

Carbon Gap

ENVISIONING A CARBON REMOVAL STRATEGY FOR EUROPE

MARCH 2024





EXECUTIVE SUMMARY

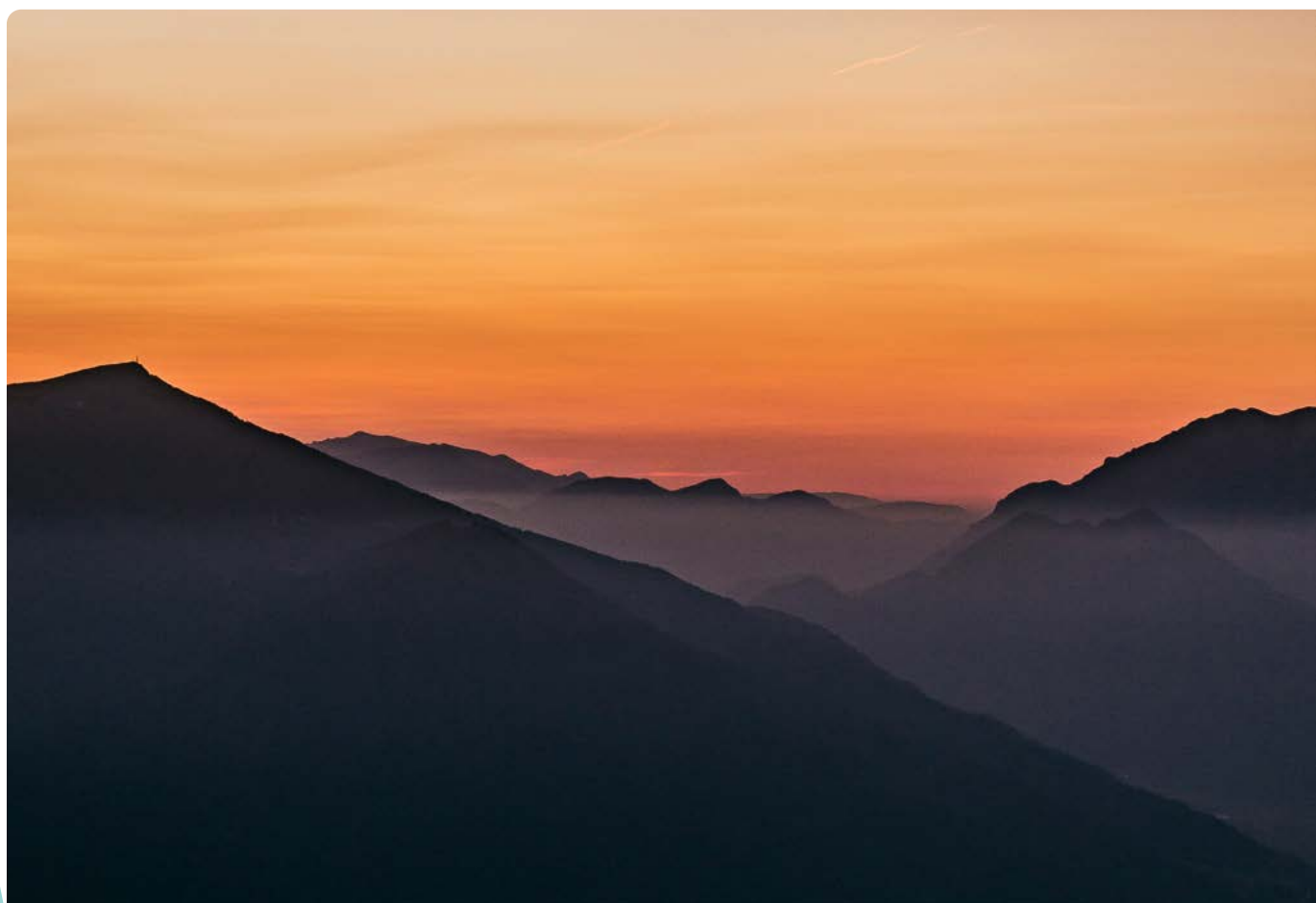
THE CASE FOR A DEDICATED EU CDR STRATEGY

With compounding crises vying for political attention comes the risk for climate action to be deprioritised just as it most urgently needs to be ramped up. 2023 was the hottest year ever recorded¹ and impacts worsen as we near temperature thresholds set by the Paris Agreement.² Swift action will be needed to counteract these negative trends. Bold policies are required to decarbonise the EU and global economy and address the remaining governance gaps that hamper progress toward a safe climate for all.

Severe and continued emissions cuts remain the primary means of reaching global and EU climate targets. However, carbon dioxide removal (CDR) will play a complementary and increasingly significant role in Europe's plan to reach climate neutrality by 2050. Despite its key role, there is not yet a cohesive

governance structure in place for CDR in the EU. The current legislative framework is fragmented, addressing CDR across several pieces of legislation. Leaving these policy gaps unattended risks the EU failing to deliver CDR at the volumes required by 2040, 2050 and beyond, thereby jeopardising Union-wide, legally binding climate objectives. Conversely, agreeing upon an EU framework to develop, deploy and scale CDR responsibly and, in time, would represent a major political achievement and a significant step towards reaching the 2050 EU climate target.

