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Carbon Dioxide Removal: Climbing up the EU Climate Policy Agenda[1]

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1. Introduction

Since the adoption of the Paris Agreement and the publication of the IPCC's Special Report on 1.5°C Global Warming (IPCC 2018), net zero emission targets have diffused rapidly across almost all political levels. While their scope varies and is often ambiguous (Rogelj et al. 2021), the concept of counterbalancing residual emissions with carbon dioxide removal (CDR) is emerging as a new organizing principle of climate policymaking. In the EU, net zero greenhouse gas (GHG) emissions developed from a long-term aspirational pledge in the context of the European Green Deal into a component of EU climate legislation in the so-called EU Climate Law (Regulation (EU) 2021/1119).

Modelling facilitated by the European Commission for its draft EU long-term climate strategy (Commission 2018b) as well as national modelling efforts (e.g. for the UK, CCC 2019 or Germany, Prognos et al. 2021) indicate that achieving net zero GHG emissions by 2050 or earlier requires significant amounts of CDR. The rapidly growing scientific literature on CDR identifies numerous methods to remove CO_2 from the atmosphere (for an overview, see Babiker et al. 2022), ranging from already established afforestation to more speculative direct air capture combined with carbon capture and storage (DACCS) (for details, see section 2). The need to deploy a portfolio of these methods to counter-balance hard-to-abate emissions e.g. from agriculture, industry, or long-haul transport, raises important questions about the operationalization of the net zero target within EU legislation. Although there are numerous political challenges in the process of accelerating a transition towards net zero GHG emissions, CDR stands out due to its potential to challenge the prevailing public policy paradigm in EU climate policy (Geden et al. 2018). Therefore, it is key to explore how removals are and will be integrated in the climate policy mix, how related politics play out, and how other aspects of climate policy will be affected.

There are three key reasons why a better understanding of how the EU is addressing CDR politically is required. First, the EU and its representatives perceive themselves and are being perceived as frontrunners in international climate policy. The way the EU is starting to regulate CDR can therefore be anticipated to have an impact on the international debate and governance under the UNFCCC, other fora for international cooperation, and climate-related regulation in other countries. Secondly, OECD countries with their large shares of historic emissions are (in the academic literature, at least) generally expected to implement large amounts of CDR (Lee et al. 2021; Pozo et al. 2020). Thirdly, the issue will get more attention when the time period beyond 2050 comes to be addressed in climate policy. As already stipulated in the EU Climate Law, after achieving net zero in 2050 the EU will need to achieve net-negative GHG emissions.

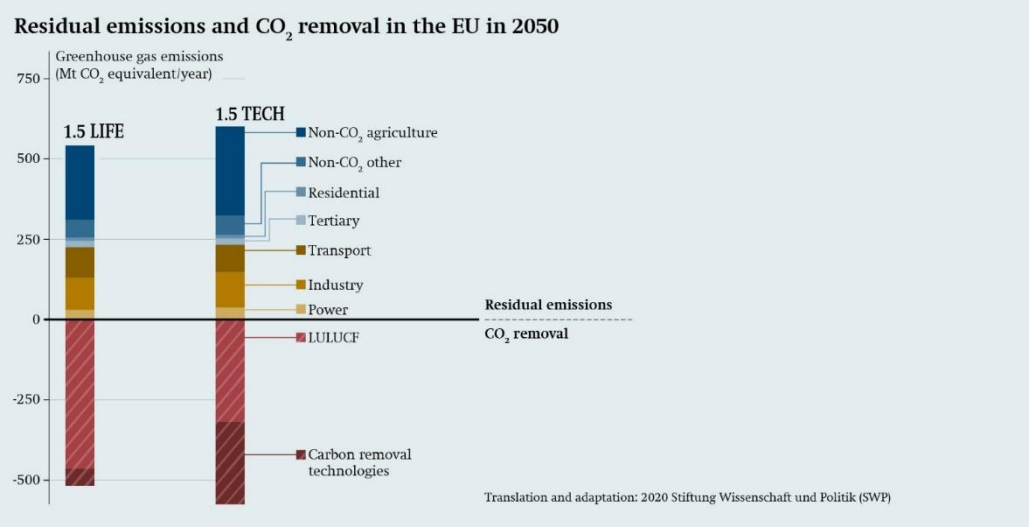
CDR policymaking is a rapidly emerging component of climate policy (Schenuit et al. 2021). In order to trace its struggle onto and up the EU climate policy agenda, we start by providing a brief overview of CDR-related aspects of the EU's 2030 Climate and Energy Framework as adopted in 2018 and show that CO_2 removal is not entirely new to EU climate policymaking. We then turn to more recent developments, in particular the EU Climate Law and the new 'Fit for 55' package under the Green Deal to explore relevant actors in EU climate policymaking and their (evolving) political positioning towards CDR. On this basis, we conclude with an outlook on plausible future developments in CDR policy.

