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Build carbon removal reserve to secure future of EU emissions trading

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KIEL POLICY BRIEF

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Build Carbon Removal Reserve to Secure Future of EU Emissions Trading



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OVERVIEW

- A carbon central bank (CCB) that translates carbon removals into allowances would transform the European Union Emissions Trading System (EU ETS) from a fiat allowance to a gold standard system, ensuring unchanged net emissions on the path to net-zero greenhouse gas (GHG) targets.
- Meeting such expectations would require a CCB with a clear commitment to a net-zero GHG target, but also with the capacity to manage the market on the path to that target.
- This requires a strong institutional framework, which could be achieved by integrating the CCB into the European Central Bank (ECB), building on its reputation and capacity.
- Given the long lead time to set up such an institution, the European Commission should already take the first steps to fulfil the other requirement, namely building up a large carbon removal certificate (CRC) reserve, which would provide the CCB with the credibility to stabilize the market in the future.
- To fill the CRC reserve, the EU should emulate the US approach by immediately initiating result-based carbon removal procurement as a first key step of a sequential approach to integrated carbon removal into climate policy.
- This could be achieved by developing a centralized procurement program, supporting existing procurement programs, such as Sweden's or Denmark's, and incentivizing additional EU member states to initiate procurement.
- An important prerequisite for this is the ability to bank CRCs that are not yet eligible for compliance with near-term EU climate targets and use them in later crediting periods.

Keywords: Carbon Dioxide Removal, Carbon Central Bank, Carbon Certificate Banking, Net-Zero Emissions Targets, Net-Negative Emissions Targets

ÜBERSICHT

- Eine CO₂-Zentralbank (Carbon Central Bank, CCB), die atmosphärische CO₂-Entnahme in Zertifikate übersetzt, würde das Emissionshandelssystem der Europäischen Union (EU ETS) langfristig von einem Fiat-Zertifikate-System in ein Goldstandard-System umwandeln und damit unveränderte Nettoemissionen auf dem Weg zu Netto-Null-Treibhausgasemissionen gewährleisten.
- Um diese Erwartungen zu erfüllen, bedarf es einer starken CCB mit einem klaren Bekenntnis zu einem Netto-Null-Treibhausgas-Ziel. Zudem sollte die CCB mit der Fähigkeit ausgestattet werden, den Markt auf dem Weg zu diesem Ziel zu stabilisieren.
- Dies erfordert einen starken institutionellen Rahmen, der durch die Eingliederung der CCB in die Europäische Zentralbank (EZB) erreicht werden könnte, wobei auf deren Ruf und Kapazität aufgebaut werden könnte.
- Angesichts der langen Vorlaufzeit für die Einrichtung einer solchen Institution sollte die Europäische Kommission bereits jetzt erste Schritte unternehmen, um die andere Voraussetzung zu erfüllen, nämlich eine Reserve an CO₂-Entnahme Zertifikaten aufzubauen, die einer CCB in der Zukunft die Glaubwürdigkeit verleihen würde, den Markt zu stabilisieren.
- Um die CRC-Reserve aufzubauen, sollte die EU nach dem Vorbild der USA sofort mit der ergebnisorientierten Beschaffung von CO₂-Entnahme zu beginnen, der dann den ersten Schritt für eine sequenzielle Integration von CO₂-Entnahme in die Klimapolitik bilden würde.
- Dies könnte durch die Entwicklung eines zentralen Beschaffungsprogramms erreicht werden, das bestehende Programme wie in Schweden oder Dänemark unterstützt und neue Programme in weiteren Mitgliedstaaten anreizt.
- Eine wichtige Voraussetzung dafür ist die Möglichkeit, CO₂-Entnahme-Zertifikate, die noch nicht für die Erfüllung der kurzfristigen EU-Klimaziele in Frage kommen, zu "sparen" und in späteren Anrechnungszeiträumen zu nutzen.