Against this backdrop, Carbon Gap calls for the development of an **"EU Carbon Dioxide Removal Strategy"**. Like other EU strategies,³ this blueprint could be put forward as a Commission communication, laying out a roadmap for CDR from now to 2050. The strategy would outline distinct, overlapping phases

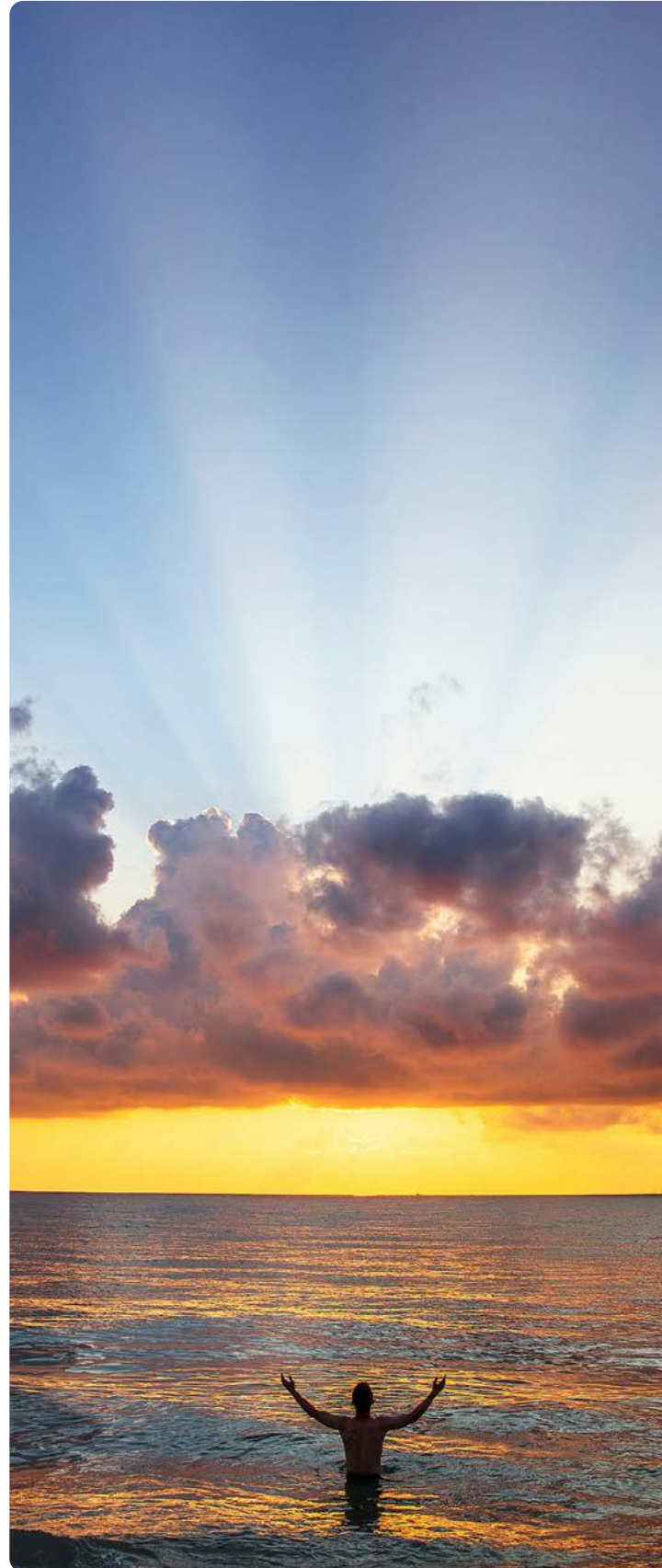


of policy support to meet the needs of the CDR sector on its journey to scale. Carbon Gap recommends that the scope of an *EU CDR Strategy* cover both enabling conditions (including the establishment of targets, rules governing the quality and use of carbon removal and physical CO₂ transport and storage infrastructure), as well as proactive measures to develop, scale and sustain carbon removal's contribution to EU climate action.

In this document, Carbon Gap offers **18 actionable policy recommendations** for how the EU could support CDR over the next thirty years as part of an *EU CDR Strategy*. The recommendations are spread across four key “pillars” that should be pursued collectively to deliver effective and just CDR. The foundational pillar of fair and inclusive governance and deployment cuts across the other three pillars, integrating justice provisions into the CDR sector. The other three pillars overlap and are phased across time, first prioritising research, development and innovation, then introducing dedicated deployment incentives and finally, solidifying an enduring policy framework comprised of binding targets, EU-level compliance mechanisms, and member state initiatives. The recommendations provided under each of these pillars would help grow the pool of potential CDR methods, test the viability of scaling promising, yet high-cost methods, and secure future demand for CDR.

The upcoming political cycle offers EU policymakers the opportunity to make CDR a political priority by launching a dedicated *EU CDR Strategy*. A holistic ambition for CDR could serve as the basis for widespread public engagement and discussion on CDR in Europe, whilst inspiring action in other jurisdictions beyond Europe. It would help set the direction of travel for CDR, clarify the EU's overall CDR ambition

and kickstart decades of concerted action to integrate CDR into ongoing mitigation efforts. Developing a dedicated *EU CDR Strategy* would therefore help ensure delivery on EU climate targets, cementing the position of the EU as a global leader on climate action.