2. Status quo: CDR in currently enacted EU climate policy

According to the IPCC Special Report on 1.5 °C, CDR describes a set of "anthropogenic activities removing CO_2 from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products. […]" (IPCC 2018). In order to limit global warming to 1.5 °C by the end of the century, such activities will be necessary to counterbalance hard-to-mitigate, so-called residual emissions (mainly in industry, transport, and agriculture, see figure 1), and potentially bring global temperature down to 1.5°C after a temporary overshoot (IPCC 2018; Commission 2018).

Several recent assessments of specific CDR methods and their removal potentials helped to structure the debate (Smith et al. 2016; Fuss et al. 2018; IPCC 2021). Since then, studies and research projects on CDR governance and policy have emerged (e.g., Fridahl et al. 2020; Schenuit et al. 2021). Research on the economic and political feasibility aspects indicates that CDR deployment will require (Fuss et al. 2020), and has the potential to facilitate, new alliances. At the same time, it can also lead to new, or exacerbate existing, conflicts (McLaren et al. 2019; Geden and Schenuit 2020; Carton et al. 2020).

Figure 1: Residual emissions and CO_2 removal in the EU-27 + UK in 2050



Source: Geden and Schenuit 2020, based on EC (2018)[2]

In public policy debates, a distinction is often drawn between "natural" and "technological" CDR methods. These framings carry substantial political implications (Osaka et al. 2021) and the terminology used to distinguish the methods in academic publications is still in flux. In an attempt to avoid value-laden terminology, we distinguish between *ecosystem-based* and *geochemical-based* approaches. While ecosystem-based methods aim to strengthen biological sinks such as forests and soils through reforestation and soil carbon sequestration, respectively, geochemical-based methods include different ways to absorb CO_2 and store it permanently (e.g. DACCS or Enhanced Mineral Weathering).

[2] 1.5TECH and 1.5LIFE are two decarbonization scenarios consistent with net-zero GHG emissions in 2050. While 1.5TECH makes more use of technological options, both for emission reductions and removals, 1.5LIFE has stronger assumptions regarding demand-side measures and enhanced land-based sinks. For details see Commission 2018, p. 325-326.

In addition to the general acknowledgement of the necessity of CDR, IPCC's SR 1.5, the Special Report on Land (IPCC 2019), and AR6 Working Group I (IPCC 2021) identified wider implications of CDR measures for sustainability. For ecosystem-based methods, for instance, substantial impacts on environmental services and ecosystems as well as agricultural and food systems are likely (IPCC 2018), depending on, among other things, deployment rates. The actual impact on ecosystem services and the sustainable development goals is part of the scientific debate on land-based CDR measures (IPCC 2019; IPCC 2021). A geochemical-based method like DACCS does not have a high land impact, but for now, high costs and high amounts of energy use are clearly limiting factors (Fuss et al. 2018; Shayegh et al. 2021).

Climate and Energy Framework 2030

Although the scientific debate on integrating CDR into climate change mitigation policy is much older (Obersteiner et al. 2001), it was the IPCC's Fifth Assessment Report and the Paris Agreement that elevated a rather technical debate into the commentary sections of *Nature* and *Science* (Fuss et al. 2014; Geden 2015; Anderson and Peters 2016). Decisive starting points for the discussion were, on the one hand, the large amounts of CDR assumed in the IPCC 5th Assessment Report's emission pathways that required net-negative emissions compatible with the 2°C temperature target. When, to the surprise of many observers, an even more ambitious 1.5 °C target level was agreed in Paris it was feared that required amounts of CDR built into integrated assessment models would be even less feasible and less sustainable.

