtige freiwillige Initiativen des Privatsektors vorgestellt. Der Schwerpunkt liegt auf den Instrumenten, die auf nationaler Ebene erprobt wurden oder auf Regulierungsinstrumenten beruhen. Für jedes Instrument wird ein kurzer Überblick über die potenziellen Stärken und Risiken gegeben. In Kapitel 4 werden die Zusammenhänge zwischen der Umsetzung der CRCF und bestehenden nationalen Finanzierungsinstrumenten am Beispiel Deutschlands dargestellt. Das Kapitel stellt zunächst die Herausforderungen für nationale Finanzierungsinstrumente für den Kohlenstoffabbau dar und zeigt dann potenzielle Wechselwirkungen mit anderen Instrumenten auf. Bestehende nationale Finanzierungsinstrumente und ihre finanziellen Möglichkeiten werden diskutiert. Schließlich werden Schlussfolgerungen zur Rolle der Regierung gezogen.

Table of content

List of tables

Summary

Drastic and immediate reductions in greenhouse gas (GHG) emissions are needed to limit global temperature increases to well below 2°C, and preferably to 1.5°C above pre-industrial levels. However, these reductions alone are deemed insufficient. According to the Intergovernmental Panel on Climate Change (IPCC), most emission reduction pathways that aim to limit warming to these levels also assume the removal of CO_2 from the atmosphere. The European Climate Law (ECL) establishes a legally binding target for the EU to reach net zero emissions by 2050, necessitating a balance between GHG emissions and removals. The EU Carbon Removal Certification Framework (CRCF) adopted in 2024 caused the political debate in the EU on carbon removals to enter a new phase. With the CRCF the EU established a voluntary framework for carbon removal certification, which includes criteria for the certification of removals, rules for the certification process and the recognition of certification schemes. Against this backdrop, this 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.

The report first discusses the different uses of certified carbon removal units and certificates. These include their incorporation into the EU's Nationally Determined Contributions (NDC) as part of the overall GHG emission reduction targets, and their potential integration into EU regulations such as the Emission Trading Scheme (ETS), Effort Sharing Regulation (ESR), and Land Use, Land-Use Change, and Forestry (LULUCF) Regulation. Other potential uses include compliance under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) and national or sub-national laws, such as carbon taxes and removal credits for permitting. Voluntary uses for offsetting by companies, institutions, jurisdictions, or individuals are also explored, alongside their use for contribution claims and as vehicles for disbursing subsidies or providing incentives.

Chapter three provides an overview of existing incentive mechanisms for carbon removals, highlighting various policy instruments and initiatives. These include the U.S. Department of Energy's Carbon Negative Shot Initiative, production and investment tax credits in the U.S. and Canada respectively, and reverse auctions such as Sweden's scheme for Bioenergy with Carbon Capture and Storage (BECCS). The chapter also examines policy exemptions like Switzerland's agreement with waste treatment installation managers, and private impact investments by companies such as Apple's Restore Fund and Milkywire's Climate Transformation Fund. Additionally, advance market commitments by organizations like Stripe Climate and Frontier are discussed. Each instrument is briefly evaluated for its potential strengths and risks.

The fourth chapter presents Germany as a case study to examine the interlinkages between the implementation of the EU's Carbon Removal Certification Framework (CRCF) and existing national funding instruments. It outlines the challenges faced by national funding instruments in supporting carbon removals, including issues of additionality, baseline setting, double counting, and visibility in GHG inventories. The chapter then explores potential interlinkages between CRCF and national funding instruments, discussing how existing relevant national funding instruments and their financial capacities can be integrated to support the broader goals of the CRCF. Conclusions are drawn on the financial capacities of existing funding instruments and the role of the German government in facilitating these interlinkages.

The report concludes by summarizing the critical role of carbon removals in achieving climate targets. It emphasizes the necessity of certified carbon removal units and the development of robust funding mechanisms to support these efforts. The interlinkages between various policy instruments and national funding mechanisms are crucial for creating a cohesive and effective

framework for carbon removals. The case study of Germany illustrates the complexities and opportunities in aligning national efforts with broader EU initiatives under the CRCF.

Zusammenfassung

Eine drastische und sofortige Verringerung der Treibhausgasemissionen ist erforderlich, um den globalen Temperaturanstieg auf deutlich unter 2°C, vorzugsweise auf 1,5°C über dem vorindustriellen Niveau zu begrenzen. Diese Reduktionen allein werden jedoch als unzureichend angesehen. Dem Zwischenstaatlichen Ausschuss für Klimaänderungen (IPCC) zufolge setzen die meisten Emissionsminderungspfade, die auf eine Begrenzung der Erwärmung auf diese Werte abzielen, auch die Entfernung von CO_2 aus der Atmosphäre voraus. Das Europäische Klimagesetz (ECL) legt ein rechtsverbindliches Ziel für die EU fest, um bis 2050 Netto-Null-Emissionen zu erreichen, was ein Gleichgewicht zwischen Treibhausgasemissionen und -abbau erfordert. Der 2024 verabschiedete EU-Zertifizierungsrahmen für den Kohlenstoffabbau (Carbon Removal Certification Framework, CRCF) hat die politische Debatte in der EU über den Kohlenstoffabbau in eine neue Phase geführt. Mit dem CRCF hat die EU einen freiwilligen Rahmen für die Zertifizierung des Kohlenstoffabbaus geschaffen, der Kriterien für die Zertifizierung des Abbaus, Regeln für den Zertifizierungsprozess und die Anerkennung von Zertifizierungssystemen umfasst. Vor diesem Hintergrund erörtert dieser Bericht die Möglichkeiten, wie zertifizierte Kohlenstoffabbaueinheiten verwendet werden können, und welche politischen Optionen zur Verfügung stehen, um die Finanzierung des Abbaus neben den durch die CRCF erzielten Einnahmen zu ergänzen.

In dem Bericht werden zunächst die verschiedenen Verwendungsmöglichkeiten von zertifizierten Kohlenstoffabbaueinheiten und -zertifikaten erörtert. Dazu gehören ihre Einbeziehung in die Nationally Determined Contributions (NDC) der EU als Teil der Gesamtziele für die Verringerung der Treibhausgasemissionen und ihre potenzielle Integration in EU-Verordnungen wie das Emissionshandelssystem (ETS), die Verordnung über die Lastenteilung (ESR) und die Verordnung über Landnutzung, Landnutzungsänderungen und Forstwirtschaft (LULUCF). Andere potenzielle Verwendungszwecke sind der internationale Luftverkehr im Rahmen des Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) sowie nationale oder regionale Gesetze, wie CO_2-Steuern und Kohlenstoffgutschriften für Genehmigungen. Freiwillige Verwendungszwecke für Kompensationen durch Unternehmen, Institutionen, Länder oder Einzelpersonen werden ebenso untersucht wie ihre Verwendung für Beitragsforderungen und als Mittel zur Auszahlung von Subventionen oder zur Schaffung von Anreizen.

Kapitel drei gibt einen Überblick über bestehende Anreizmechanismen für den Kohlenstoffabbau und hebt verschiedene politische Instrumente und Initiativen hervor. Dazu gehören die Carbon Negative Shot Initiative des US-Energieministeriums, Produktions- und Investitionssteuergutschriften in den USA bzw. Kanada sowie umgekehrte Auktionen wie das schwedische System für Bioenergie mit Kohlenstoffabscheidung und -speicherung (BECCS). Das Kapitel befasst sich auch mit politischen Ausnahmeregelungen wie dem Schweizer Abkommen mit Betreibern von Abfallbehandlungsanlagen und mit privaten Impact-Investitionen von Unternehmen wie dem Restore Fund von Apple und dem Climate Transformation Fund von Milkywire. Darüber hinaus werden Vorab-Marktverpflichtungen von Organisationen wie Stripe Climate und Frontier diskutiert. Jedes Instrument wird kurz auf seine potenziellen Stärken und Risiken hin bewertet.

Im vierten Kapitel werden die Zusammenhänge zwischen der Umsetzung des EU-Zertifizierungsrahmens für den Kohlenstoffabbau (Carbon Removal Certification Framework,

CRCF) und bestehenden nationalen Finanzierungsinstrumenten mit Deutschland als Fallstudie untersucht. Es beschreibt die Herausforderungen, mit denen nationale Finanzierungsinstrumente bei der Unterstützung des Kohlenstoffabbaus konfrontiert sind, einschließlich Fragen der Zusätzlichkeit, der Festlegung von Referenzwerten, der Doppelzählung und der Sichtbarkeit in THG-Inventaren. Das Kapitel untersucht weiter potenzielle Verknüpfungen zwischen dem CRCF und nationalen Finanzierungsinstrumenten und erörtert, wie bestehende relevante nationale Finanzierungsinstrumente und ihre finanziellen Kapazitäten integriert werden können, um die umfassenderen Ziele des CRCF zu unterstützen. Es werden Schlussfolgerungen zu den finanziellen Kapazitäten der bestehenden Finanzierungsinstrumente und der Rolle der deutschen Regierung bei der Erleichterung dieser Verflechtungen gezogen.

Der Bericht schließt mit einer Zusammenfassung der wichtigen Rolle des Kohlenstoffabbaus bei der Erreichung der Klimaziele. Er unterstreicht die Notwendigkeit zertifizierter Kohlenstoffabbaueinheiten und die Entwicklung robuster Finanzierungsmechanismen zur Unterstützung dieser Bemühungen. Die Verknüpfung verschiedener politischer Instrumente und nationaler Finanzierungsmechanismen ist entscheidend für die Schaffung eines kohärenten und effektiven Rahmens für den Kohlenstoffabbau. Die Fallstudie Deutschlands veranschaulicht die Komplexität und die Möglichkeiten, die sich aus der Abstimmung der nationalen Bemühungen mit den umfassenderen EU-Initiativen im Rahmen des CRCF ergeben.

1 Introduction

To limit an increase in temperature to well below 2°C or below 1.5°C compared to pre-industrial levels, drastic and immediate reductions of greenhouse gas (GHG) emissions are essential, but likely insufficient. According to the IPCC, effectively all emission reduction pathways that limit warming to 1.5°C (>50% likelihood) with no or limited overshoot, and those that limit warming to 2°C (>67% likelihood), assume that CO_2 is removed from the atmosphere (Carbon Dioxide Removal (CDR) (Cambridge University Press 2021). The deployment of **CDR to counterbalance hard-to-abate or residual emissions is considered "unavoidable"** (Cambridge University Press 2021).

EU policies and laws recognise the importance of carbon removals. The European Climate Law (ECL), for example, establishes a legally binding target for the EU to reach net zero emissions by 2050. By then, greenhouse gas emissions (GHG) and removals regulated in the EU must be balanced. The ECL also sets an EU net GHG emissions target for 2030 allowing a contribution of net removals to this target of a maximum of 225 million tonnes of CO_2e. Furthermore, the ECL requires the EU to aim at removing more GHG than it emits after 2050. The Communication on Sustainable Carbon Cycles by the European Commission[1] also states that by 2050 each single tonne of CO_2e emitted into the atmosphere will have to be neutralised by a tonne of CO_2 removed from the atmosphere. To reach the climate neutrality objective of the EU Climate Law, carbon removals will therefore play a central role in EU climate policy. The LULUCF Regulation sets an EU and national targets for removals and also the long-term climate strategies of Member States require the removal of carbon. For the longer term, the amount of residual emissions that needs to be counterbalanced by removals has not yet been defined though.[2]

The EU Carbon Removal Certification Framework (CRCF) adopted in 2024 caused the **political debate in the EU on carbon removals to enter a new phase**. With the CRCF the EU established a voluntary framework for carbon removal certification, which includes criteria for the certification of removals, rules for the certification process and the recognition of certification schemes.

Against this backdrop, **this 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

[1] COM(2021) 800 final, see https://climate.ec.europa.eu/document/download/26c00a03-41b0-4d35-b670-fca56d0e5fd2_en?filename=com_2021_800_en_0.pdf.

[2] In June 2023, modelling results by Prognos and FutureCamp that will inform the German Carbon Management Strategy predicted that from 2045, in Germany between 17 and 69 Mt "hard to abate" CO_2 emissions must be compensated by geological storage of these emissions (see https://background.tagesspiegel.de/energie-klima/mengengeruest-fuer-co2-speicher-steht).

instruments. Existing relevant national funding instruments and their financial capacities are discussed. Finally, conclusions on the role of German governments are drawn.