- 1 Make a clear and significant financial commitment to EU RD&I on carbon removal, equalling around EUR 2.6 billion in the next Multiannual Financial Framework for 2028–2034 to cement the EU's global leadership in the green transition and retain human capital and intellectual property.
- 2 Make carbon removal a research priority area in the next Framework Programme for R&I (FP10) and Multiannual Financial Framework.
- 3 Ensure that an overarching EU CDR Strategy outlines a long-term plan for CDR RD&I in Europe, including clear goals and a mapping of research gaps.
- 4 Modify the eligibility criteria and application processes for research funding to make them clear and easy to navigate.
- 5 Develop a centralised platform for EU-level RD&I funding for CDR to make it easier to find available EU funding options and track CDR funding flows.
- 6 By 2025, the Commission should kick-start the demand for CDR by launching a pilot procurement programme, or other comparable deployment incentive, for high-durability and high-cost CDR methods with dedicated EU funding.
- 7 Based on the success of the first pilot procurement programme, a second wave of procurement mixing public and private funding would significantly boost the scale-up of CDR supply and leverage private investments.
- 8 By 2030, a Carbon Clearing-house should be launched to enable the aggregation of demand and procurement of carbon removal at scale, setting the stage for an enduring EU policy framework for CDR.
- 9 Revise policies governing land management to halt the decline of, and hasten the restoration of, the land sink.
- 10 Embed removals across existing EU legislation, going beyond compensation to drive organic demand for a wide range of carbon removal.
- 11 Set a binding overall target for carbon removal with dedicated sub-targets, including for the LULUCF sector and higher-durability removals.
- 12 Integrate removals into an EU-wide compliance mechanism to enlist private entities in carbon removal scale-up, such as via direct integration of CDR into the ETS under strict guardrails, or the creation of a separate RTS.
- 13 Allocate the remainder of the binding removal targets to the member states using the ESR, sharing responsibility commensurately among member states to deliver the target domestically, or to financially contribute to the CDR Clearing-house to bridge the shortfall.
- 14 Boost the European Scientific Advisory Board's capacity to advise EU policymakers on developing CDR in a just way.
- 15 Evaluate and monitor social and environmental impacts of CDR projects as part of EU funding criteria.
- 16 Earmark funding for research into the social and ethical dimensions of CDR.
- 17 Consider establishing a Carbon Removal Communities Initiative that empowers local actors to deploy CDR from the bottom-up.
- 18 Convene a CDR Forum and support the co-development of a Community Code of Conduct for CDR.

The years building up to 2050 are a critical window of opportunity for the EU to lead the way in boosting carbon removal, a suite of key technologies that will help it achieve its net neutrality goals.

THE CASE FOR A DEDICATED EU CDR STRATEGY

INTRO

1 INTRODUCTION

THE CASE FOR A DEDICATED EU CDR STRATEGY

The 2050 climate neutrality deadline looms just five election cycles away. In the EU, plans are taking shape for intermediate climate targets for 2040, supported by policy trajectories to help their delivery. Dramatic emissions cuts remain the most important means of achieving EU climate goals. Still, to accelerate the decarbonisation of European society, even more ambition is needed on top of the host of strategies and policy frameworks currently in place or under negotiation.

Addressing the EU's contribution to climate change in time will also require actively deploying carbon dioxide removal. As defined by the IPCC, CDR refers to "anthropogenic activities that remove CO₂ from the atmosphere and store it durably in geological, terrestrial, or ocean reservoirs, or in products".⁴ CDR comprises an array of methods spanning sectors as diverse as forestry, the built environment and energy.

Many CDR methods are still nascent and unfamiliar to the public. Whereas other global jurisdictions are forging ahead with dedicated policies to support the development and scale-up of CDR, carbon removal in Europe currently lacks significant and targeted policy and financial support. Without a plan for how to overcome these and other challenges, the EU risks leaving it up to chance as to whether CDR can fulfil its role in delivering a stable climate. Despite some key elements of the EU's approach to CDR crystalising through recent policy proposals, there is currently no overarching plan for how to address the needs of CDR as a family of methods.

The years leading up to 2050 are a critical window of opportunity for the EU to both tackle climate change and bolster its competitiveness as part of a green transition. The Commission should therefore act by publishing a communication setting out an "*EU Carbon Dioxide Removal Strategy*". As with the EU Hydrogen Strategy⁵ adopted in 2020, this communication should set out a roadmap for CDR development across all verifiable methods over the next 30 years. In this document, we seek to launch the discussion on what such a strategy could look like. To facilitate the development of an *EU CDR Strategy*, we have developed 18 recommendations to enable decisive action on CDR. In our view, the *EU CDR Strategy* should provide answers to two pressing questions:

- 1 How can the EU ensure sufficient enabling conditions are in place for carbon removal to operate at scale when ready?
- 2 How can the EU introduce tailored policies to support the CDR sector in reaching its required scale?