In the years following COP21, EU policymakers were quite reluctant to deal with the issue of CDR politically and awaited more expertise, both from the IPCC and from modelling efforts informing the Commission's proposal for a long-term EU mitigation strategy. Accordingly, the 2030 Climate and Energy Framework adopted in 2018 does not include any explicit CDR policy. In the Energy Union Governance Regulation (Regulation 2018/1999) however, CDR (alias "negative emissions") is mentioned, e.g. in its recitals and Art. 15, which calls for a long-term strategy with a perspective of at least 30 years. In particular, the European Council and the European Parliament as co-legislators asked the Commission to provide various scenarios in its Long-Term Strategy (LTS), including one "on achieving net zero GHG emissions within the Union by 2050 and negative emissions thereafter" (Art. 15, 2a). Since the Commission's Communication on its proposal for the LTS as well as the accompanying in-depth analysis have been influential preparatory work for the European Green Deal initiative kicked off in 2019, we will come back to this in the next section. Before we explore the role of CDR in the context of the Green Deal, we briefly summarize the aspects of the 2018 legislation that are of relevance for CDR.

Identifying aspects of implicit CDR policy within the body of already enacted climate policy is important, firstly to show that the concept of CO_2 removal is not entirely new to EU climate policy, and secondly to explore legislative and political entry points to anticipate the prospects of CDR politics and policymaking. The analysis provides insights into the context and path dependencies of current climate policy that are relevant to examining emerging policy related to CDR integration. We will focus on two of the three main pillars of EU climate legislation: The Land-Use Change and Forestry (LULUCF) Regulation and the EU Emissions Trading System (ETS). The third pillar, comprising national emissions reduction targets under the ESR regulation, does not yet entail specific EU-wide aspects relevant for CDR, except for flexibilities to the LULUCF regulation (see below and Romppanen, forthcoming).

LULUCF Regulation

In 2018, EU institutions agreed on the LULUCF regulation for 2021-2030 (2018/841) after intense and complex negotiations. From 2021 onwards, the newly established third pillar of EU's 2030 climate and energy framework regulates emissions and removals in this sector. Negotiations on the inclusion of the sector in EU climate targets officially started with a European Council decision in 2014 (European Council 2014). A preparatory EU decision (No 529/2013/EU) in 2013 included a general agreement on accounting rules, but did not regulate consideration of the sector in the achievement of EU-wide climate policy targets.

The LULUCF sector is known as a very contested issue in both international climate negotiations (Krug 2018) and EU policymaking (Savaresi et al. 2020). The main concerns have been uncertainty in reporting, opposition to offsetting and permanence of ecosystem-based carbon sequestration (Nabuurs et al. 2018). In addition, strong Member State-level interests, and low EU regulatory powers in the field of forest policy (Meyer-Ohlendorf and Frelih-Larsen 2017) prevented an earlier inclusion of the LULUCF sector in EU climate policymaking.

The central building block of the 2018 LULUCF legislation is the 'no-debit rule', a binding commitment "that accounted emissions from land use are entirely compensated by an equivalent removal of CO_2 from the atmosphere through action in the sector."[3] This means that sinks within the LULUCF sector (especially forests) balance emissions from other forms of land use (e.g. from managed cropland or deforestation). To secure verifiable compliance with the 'no-debit rule', the Regulation obliges all Member States to apply detailed accounting rules that result in LULUCF credits and debits.[4]

During the legislative process, the integration of the LULUCF sector into the overall target structure was contested. In particular, the linking of different climate policy pillars through new flexibilities proved to be controversial. Countries with large forestry and/or agricultural sectors were very active in trying to establish and shape flexibilities in their interest. NGOs criticized these countries for trying to water down climate ambition. However, these countries had the 2014 European Council decision on the 2030 Climate and Energy Framework as an argumentative reference point for the inclusion of new flexibilities. Here, the Heads of States and Government had already agreed on a formulation proposing the compensation of emissions in the agricultural sector through afforestation (European Council 2014). Also, a Commission impact assessment on a future LULUCF Regulation made clear that there is a "need for flexibility towards agriculture" in the Effort Sharing Regulation (ESR) (Commission 2016, p.28).