2 The use of certified carbon removal units[3]

2.1 Possible ways of using carbon removal units and certificates

Carbon removal units or certificates can in principle be used for various purposes. Possible uses include:

1. Compliance use of units under EU climate regulations for achieving national or EU climate targets, thereby offsetting emissions covered by these regulations (EU NDC, EU ETS, LULUCF Regulation, Effort Sharing Regulation),
2. Compliance use of units to meet EU or national removal targets,
3. Compliance use of units by airline operators under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), thereby offsetting international aviation emissions,
4. Compliance use of units under other EU, national or sub-national policies, e.g. the EU Fuel Quality Directive,
5. Voluntary use of units for offsetting by companies, institutions, jurisdictions or individuals,
6. Voluntary use of units for other purposes than offsetting, including contribution claims, or
7. Using certificates for labelling purposes for meeting legal requirements – e.g. permitting or tax purposes, or the distribution of subsidies (Meyer-Ohlendorf et al. 2023).

In current practice, carbon removal credits are mostly used to 'offset' or balance out GHG emissions associated with a buyer's activities on the voluntary carbon market (Fearnehough et al. 2020). Using removal units for compliance with legal mitigation obligations is currently an exception but applied, e.g. in California's forest carbon offsets program.

It is crucial to stress that the **uses of removal units are of great importance for the environmental integrity[4] of the CRCF** and any other removal crediting scheme. Some uses pose limited or no risk to the environmental integrity of the respective mechanism, while others can undermine it. Removal units used for meeting emission reduction obligations or voluntary targets bear greater risks than units used for other purposes, such as contribution claims, labelling purposes, or the disbursement of subsidies (see text box below).

The CRCF Regulation contains no explicit rules on the use of carbon removal units, thereby allowing the use for any **possible purpose.[5] Although it is not explicit on the uses of units, the discussions on the CRCF suggest that besides providing finance for increasing natural and technical sinks, offsetting is intended to be a main purpose of the scheme.** It must be noted, however, that currently other pieces of EU law limit the use of carbon removals (see below).

A central question is how removals will be integrated into existing EU climate policy instruments for complying with emission reduction targets beyond 2030, particularly concerning the EU ETS. At the moment, removals cannot be used by operators under the EU ETS to meet their

3 We use the term "credits" when referring to the general context of carbon markets and the term "units" in the specific context of the CRCF.

4 We refer here to environmental integrity in the light of climate policy and follow a definition provided by Schneider and La Hoz Theuer (2019) who define the term as "no increase in global aggregate emissions". Environmental integrity would be ensured if the framework leads to aggregated GHG emissions that are not higher as compared to a situation where the framework was not in place.

5 Recital 21 states "it is appropriate that carbon removal certificates underpin different end-uses, such as the compilation of national and corporate greenhouse gas inventories, including with regard to Regulation (EU) 2018/841 of the European Parliament and of the Council, the proof of climate-related and other environmental corporate claims (including on biodiversity), or the exchange of verified carbon removal units through voluntary carbon offsetting markets."

obligations. Options for integrating removals into the EU climate policy architecture and associated risks are described below (section 2.3).

Carbon removals and the integrity of climate policies

Compared to emission reductions, carbon removals are often a less certain climate action as they generally face challenges that do not apply to emission reductions:

Permanence: Emission reductions are generally considered permanent, because e.g. a reversal of emission reductions achieved by transitioning from fossil fuels to renewable fuels is generally unlikely, though not impossible. For the currently mostly biogenic carbon removals, reversals are more likely. Depending on the governance in place as well as the choice of management, measures to enhance the removal and storage of carbon in biomass and soils can be partially or fully reversed through intentional activities such as harvesting or burning. Further, natural disturbances can lead to unintentional reversals. Through climate change, the risk for unintentional reversals is increasing. Often it can take only moments to release amounts of carbon back to the atmosphere, which had taken decades for the biomass growth to originally remove from the atmosphere. Approaches such as buffer pools and discounting have been proposed to address potential non-permanence of biogenic carbon storage and tested on the voluntary carbon market. Yet, all of these mechanisms have their pitfalls and may be insufficient to guarantee permanence in the land use sector in practice (Carbon Plan 2021; CCQI 2022; Badgley et al. 2021). While nature-based solutions thus do not provide a permanent storage option, they are currently the only option capable of removing carbon at scale. Good governance and appropriate management can reduce the risk of reversal and increase the longevity of storage by decades or centuries and reduce the reversal-induced fluctuation of the net-removals in an area over time.

Carbon stored in products is not in itself a carbon removal but represents a transfer of the carbon originally removed through biomass growth in an ecosystem to another carbon pool. It faces similar challenges as carbon stored in ecosystems. Atmospheric or biogenic carbon stored in e.g. building materials will only be kept out of the atmosphere during a building's lifetime. Utilising carbon in production processes (CCU) postpones the emission of the stored CO_2 for up to several decades only (EC 2022). However, the use of biomass in structural components of buildings as well as the development of circular solutions can increase the length of storage in products to more than a century.

Industrial removals generally provide more certainty of permanent storage. Due to geological storage, they can store carbon for centuries or even longer. BECSS, is theoretically capable of removing large amounts of carbon. However the removal takes place through the biomass growth in the ecosystem where it comes form. BECCS only prevents the release of the emissions through the combustion of the biomass. Therefore, if it includes increasing the existing use of biomass, BECCS is at most climate neutral. It becomes particularly problematic if it fails to meet stringent sustainability requirements. DACCS and enhanced weathering are from a technical and permanence perspective, therefore the main promising removal options as they are capable of storing carbon permanently. However, their long-term impacts are unclear.

Permanent and temporary removal options are thus inherently different: They should be promoted by different targets and policy instruments. In regulating the use of carbon removal units from CRCF, it will therefore be essential to lay down different rules for temporary types of removal units and those activities which store carbon permanently.

Uncertain removal capacities may not materialise: Partly linked to issues of data quality, it is challenging to project the EU's removals potentials. Significant uncertainties persist, in particular

because of expected and unexpected impacts of climate change or natural disturbances on the removal capacities of natural sinks (Gatti et al. 2021; Jones et al. 2016). Industrial removal options require large amounts of (sustainable) energy (Fuss et al. 2018) which will remain a scarce good and are currently associated with high costs. Some leakage risks remain, depending on site location. In turn, their future potential remains uncertain. In light of these uncertainties, there is a risk that emissions will continue, while projected removals do not materialise.

Challenges with ensuring high quality of removal units: Compared to emission reductions from fossil fuels or abatement of non-CO_2 gases, the certification of nature-based carbon removals is challenging. Besides the risk of non-permanence outlined above, data quality of removal activities is often poor and they may have wider negative environmental impacts and global implications with regard to leakage and food security. Furthermore, establishing baselines for some removal activities remains challenging and ensuring their additionality is associated with significant challenges (see (Meyer-Ohlendorf et al. 2023; McDonald et al. 2023; Siemons et al. 2023). Carbon removals cannot simply repair delayed or foregone emission reductions (Zickfeld et al. 2021).

2.2 Removals in the EU NDC as the overall GHG emission reduction target

The present EU NDC features a target of reducing net GHG emissions by at least -55% by 2030 vs 1990. This target includes emissions and removals covered by the GHG inventory categories 1 (energy), 2 (industrial processes and product use), 3 (agriculture), and 5 (waste)[6]. Removals may contribute a maximum of 225 $MtCO_2e$ net removals to the target of reducing net emissions by -55% by 2030 (only removals visible in the EU GHG inventory are considered).[7] This limit for the contribution of removals towards reaching the EU climate targets reflects the requirement of the ECL that the EU and Member States have to "prioritise swift and predictable emission reductions" (Article 4.1). For 2050, the European Climate Law sets a neutrality target for the EU, requiring that GHG and removals in the EU must be balanced.

In order to measure progress towards reaching the EU's NDC, total emissions are determined on the basis of annual accounting for emissions and removals reported in the EU's GHG inventory. In doing so, one tonne of CO_2 removal reported in the inventory is fully offsetting one tonne of CO_2 emissions reported elsewhere in the inventory (up to the above-mentioned limit of -225 Mt CO_2eq). The -55% NDC target aims to reduce net-emissions from 4,650 Mt CO_2e in 1990 to about 2,100 Mt CO_2eq.[8]

It is important to **avoid potential double counting of removals that are reflected in GHG inventories and removal units generated under certification standards.** This could occur, if removal units generated by certified removal projects were accounted for under the EU's NDC in EU compliance schemes, while the GHG inventories used for accounting already include these removals.

It has to be noted, however, that not all emission reductions achieved through project activities that lead to the issuance of removal units may be reflected by reporting on removals in GHG

[6] Inventory category 6 (Other) is so far empty in the EU GHG inventory, and not included in the definition of the EU 2030 NDC, nor in the definition of emissions/removals subject to the EU Effort Sharing Regulation (see section 2.3.3). However, some emerging removal activities like DACCS are likely to be reported in that inventory category 6 (Other). For consistency with other removal activities considered in other inventory categories, scope definitions of future EU NDC updates and ESR revisions should be expected to include that inventory category.

[7] Historically, all removals were reported under category 4 LULUCF which comprises emissions as well as removals from the land use sector. One example for removals that are reported under category 4 LULUCF is the increase of carbon stored in forests or the capture of biogenic CO_2 for geological storage (BECCS) (reported under category 1 energy or 2 industrial processes and product use).

[8] Due tot the contribution of net sinks from LULUCF that can contribute up to -225 Mt CO_2e total GHG emissions have to be reduced only to ~2300 Mt CO_2e , corresponding to an emission reduction of ~53% compared to 1990.

inventories. Furthermore, **the quantification of removals in a certification context follows a fundamentally different logic from quantifying removals in emission inventories:** Projects delivering certified removal units need to fulfil criteria like additionality, long-term storage and delivering environmental co-benefits. Emission reductions and removals achieved within specific project boundaries are integrated over a defined period of years and compared to/measured against a **project-specific baseline**. Emission inventories by contrast are set up as **time series of annual emissions balances**. Reporting emissions and removals in GHG inventories must adhere to the TACCC criteria: transparency, accuracy, completeness, comparability and consistency (IPCC 2006). In GHG inventories, CO_2 uptakes (e.g. in woody biomass) can be reported in one year, while emissions of the stored carbon through biomass extraction could be reported in the subsequent year. Furthermore, emissions and removals associated with different steps of a removal activity can be spread across several inventory categories.[9]

Furthermore, it should be noted that removal units possibly certified under the CRCF are not necessarily reflected as removals reported in the GHG inventories. There are challenges to make carbon removals visible in national GHG inventories (Jörß et al. 2022). Firstly, for carbon removal activities such as DACCS, storage in durable products, rock carbonisation/enhanced weathering or marine geo-engineering, no quantification methodologies have (yet) been agreed under the IPCC and approved for use in reporting under the UNFCCC. Secondly, the allocation of some of the potential removal activities to the different inventory categories has not yet been clarified. Moreover, for some land-use activities such as enhancement of soil carbon, the granularity of national GHG inventories is often not sufficient to ensure visibility (Schneider et al. 2022b). Visibility of removal activities in inventories and allocation to inventory categories are, however, crucial for the EU in order to account these removals towards the achievement of its NDC.

2.3 Compliance use under the EU regulations governing the target architecture: Emission Trading, Effort Sharing Regulation and LULUCF Regulation

As one theoretical option, carbon removals units could be used to meet obligations, i.e. to offset emissions under the Emission Trading System (ETS) Directive, the Effort Sharing Regulation and the LULUCF Regulation. However, in the following we discuss that using removal units for compliance use under these Regulations is associated with various risks including non-permanence and limited additionality. Using removals for offsetting emissions in the ETS can help reach climate neutrality but will not lead to net-negative emissions as set out in the ECL for the time after 2050.

[9] For example wood based BECCS: The uptake of CO_2 by woody biomass is reported as a removal in the LULUCF category for the years where the respective trees are growing. In the year of harvesting, wood extracted for energy use is reported as an emission in the same LULUCF subcategory where CO_2 removals are reported. The combustion of wood is reported in the energy category. CO_2 emissions from biomass combustion, however, are not included in national totals in order to avoid double counting as wood extraction was already reported as an emission under LULUCF. Capture for geological storage of CO_2 from biomass combustion is reported as a removal / negative emission in the energy category. Such negative amounts are included in national totals. Any additional fuel consumption needed to operate the BECCS process would show up as respective fuel use and CO_2 emissions in energy categories. From the inventory perspective, wood-based BECCS would thus appear ideally as a **net-zero** process for the year of harvest, combustion, CO_2 capture, and storage.