Schlüsselwörter: CO₂-Entnahme, CO₂-Zentralbank, CO₂-Zertifikatereserve, Netto-Null Emissionsziele, Netto-Negative Emissionsziele

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Build Carbon Removal Reserve to Secure Future of EU Emissions Trading

Introduction

The European Union Emissions Trading System (EU ETS), the world's most important CO₂ compliance market and the main pillar of EU climate policy (Fridahl et al., 2023), could auction its last allowances by 2040. Increasing pressure to include carbon dioxide removal (CDR) in the EU ETS is coming from two directions: potentially high carbon prices for installations covered by the EU ETS in the 2030s, and the need to establish a climate policy that is aligned with the long-term goal of net-negative CO₂ emissions to achieve net-zero greenhouse gas (GHG) emission (i.e., CO₂ removal that exceeds gross CO₂ emissions to counterbalance also non-CO₂ GHG emissions), and net-negative GHG emissions thereafter.

The EU has recently launched the process to adopt an EU-wide GHG target for 2040 and an associated industrial carbon management strategy. This will be followed by a report by the European Commission in 2026 on how permanently stored CO₂ removal (CDR) could be covered by emissions trading and how carbon removal credits (CRC) trading could be organized. The revision of the EU ETS and the other pillars of EU climate policy for the period 2031–2040 therefore constitutes a key opportunity to pioneer the conditional inclusion of CDR in a compliance market.

Transforming an existing ETS that covers gross emissions into a net-emissions system that covers both emissions and removals and introducing a net-zero cap followed by a net-negative cap, poses the challenges of ensuring that the market remains operational and that the policy objectives underlying the ETS are maintained during the transition period. The EU faces this dual challenge. Delpla and Gollier (2019), Rickels, Proelß, et al. (2021), Rickels, Rothenstein, et al. (2022), and Edenhofer et al. (2024) propose introducing a Carbon Central Bank (CCB) to manage the inclusion of CRC trading and the transformation of the existing EU ETS into a net-zero and then net-negative ETS.

Introducing a CCB in the EU ETS: A sequenced approach

The idea of a CCB or similar entity to manage cap-and-trade systems is not new (McKibbin and Wilcoxon, 2002; Mason, 2009; Whitesell, 2011; Christian de Perthuis, 2012; McKibbin, 2012). While some of these proposals include a mandate to purchase carbon removal, they focus on the role of managing the distribution of an existing pool of allowances. With interventions restricted to an

existing allowance pool, any creation and release of additional, new allowances would increase the emissions beyond the target (i.e., fiat allowances in analogy to fiat money). The explicit inclusion of purchasing CDR into the mandate of the CCB, however, would provide the opportunity to create allowances—the EU ETS currency—with a physical underlying. A CCB facilitating this allowance generation would move the EU ETS from fiat allowance (money) to a gold standard system, ensuring unchanged net emissions under the issuance of such allowances (Rickels, Rothenstein, et al., 2022).

In order to achieve such a system for the EU ETS, the CCB could, upon implementation, start by procuring CRCs to fill an appropriate reserve (Figure 1, Phase I), while maintaining existing features of the EU ETS such as the Market Stability Reserve (MSR). This would be followed by a phase in which the CRCs in the reserve would be auctioned to the market, i.e. depending on the price, initially alongside the existing MSR and later, when the MSR has been exhausted, as the sole reserve to stabilize the market (Phases IIa and IIb respectively). Importantly, the rule-based design for withdrawing, cancelling, and releasing allowances of the MSR could remain in place whereas the additional auctioning of CRCs is to be conditional on the actual market outcome and price evolution of the EU ETS.

The CCB mandate would stepwise be extended to depart from the rigid rule-based to a more flexible approach, similar to the European Central Bank (ECB), whose primary objective of monetary policy is to maintain price stability. The mandate of the CCB could be broadened to sell fewer allowances from the pool in periods when prices tend to be low, in contrast to the current rule-based approach, which prescribes a linearly declining number of allowances to be supplied each year. Such flexibilities are particularly important for the net-negative phase (indicated as Phase III in Figure 1) when, in addition to CRC supply to the market, CRCs also need to be cancelled to achieve the net-negative cap. A number of other design options are possible, in particular the possibility of direct trading between emitters and removers, with the CCB acting as a buyer and seller of CRCs and managing the inclusion of international removal credits.