[3] See Commission homepage: https://ec.europa.eu/clima/policies/forests/lulucf_en.

[4] In order to take account of natural and country-specific characteristics of the sink effects of managed forest areas (e.g. age structure), the regulation establishes a process in which Member States propose individual reference values, which must be confirmed by the Commission and will then be the starting point for calculations of sink effects and emissions. The reference levels aim to ensure that only human-induced changes (e.g. more sustainable harvesting) are generating LULUCF credits and that the mere presence of a large LULUCF sinks in Member States does not automatically lead to a high number of LULUCF credits. These reference values will be set gradually for two phases (2021-2025 and 2026-2030). With regard to CDR it is important to note that afforested or deforested land is accounted for differently. For a comprehensive overview of the accounting rules, see Böttcher et al. (2019, 2021).

The final LULUCF Regulation includes several flexibilities (Savaresi et al. 2020; Romppanen, 2019). Most relevant for CDR is the inter-pillar flexibility between LULUCF and ESR. If Member States do not comply with the 'no-debit rule' and no other flexibility option is available, annual emissions allowances from the ESR need to be transferred to balance emissions in the LULUCF sector. At the same time, a limited amount of 280 Mt (i.e. 1% of annual ESD emissions from 2005) LULUCF credits can be transferred to achieve the national reduction targets under the ESR. In principle, this flexibility provides the option that fossil fuel and agriculture emissions could be counterbalanced by forestry credits.

Through the established flexibilities, the LULUCF regulation thus already provides an opportunity to account for CDR. It is important to highlight that this integration was not framed as an initiative to anchor CDR as a mitigation measure in EU climate governance by EU policy-makers (see Böttcher et al. 2019, p. 30). The flexibilities follow the "purpose […] to help Member States meet their no-debit commitment rather than to compromise the EU's GHG emission reduction targets." (Romppanen 2019, p. 4). Although the amount of this flexibility is strictly limited, the agreed accounting procedures are expected to establish new incentive structures for Member States by introducing counterbalancing emissions through CDR conceptually – especially if revised Regulations under the European Green Deal follow-up on this idea and expand the scope of the inter-pillar flexibility (see section 3).

EU ETS

In principle, an emission trading scheme (ETS) would provide an opportunity to govern and incentivize the implementation of CDR. New Zealand's ETS, where forestry CO_2 emissions and removals are accounted as fully equivalent to emissions or avoided emissions from other sectors (Schenuit et al. 2021), provides an example of how absorbing CO_2 could lead to generating allowances. To date, this is not possible within the current design of the EU ETS and would even contradict the overall design of the EU ETS Directive as outlined in its Article 2(1) (Rickels et al. 2021). The most relevant CDR-related aspect of the 2018 EU ETS Directive is the fact that research and demonstration projects on CDR in combination with CCS can be funded through the EU ETS Innovation Fund (about €25 billion, depending on the price for EU ETS allowances).

The status quo of the EU ETS therefore does not provide a clear way forward for the integration of CDR. However, as increasing attention by experts and scholars shows, the political commitment to net zero GHG emissions and ongoing processes of operationalizing it into EU's climate policy will move the integration into the ETS up on the political agenda. In the Commission's technology-oriented scenario, outlined in its draft LTS, the EU ETS achieves a net-negative cap of emissions by 2045. The scenario further assumes that in 2050 emissions in the entire ETS will be at minus 50 Mt, achieved with CDR (Rickels et al 2021). The EU ETS would need to be substantially redesigned to allow and achieve such net-negative numbers.

3. Carbon dioxide removal and the European Green Deal

The European Green Deal started as political strategy of the incoming Commission led by Ursula von der Leyen in 2019. The new Commission declared the political objective of Europe becoming the first "climate-neutral continent" by 2050. It announced its intention to table a proposal for a climate law during its first hundred days in office, as well as to revise existing climate regulations accordingly (Commission 2019). To assess the role for CDR in the Green Deal, we first focus on the EU Climate Law and turn to the political positioning of key actors in a second step. The latter not only allows us to continue tracing how the topic struggled onto the agenda of different EU institutions, but also enables us to anticipate plausible future developments.