For BECCS based on agricultural biomass, CO_2 uptake in the plant and harvest are assumed to occur in the same year. Thus, no emissions or removals are reported in the LULUCF category. Combustion and CO_2 capture for geological storage are reported as a negative emission in the energy sector as for wood based BECCS explained above. Emissions related to energy use in intermediate process steps, like transport or biorefineries would be reported in the respective subcategories of the energy sector. From the inventory perspective non-woody BECCS is thus a **net-negative** process if emissions from intermediate process steps do not exceed the amount of CO_2 captured for underground storage.

2.3.1 Emission Trading Scheme

2.3.1.1 Introduction

The CRCF Regulation states that the certification of carbon removals does not apply to emissions falling within the scope of ETS Directive (Art. 1.2).[10] Currently, the ETS Directive does not allow using CO_2 removal units for complying with the obligations under the Directive.[11]

Currently the ETS Directive does not allow the use of external offsets–largely because of negative experiences made with the use of offset credits between 2008 and 2020 (Hermann and Matthes 2012). The revised ETS directive defines a timeline regarding the further process on negative emissions. The Commission will prepare a report accompanied, where appropriate, with a legislative proposal by 31 July 2026 on "*how negative emissions (…) could be accounted for (…) including safeguards to ensure that such removals are not offsetting necessary emissions reductions in accordance with Union climate targets*" (Article 30 (4a)).[12]

2.3.1.2 Options for integrating carbon removal units in the EU ETS

Currently, options for how to account for removals in the EU ETS are primarily discussed in academic circles, but they are gaining momentum in the political discussion (Edenhofer, Rickels). Some researchers have argued for integrating removals into the ETS to compensate residual emissions, to cushion price increases, to maintain the acceptance for the ETS and to incentivise carbon removals (see e.g. Rickels et al. 2020). In line with the current Linear Reduction Factor (LRF), the ETS will stop issuing new certificates from 2040 on, while it is widely expected that some ETS activities (e.g. aviation, maritime sector and maybe even some industry sectors) will not be fully decarbonized by then. Carbon removal certificates are believed to offer an option to offset residual emissions in the ETS.

There are **various options on how to potentially integrate removals into the ETS**, ranging from full integration to partial integration (see also Meyer-Ohlendorf 2023). Full integration would make removal units equivalent to ETS units. Partial integration includes options such as (1) use of removal units limited to specific removal options (e.g. removals with permanent storage), and (2) use of removal units only up to a certain maximum amount (cap). The establishment of a Carbon Central Bank (CCB) is another option that has recently received considerable attention (e.g. Schenuit et al. 2023,). Under this option, a Carbon Central Bank or another intermediary agency would buy temporal removal units and in return would issue additional ETS allowances. It is important to note that combinations of these options are possible.

Each option features **distinct advantages and disadvantages**.

- **Full integration:** Theoretically, full integration of any type of removal units generated under the CRCF into the EU ETS would be possible. Full integration could be a way to incentivise carbon removal activities. It could also have a dampening effect on ETS prices. Because of

[10] However, Art. 1.2 of the CRCF states that the framework does not apply to emissions falling within the scope of ETS Directive, with the exception of the storage of carbon dioxide emissions from sustainable biomass that are zero-rated by the Directive.

[11] However, for avoided emissions captured and stored geologically, no allowances need to be surrendered (Art. 12.3(a) of the ETS Directive), meaning that fossil CCS can already be used for meeting ETS targets (while they are not occurring at large scale yet).

[12] Art 30a, paragraph 4a: "By 31 July 2026, the Commission shall report to the European Parliament and to the Council on the following, accompanied, where appropriate, by a legislative proposal and impact assessment: (a) how negative emissions resulting from greenhouse gases that are removed from the atmosphere and safely and permanently stored could be accounted for and how these negative emissions could be covered by emissions trading, if appropriate, including a clear scope and strict criteria and safeguards to ensure that such removals are not offsetting necessary emissions reductions in accordance with Union climate targets as laid down in Regulation (EU) 2021/1119;".Online available at: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32023L0959&qid=1684218852261

this expected effect on carbon prices, full integration into carbon removals could maintain political acceptance for the ETS.

However, this option could deter further innovation and measures to mitigate emissions (so called mitigation deterrence), particularly where alternative options are already technologically available. It would also make it possible to offset GHG emissions with non-permanent carbon storage. Private actors (i.e. operators covered by the EU ETS), would be responsible to continually replace temporary credits with "fresh" temporary credits. If private actors can replace temporary credits indefinitely, this is very likely to undermine the environmental integrity of the ETS. While, this option is likely to prioritise currently cheap removals with either permanence risks or a limited permanence (such as afforestation and soil carbon enhancement) over the development of technical sinks with permanent storage, which have higher investment costs (Rickels et al. 2020), it would be in line with the prioritisation of natural sink enhancement in the German Climate Law. Furthermore, these measures bring many co-benefits (i.e. soil protection, clean water, biodiversity) that technical sinks do not. It is however uncertain whether this option could fully balance emissions within the ETS-Sector, as some nature-based removals may become scarce and expensive, particularly in light of accelerating climate change. For these reasons, **full integration of removal units into the EU ETS should not be pursued.**

- **Only permanent removals eligible:** As permanent the CRCF refers to the duration of several centuries. Currently, nature-based removals are the only option capable of removing carbon at scale, but they cannot guarantee permanent storage. With the accelerating climate crisis, their removal potential is likely to decrease, in some areas possibly very rapidly, e.g. as in the case of California due to wildfires. Limiting eligible removal units to specific removal options could address some of the shortcomings of full integration. By excluding temporary removals, the system would not create incentives to primarily use cheap temporary removals but instead incentivise the development of permanent removal options. Additionally, if only removals with permanent storage in geological formations are eligible, concerns of leakage and double-counting under the LULUCF Regulation could be addressed.

  Against this backdrop, **removals through DACCS and enhanced weathering would be the only eligible type of removal units**. As their removal potential is still tiny and future removal rates are uncertain, the actual use of removals is bound to be very low at the start, but it could increase as technologies mature and increase their removal capacities. Using removal units from BECCS activities is problematic due to conflicts with other land-uses such as food production and the protection of ecosystems. Limited additionality of the emission reduction is another concern (when biomass is harvested for BECCS this reduces other carbon sinks such as forests). Another problem with BECCS arises, when the biomass is imported from non-EU countries and combusted and stored in EU. In this case, removals would be accounted for in EU, whereas the harvesting is accounted for in Non-EU countries. For these reasons, strict sustainability requirements for the used biomass are necessary but establishing and implementing strict sustainability requirements has proven challenging in the past. The CRCF refers to sustainability criteria in the Renewable Energy Directive (RED II) that were criticized for not being strict enough. (Searchinger et al. 2018; Hennenberg et al. 2018). As a consequence, the amount of eligible BECCS removals is limited to narrowly defined waste biomass.

- **A cap for removal units:** A cap for eligible removal units under the ETS is another option. There could be two options to set this cap:

- The cap could correspond to the amounts of available **permanent removal units from DACCS, BECCS using waste biomass or enhanced weathering** (see above). This means that the cap initially would be very low as this type of removal units is scarce. The cap would also enhance the system's transparency and planning reliability as it would quantify the amount of permanent removal units eligible for meeting ETS obligations.
- The size of the cap could be limited to the estimated number of emissions from sectors with non-avoidable or hard to abate emissions.

► **Carbon Central Bank:** Different options for integration through a Carbon Central Bank (CCB) exist, ranging from full integration to indirect integration, i.e. by a separate cap for removal units. The CCB would create added value, when it addresses the challenges of non-permanence and limited additionality of carbon removal units. This could be addressed in the following variant without full integration (compare section 5.2.5 in Edenhofer et al. 2023): The CCB or another intermediary agency would be mandated for procuring carbon removal credits (e.g. in a reverse auction). Following the procurement of removals credits, the CCB would conduct auctions for normal EU ETS allowances. Installations regulated by the ETS would use these allowances to meet their ETS obligations.

Although many details need clarification, the option promises several benefits. The framework could, for example, stabilize carbon prices while maintaining the net-emissions path. At the same time, the option also raises concerns. Depending on its mandate, the CCB could undermine reduction efforts, in particular if its mandate allows to turn any removal unit into a compliance unit for mitigation obligations. To address this concern, there should be a clearly defined and transparent limits to the quantity of usable removal units. There should be also clear requirements on the quality of removals, however the quality of removals should not be determined by the CCB. The mandate of CCB should not encompass setting the emission budget of the EU. Only democratically elected legislators should be assigned with the task to take such far-reaching decisions with significant implications for the EU, its Member States and its citizens. The CCB mandate should also differentiate permanent and non-permanent types of removals and exclude units from non-permanent storage from direct use under the EU ETS (Meyer-Ohlendorf 2023).

► **Requirement to surrender allowances for biomass combustion without CCS:** Currently, there is no obligation to surrender EU ETS allowances for biogenic CO_2 emissions from biomass that complies with sustainability criteria, despite the fact that burning biomass increases CO_2 concentration in the atmosphere. This is a significant flaw in the current ETS. To address this problem, it is conceivable to amend the ETS directive, making it mandatory for covered installations to surrender allowances for all biogenic CO_2 emissions, unless these emissions are permanently stored. This amendment would not only rectify a loophole in the ETS, where emissions from other sectors (LULUCF) or even other countries go unaccounted for, but it would also serve as an incentive for BECCS. However, considering the numerous challenges associated with BECCS, as discussed earlier, any amendments to the ETS should ensure that BECCS is only eligible for the generation of removal credits when using narrowly defined waste biomass.

2.3.2 LULUCF Regulation

Under the revised LULUCF Regulation 2023/839[13], Member States have to ensure that greenhouse gas emissions from land use, land use change and forestry are balanced by at least

[13] See https://eur-lex.europa.eu/eli/reg/2023/839/oj.

an equivalent amount of CO_2 removal from the atmosphere in the period 2021 to 2025 (no-debit-rule). In the period from 2021 to 2025 net emissions are accounted against reference values. No reference values are applied for the period after 2026 to 2030. Instead, **absolute targets for net removals are in place that prescribe a linear path to -310 Mt of CO_2eq for the whole EU in 2026-2030**. This EU-target is broken down into specific removal targets for each Member State based on historic removals and area.

Accordingly, **under the LULUCF Regulation, removals and emissions from the LULUCF sector are directly offset in a net emissions balance**. Removals are thus directly accounted towards the net emissions target for 2021-2025 and towards the net removal target for 2026-2030. Moreover, a limited amount of removals from the LULUCF sector that go beyond the level of removals required for reaching the targets under the LULUCF Regulation can be used for compliance under the Effort Sharing Regulation (ESR, see section 2.3.3). A proposal to introduce a target of GHG neutrality of the combined LULUCF and Agriculture non-CO_2 emissions by 2035 was not adopted in the revised Regulation.

It is important to note that while the LULUCF Regulation establishes removal targets for Member States, it does not require them to certify removals according to the CRCF, nor does it require landowners to do so. Hence, one of the motivations for the publication of CRCF is to create incentives for public and private actors for removals, which can help achieving LULUCF targets. **Assessing compliance is based on the emissions reported in national GHG inventories submitted to the EU.** As discussed in section 2.2, certified removal activities may be reflected in these GHG inventories, but this is often not the case due to insufficient granularity of the inventories. This limited visibility could potentially limit the effectiveness of the CRCF as a policy tool for Member States to increase removals and meet their national targets under the LULUCF Regulation. Nevertheless, **removal units should not be accountable for reaching targets under the LULUCF Regulation.** This is to avoid potential double counting of removals that are credited via a certification programme and result in removal units while at the same time being reflected in the GHG inventory and accounted towards targets in the LULUCF Regulation.

2.3.3 Effort Sharing Regulation

The Effort Sharing regulation (ESR) 2023/857[14] allows Member States to use up to 280 Mt of net removals accounted under the LULUCF Regulation (see 2.3.2) to meet their reduction obligations under the ESR (Article 7). The removals (LMUs) allowed under the Effort Sharing Regulation refer to removals reported in GHG inventories for the LULUCF sector (see section 2.3.2) and not to removal units issued under the CRCF. This rule provides a certain degree of flexibility to Member States by using removals from another sector for reaching their emission reduction targets under the ESR.