CREATING THE RIGHT ENABLING CONDITIONS FOR SCALING CDR

Three key enabling conditions must be considered by the EU's potential strategy to secure an effective regulatory and infrastructural environment for CDR that is compatible with international and member state action. Progress towards all three conditions has already been made, but a comprehensive *EU CDR Strategy* would help identify and bridge the remaining gaps.

1. Set Targets

First, a CDR strategy must be grounded in a clear mandate for action. Whereas there is already a 2030 target and framework in place for land sink net removals, there is no explicitly stated target or governance mechanism for higher-durability CDR methods, despite their featuring prominently in the Commission's 2040 Climate Target Communication.⁶ To complement existing targets on emissions reductions, a Union-wide, binding target for carbon removal should be established, with nested targets for land-based and higher-durability* removals, respectively.⁷

These targets, set to be enshrined in legislation through the revision of the European Climate Law, would ideally look beyond climate neutrality towards achieving durable net zero by 2050, where remaining fossil emissions are balanced with higher-durability removals.⁸ Figure 1 provides a visual representation of the EU's current and proposed net emissions targets, combined with illustrative overview of how these can be achieved through steep emissions cuts and increasing removals (including additional higher-durability removals if the EU is to attain durable net zero).

Interconnected emissions and removals targets will be needed to reach climate neutrality by 2050. If EU efforts to lower emissions are more successful than projected, the removals targets should be adjusted. Conversely, if EU emissions reductions proceed slower than planned, the removals target will need to be increased for climate policy goals to be achieved. Review mechanisms should be foreseen in the formulation of the binding emissions reduction targets to ensure that such adjustments can be made.



* see page 34

2. Clarify Rules

Second, an *EU CDR Strategy* should identify the enabling rules, guardrails and corresponding governance tools needed to safeguard the integrity of the sector. To build trust and ensure that high-quality removals are delivered, a system for accurately accounting climate benefits will be paramount. The EU has already taken welcome steps in this direction through its soon-to-be-operational Carbon Removal Certification Framework (CRCF),⁹ which aims to set robust,

transparent and science-based rules for what constitutes CDR. A similar effort must clarify how different “end uses” of CDR certificates will be governed, which can partly be addressed through the proposed EU Green Claims Directive.^{*,10} Furthermore, an *EU CDR Strategy* should help identify other gaps in the enabling regulatory environment, including issues around double-counting and interoperability with burgeoning international carbon accounting frameworks such as the Article 6 mechanisms of the Paris Agreement.¹¹