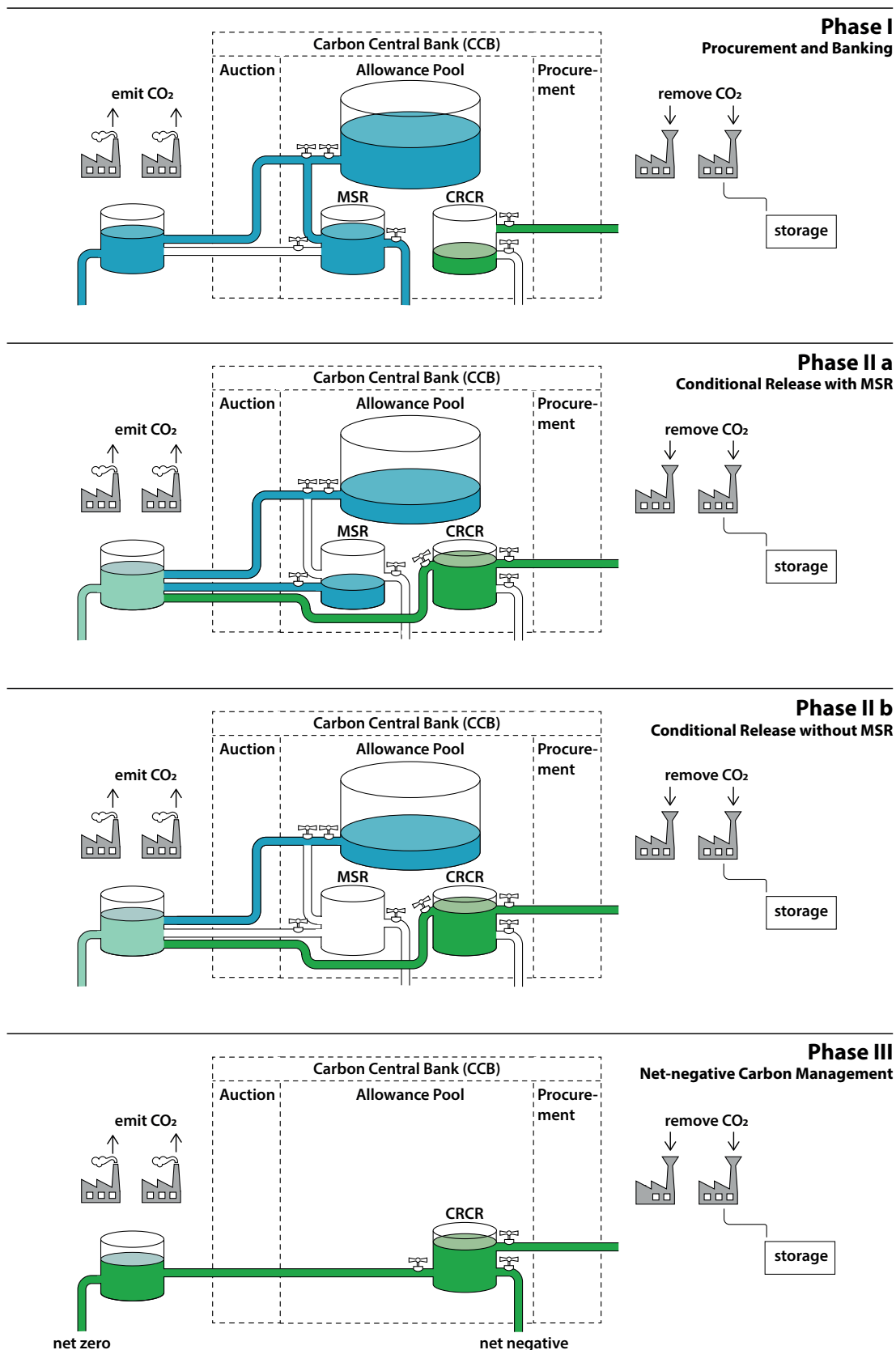


Figure 1: Sequenced Approach of a Carbon Central Bank Managing the Transition to Net-Negative European Emissions Trading System (MSR, Market Stability Reserve and CRCR, Carbon Removal Certificate Reserve).