Although limited to 280 Mt, this **flexibility is problematic** though. First, it makes removals and reductions equivalent, despite their inherent differences. It thereby constitutes an exception to the principles of EU climate law that removals cannot substitute reductions. Second, this flexibility makes temporary removals a compliance unit for reduction obligations. Third, it can be an incentive to prioritise low-cost removals (e.g. afforestation and soil carbon enhancement), thereby deterring emission reductions and the development of more mature technical sinks with higher investment costs (see sections 2.1 and 2.2). For these reasons, **this flexibility should discontinue, and should not be expanded.**

In addition to the LULUCF flexibility, some types of removals (not removal units) will show up as negative emissions ("pseudo-offsets") in the ESR sector unless ESR definitions are drastically

[14] See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32023R0857

changed. This is due to the way removals would show up in inventories in particular related to CO_2 capture for geological storage reported for BECCS (see section 2.2).

So far, there is no relation between the ESR and removal units issued under the CRCF. If removal units were eligible for use under the ESR, this could lead to double counting of removals that are reflected in GHG inventories and removal units generated under certification standards (see section 2.2).

On the other hand, removal units, if admitted into the ETS (see 2.3.1), could possibly affect emissions accounted under the ESR, depending on the further possible evolution of ESR scope definitions. In such a case it would be crucial whether the ESR scope would be based on 'gross' residual emissions from ETS installations or on 'net' emissions including offsets by removal units.

2.4 Compliance use to meet separate differentiated removal targets

Apart from the LUCUCF Regulation, there is currently no specific target in EU law to remove carbon, neither for Member States nor for other entities. The EU's 2030 climate target does not mandate a specific amount of carbon removal, but it allows for the use of up to 225 Mt CO_2e of removals to achieve its 55% reduction target. However, at some point, the intended/expected level of residual emissions in the EU in 2050 will need to be defined. This may also imply setting a target expanding the amount of removals that needs to be achieved in order to reach carbon neutrality and net negative emissions after 2050.

Beyond defining the amount of removals needed to reach carbon neutrality as defined in the EU Climate law, the EU could establish separate removal targets or instruments that specifically require carbon removal. Distinct targets could be defined for different types of removal activities taking into account differences in costs, potential, permanence of storage etc.

There are basically two options to define such removal targets:

- **Removal targets which are complementary to parallel emission reduction targets**
  Such removal targets would be defined in a similar way as sector-specific targets. Compliance would be assessed on the basis of accounting removals reported in GHG inventories. For that purpose, a definition of the 'removal sector(s)' would need to be developed based on GHG inventory categories. At the same time, GHG inventory-based definitions of parallel emission reduction targets, in particular for the ESR or the LULUCF-Regulation, would possibly need to be adapted in order to avoid double-counting of removals in both the 'removal sectors' and the 'emission sectors'[15]. As discussed in section 2.2, the inventory visibility of removal units certified under the CRCF is very limited, including fundamental differences in quantification of removals and allocation to specific years. Therefore, **removal units should not be used for the definition of complementary removal targets.**

- **Removal targets which are subordinate to superior overall emission reduction / GHG neutrality or net-negative targets**
  In case of subordinate removal targets, double counting with the superior reduction/neutrality/net-negative targets (e.g. an inventory-based EU NDC) is not problematic. Subordinate removal targets would not necessarily need to be defined by means of GHG inventory categories. Instead, **subordinate removal targets could possibly be defined by means of amounts and/or types of carbon removal units certified under**

[15] See discussion of coverage of removals in the LULUCF and ESR scopes in chapters 2.3.2 and 2.3.3.

the CRCF. To meet such distinct removal targets, carbon removal units issued under the CRCF could be used as there would be no concerns about equivalence since they would not be interchangeable with reductions. Assessing compliance with these targets could be based on generated or retired[16] removal units. In this case, the removal targets would not reflect the obligation to balance out residual emissions and removals to reach carbon neutrality; they would only work as a tool to promote removals in the EU.

2.5 Compliance use under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

In theory, it is conceivable that CRCF carbon removal units be recognised under CORSIA. Using carbon removal units towards CORSIA would, however, require that the EU authorises the underlying mitigation outcomes under Article 6 of the Paris Agreement for use towards other international mitigation purposes (OIMP) in order to avoid double claiming with the EU NDC. The CRCF states, however, that all units generated shall contribute to achieving the EU's Nationally Determined Contribution (NDC) and its climate objectives and not to third party-NDC or international compliance schemes. Thus the use of any removal units under CORSIA is not allowed. Currently, the EU NDC does not foresee any engagement in project-based crediting under Article 6.

In addition, there are **several other concerns** regarding the integration of carbon removal units into CORSIA:

- Firstly, **CORSIA does not address the equivalence problem by not differentiating between permanent and non-permanent types of removals**. To the contrary, it allows units with high non-permanence risks to be used to offset permanent emissions from fossil fuel combustion. Additionally, the requirements that offset credits need to fulfil are unspecific and not able to guarantee that only credits of high quality are used. There is thus no guarantee that the mitigation action is additional and permanent, undermining the environmental integrity of the scheme (Schneider et al. 2019; Schneider and Wissner 2021).
- Secondly, **CORSIA has several other fundamental flaws.** The scheme lacks an ambitious in-sector reduction target. It is thus not defined how much mitigation needs to be achieved through emissions reductions and to what extent offsets can be used. The target is not ambitious: the scheme features a climate neutrality growth target, which only requires offsetting CO_2 emissions that exceed 2019 levels for CORSIA's pilot phase (2021-2023) and 85% of 2019 emissions for the phase 2024-2035[17]. The scheme does not address non-CO_2 emissions although they are responsible for two thirds of aviation's climate effects (Lee et al. 2021).

2.6 Compliance use under other national or sub-national laws

As another conceivable option, the EU, its Member States, or sub-national jurisdictions could adopt laws that require or allow certain entities to surrender carbon removal units to fulfil legal obligations **other** than those under the ETS, ESR or LULUCF Regulation. Such obligations include, for example, those under the carbon taxation, granting permits or the Fuel Quality

[16] Definitional details with respect to generated vs. retired units would strongly affect any risk of double-claiming with other potential uses of removal units.

[17] See https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-and-Covid-19.aspx.

Directive (FQD). Member States could require that only removals certified under the CRCF are eligible for this use.

2.6.1 Compliance use for carbon taxes

Carbon removal units could also be used to **reduce tax liability under carbon taxes.** Tax laws in Colombia and South Africa, for example, allow the use of carbon offsets – including carbon removals – to comply with tax obligations.

The **Colombian Carbon Tax** (Art. 221 of Law 1819) puts a tax on specific industries for the combustion of fossil fuels. Coal is exempted from this tax. The tax law allows entities in the country to offset up to 100% of their tax liability with certified carbon credits from projects in Colombia, such as credits issued in Verra's Verified Carbon Standard Program (VCUs) or credits generated under the Clean Development Mechanism (CDM)[18]. The law resulted in an increased demand for Colombian carbon credits and Colombian emission reduction projects. It is important to note that ten projects in the forest sector accounted for around 80% of offsets used under the carbon tax (Alarcon-Diaz et al. 2018).

South Africa's Carbon Tax Act (Act No. 15/2019) introduced an offset mechanism to enable companies to substitute tax payments by surrendering offsets. Unlike Colombia's law, South Africa limits the use of offsets to reduce taxpayers' tax liability to up to 5 or 10% of their total greenhouse gas emissions contingent on the sector. Offsets are eligible if they are generated through investments in projects outside their taxable activities and not benefiting from other government incentives (Gazette No. 42483). Offsets must be certified by the Gold Standard (GS), the Verified Carbon Standard (VCS) or the CDM.

The **integration of carbon removals into carbon tax schemes** serves one of its purposes well – to lower the tax burden – but falls short to achieve its other purposes – to effectively combat climate change:

- **Deterring emission reductions:** The integration of emissions and removals into carbon taxation laws does not address the issue of equivalence, treating emissions reductions and removals as having the same tax value. This approach can create perverse incentives, as lower prices for removal credits compared to the costs of mitigation can discourage emissions reductions (Wang-Helmreich and Kreibich 2019).
- **Lower tax revenues:** The integration of offsets can potentially result in a loss of tax revenues, as companies may choose to invest in carbon removal credits from forestry projects, which are currently cheaper than mitigation measures. Since offsets substitute for emissions reduction, this system may reduce the amount of revenue generated from the carbon tax.
- **Amplifying problems of voluntary carbon markets:** The integration of carbon credits into carbon taxation can amplify the issues present in voluntary carbon markets, particularly in their use of baselines. A 2021 report by Carbon Market Watch and the Latin American Center for Investigative Journalism found, for example, that two large-scale REDD+ projects in Colombia had set artificially high baselines, leading to a significant overestimation of the emissions reductions achieved (Badgley et al. 2021). As a result, purchased credits were used to substitute carbon tax payments, potentially undermining the environmental integrity of Colombia's carbon offset mechanism and resulting in a loss of tax revenues.

[18] As of 2018, only offsets generated on national territory are eligible under specified certification programmes.

- **Undermining incentives to invest in innovative removal options:** If the tax rate under a carbon tax is lower than the cost of more expensive emissions removal options, it does not provide incentives for investing in those options, even though they may be necessary for permanent carbon storage. For instance, Colombia's carbon tax rate has not increased in real terms from its initial level of USD 5/tCO_2e,[19] as scheduled each year since its introduction. At this level, the tax rate remains drastically below the prices required to incentivise the scaling up of more expensive removal options.

2.6.2 Removal credits for permitting?

There are several examples where **third-party verified certificates** are required for issuing permits or making other decisions with legal force, such as granting subsidised loans for energy-efficient homes, construction permits, or import licenses. Issuing operating licences for cars is another example. It is conceivable that carbon removal units under the CRCF are used for the same purposes – as a requirement to receive permits, such as permits under the Industrial Emission Directive (IED), or other permits related to greenhouse gas emissions.

Depending on its design, such a system could provide strong incentives for generating carbon removals. However, in some instances it could face similar challenges as using removals to meet obligations under the ETS or carbon taxes, as discussed above. Environmental integrity could be undermined if carbon removals were used to lower the requirements for emission standards contained in a permit under the IED, for example. In this case, the use of removals could indirectly lead to fewer GHG emissions reductions. The IED does not regulate CO_2 emissions but other emissions that are precursor of non-CO_2 GHGs.

2.6.3 EU Fuel Quality Directive

The Fuel Quality Directive (FQD) requires Member States to reduce the **greenhouse gas intensity of transport fuels** by a minimum of 6% by 2020. The greenhouse gas intensity is calculated on a life-cycle basis, covering emissions from extraction, processing, and distribution, with emissions reductions calculated against a 2010 baseline of 94.1 gCO_2eq/MJ. This reduction target can be achieved through the use of biofuels, alternative less carbon intense fossil fuels, electricity for road transport, or renewable fuels of non-biological origin or a reduction of upstream emissions (such as flaring and venting) at the extraction stage of fossil feedstocks. However, for biofuels to be considered towards the greenhouse gas emission reduction targets, they must meet specific sustainability criteria outlined in the FQD and the Renewable Energy Directive (RED).

In addition, the FQD mandates that Member States ensure that at least **10% of their transport fuels come from renewable energy sources.** The FQD also permits the introduction of additional measures for suppliers to reduce life cycle greenhouse gas emissions per unit of energy by 2%, compared to the fuel baseline standard. These targets can be achieved, among others, through the use of new technologies, such as electric vehicles or an increased use of credits purchased through the Clean Development Mechanism (CDM). Furthermore, if carbon is stored in accordance with Directive 2009/31/EC on the geological storage of carbon dioxide, it can be credited as a reduction in emissions.

Building on these provisions, entities obligated by the FQD could be entitled to use carbon removal units to meet their compliance obligations regarding the emissions intensity of transport fuels. More specifically, the carbon content of fuel could not be counted as an emission if carbon is removed according to the rules of the CRCF. In this way, **the units issued under the**

[19] https://carbonpricingdashboard.worldbank.org/map_data (Accessed: 25.04.2023), latest update April 2022.

CRCF would become eligible for meeting the targets under this Directive. However, this use raises the equivalence concerns of potentially offsetting emissions by non-permanent carbon removal as discussed above if eligible use is not constraint to permanent options of carbon removal. This approach could also undermine the uptake of electric vehicles.