Illustrative emissions and removals pathway for the EU

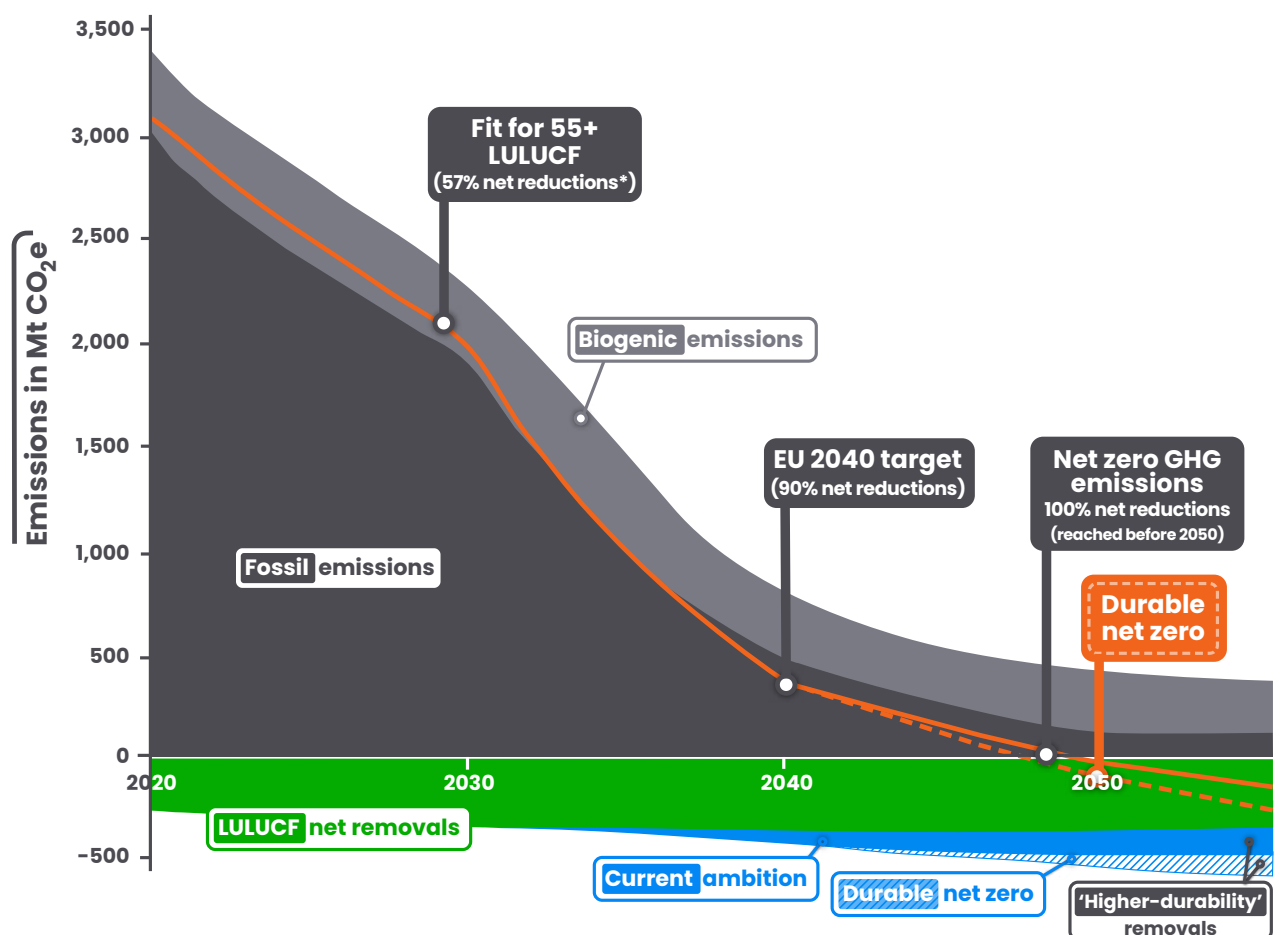


Figure 1: Illustrative emissions and removals pathway for the EU. This hypothetical scenario shows net greenhouse gas (GHG) emissions (orange line) reaching the existing 2030 target and delivering 90% and 100% reductions in net GHG emissions relative to 1990 by 2040 and shortly before 2050, respectively. The 2030 target corresponds to the 55% emissions reductions target and the additional ambition set under the LULUCF Regulation. The 2040 and 2050 emission levels are based on scenario 3 from the 2040 Climate Targets impact assessment.¹³ Given that durable net zero is not met in this modelled scenario, the dashed blue area represents the additional higher-durability removals needed to reach such a state. Biogenic emissions include agricultural emissions and half of the emissions from waste treatment based on an assumed 50% biogenic fraction (LULUCF),¹⁴ reaching 333 MtCO₂/year in 2050 based on scenario 3 of the 2040 targets impact assessment.

* see page 34

3. Physical Infrastructure

Finally, the EU should ensure that the physical infrastructure required to transport and store atmospheric and biogenic CO₂ is in place by the time CDR methods need it. Much of the current strategic planning (e.g. Industrial Carbon Management Strategy) and legislation (e.g. Net Zero Industry Act and the CCS Directive)¹² are not CDR-specific. The absence of CDR-specific infrastructure planning is the result of current EU priorities to advance non-removal carbon management methods that also require durably storing carbon such as carbon capture and storage (CCS). A CDR strategy should, therefore, evaluate existing and ongoing EU plans to determine whether they sufficiently support the delivery of EU CDR objectives and, if not, offer concrete actions to bridge this gap.

THE 4 PILLARS OF BUILDING A SUCCESSFUL EU CDR STRATEGY

Beyond securing these three enabling conditions, the EU will need to take proactive measures to catalyse the growth of CDR. We have split the measures into overlapping phases to ensure policy support evolves in line with the growth of the CDR sector. Our document focuses on these measures, presented as four linked pillars that can collectively shape CDR's journey to scale:

Pillar 1: Support research development & innovation

Enhancing RD&I can unlock development and diversify the pool of scalable CDR methods, improve environmental baseline data crucial for measuring carbon fluxes, and explore vital questions on the impacts of CDR and its governance.

Pillar 2: Introduce dedicated deployment incentives*

An injection of stably priced, predictable incentives deployed over decades could drive the initial scale-up of higher-cost CDR methods to reveal whether (and how fast) their cost will decrease. These deployment incentives will also help generate a body of experiential knowledge and reveal which solutions to accelerate.

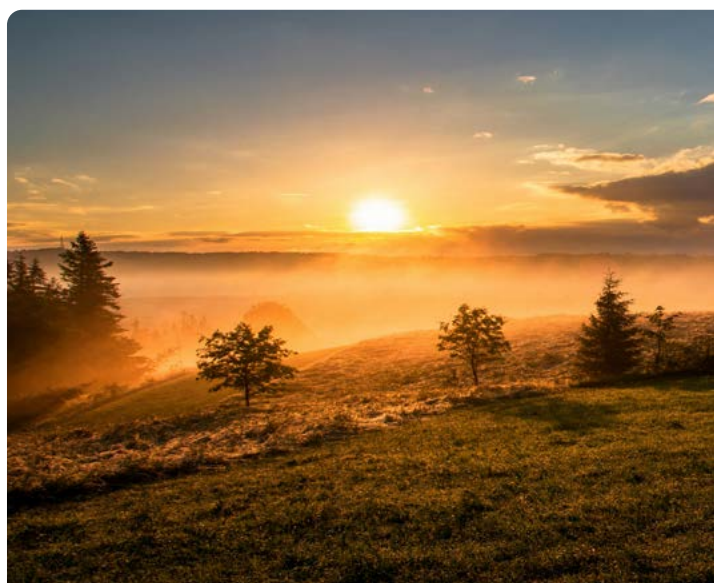
Pillar 3: Secure an enduring policy framework

Like other essential public services such as waste collection, CDR is necessary but not intrinsically profitable. Only regulation can create sustained demand. Just as regulation governs the management of other forms of waste, policymakers must therefore integrate CDR into long-term climate governance to ensure that the required volumes will be delivered.