The broader mandate of the CCB

Atmospheric CO₂ removal can be achieved by various methods with different characteristics with respect to means of verification and the permanence of carbon storage. Obvious candidates for the inclusion in the EU ETS are bioenergy with carbon capture and storage (BECCS) and direct air carbon capture and storage (DACCS), where the former even includes an 'emitting activity' and would fall under the scope of EU ETS Directive if the exception for installations exclusively using biomass would be repealed (Rickels, Proelß, et al., 2021). More importantly, the CCS Directive is not restricted to point-source carbon capture and would in turn already provide safeguards and guidance regarding monitoring and verification for BECCS and DACCS (Rickels, Proelß, et al., 2021). However, the supply of carbon removal through BECCS and DACCS will most likely not be sufficient to meet EU demand, especially if demand is not limited to the estimated "too costly to abate" emissions and net negative carbon targets in the EU ETS, but also takes into account emissions and targets in other pillars of EU climate policy (Fridahl et al., 2023; Rickels, Rischer, et al., 2023; Lamb et al., 2024). Accordingly, demand is likely to expand to carbon removal with lower permanence and verification ratings. Approaches to dealing with these lower-rated carbon removal include i) restricting carbon removal below a certain permanence threshold to be eligible only for the agricultural sector to offset particularly short-lived non-CO₂ GHG emissions, and ii) ensuring that a sufficient CRC buffer is set aside in the conversion of physical carbon removal into CRCs to deal with impermanence issues. Such an impermanence reserve should be supported by active carbon portfolio management by the CCB to minimize the size of the impermanence reserve and provide homogeneous and reliable CRCs.

To date, EU climate policy is organized in three key pillars: 1) the EU ETS for industry, energy production, aviation and maritime transports, 2) the Effort Sharing Regulation (ESR) for road transport, buildings, waste, non-CO₂ emissions from agriculture, and a few other sources, and 3) the Land use, land use change and forestry regulation (Fridahl et al., 2023). As part of the EU Green Deal, the EU has agreed to introduce a second ETS for emissions from the road transport and buildings sectors from 2027 onward, and discussions are underway to establish a third ETS for the land-use sectors aiming at pricing agricultural emissions. Certain flexibilities already exist to link the existing three pillars in the EU climate policy architecture, and since the possibility of shifting emissions reductions shrinks with declining emissions, CDR could become the main hinge between the different pillars if they are not merged anyway (Fridahl et al., 2023). If the plans to establish emission trading systems for all three pillars are realized, a CCB could play a central role in managing the flexibilities between the pillars.

Active procurement of international CRC would also allow the EU to play a more active role

in international climate policy (Delbeke, 2024). Currently, the drafting of Article 6.4 of the Paris Climate Agreement, which is intended to shape international carbon trading, is stalled. This is partly because regions such as the EU want to protect their compliance markets from weak international CRCs arising from for example afforestation and do not want to reduce the incentive for domestic emission reductions. Combined with the introduction of the Carbon Border Adjustment Mechanism, this reluctance gives the impression of a highly protectionist climate policy and, apart from the loss of efficiency, does not lead to progress in international cooperative climate policy. However, given the pressure that due to limited removal potentials in Europe the EU cannot close itself off from the international supply of such CRCs in the long run, it is a good idea to use the stock characteristics of the problem. Hence, procuring such CRCs, but banking them for later periods, potentially under active carbon portfolio management, allows to manage the speed of the domestic emissions reductions and provides the option to even cancel these banked CRCs later to realize net-negative removal contributions. As long as a CRC remains in the reserve, it is potentially a net-zero contribution, since releasing it to the market implies that it is surrendered in exchange for emissions, physically canceling out the underlying removal. Canceling the banked CRC in turn implies that the removal does not translate into an equivalent emission. Holding CRCs in reserve allows for a decision to be made at a later date, potentially in response to the evolution of international climate policy, as to which fraction will be canceled at what time (Rickels, Rothenstein, et al., 2022).