CDR in the EU Climate Law

For CDR policymaking, the specific designs of the 2030 and 2050 targets are the most relevant aspect of the EU Climate Law. The 2030 target is – as originally proposed by the EC and Council, but initially opposed by the European Parliament (EP) – a net target that accounts emissions and removals towards the overall reduction. After strong criticism by NGOs and some MEPs, however, EU legislative actors agreed to cap the contribution of LULUCF removals to the net target to 225Mt CO_2 equivalent (Art 4.1).

The 2050 net zero GHG emission target was already agreed by Heads of State and Governments in the European Council in December 2019 (European Council 2019).[5] The fact that it is established as an EU-wide target (Art. 2) is expected to raise distributional questions across Member States and is relevant for CDR policymaking. For example, countries with large shares of hard-to-abate emissions might demand to be allowed to achieve net zero emissions later than 2050, implying that other countries would need to compensate their delay by achieving net-negative emissions earlier than 2050 (Geden and Schenuit 2020). An important element of the long-term goal in the Regulation is the wording "[…] the Union shall aim to achieve negative emissions thereafter" (Art. 2.1). In fact, the call for Union-wide net-negative emissions after 2050 opens the door to new debates about CDR and overshoot of temperature targets that have been prevalent in academic discussions and IPCC assessments (IPCC 2018, 2021), but rarely addressed in climate policy.

Legislative actors and their positions towards CDR

European Commission

As noted in section 2, the Commission started to address CDR proactively with the publication of its long-term strategy (LTS) proposal in 2018 (Commission 2018a). Here, CDR is identified as one of the key building blocks of the modelled scenarios. Since then, the Commission proposed several initiatives to address CDR at the political level.

The Commission included straightforward language on CO_2 removal in the draft for the above-mentioned Climate Law (Commission 2020c). In particular, the draft stated that the net zero GHG emissions goal will require "natural and technological" CDR (Recital 12). A

[5] Even though Poland insisted on adding the following footnote to the conclusions: "One Member State, at this stage, cannot commit to implement this objective as far as it is concerned" (European Council 2019).

slightly different formulation was adopted in the final EU Climate Law (Regulation (EU) 2021/1119, recital 20)[6], allowing policymakers and stakeholders to push for integration of a wide range of CDR methods into EU climate policymaking in future legislative processes. Subsequently, the Commission's impact assessment of the 2030 Climate Target Plan and proposed reforms in the 'Fit-for-55' package are additional indicators pointing to the Commission's proactive role in establishing CDR policies. The proposed revised LULUCF regulation aims to establish a "2030 Union target for net GHG removals" of 310 Mt for the LULUCF sector, with differentiated removal efforts across Member States (Commission 2021a), that could contribute to the 2030 reduction target. This contribution, however, would be limited to the 225Mt cap as defined in the Climate Law (see section 3.1). This proposal indicates that the Commission is proactively pursuing and testing ideas and concepts to integrate the deliberate enhancement of the LULUCF sink into EU climate policy.

Simultaneously, the Commission has started to support geochemical-based CDR methods and related infrastructures. With the CCS-project Northern Lights in Norway, for example, the Commission is engaged in supporting and co-funding a CCS project (Commission 2022a) that declares envisaged CO_2 storage infrastructure will be linked to carbon removal programs (Northern Lights 2022). The Porthos (Port of Rotterdam CO_2 Transport Hub and Offshore Storage) project in the Netherlands is a second example for a geological storage project supported with EU funds (Commission 2021c). Furthermore, the already mentioned EU ETS Innovation Fund is open for CCS and carbon removal projects and some CDR-related projects like CarbFix in Iceland (Commission 2021d) or a BECCS project coordinated by Stockholm Exergi in Sweden receive funding from the Innovation Fund (Commission 2022b).