Pillar 4: Ensure just governance and deployment

Incorporating justice principles and processes into the design and execution of an *EU CDR Strategy* is needed to uphold trust among stakeholders and widen the scope of Europe's commitment to a just transition.

While principles of justice and equity should continuously inform CDR governance, the other three pillars can be phased in over time (see Figure 2).



* see page 34

The role of the EU CDR Strategy pillars in EU policy between 2024–2040

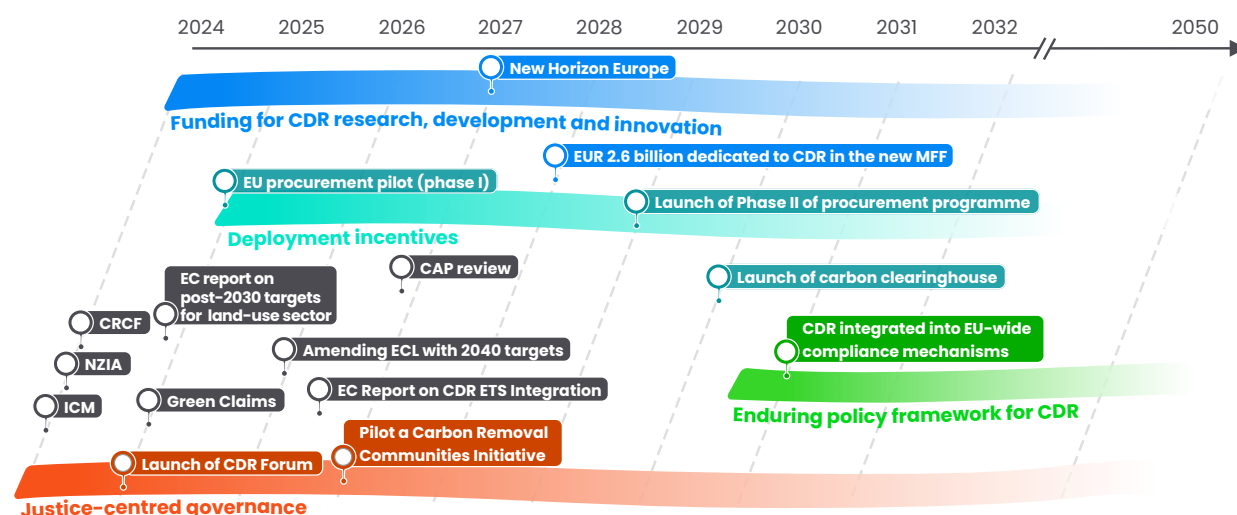


Figure 2: The role of the EU CDR Strategy pillars in EU policy between 2024–2050. This timeline depicts a phased approach to CDR policymaking across our four proposed pillars. Shown alongside foreseen EU legislative developments (grey boxes), it shows how pillars 1 and 4 – RD&I and justice-centred governance, respectively – would underpin efforts to develop and scale CDR throughout the period 2024–2040, whereas pillars 2 and 3 would come into play later. The timeline also shows some key recommended policy initiatives under each pillar to help develop and deploy CDR in the decades to come.

To start, in 2024 the EU must urgently boost RD&I funding for carbon removal through existing and eventually new channels to diversify innovation within the sector. In the second half of the 2020s, the EU should use deployment incentives to expedite discovery of which CDR methods can viably scale. Beginning in the late 2020s and early 2030s, an enduring policy framework can take shape as multiple compliance mechanisms kick in, ensuring CDR continues to scale in a manner that is sustainable and well-regulated. Throughout the 2030s, all four pillars should work closely together to set the EU on track to meet its climate neutrality target.

THE CASE FOR A MULTI-FACETED EU CDR STRATEGY

Now is the time for the EU to show leadership and inspire action in Europe and beyond by enabling the responsible and rapid growth of CDR in the EU. Carbon Gap calls on the European Commission to develop a dedicated, cohesive *EU CDR Strategy* that aligns targets with science, defines rules and guiding principles, and fosters the scale-up of CDR methods safely, fairly and effectively.

An EU-wide strategy would offer concrete and complementary policy actions across the four pillars of CDR governance. There are several advantages to developing such a roadmap from now until 2050, including:

- 1 Bolstering the industrial competitiveness of the EU** as part of the green transition by setting out a long-term trajectory for CDR.
- 2 Retaining talent and promoting innovation** whilst offering expertise to the international community.
- 3 Inspiring and catalysing member states to act at the national level**, safe in the knowledge that their initiatives are compatible with the EU's policy trajectory.
- 4 Leveraging the EU's position as a global climate leader**, promoting international cooperation and increased ambition through bold action. EU action could help set the standard for ongoing efforts to deploy, scale and trade removals on the global scale in the context of Article 6 of the Paris Agreement or other mechanisms.¹⁵

By dedicating EUR 2.6 billion to research, development, and innovation (RD&I), the EU would position itself as a global leader in the green transition, making it a global leader in CDR research.