These considerations show that it still needs to be discussed which management, accounting and clearing house services would be covered by the mandate of the CCB and which services would be provided by other institutions or private companies. However, it seems unlikely that all contingencies can be anticipated and addressed by an appropriate rule-based design, favoring a system with greater flexibility like that which would be provided by the CCB. Furthermore, an independent institution may be needed to avoid political pressure to use the CRCs in the reserve to meet short-term emission reduction targets.

Meeting such expectations would require a strong CCB with a clear commitment to a net-zero GHG target, but also with the capacity to manage the market. First, this requires a strong institutional framework, which could obviously be achieved by integrating the CCB into the ECB, building on its reputation and capacity. Second, it requires a large CRC reserve, which would provide the CCB with the credibility to stabilize the market, implying that ultimately fewer CRCs might enter the market compared to a rule-based design with predefined proportions. In order to have a meaningful impact on market outcomes, CRCs will need to be stockpiled in sufficient quantities (the MSR's lower quantity trigger of 400 MtCO₂ could serve as a ballpark figure for the CRC reserve).

Such a procurement program to fill the CRC reserve would realize learning-by-doing and economies

of scale effects to potentially reduce procurement costs in the future when CRC supply needs to exceed CRC market demand to achieve a net-negative ETS (Rickels, Rothenstein, et al., 2022). Early procurement as a key step in a sequencing strategy is therefore recommended, even if some implementation details are still open (Burke and Schenuit, 2023).

Building a CRC Reserve

The transformation of the EU ETS to a net-negative ETS should start immediately, with procurement of technology-specific CDR tenders to fill a CRC Reserve (Figure 1, Phase I). The details pertaining to integrating CRCs in the allowance market can be sorted out in parallel to banking CRCs in the reserve.

First, the EU should develop a centralized procurement program. While the EU already finances several CDR projects through its Innovation Fund, a result-based CDR procurement scheme should be added to the EU climate policy architecture. The US Department of Energy's Office of Fossil Energy and Carbon Management procurement program could act as blueprints for the urgent task of establishing and filling a CRC reserve in the EU. The US procurement programs, investing for example US\$ 35 million in the DAC Commercial CDR purchase pilot prize program, are small compared to the funding provided for CDR development by the Inflation Reduction Act and the Bipartisan Infrastructure Law. The Bipartisan Infrastructure Law alone provides US\$ 3.5 billion to carbon removal hubs, i.e., testbeds for different CDR technologies (Institute, 2023). Despite their relatively small size, the two result-based procurement prize schemes are an important step in developing CDR technologies.

Second, the EU should support existing procurement programs of member states. The most prominent example is prepared by the Swedish government's plan to realize Sweden's technical potential for BECCS through targeted procurement. The plan is to disburse EUR 3.6 billion in state aid for BECCS, which will be allocated to contractors through reverse auctions. The first auction was originally planned for the end of 2022, but has been delayed and is currently awaiting approval from the European Commission that it complies with EU state aid rules. However, the Swedish government will most likely not be able to use the carbon removal resulting from the auctions to meet its 2030 obligation under the Effort Sharing Regulation. Yet, the EU could offer that these removals are transferred to a central account and banked for later periods. Similar considerations apply to the Danish CDR procurement program which aims to achieve annual removal of 0.5 Mt CO₂ from 2025 onward via biogenic sources and subsequent geological storage. Such reverse auction or other procurement systems in EU Member States could be scaled up and used as channels to start

filling the CCB's CRC reserve. The EU could, for example, increase the procurement volume with revenues from the allowance auctions under the Innovation Fund or the carbon border adjustment mechanism.

Third, the EU should encourage more member states to initiate procurement programs. Member States could contribute directly to filling the CRC reserve, effectuated through Member State obligations. It would entail that CDR resulting from public expenditure would not be entered into Member States' GHG inventories but instead be banked in the CRC reserve. A future net-negative ETS likely requires EU or Member State financing if it is not possible to realize a sufficient spread between CRC procurement prices and CRC auction prices to cancel CRC corresponding to the net-negative target. This is especially true if Phase III (Figure 1) also allows for direct CRC trading between emitters and removers, with the CCB as a major buyer and supplier. Future shortfalls (or, more generally, financial needs) will likely be required to be covered by Member States in proportion to past verified emissions, similar to the current distribution of auction revenues among the Member States. To incentivize Member States to make early contributions to the CRC reserve instead of using CRCs to meet near-term climate targets, some form of interest payment on these CRCs could be provided, either reducing the required future contribution or increasing the proportional share of revenues from CRC auctions.