In December 2021, the Commission published a new Communication titled "Sustainable Carbon Cycles" (Commission 2021b) aiming to pre-structure the public debate and legislative procedures. The strategy document identifies three main challenges and related key actions required to implement CDR in the EU. First, a comprehensive strategy to scale up so-called "carbon farming". Here, the main idea is to create new revenue streams for land managers in agriculture and forestry to incentivise the increase of carbon captured and stored in plants and soils to 42Mt in 2030. The Common Agriculture Policy and the Cohesion Funds, the two biggest parts of the EU budget, are identified as potential sources for these monetary incentives. Secondly, the Communication highlights the importance of industrial capture, use, and storage of carbon and proposes to set a quantified target for carbon removal of 5Mt in 2030 through methods such as DACCS and bioenergy plus CCS (BECCS). Providing increased research funding through the Horizon Europe research and innovation programme as well as supporting frontrunner projects via the ETS Innovation Fund are among the key actions identified to support niche technologies. Lastly, the Commission used the document as an opportunity to specify its initiative for a regulatory framework for the certification scheme for removals. The initiative was first announced in the Circular Economy Action Plan (Commission 2020a) and was taken up the "Farm to Fork" strategy, which already proposed payments for farmers and foresters under the Common Agriculture Policy (CAP) who sequester carbon (Commission 2020b, see also Matthews, this volume). This third element of the new initiative demonstrates the Commission's ambition, not only to promote innovation in the field of CDR deployment, but also to position itself as a pioneer in its regulation. However, following the EU's ordinary legislative procedure, it will be the European Parliament (see section 3.2.2) and Member States (see section 3.2.3) that will eventually decide on the actual design and implementation of CDR-related reforms of the existing climate policy mix.

[6] „[…] Sinks include natural and technological solutions, as reported in the Union's greenhouse gas inventories to the UNFCCC. Solutions that are based on carbon capture and storage (CCS) and carbon capture and use (CCU) technologies can play a role in decarbonisation, especially for the mitigation of process emissions in industry, for the Member States that choose this technology." (Regulation (EU) 2021/1119, recital 20).

European Parliament

The European Parliament (EP) is known for striving for more ambitious climate policies (Buzogány and Ćetković 2021). This was confirmed during the Climate Law negotiations, where the EP Plenary not only opted for a more ambitious target of 60% by 2030, but also rejected the option to establish a net-logic, i.e. unlimited fungibility of emission reductions and removals (EP, 2020). During this process, the EP did not call for an integrating CDR proactively into climate policymaking. However, the EP welcomed the Commission's initiatives on establishing a carbon credit framework for ecosystem-based CDR during the legislative process on the Climate Law (EP 2020 recital 12d). The EPs central role in driving ambition and credibility in climate policymaking has led many MEPs, especially in the Committee on the Environment, Public Health and Food Safety (ENVI), to perceive the issue of CDR with suspicion. The fear that that CDR could weaken the level of climate ambition and reduce pressure for climate action is reflected in EP's position during the EU Climate Law legislative process (EP 2020) and the final agreement to limit the amount of LULUCF removals allowed to contribute to the 2030 target (Regulation (EU) 2021/1119).

In the aftermath of adopting the Climate Law, however, MEPs started to deal more openly with CDR-related issues. Political positions in the legislative processes under the 'Fit-for-55' package, for example, suggest that most MEPs in the Committee on the Environment, Public Health and Food Safety (ENVI) acknowledge the need for CDR and some called for its proactive integration into revised EU ETS, ESR and LULUCF regulations. As the legislative procedures have not yet been completed at the time of writing, a detailed analysis of the EP's decisions is beyond the scope of this chapter. Draft reports and amendments tabled by MEPs indicate, however, that in addition to positions of different parties and EP committees, national interests and regional alliances will shape MEPs positions on CDR in future legislation (for an overview of tabled positions, see procedure files ESR (2021/0200(COD), LULUCF (2021/0201(COD), and EU ETS (2021/0211(COD).

Member States

Previous developments in EU climate policymaking have been substantially shaped by Member States (Wurzel et al., forthcoming). In the past few years, Heads of State and Government have set specific guardrails for the 2030 Climate and Energy Framework adopted in 2018 and claimed authority for setting the overall ambition of the new 2030 target. Well before the end of the inter-institutional trilogue negotiations on the target ambition in the Climate Law, the Council submitted a net 55% 2030 target to the UNFCCC as an updated EU NDC in December 2020 (European Council and European Commission 2020).