2.7 Voluntary use for offsetting by companies, institutions, jurisdictions, or individuals

Voluntary market standards establish various rules for certifying carbon removal units, with certification rules varying depending on the standard.

A number of **risks are associated with offsetting through voluntary markets,** including non-permanence of achieved removals or emission reductions, double claiming of mitigation results, non-additionality of projects, over-estimation of achieved mitigation as well as negative environmental or social impacts. For crediting biogenic removals through soil carbon sequestration or afforestation for example, there is a high risk that achieved removals will be reversed at a later point in time through human activities or natural disturbances. If rules are lacking to adequately address these risks, they threaten to undermine the integrity of crediting mechanisms, as they could ultimately lead to higher GHG concentrations in the atmosphere than if no offsetting took place. Recent scandals around the environmental integrity of voluntary carbon markets (see e.g. Badgley et al. 2021; Badgley et al. 2022; Greenfield 2023) suggest that the shortcomings of the voluntary carbon market cannot be fixed unless the rules and requirements of crediting standards are fundamentally revised, including refraining from offsetting emissions with temporary removals.

For credits used by private actors, these risks are severe, but they do not directly affect legally binding reduction obligations at national or sub-national level. Nevertheless, double claiming between actors on the voluntary carbon markets and actors on compliance markets can occur e.g. if private actors purchase and claim credits from projects on the voluntary market, and the same removals/emissions reductions are claimed by a country towards meeting its NDC under the Paris Agreement (Fearnehough et al. 2020). To avoid this form of double claiming, the host country of the mitigation activity would need to authorise the activity under Article 6 of the Paris Agreement for "other international mitigation purposes" (OIMP), including use on the voluntary carbon market. As a consequence, the country would need to apply 'corresponding adjustments' to its own emissions balance, i.e. by making additions to its reported emissions corresponding to the authorised credits (Schneider et al. 2022a). The underlying removals could no longer be used by the EU to achieve its own NDC. Another double claiming risk is that the same removals would be used both by EU Member States to fulfil their obligations under the EU LULUCF Regulation and by the entities using to the carbon removal units for offsetting. This raises similar concerns as double claiming with NDCs. The CRCF, however, states that all carbon removals and emission reductions generated under the CRCF shall contribute to EU NDC.

Despite these risks, few of the certification standards limit the use of credits or set specific certification requirements for particular uses. As long as a removal activity meets the relevant requirements, it will be certified, regardless of whether it is being used to offset emissions, make a contribution claim, or for other purposes. In practice, most credits issued on voluntary carbon markets are primarily used to offset emissions, provided that the project meets the standard's certification requirements. Gold Standard is an exception here, as it developed claims guidelines. These guidelines set rules for the conditions under which offsetting claims are "authorised" by Gold Standard, meaning that these claims keep with the values and principles of Gold Standards. This implies that credits should only be used for compensating

residual emissions, that only those credits should be used for offsetting claims that have robust baseline definitions, are highly likely to be additional, permanent and not double-counted in line with Gold Standard's requirements. The emission reduction or removal associated with a carbon credit should not be used for meeting any other compliance or voluntary target and the users of carbon credits should transparently document the reasons for using the credits as well as underlying calculations, assumptions, limitations and caveats. Additionally, the guidelines include recommendations for avoiding the deferral of mitigation actions by countries to achieve their NDCs or companies in achieving Science-Based Targets as a response to voluntary carbon market action (Gold Standard 2022).

The CRCF would not directly impact on voluntary markets – legally these markets could continue to certify activities according to their own rules, irresectable of the new requirements set by the CRCF. However, the CRCF could have a significant effect on voluntary carbon markets. For the first time, the EU – home of the world's largest carbon market – would set legally binding rules for the certification of carbon removals. Project developers as well as buyers of carbon credits are likely to prefer certification under the CRCF because of its greater legal and political weight and credibility.

The voluntary use of CRCF credits for offsetting is not addressed within the CRCF but in two other EU directives. The Directive for empowering consumers for the green transition, adopted and published in early 2024, forbids any offsetting claims for products that are based on GHG offsetting, such as 'climate neutral'.[20] This provision effectively forbids the use of carbon credits for offsetting purposes in relation to products. However, it does not address claims at corporate levels, such as companies claiming to be 'carbon neutral'. Moreover, this directive will be complemented by a proposed directive on green claims which aims to protect consumers from greenwashing.[21] The Green Claims Directive may establish more specific rules in relation to greenwashing and the use of carbon credits for offsetting. As the Green Claims Directive is a 'lex specialis', these provisions may override any provisions in the Directive on empowering consumers for the green transition as a 'lex generalis'. In March 2024, committees of the European Parliament adopted a position in which the CRCF would play a key role with respect to claims. According to this position, "*climate-related compensation and emission reductions claims*" are permissible under certain circumstances, namely through carbon credits certified under the CRCF or other schemes that meet equivalent requirements. Effectively, this position would establish the CRCF as a benchmark for the necessary quality of carbon credits to continue to make compensation claims. The provisions further specify that only 'permanent removals' may be used towards such claims. This position does not address the concerns raised in relation to double claiming, i.e. that the removals from the carbon credits may also be claimed towards the EU NDC and by Member States to meet their obligations under relevant other EU directives, such as the LULUCF Regulation. The Directive is expected to be agreed after the elections of the European Parliament in June 2024.

2.8 Voluntary use for contribution claims

Several stakeholders have proposed that removal units could be used by companies, institutions, jurisdictions, or individuals to make climate contributions, without counting the associated removals towards own goals or targets. These concepts are also referred to as "contribution claims" or "climate responsibility" (WWF 2022; Grandpré et al. 2021; NewClimate Institute

[20] Directive (EU) 2024/825 of the European Parliament and of the Council of 28 February 2024 amending Directives 2005/29/EC and 2011/83/EU as regards empowering consumers for the green transition through better protection against unfair practices and through better information. See Recital 12 and paragraph (2) in the Annex.

[21] https://environment.ec.europa.eu/publications/proposal-directive-green-claims_en

2020). This could also entail the development of a respective label. According to the Gold Standard´s guidance for impact claims, all carbon credits issued may be used towards "contribution claims" that reflect or describe the climate change mitigation impact represented by the credit (Gold Standard 2022).

Using removal units as contribution claims mitigates the risks for environmental integrity associated with using removal units for offsetting purposes.

2.9 Use as vehicle to disburse subsidies or provide incentives

There are **various examples of the use of carbon removals for the distribution of subsidies.** One example is the EU's Common Agricultural Policy (CAP), which provides subsidies to farmers for various agricultural practices, including those that have positive environmental impacts such as carbon removal through soil carbon sequestration. Another example is the EU's Innovation Fund. Carbon removal technologies, such as direct air capture and carbon mineralization, are eligible for funding under this fund. The UK government's Woodland Carbon Guarantee scheme or the US Department of Agriculture's Conservation Reserve Program are examples from outside the EU.

The CRCF could facilitate the distribution of results-based subsidies for certified activities (in contrast to investment subsidies) which provide incentives for the effective implementation of removal activities. If the subsidies are auctioned aiming at carbon contracts for difference (CCfD) they could provide additional incentives for technological learning and innovation as such auctions would reward least cost options. For this instrument, different removal operators would offer a quantity and price of carbon that they aim to remove trough a project activity. Through a competitive process with defined selection criteria, those operators offering least-cost options are awarded a contract that guarantees them a payment in the amount of the difference between the offered price and an agreed reference price for removals. This reference price could e.g. be the price at which CRCF units are traded at the time certificates are issued for the activity under a CRCF eligible certification scheme.

The use of removal certificates under the CRCF would constitute **little environmental risks –** provided the CRCF has a robust design. In addition, this use does not imply any risk of double claiming.

2.10 Conclusions

The use of removal units is a crucial aspect of any carbon removal regulation. An unrestricted usage raises several significant concerns. There is a risk in conflating carbon securely stored in geological reservoirs like coal, gas, or oil (which lack natural reversal risks) with carbon temporarily stored in terrestrial reservoirs, such as biomass or products prone to significant anthropogenic and natural reversal risks. Overreliance on removals, rather than emission reductions, could solidify emission pathways that impede achieving the 1.5°C target and bring atmospheric CO_2 concentrations to levels that trigger climate tipping points that amplify emissions and hasten climate change. Furthermore, unlimited usage, in particular for offsetting, poses risks of double counting.

For these reasons, removal units should not be used for meeting emission reduction obligations in particular if they store carbon only temporarily. Uses of removals units should be restricted to these three categories:

- fulfilling carbon removal obligations under EU, national, or sub-national policies other than the EU ETS, ESR, or LULUCF Regulation,

- voluntary purposes other than offsetting, like contribution claims, and
- disbursing subsidies and incentives.

Carbon removal units should not be used to reduce tax liability under carbon taxes.

3 Funding carbon removals: activity and result-based incentives

The landscape of carbon removal finance is currently characterized by a patchwork of mostly voluntary initiatives that are advanced by coalitions of public and private actors with the objective to demonstrate maturity of certain removal technologies or contributing to climate action. The lack of a more systematic policy framework for mobilizing resources for carbon removals has been attributed to earlier scepticism by social scientist and environmental advocacy groups. They argued that investing on removal technologies might divert scarce resources from urgently required mitigation efforts (Honegger 2023). In recent years, the recognition that limiting global mean temperature increase to 1.5°C will require significant carbon removals became more widespread, spurring governments into exploring how to create an enabling environment for scaled-up implementation of different removal options.

3.1 Overview of existing incentive mechanisms for carbon removals

The following sections provide an overview of some of the 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.

3.1.1 Policy targets – The U.S. Department of Energy's Carbon Negative Shot Initiative

The U.S. 2021 Infrastructure Investment and Jobs Act (Bipartisan Infrastructure Law) includes an allocation of USD 62 billion for the U.S. Department of Energy (DOE) for scaling clean energy solutions. Approximately USD 12 billion over five years will be available to deploy new carbon management solutions, including direct air capture and carbon capture, transport, and storage.

The DOEs carbon management activities are part of its "Carbon Negative Shot" initiative, which is built around a target to achieve durable and scalable CO_2 removals for a price of USD 100 per metric ton CO_2e within one decade.

Solutions that are supported through the initiative include direct air capture with storage, soil carbon sequestration, biomass carbon removal and storage, enhanced mineralization, ocean-based carbon dioxide removal, as well as afforestation/reforestation.

The DOE has launched several funding instruments under Carbon Negative Shot initiative that aim at supporting technology development (see Table 1).

Although being in its very early stages, the two-pronged approach of the Carbon Negative Shot of providing an actionable and measurable policy goal of driving down removal cost to USD 100/ton CO_2e by the end of the decade, complemented by concrete funding opportunities creates an attractive policy environment that fosters competition and innovation.

Table 1 Selected DOE initiatives under the Carbon Negative Shot

Title	Description
Carbon Dioxide Removal Purchase Pilot Prize	Through the initiative the U.S. DOE will offer up to USD 35 million in cash awards for "American-Made" carbon removals. The prize will work through a certification scheme that verifies removals.
Voluntary Carbon Dioxide Removal Purchase Challenge	Public-private partnership that aims to mobilize external organizations to join the U.S. DOE in purchasing carbon dioxide removal credits under the Carbon Dioxide Removal Purchase Pilot Price.
Carbon Negative Shot Pilots	USD 100 million funding for pilot projects, initially in the following three areas: small biomass carbon removal and storage; small mineralization, and multi-pathways carbon dioxide removal testbed facilities.

Sources: (DoE 2024c; 2024a; 2024b)

3.1.2 Production tax credit – The U.S. tax code section 45Q – credit for carbon oxide sequestration

The federal tax code of the United States in section 45Q contains provisions that allow companies that deploy carbon sequestration, storage, and removal technologies to apply a credit to the taxes they owe to the federal government. The provisions were added to the tax code in 2008, and since then have been updated and extended in 2018 and 2022.

To claim tax credits, companies must demonstrate secure geological storage of CO_X, using methodologies of the U.S. Environmental Protection Agencies (EPA) 2009 mandatory reporting of greenhouse gases rule. This rule inter alia requires that facilities follow monitoring, recordkeeping and verification requirements (IRS 2021).