BOOSTING RESEARCH, INNOVATION & DEVELOPMENT FUNDING



02/2021

- **Why the EU needs to make carbon removal a research priority area.**
- **How EUR 2.6 billion dedicated to RD&I could help cement the EU's global leadership in the green transition and make Europe a hub for CDR research.**
- **What streamlined project application processes, dedicated eligibility criteria and a centralised funding platform could do to facilitate research into CDR.**

European and global climate targets cannot be met without assembling a diverse portfolio of carbon removal methods that can deliver at scale. Some novel, promising CDR methods are still at an early development stage and need targeted research and innovation support to rapidly prove or disprove their technical, financial and social viability. Others could readily benefit from pilot support to generate learnings regarding costs, failure points, optimisation and practical applications. Even the more mature methods are dependent on targeted, outcome-driven research to more precisely quantify their climate benefit, second order impacts and social acceptability.

SCALING FUNDING FOR CDR ACROSS THE EU

The EU has already committed to deploying significant amounts of CDR and is among the world's leaders in addressing climate change. Yet, its research and innovation funding strategy for CDR does not reflect this level of ambition. To address this gap, the EU should allocate volumes of innovation funding commensurate with the role these technologies are expected to play. Specifically, the EU should dedicate around EUR 2.6 billion in the next Multiannual Financial Framework for

2028–2034 to solidify the EU's leadership in the green economy.

Research, innovation and development funding for CDR needs to be frontloaded in the next decade to be effective and pay climate dividends. A large injection of RD&I support today can help earlier-stage CDR methods reach maturity and close critical knowledge gaps on the scale of ecosystem impacts and the fate of carbon in open natural environments. Increased funding needs to be structured to allow for the emergence of a diverse and competitive portfolio of CDR, using targeted and criteria-based funding to help tackle the diversity of challenges that CDR faces.



Make a clear and significant financial commitment to EU research, development and innovation (RD&I) on carbon removal, equalling around EUR 2.6 billion in the next Multiannual Financial Framework for 2028–2034 to cement the EU's global leadership in the green transition and retain human capital and intellectual property.

As a research powerhouse for the green transition, the EU has successfully spearheaded cleantech development in the past. By making CDR a new research priority in the next Framework Programme for R&I (FP10) and Multiannual Financial Framework, the EU can build on past experience to deliver on several strategic objectives:

- 1 Develop know-how and practical CDR experience through applied research;
- 2 Create CDR champions within the EU that can meet the majority of its domestic CDR needs, and thereby gain a crucial competitive advantage in this new sector with the potential to involve capital flows from what promises to be a USD 1.2 trillion market¹⁸ by 2050;
- 3 Develop its knowledge through fundamental research to solve outstanding issues in CDR and inform CDR governance.

 Make carbon removal a research priority area in the next Framework Programme for R&I (FP10) and Multiannual Financial Framework.

PLUGGING AVAILABLE RD&I FUNDING GAPS FOR CDR

Carbon Gap has mapped the main EU RD&I funding mechanisms available to CDR technologies and projects between Technology Readiness Level (TRL) 1–7, identifying potential funding gaps and possible improvements that could be made to existing funding schemes. To ensure that CDR technologies receive the critical funding they need to scale, the EU must undertake a similar exercise to identify clear goals and funding gaps.

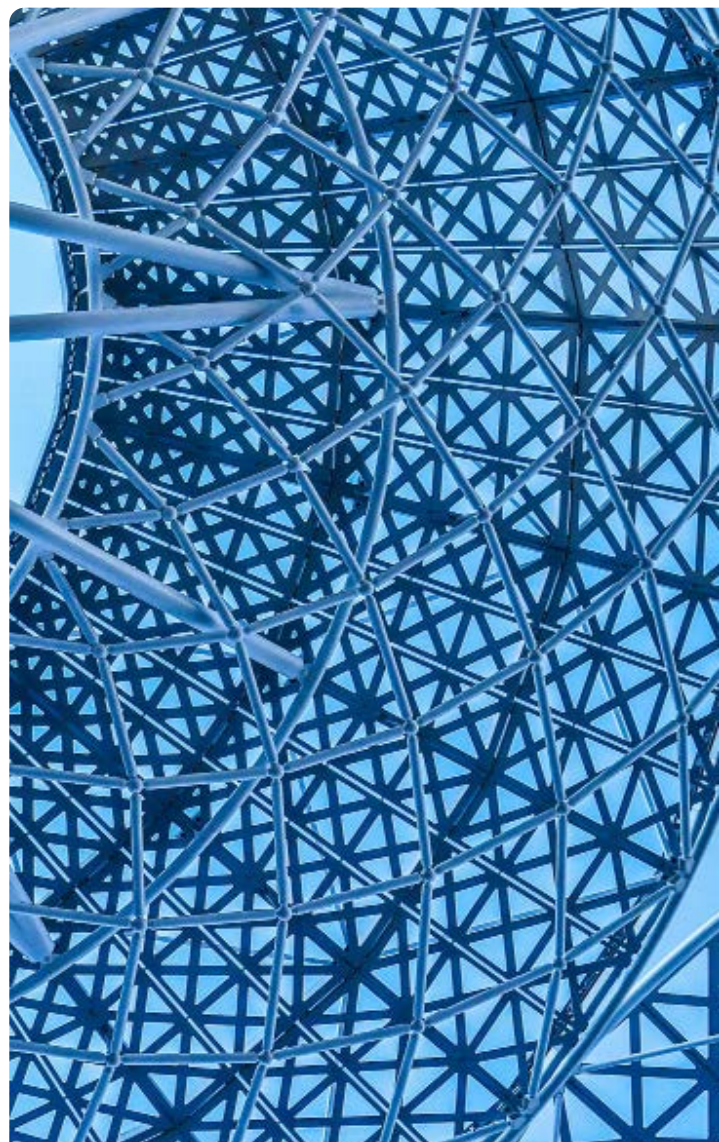
 Ensure that an overarching EU CDR Strategy outlines a long-term plan for CDR RD&I in Europe, including clear goals and a mapping of research gaps.