With regards to CDR policymaking, Member States differ substantially in the way they address CDR politically: While some, like Germany for example, prefer a rather incremental modification, others, such as Sweden, addresses the issue proactively and take a pioneering role in regulating and deploying CDR with incentive schemes for BECCS (Schenuit et al. 2021). These differing socio-political preferences towards CDR methods can be observed in the National Energy and Climate Plans (NECPs), which all Member States had to submit as part of the Governance of the Energy Union Regulation (Regulation (EU) 2018/1999, Art. 3 & 4). At the same time, the NECPs and more recent statements reveal that political positioning across Member States is at an early stage and preferences are so far indeterminate. The heterogeneity and provisional nature of current positions towards CDR indicate the room for new alliances as the importance of removals in EU climate policy increases. However,

across some front-running countries, first groupings are emerging. For instance, the Netherlands, Norway, Denmark, and Sweden have already published a joint non-paper on CCS calling for "more integration of CO_2 removal by negative emission technologies into EU climate policy and analysis of policy options to promote their development and deployment." (Klima- Energi- og Forsyningsudvalget Danmark 2020).

Another relevant dimension is the timing of national net zero targets and net-negative commitments. While Sweden, for example, has set its target for 2045, Finland aims for net zero GHG by 2035, followed by net-negative emissions thereafter. A differentiated timing of national net zero pledges across Member States is expected to become a relevant factor in climate policymaking at the EU level. The EU-wide net zero target by 2050 in the EU Climate Law will almost certainly lead to differentiated net zero years across Member States since countries with larger shares of emissions in the power, agriculture or industry sectors will demand a longer transition period to achieve GHG neutrality. If CDR is integrated in the EU policy architecture, this could eventually lead to a situation where countries not only vary in ambition for emissions reductions, but also in efforts of removing carbon from the atmosphere. Political compromises in EU climate policy have often been shaped by such kind of differentiation (Dupont and Oberthür 2015). CDR will add a new layer of potential flexibilities that would ease the pressure for emissions-per-capita convergence by 2050.

4. Discussion: Prospects for CDR in EU's multi-level system

After the Climate and Energy Framework 2030 legislation aimed at coordinating policy packages bridging climate and energy policymaking (Skjærseth 2021), the European Green Deal is now expected to expand interlinkages and coordination between climate policy and other policy fields. Tracing the initial efforts to integrate CDR – mostly led by the Commission, but also small groups of Member States – indicates that it might evolve into a relevant tool for establishing new coordination across policy domains, especially regarding the Common Agriculture Policy and forestry. Future prospects of CDR integration will be mainly shaped by two familiar and two new dynamics in EU climate policymaking.

Familiar conditions

The Commission clearly stands out as the institution that most proactively pursues the integration of CDR into EU climate policy architecture. The Communication on the role for CDR (Commission 2021b) to achieve net zero and net negative GHG emissions indicates that it is planning to remain the driving force for the coming years. It is not the first time that the Commission has initiated and led policy debates and legislative processes towards addressing unconventional aspects of climate policy. The most prominent example is the EU ETS, which was a rather unknown and contested instrument in the early 2000s. It entered EU climate policymaking through "entrepreneurial and intellectual leadership" by the Commission (Skjærseth 2017). In a situation of asymmetrical distribution of expertise about ETS as well as indeterminate preferences towards this new kind of instrument, the Commission made use of its "potential as the 'engine' of EU climate-policy development" (Skjærseth 2017, p. 96). Although CDR is not a new climate policy instrument but an additional tool in the mitigation toolbox, it does have the potential to alter EU climate politics. This potential of CDR not only relates to target structures and differentiation of climate ambitions across countries and sectors. It might also instigate polarized debates (Colvin et al. 2020), the de-

bate about the net-2030 target being a prime example for this. In this situation, the entrepreneurial and intellectual leadership by the Commission might – like in the case of the EU ETS – help facilitate a constructive and open debate, political positioning, and maybe agreement on different ways of addressing CDR in EU climate policy. Actual implementation, however, will depend on the two co-legislators: the Council and the European Parliament.