To be eligible for the tax credit, companies initially had to capture at least 500,000 metric tons per taxable year. For permanently stored carbon oxide, this threshold was decreased in 2018 to 100,000 metric tons. In 2022, thresholds have been reduced significantly to make the credits accessible to a larger set of economic actors. (see Table 2).

Table 2 Evolution of eligibility thresholds under the U.S. tax credit scheme

	45Q eligibility thresholds [tons]		
Measure	**2008**	**2018**	**2022**
Storage in saline geological formations from carbon capture on industrial and power generation facilities	500,000	100,000	18,750 (power) 12,500 (industry)
Utilization from industrial and power generation carbon capture	500,000	500,00	18,750 (power) 12,500 (industry)
Storage in saline geological formations from direct air capture	n/a	100,000	1,000
Utilization from direct air capture	n/a	100,000	1,000

Sources: (CATF 2023)

Initially, the credit was assessed per metric ton of CO_2. Since 2018, the tax credit can also be applied to carbon oxide CO_X. In 2008, the incentives were set at USD 20 per ton CO_2 for storage, and USD 10 for utilization. In 2018, values have been increased and the scope was broadened to include direct air capture. As part of the Inflation Reduction Act (IRA), values were again substantially increased, with the value for DAC storage increasing by 250% compared to the 2018 value (see Table 3). After 2026, values will be adjusted each year to rise with inflation. In addition to the higher values, the IRA amendment also introduced the ability to transfer tax credit to an unaffiliated third party in exchange for a cash payment.

Table 3 Evolution of incentives under the U.S. tax credit scheme

	45Q tax credit incentives [USD per ton CO_X]		
Measure	**2008**	**2018**	**2022**
Storage in saline geological formations from carbon capture on industrial and power generation facilities	20	50	85
Utilization from industrial and power generation carbon capture	10	35	60
Storage in saline geological formations from direct air capture	n/a	50	180
Utilization from direct air capture	n/a	50	130

Sources: U.S. tax code §45Q – Credit for carbon sequestration; (CATF 2023)

Modelling of the effects of the increases in tax credit values adopted through the IRA, project that these would potentially stimulate CO_2 capture of between 100-200 million tons per year by 2030 (Jenkins et al. 2022; Della Vigna et al. 2023). The Congressional Budget Office estimates that the tax credits will reduce tax revenues by about USD 5 billion between 2023-2027 (CBO 2023). The U.S. treasury projects higher losses of USD 30.3 billion between 2002-2032 (see Table 4).

Table 4 Estimated tax revenue loss due to section 45Q tax credits (in USD million)

2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Total
360	310	370	570	740	1,890	2,470	2,740	5,760	7,660	7,790	30,300

Source: (U.S. Department of Treasury 2023)

Industry associations have widely welcomed the new tax credits stating that they are a major turning point for removal technologies in the U.S. as they create a highly competitive policy environment that promises to rapidly bring down technology cost. At the same time there has been criticism in the past questioning the integrity of the instrument. An investigation showed that between 2010 and 2019 a total of USD 894 million were claimed by companies under section 45Q without meeting EPA regulations for MRV. The IRS subsequently disallowed 59% of non-compliant credits with the investigation still ongoing (Taxpayers for Common Sense 2023).

These issues point to the need to ensure that incentive instruments are embedded in robust regulations for removal accounting to ensure integrity of subsidy schemes and avoid abuse.

3.1.3 Investment tax credit – Canada investment tax credit for carbon capture, utilization, and storage

Like the U.S., Canada adopted a tax credit for carbon capture, utilization, and storage projects. In contrast to the U.S. scheme, which is a production tax credit, the Canadian scheme is an investment tax credit. This means the credits are assessed based on investments in CCUS equipment and not per ton of removal generated. For a period from 2022 to 20230, tax credit rates will be set as follows (Tossou et al. 2024):

- 60% for investment in equipment for DAC projects;
- 50% for investment in equipment in all other CCUS projects;
- 37.5% for investment in equipment for transportation, storage and use.

After 2030, the rates will be reduced by 50% for a period 2031-2040 to provide an additional incentive for market actors to engage in early action.

One advantage of an investment tax credit is, that they come in relatively upfront in a project's implementation cycle. They reduce the cost of installing CCUS equipment.

3.1.4 Reverse Auctions – Swedish scheme for BECCS

In 2021, the Swedish government announced that it would provide an annual EUR 46 million in funding for procuring bioenergy carbon capture and storage (BECCS) removals. The funds would be allocated using a reverse auctioning scheme, where companies offering the lowest price per unit will receive the award. The government estimates that the resources could incentivize removals in the scale of 200-400,000 tons of CO_2 per year (Höglund. R. 2021). Delivery of the removals is scheduled to start in 2026, although the start of the auctioning has been postponed several times.

3.1.5 Policy exemptions – Swiss agreement with managers of waste treatment installations

The Swiss Federal Department of the Environment, Transport, Energy and Communications (DETEC) entered into an agreement with the Association of Plant Managers of Swiss Waste Treatment Installations (VBSA) to drive forward CCUS technologies in the sector. Under the

agreement, operators of waste treatment installations are obligated to construct at least one CO_2 capture plant with a minimum capacity of 100,000 tons of CO_2 per year. Through entering in the agreement, installations are exempt from participation in the Swiss Emission Trading Scheme. This is however subject to the condition, that the minimum quantity of 100,000 tons of CO_2 is achieved by 31 December 2030 (DETEC 2022).

Policy exemptions tied to certain sectoral actions can be another incentive mechanism to support technology innovation.

3.1.6 Private impact investment – Apple's Restore Fund for carbon removal

In 2021, the Apple company together with Goldman Sachs and Conservation International launched the "Restore Fund" for carbon removal to combine carbon market approaches with impact investment capital (Apple 2024). The fund creates carbon removals by reforesting marginal and degraded agricultural and pasture lands. Once established, these forests will be commercially managed for timber production. The fund will invest up to USD 200 million and aims to remove at least 1 million metric tons of CO_2 annually from the atmosphere. In 2023, Apple expanded the Restore Fund through a partnership with Climate Asset Management and HSBC adding regenerative agricultural projects and ecosystem restoration as new project types. The expansion includes an investment of a further USD 200 million and aims at removing an additional 1 million metric tons of CO_2 annually.

Projects developed for the Restore Fund will be registered under existing carbon crediting programs such as Verra, Climate Action Reserve, ACR and Gold Standard and must meet the respective provisions of these standards. In addition, Apple has defined separate investment criteria for the fund that relate to environmental, social and governance aspects.

Apple plans to use the removals generated by the Restore Fund to offset its residual emissions. The company has committed to reduce emissions compared with 2015 levels by 75% by 2030 and 90% by 2050.

This example shows, how climate neutrality targets can incentivize companies to invest in removal activities. It is also an example of a coalition of private and non-profit actors working together to scale removal approaches. In practice, the Restore Fund likely will predominantly rely on the infrastructure of the voluntary carbon market (e.g. by applying its additionality tests and quantification methodologies). This mean that projects will likely face similar quality risks than those certified under carbon crediting programs. Recent research for example has shown that commercial afforestation projects likely have high non-additionality risks as sales from timber revenues can generate substantial income for forest owners (CCQI 2024). Further, this project type has significant non-permanence risks, and the rules of carbon crediting programs differ in their stringency to address these risks. While these risks exist, whether they will materialize for projects under the Restore Fund depends on the design of each individual project. In principle the direct involvement of a large market actor such as Apple could create an opportunity to push for the voluntary market to address known quality gaps and drive necessary reform and innovation of the system.

3.1.7 Private impact investment via contribution claims – Milkywire's Climate Transformation Fund

Established in 2021 by Swedish tech-platform Milkywire, the Climate Transformation Fund provides a digital infrastructure for companies to support removal activities, using the contribution claim model. Under this model, companies do not buy removals for offsetting but invest in removal projects and communicate about the impact of their investment for climate

protection. Milkywire recommends that companies calculate their contributions by establishing an internal carbon fee to tax their emissions. An advantage of such an approach is that it takes the focus away of buying carbon credits as cheap as possible and instead focusing on identifying interventions with high impacts. Guidance documents provided by Milkywire recommend setting the fee somewhere between USD 100-200 per ton to be credible but also suggest differentiation by companies to factor in their emission intensity and profit per ton (Arefaine and Kashwa 2015; Milkywire 2022).

The fund is currently supported by several companies, including Klarna, Spotify, ING Bank, Pangaia, Northzone, and Mentimeter. The initiative is the largest effort to date to pilot the contribution claim approach. Its focus on high impact approaches might be well suited for incentivizing removals as the market is still nascent and requires significant funding for technologies to mature.

3.1.8 Advance market commitments – Stripe Climate and Frontier

In 2020, financial solutions provider Stripe announced a new fin-tech service called "Stripe Climate" which provides a service platform for companies to fund carbon removal solutions. Customers can use the platform to either pre-order a specific number of tons of removals that they can use to meet a climate target or make a "climate commitment" by supporting early-stage projects. This digital solution mostly aims at reducing the transaction cost of removals by linking projects with potential buyers.

The solution further entails an incentive mechanism called "Frontier" which is a nine-year advance market commitment to accelerate the development of permanent carbon removal technologies. Under Frontier, Stripe, Alphabet, Shopify, Meta, and McKinsey Sustainability committed to purchase a value of USD 1 billion of carbon removals in the next nine years (Clancy 2022).

Advance market commitments have their origin in vaccine development. They constitute a promise to buy a product if it is successfully developed (Kremer et al. 2020). Such guarantees can incentivize private investment in cases where development costs and technology uncertainties are high.

3.2 Conclusions

As removals are getting a more prominent role in the climate change policy mix, the question about creating an enabling environment for scaling up investments becomes more important. With the CRCF, the European Union has put in place a market-based incentive structure with the objective to mobilize funding at scale. At the same time, many technologies are still nascent and require significant amounts of funding now. While the CRCF matures in the coming years, some of the instruments presented above could complement the CRCF and ensure that sufficient funds are available in the coming years. It should for example be closely observed whether the CRCF will be able to establish prices for removals that match those of the tax credits provided by the United States. If not, complementary instruments could help to ensure, that the EU policy environment for removals remains competitive with those of other jurisdictions.

4 Interlinkages between CRCF implementation and existing national funding instruments – Germany as a case study

4.1 Challenges for national funding instruments for carbon removals

The adopted CRCF aims to promote natural and technical carbon removal processes and investments across EU Member States. Member States themselves have developed national funding instruments for carbon removals using different types of instruments. These include, among others, incentive schemes, subsidies, and voluntary markets. The implementation of the CRCF at national level raises question about potential interactions between national funding instruments and the CRCF. In this section, we discuss potential interactions for the case of Germany where we look at national instruments for funding carbon removals in the land use sector.

In general, challenges related to interactions between the CRCF and national funding instruments in Germany could entail harmonization and alignment of funding allocation, monitoring and verification, as well as consistency of processes. To be included in the CRCF, national funding schemes need to be both coherent and conform with the EU Regulation. In the following we discuss four topics relevant for aligning and harmonising processes, i.e. issues of additionality, challenges for baselines, issues of double counting and visibility of contributions in national GHG inventories.

4.1.1 Additionality

Additionality is a substantial element for ensuring environmental integrity and efficiency of funding of carbon removals. Funders of support schemes or investors into voluntary carbon markets rely on additionality to know that their finance has created real removals that the atmosphere 'sees'. For documenting additionality two different approaches are typically followed. **Financial additionality** means to provide proofs that carbon removals for which credits have been issued would not have taken place without the received revenue from credits. **Legal additionality** describes that the credited activities are not required by national law and thus would have to be implemented without funding, e.g. preserving forests after harvest or disturbance events as demanded by German Forest Law. Legal additionality is therefore also referred to as **regulatory additionality**. Other approaches to prove additionality are **common practice tests** looking at whether a practice or technology is already commonly used in the field, which is similar to business as usual and therefore considered commercially viable without additional funding. Also, **barrier analyses** are often used to identify potential non-financial barriers for the implementation of carbon removal projects, such as lack of information or scarcity of resources.