Such institutionally organized procurement schemes that adapt CDR-specific financing to permanent CDR methods, similar to the US procurement programs, could be seen as a precursor to the CCB, with an expansion of the procurement mandate once the CRC reserve begins to fill. An important step is to acknowledge the stock characteristics of the underlying problem and to develop a framework which allows banking of early carbon removals (and potentially corresponding CRCs) for later commitment periods.

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References

- Burke, Josh and Felix Schenuit (2023). *Governing permanence of Carbon Dioxide Removal: a typology of policy measures*. Policy Report. CO2RE – The Greenhouse Gas Removal Hub.
- Christian de Perthuis (2012). “Pourquoi l’Europe a besoin d’une banque centrale du carbone”. In: *Revue de l’OFCE* 120.1, pp. 155–175.
- Delbeke, Jos (2024). *How the EU can support carbon pricing at global level*. Policy Paper. European University Institute. URL: <https://hdl.handle.net/1814/76815>.
- Delpla, Jacques and Christian Gollier (2019). *Pour une Banque Centrale du Carbone*. Analyses pour la politique économique. ASTERION.
- Edenhofer, Ottmar et al. (2024). “On the Governance of Carbon Dioxide Removal – A Public Economics Perspective”. In: *FinanzArchiv* 80.1, pp. 70–110. DOI: 10.1628/fa-2023-0012.
- Fridahl, Mathias et al. (2023). “Novel carbon dioxide removals techniques must be integrated into the European Union’s climate policies”. In: *Communications Earth & Environment* 4.1, p. 459.
- Institute, World Resource (2023). *Carbon Removal in the Bipartisan Infrastructure Law and Inflation Reduction Act*. Tech. rep. URL: <https://www.wri.org/update/carbon-removal-BIL-IRA>.
- Lamb, William F. et al. (2024). “The carbon dioxide removal gap”. In: *Nature Climate Change*. DOI: 10.1038/s41558-024-01984-6.
- Mason, Joseph R (2009). *The economic policy risks of cap and trade markets for carbon emissions: A monetary economist’s view of cap and trade market and carbon market efficiency board designs*. Tech. rep. The U.S. Climate Task Force. URL: <https://www.energy.senate.gov/services/files/bf03807a-ad55-cf29-d45f-4568be4a735b>.
- McKibbin, Warwick J (2012). “A new climate strategy beyond 2012: Lessons from monetary history”. In: *The Singapore Economic Review* 57.03, p. 1250016.
- McKibbin, Warwick J and Peter J Wilcoxon (2002). *Climate change policy after Kyoto: Blueprint for a realistic approach*. Rowman & Littlefield.
- Rickels, Wilfried, Alexander Proelß, et al. (2021). “Integrating Carbon Dioxide Removal Into European Emissions Trading”. In: *Frontiers in Climate* 3. DOI: 10.3389/fclim.2021.690023. URL: <https://www.frontiersin.org/articles/10.3389/fclim.2021.690023>.

- Rickels, Wilfried, Christian Rischer, et al. (2023). "Mögliche Effizienzgewinne durch die Einführung eines länderübergreifenden Emissionshandels für den Gebäude-und Straßenverkehrssektor in der Europäischen Union". In: *Perspektiven der Wirtschaftspolitik* 0.
- Rickels, Wilfried, Roland Rothenstein, et al. (2022). "Procure, Bank, Release: Carbon Removal Certificate Reserves to Manage Carbon Prices on the Path to Net-Zero". In: *Energy Research & Social Science* 94, p. 102858.
- Whitesell, William C (2011). *Climate policy foundations: Science and economics with lessons from monetary regulation*. Cambridge University Press.

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