Evolving Member State positions indicate that intergovernmentalism will, as is usually the case in EU climate policymaking, play an important role in the development of CDR policy. In addition to their sheer competence, reasons also lie in 'geographies of net zero' across Member States. First, Member States differ substantially in their ambitions to achieve net zero emissions. The Union-wide character of the adopted net-zero target helped to bridge these differences, but is expected to have implications on differentiating reduction and removal efforts. Secondly, countries will differ with regard to their residual emissions. The amount of hard-to-abate emissions depend on the structure of domestic industries and other sectors. In Ireland, for example, the agriculture sector will be a key source for residual emissions that have to be balanced to achieve net zero. In other countries, process emissions from cement clinker production in particular are currently perceived to be hard-to-abate. Thirdly, countries have different socio-political preferences for different CDR methods. For example, while BECCS is widely accepted and part of climate-related regulation in Sweden, everything linked to CCS is highly contested in Germany. These preferences will emerge in the coming years and will significantly influence the actual implementation of CDR.

All three dimensions will shape national preferences towards the integration of CDR. Balancing varieties of preferences and interests has always been a defining characteristic of EU climate policymaking. Thus, the integration of CDR is not expected to turn the functioning of EU climate policy completely upside down. At the same time, however, climate policy is expected to take on new facets.

New facets

One of the new facets is the emergence of new alliances across Member States and sectors. Our analysis of the emergence of the 2018 LULUCF regulation and its flexibilities as well as very different structuration and projected development of LULUCF sinks in Member States indicate that new alliances beyond the common *Green Growth* and *Visegrád group*s could form throughout the positioning towards the integration of CDR. In particular, the new political attention directed towards enhancing the LULUCF sink and carbon farming will be relevant in this context. The fact that Commission's envisaged CDR certification scheme has the potential to establish new revenue streams at the interfaces of agriculture, forestry and climate policies, will play a crucial role is expected to shape interests in countries with large potential for ecosystem-based CDR.

A second new facet will be a presumably modified target structure in which CDR will be addressed through an additional removal target. The idea of a newly created EU target has been explored by several studies since the importance of CDR received more attention (Böttcher et al. 2021; Meyer-Ohlendorf 2020; Geden and Schenuit 2020; Geden et al. 2019). They explore possible policy designs, discuss their implications, and agree that the revision of all major climate legislation in the context of the Green Deal is a window of opportunity for establishing a new sub-target. The new net emissions logic in the Climate Law together with the proposed LULUCF removal target and other initiatives in the context of the Fit-fit-

55 package are new steps in this direction. However, whether the EU will adopt a distinct removal target, what type of removals it will include, and how it will be designed and implemented across sectors are likely to be contentious issues in future climate policy.

5. Conclusions

With the Paris Agreement, IPCC's Special Report on 1.5°C Global Warming and the European Green Deal, the necessity to remove carbon from the atmosphere received significantly more attention in EU climate policy. Acknowledging the need to balance hard-to-abate emissions by mid-century in particular led to a rapid career for the issue of CDR. Our analysis of different pieces of EU legislation and major actors reveals that after bein governed implicitly in the LULUCF sector, the issue of CDR has now climbed up the political agenda and policy actors are now starting to proactively address the need to enhance EU's carbon sink capacity.

So far, EU policymaking focuses on ecosystem-based CDR and attention for geochemical-based methods is limited. However, recent shifts in actor positions indicate that this is expected to change in the coming years. Policy initiatives in some Nordic countries as well as the policy-entrepreneurship by the Commission show that research, demonstration and deployment of geochemical-based methods will accelerate. At the same time, initial political resistance against the inclusion of removals in climate targets, varying socio-political preferences and the 'geographies of net zero' point to contingencies of when and where different methods will be deployed. In the coming years, political pressure to deploy a broad portfolio of CDR methods could come from outside the EU. Should the U.S., the U.K. or countries like China follow through on their announcements to deploy CDR, expectations towards the EU as a climate leader would increase.

In the medium-term, the EU's intermediate climate target for 2040 and the governance architecture established to achieve it will determine the role for CDR in EU's transition towards a net zero emissions society. Continuing to explore 'geographies of net zero' and their political implications will be key to anticipate and inform looming discussions of how to regulate CDR and help avoid polarization as the issue climbs up the political agenda.

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