The importance of demonstrating additionality has increased with the Paris Agreement that requires Nationally Determined Contributions (NDCs) from all countries. These include plans for policies and measures that a government introduces to contribute to the Paris Agreement's target of keeping global temperature increases well below 2°C or below 1.5°C compared to pre-industrial levels. This increases the importance of demonstrating, especially, regulatory additionality, as activities are only additional if they are not required or enabled by policies and measures introduced by the government (Gold Standard 2024). Regarding requirements for the development and assessment of mechanism methodologies, Article 6.4 of the Paris Agreement states in an information note that demonstrating additionality shall take "*into account all relevant national policies, including legislation, and representing mitigation that exceeds any mitigation that is required by law or regulation, and taking a conservative approach that avoids*

locking in levels of emissions, technologies or carbon-intensive practices" (UNFCCC 2022). However, some standards argue that a different additionality approach is required (Schwarz et al. 2022). Hypothetically, all NDCs together should lead to the achievement of the 1.5°C target. However, analyses by the UN document show a gap between NDCs and the requirements by the Paris Agreement (UNEP 2023). Additionality should thus link to the achievement of the 1.5°C target and not to national NDCs (Schwarz et al. 2022). However, this requires detailed consideration of the situation in the country, including current state of implementation of measures and their effectiveness. The assessment of regulatory additionality should take into account tax and subsidy regimes, regulations at sub-national level as well as policies or measures that are intended but have not yet been adopted (Gold Standard 2023).

It has to be noted that additionality testing is subjective. Its demonstration should therefore be accompanied by independent third-party assessments that ensure that carbon finance is targeted towards additional carbon removals that would not have occurred in its absence (Gold Standard 2023).

Additionality is a situation that is not cast in stone. Legislation and rules change, government programs and related policies and measures change so that demonstrating additionality is required during the course of projects and whenever crediting periods are renewed (Gold Standard 2024). The same applies to establishing baselines.

4.1.2 Baselines

The CRCF through its QUALITY criteria requires that "*carbon removal activities must go beyond standard practices and what is required by law*". It further refers to the approach of a standardised baseline that aims to accurately reflect what can be considered "*standard practices and the regulatory and market conditions in which the activity takes place*". As for additionality testing the NDC cycle of continuously updated and increasingly ambitious submission of new NDCs every five years requires to review and update also baselines on a regular basis (Gold Standard 2024). Thus, historic or simple business as usual baselines should not be used to assess performance of projects.

Standardisation reduces efforts by projects for establishing baselines and can avoid overcoming information asymmetry that is one of the causes why baselines get inflated. However, they still allow for generation of carbon credits without altering through adverse selection, meaning that a higher proportion of projects apply that have favourable initial conditions. Baselines should therefore be based on methods that account for geographical and ecological gradients within the country (Randazzo et al. 2023). As discussed above, aligning incentive schemes or voluntary market regulations for carbon removals with existing national funding instruments should also consider administrative differences to avoid adverse selection.

4.1.3 Double counting

Double counting is among the most debated issues around interlinkages between national and international funding instruments and mechanisms and avoiding it an important element of environmental integrity. Not for all national funding instruments double counting may be an issue in the same way. Therefore, differentiating types of double counting is useful. While **double issuance** means that one unit is issued for the same removal, in the case of **double use** the same issued unit is used twice. **Double claiming** instead occurs if a removal unit is counted by buyer and seller.

National funding instruments need to consider and address the risk of double claiming in case the buyer (funder) is seeking to make compensatory claims through the use of a carbon credits,

and the government when it tracks progress towards its NDC that includes the area where the project took place (Gold Standard 2024). National registries can avoid the risk also that of double claiming between different corporates and their claims.

A challenging interlinkage regarding double counting is between voluntary carbon markets and national policies and measures towards implementation of the NDC. It can be argued that if voluntary carbon markets lead to a country deferring or delaying mitigation activities due to results achieved by the voluntary carbon market, double claiming would occur if the voluntary carbon market would issue credits for **offset claims** (Gold Standard 2024). Given the fact that currently countries are not on track towards achieving the Paris Agreement goal with their NDCs such carbon removals underlying claims should not be counted towards the country's NDC. This can be guaranteed by applying '**corresponding adjustments**', a mechanism established under Article 6 of the Paris Agreement foreseen to reflect transfers of emission reductions and removals between countries with NDCs. Alternatively, only non-compensatory or **contribution claims** should be allowed that cannot be used to offset emissions or claim carbon neutrality (Gold Standard 2024).

4.1.4 Visibility in GHG inventories

Another challenge for aligning national funding instruments with the implementation of the CRCF is the visibility of emissions and carbon removals in national GHG inventories. Inventory visibility refers to whether changes in emissions resulting from mitigation actions are visible, and is different from accuracy, which is a measure of the agreement between the true value and the average of repeated measured observations or estimates (Schneider et al. 2022b).

National GHG inventories include the sector Land Use, Land Use Change and Forestry (LULUCF). It consists of six land categories, namely Forest land, Cropland, Grassland, Wetlands, Settlements, Other land, and the reporting category Harvested Wood Products (HWP). Emissions and removals are reported using gain-loss or stock change methods for seven carbon pools that include living biomass, dead organic matter (DOM, including litter and dead wood), mineral soils, organic soils, and HWP. The sector is regulated by the LULUCF Regulation that requires that in the period 2021 to 2025 GHG emissions from the sector are balanced by at least an equivalent amount of CO_2 removals (no-debit-rule). For the period 2026 to 2030 national targets for 2030 and a budget for the time 2026-2030 need to be fulfilled (see Böttcher et al. 2024).

Reporting under the LULUCF Regulation is based on IPCC guidelines that provide methodologies but also provide default values for estimating emission factors for the different pools and covered gases (CO_2, CH_4, and N_2O). The methods under the CRCF are based on Life Cycle Analyses (LCA) that estimate emissions and removals along the processing chain of products. While there is no direct link between the units certified under CRCF and the accounting of carbon removals and soil emissions under the LULUCF Regulation, the 'certificate of compliance' of CRCF certifications will contain relevant information for EU and national GHG accounting (e.g. the amount of total removals).

There are two important linkages between GHG reporting under the LULUCF Regulation and the CRCF. The harmonized rules under the CRCF can facilitate the upscaling and financing of measures using different instruments like the CAP or the voluntary carbon market to contribute to national LULUCF targets. Also, by collecting data on emissions and removals by projects, the CRCF can help improving the quality of national GHG inventories. This could include updated and improved emission factors and their differentiation at sub-national level. Such improvements are required by the LULUCF Regulation that requires that Member States report all land use categories with national emission factor data (Tier 2) from the year 2028 onwards.

Improved national GHG inventories, on the other hand, may eventually better capture the contribution of CRCF and other national activities, thereby reinforcing the incentive for Member States to finance these projects (Böttcher et al. 2024).

4.2 Potential interlinkages between CRCF and national funding instruments

4.2.1 Provisions of the CRCF

The provisional agreement for establishing the CRCF (EU 2024) was analysed to assess how its design addresses possible **interlinkages between certification schemes under the CRCF and national funding instruments**, as discussed in the section before. The legal text itself does not include direct references to such potential interlinkages. The additionality-clause in Article 5 (1) establishes however that project proponents must demonstrate that "*the incentive effect of the certification is needed for the activity to become financially viable*". While this provision does not exclude blending resources from monetizing CRCF certificates with other forms of financing, it restricts this to cases, in which these forms of financing alone are not sufficient to make the activity financially viable.

The rule is consistent with common practice on voluntary carbon markets, in which most carbon crediting programs require similar demonstrations from project developers. Assessments of carbon market projects show that co-funding of projects with Official Development assistance or domestic policy support such as feed-in tariffs or tax breaks are associated with high-additionality risks (Cames et al. 2016).

The provisions in Article 5 do not provide further details on the approach which project proponents must take in demonstrating additionality. Existing certification schemes on the voluntary carbon markets such as the Gold Standard or Verified Carbon Standard either developed specific additionality tools containing step-by-step guidance to demonstrate additionality or detail such guidance in the methodologies for quantifying the emission reduction impact of an activity. An investment analysis for demonstrating financial additionality is a key component of such requirements.

Article 5 (1) differentiates requirements for demonstrating additionality between activities using a standardised baseline and those using an activity-specific baseline. Projects applying the standardised baseline are considered automatically additional, while under activity-specific baselines, specific additionality tests in accordance with applicable quantification methodologies must be met.

For standardised baselines, the institution setting the standardised baselines is responsible for ensuring additionality of removal activities. The CRCF delegates this responsibility to the European Commission. It further notes that standardised baselines "*should reflect the statutory and market conditions in which the activity takes place",* as well as reflect *"if an activity is imposed upon operators by the applicable law, or it does not need any incentives to take place"* (Recital 12).

In developing the additionality thresholds in standardised baselines, the policy environment for the removal activity will play an important role. If activities take place in settings where several other incentive mechanisms such as subsidies or tax breaks are available to project developers, the standardised baseline needs to take these into account. A thorough analysis will be required in these cases, whether existing incentive mechanism are indeed not sufficient to make the removal activity financially viable. It is likely that policy environments will differ among regions and jurisdictions. Capturing these differences will be challenging as it requires reviewing a large amount of local data and policy frameworks. It will however be important to ensure that standardised baselines are robust in ensuring that only projects that require revenues from

monetizing CRCF units will receive certification. If it is impossible to set a standardise baseline that robustly captures difference between jurisdictions and regions, another option could be to separate demonstration of financial additionality from standardised baselines and require project developers to demonstrate this on a project-by-project basis. The disadvantage of this approach would be that this will add additional cost to project developers in preparing the project. There are precedents in the voluntary carbon markets for such an approach. The Climate Action Reserve for example applies standardised baseline but requires project developers to demonstrate legal additionality on a project-by-project basis.

For activity-specific baselines, applicable additionality tools should include requirements for project developers to provide information on the financial model of the removal activity to transparently demonstrate the need for additional funding from monetizing CRCF units. This should include

4.2.2 Attribution

If projects blend revenues from market-based mechanism with other funding sources, an important consideration is how CRCF units are attributed to the different funding streams.

If, for example, revenues from monetizing CRCF units only contribute 10% to the overall investment required for the removal activity, it might be questionable if all removal units are allocated to the project developer of the carbon market project. This is especially relevant when funding from market-based mechanisms is blended with public resources. If 100% of the removal units are attributed to the carbon finance, although it only contributes 10% to overall investments, public resources would subsidies CRCF removal units. This could lead to market distortions and prices not reflecting true costs.

A more suitable approach might be to use a proportional attribution approach, where removal units would be allocated to each funding stream proportionate to their share in the overall investment envelope for a project (Füssler et al. 2019; Kohli et al. 2021; Schneider and Haase 2023).

4.2.3 Interlinkages with national market-based mechanisms

Next to interlinkages with non-market-based mechanism, there is also a potential overlap between the CRCF and national market-based certification schemes for removal activities. Here it is important that there is no double-certification (and double-funding) for the same activity. The CRCF text addresses this issue by mandating the Commission to create a Union wide registry for carbon removals and soil emission reductions (Recital 26) with one of the objectives being to avoid fraud and double counting. The details of the Union wide registry are contained in Article 12 which stipulates that "*any certified unit shall not be issued more than once and shall not be used by more than one legal or natural person at any point in time*".

While the provisions of Article 12 regulate units issued under the CRCF, it remains unclear how the Union registry will address certification schemes that issue credits on the voluntary market but that are not recognized under the CRCF. To fully ensure that no double-financing, or even double-counting, takes place, these would need to be monitored as well, to ensure that one project cannot receive credits and removal units for the same activity.

4.2.4 Case study: demonstration for financial additionality in the Label Bas-Carbon

An example of a national certification framework that shows many similarities with the structure of the CRCF is the **French Label Bas-Carbon (LBC) certification framework**, which was established through a ministerial decree on Nov 28th, 2018. It has a very wide scope of

covered activities, potentially including all sectors not covered by the EU-ETS and allows certification of both, carbon removals and emission reductions. The certification methodologies for different sectoral activities were co-developed with stakeholders and experts. Currently, methodologies are undergoing a third review and update process. Until now, more than 1.137 projects have been certified and more than 3.6 Mt CO_2 emission reductions and removals have been achieved[22]. The use-case for LBC certificates is similar to the CRCF, as individuals, groups and companies can purchase certificates directly from project developers or through intermediate brokers and the certificates count under the national NDC. The LBC does not differentiate between permanent and non-permanent activities in its certificates, but activities with reversal risks must apply a 10-20% deduction when quantifying the volume of certificates being generated by a project (Tronquet 2023).

Like in the CRCF, additionality of the removal activity is an essential criterion for receiving certification with the LBC (You and Delerce 2023). The LBC applies the same sub-criteria for demonstrating additionality. Project developers must demonstrate that activities are not mandated by legal requirements and that the activities are not financially viable without revenues from monetizing LBC certificates.

Additionality must be demonstrated on a project-by-project basis (Tronquet 2023), which is a different approach to the CRCF, which establishes standardised baselines as the preferred approach. Under the methodologies for the four most popular project types under the LBC "crop field", "livestock & crops", "afforestation", and "forest restoration after natural hazards", financial additionality must be demonstrated by a scenario calculation with and without the use of carbon credits. For this, the net-present-value (NVP) method must be used that applies a discount factor for future cash flows. The discount factor is pre-set by each methodology and represents a best estimate. In the case of afforestation projects, the LBC methodology uses a standardized threshold for the level of subsidies under which an afforestation project is considered financially viable (i.e. not requiring additional revenues from removal certification).

Regarding **double-financing with public subsidies**, the LBC framework foresees that a project can never get more than 100% financing of the project costs. This means that if public subsidies cover a part of the project costs, the revenue from selling removal credits cannot surpass the total projects costs minus the public subsidy. Still, the legal person that acquires the credits can claim the full quantity of credits, even if it only financed a part of the project costs (Steffan 2023). The effectiveness of this rule to prevent double financing is currently assessed in the revision process of the methodology.

A disadvantage of the project-level demonstration of additionality is that it requires project-specific data to e.g. calculate the net present value of a removal activity. As this is not always straightforward for project developers, the LBC offers an option to apply generic values for conducting the calculations. Project developers that use this approach must apply a 20% deduction to the number of removals they estimate to generate from the activity to account for a higher level of uncertainty (Tronquet 2023). The effectiveness and robustness of this approach is also currently under review.

The initial objective of the simplified approach to demonstrate additionality under the LBC was to reduce administrative burden and cost for small-scale project operators, such as farmers and foresters. This is also reflected in the validation process of the LBC which is conducted by the French Ministry of Ecological Transition and offered free of charge for project developers. This can be considered as a public quasi-subsidy for removal activities. Nonetheless also in the LBC

[22] https://label-bas-carbone.ecologie.gouv.fr/ (accessed May 31st 2024)

private intermediaries, representatives or compliance entities play a role, which charge for technical (e.g. for data collection or monitoring) and administrative costs (Steffan 2023).

4.3 Existing relevant national funding instruments and their financial capacities

Funding for forestry and land use activities for generating carbon removals in Germany is highly differentiated with various funding programmes at federal and state programmes. In the following we will explore some existing national funding instruments regarding interlinkages with the CRCF implementation. National funding instruments for natural carbon removals in Germany relate to different policy processes. In its National Energy and Climate Plan (NECP) of 2020 (BMWi 2020), Germany refers to different fields to where national funding for measures will be allocated. These mention also potential instruments and include:

- Soil carbon conservation and enhancement in mineral soils on agricultural land. Measures and instruments foreseen are, e.g. support schemes for crop rotation to increase carbon content of agricultural soils, for establishing agroforestry systems, voluntary certification and development of tools for capacity building and consultancy of farmers;
- Conservation of permanent grassland without referring to specific instruments;
- Protection of organic soils including reduction of peat use as substrate referring to changes in existing support schemes and new support schemes for rewetting of organic soils, sharpening of funding allocation under the CAP based on the GAEC standard for improved protection of wetlands and organic soils, and funding for research and development;
- Conservation and sustainable management of forests and use of wood referring to support schemes for establishing mixed forests more resilient to climate change driven impacts through forest restoration and forest conversion, and support schemes and funding for research and development in the field of wood use, especially for using wood of broadleaved trees and cascade use of wood.

In general, at EU level, admissibility of State aid in the agricultural and forestry sectors and in rural areas is regulated by the current Agricultural Framework[23] and Regulation (EU) 2022/2472[24]. These are affecting national funding streams through provisions on accumulation of subsidies, maximum total subsidy levels, and rules for setting criteria for funding. EU Member States need to notify the European Commission about State aid payments. In the period 2014-2020, the Commission authorised over 200 aid schemes for the forestry sector under the framework. However, it was found that State aid measures in the forestry sector do not cause significant distortions of competition in the EU market. Therefore, the European Commission suggested in 2022 to exempt aid measures for the forestry sector from the notification requirement. For the same activity funded through State aid, no other subsidies can be received according to Article 46 of Regulation (EU) 2022/2472 that includes provisions on State aid for forest-environment-climate services and forest conservation. Subsidies for different activities can be accumulated up to an amount of max. 200 EUR/ha/a per forest owner (de-minimis provision).

[23] European Union Guidelines for State aid in the agricultural and forestry sectors and in rural areas , Official Journal of the European Union No. C 485 of 21 December 2022

[24] Regulation (EU) 2022/2472 of 14 December 2022 declaring certain types of aid in the agricultural and forestry sectors and in rural areas compatible with the internal market in application of Articles 107 and 108 of the Treaty on the Functioning of the European Union, Official Journal of the European Union No. L 327 of 21 December 2022

The largest funding streams with relevance for carbon removals in agriculture and forestry are payments for agri-environmental and climate measures under the second pillar of the EU's **Common Agricultural Policy (CAP)**. Farmers complying voluntarily with environmentally friendly production methods that protect the natural habitat for a period of generally five years they receive funding to compensate for the associated additional costs and income reductions. The German Federal States decide on the measures to be offered and specify how they are to be implemented (EAFRD Regulation). Nationally, the joint task of Federal States and the Federal Government on **Improvement of Agricultural Structures and Coastal Protection (GAK)** takes the role as national funding instrument under the CAP for supporting agriculture and forestry, developing rural areas and improving coastal and flood protection. In 2024, around 907 MEUR of federal funding are available for the GAK. Together with co-financing from the federal states a total of around 1.5 BEUR could be mobilised for measures. The GAK aims to ensure the efficiency of agriculture and forestry, to be competitive in the EU internal market, to promote sustainable rural areas and to improve coastal and flood protection. A framework plan for the period of four-years describes measures and their objectives, funding principles, funding recipients, funding requirements and the type and amount of funding[25].

Activities related to carbon removals are included in Funding area 5 Forestry that includes measures such as forest conversion for climate change adaptation, close-to-nature forest management, afforestation, and contractual nature conservation in the forest. The funding amounts up to 80 % of expenditures.

The **Natural Climate Action Programme (ANK)** set up by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) was adopted in 2023 and contains measures to strengthen ecosystems, including carbon removals. It promotes projects such as peatland restoration, forest management and urban nature that contribute to carbon sequestration. The ANK includes 69 measures. A total of around 3.5 billion EUR is available for funding up to 2027.

Under the ANK in collaboration with the Federal Ministry of Food and Agriculture (BMEL) the **Climate-adapted Forest Management (KWM) funding programme** was established. Launched in 2022, the programme supports municipal and private forest owners in converting their forests more resilient forests that are adapted to the impacts of climate change.

The eligibility criteria go beyond existing certifications of FSC and PEFC that are, however, a precondition for participation[26]. Since 2022, more than 8,500 private and municipal forest owners have subscribed to a catalogue of criteria for climate and biodiversity protection measures (BMUV 2023). The area receiving support through the programme extends to 1.52 Mha, which is 21% of private and municipal forests in Germany. Of this, 57% is in corporate forests and 42% in private forests. Funding is provided for 10 or 20 years and requires compliance with the 11 or 12 criteria for climate-adapted forest management. The subsidy amounts to 100 EUR/ha/a. Practically, the implementation works through additional modules provided by the existing certification bodies, mainly PEFC and FSC.

For the KWM programme, the de-minimis provision originally constrained the absolute amount forest owners could receive. In 2023, the programme was exempt from de-minimis based on Article 46. Until end of 2023 the German government allocated 200 million EUR for funding of the KWM programme.

[25] https://www.bmel.de/SharedDocs/Downloads/DE/Broschueren/gak-rahmenplan-2023-2026.pdf?__blob=publicationFile&v=4

[26] In the Federal State of Mecklenburg-Vorpommern the programme accepts also certification through the ANW standard.

Not related to carbon removals but reducing GHG emissions are measures foreseen under the German **National peatland protection strategy** and the **Target agreement on peatland soil protection.** The Federal and state governments have to reduce annual GHG emissions from peatland soils by 5 Mt CO_2eq by 2030. Funding for measures is supposed to be provided by the ANK. Assuming an average cost of rewetting of organic soils of 67 EUR/t CO_2eq (average estimate based on nature protection projects, range between 27 and 107 EUR/t CO_2eq), about 335 MEUR would be required (Reise et al. 2024). However, much higher costs per ha can be expected if areas with higher opportunity costs (e.g. productive cropland or grassland) are involved. Depending on the specific emissions that can be reduced costs per tonne of CO_2eq could be rather between 100 and 400 EUR, increasing total costs for achieving the target to 500 MEUR to 2 billion EUR.

4.4 Conclusions

4.4.1 Conclusions on financial capacities of existing funding instruments and interlinkages with the implementation of the CRCF

The overview above has shown that substantial financial capacities for national funding instruments to support carbon removals through forestry and land use activities exist in Germany. Assessing the potential for achieving natural carbon removals through the existing funding instruments and potential interlinkages with implementing the CRCF is difficult. This is for the following reasons:

- There are close relationships between different programmes that make an attribution of funding to separate instruments difficult. The ANK is closely related to the National peatland protection strategy. Only few concrete measures have been developed under the ANK, like the KWM programme. There is uncertainty about how effective measures will be until they have been formulated more concretely.
- There are large uncertainties regarding the required funding for achieving specific targets set by the government. The example on the costs of peatland protection and GHG emission reduction through rewetting shows that costs can easily range by a factor of four when assuming different cost estimates.
- There is the risk of conflicting funding. Measures funded under the GAK may not necessarily contribute to carbon removals. An example are subsidies for measures to remove deadwood from areas where forests were affected by disturbances. Funding under the ANK might then face increasing costs simply due to opposing subsidies for measures not aligned with the targets of the ANK.
- Due to the different nature of exiting funding instruments and the diversity of targets, current schemes for financing carbon removals can be considered very different standards. Not only the implied price per ton of CO_2eq can be very different. So are also co-benefits and trade-offs potentially associated with different measures. This causes a diversion of the quality of carbon removals.

For the implementation of the CRCF in Germany and the design and planning of activities there is uncertainty about the interplay with existing funding instruments. This applies to different fields of the implementation. The CRCF aims to provide a common minimum quality standard to increase comparability and can thus also support streamlining national funding instruments.

4.4.2 Conclusions on the role of German governments

To address the challenge of fragmentation in the field of existing schemes and the voluntary carbon market regarding the funding of carbon removals, Federal and state governments can support the development of more coherence with measures for centralization and standardisation. Buyers and sellers need to be able to track high-quality versus low-quality credits. Centralisation can also reduce transfer costs. Examples of area centralized trading platforms, such as Australia's carbon exchange and Japan's voluntary market, are also key to creating a more transparent and efficient market. Governments have unique legitimacy and regulatory authority compared to other actors and therefore can more effectively drive this process. This will ultimately also help increasing overall the quality of carbon removals (Dawes et al. 2023).

Federal and state governments need to set strategic priorities for carbon removal activities. The National peatland strategy is an important prioritisation of funds. However, there is currently a lack of speed and stringency of implementation. The CRCF is set up as a very broad scheme that raises expectations that a wide variety of activities might be eligible. However, there is the need for a rather narrowly focused push to support timely activities with large potential. Governments should also provide support for activities that have long lag-times before becoming effective and that are therefore less attractive for the voluntary carbon market.

Regulating how buyers use carbon credits is essential for the overall effectiveness of funding instruments for carbon removals. The German government could regulate and set overarching standards for the use of the results of activities for carbon removals. This includes setting a standard for contribution claims.

There is the need for a clear, long-term vision for the role of carbon removals from the land use sector in Germany. This includes a communication to private actors that currently lack confidence in the direction and development of policies. The demand for carbon credits has increased along with emerging climate neutrality commitments. However, in many cases there are no long-term signals for investors (CSIS 2023).

CSIS (2023) reminds that trade on voluntary carbon markets could be only one of potential end uses for the certified carbon removal certificates. The certification could be used to: (1) access public funding under state aid schemes or the Innovation Fund, (2) access private funding, (3) label sustainable building materials, (4) increase financing opportunities for companies deploying carbon removal technologies, and (5) be used in voluntary carbon markets to finance carbon removal projects.

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