Between 2020 and 2023, the EU directly* supported CDR research and innovation with a disbursement of approximately EUR 613 million,* representing ~0.1% of the EU's budget for the green transition.¹⁶ The next 20 years represent a time-sensitive

* see page 35

window of opportunity to push nascent CDR methods towards maturity.¹⁷ The EU has suggested an increase in CDR RD&I funding in the Industrial Carbon Management communication and Innovation Fund through the inclusion of CDR pilot projects in its latest round.

While significant, the amount of EU funding that is currently available for CDR RD&I is insufficient compared to current global funding estimates* of between the EUR 16 billion and EUR 32.3 billion required over the next 15 to 20 years. Using GDP to suggest relative contributions towards this global figure, the US and EU contributions would be EUR 3.79–7.68 billion and EUR 2.88–5.85 billion, respectively. Figure 3 compares US and EU CDR RD&I support relative to these suggested contributions, capturing how the EU still has some ways to go in supporting RD&I for carbon removal.*



An EU-US comparison of spending on RD&I for CDR

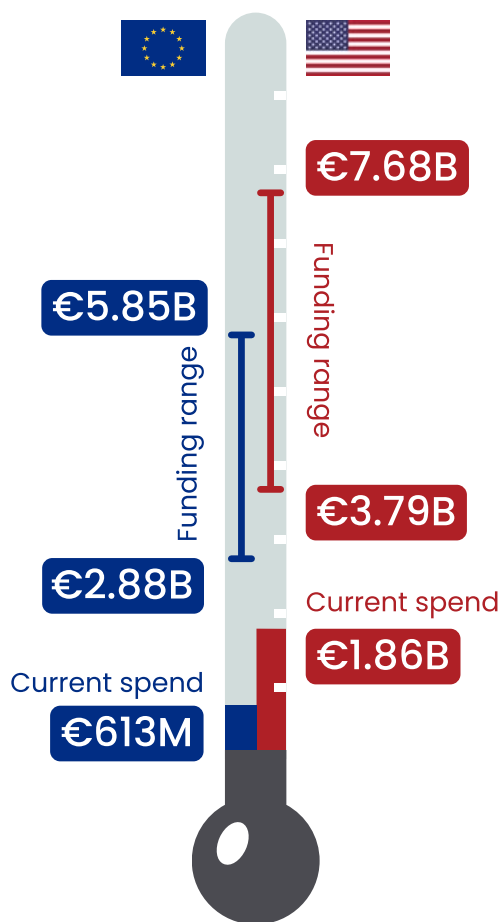


Figure 3 – An EU-US comparison of current spending and estimated funding needs for RD&I on CDR. The figure shows current volumes of RD&I funding disbursed to CDR in the EU and the US (filled bars) compared to estimated requirements to address pending research gaps over 20 years (indicative ranges).

STREAMLINING AND FACILITATING PROJECT FUNDING APPLICATION PROCESSES

The amount of funding available for CDR projects is not the only hurdle to boosting RD&I in the EU. Researchers and project managers seeking funding for CDR can sometimes struggle to navigate demanding EU application procedures, effectively preventing certain projects from applying or gaining access to the funding they need. Since CDR is often implicitly or explicitly grouped with carbon capture and storage (CCS) and carbon capture and utilisation (CCU) in funding calls, it can be difficult for CDR

project managers to assess the viability of their projects. Funding criteria are often broad and potentially ill-fitted for the characteristics of individual CDR projects. The grouping together of CDR with CCU and CCS creates an unnecessary tension between these different families of methods and solutions, with nascent CDR projects pitched against more mature and financially viable CCU and CCS projects. An EU CDR Strategy would therefore require simplifying funding application processes to streamline access to funding specific to CDR.



Modify the eligibility criteria and application processes for research funding to make them clear and easy to navigate.

To help address these issues, the EU could set aside dedicated funding for CDR under new or existing funding schemes such as Horizon Europe. These schemes would be visible under one centralised platform for EU RD&I funding for CDR. Doing so would help ensure (1) fixed and sufficient funding that avoids competition between different cleantech, (2) efficient allocation of funding across methods and research needs, (3) increased visibility and better tracking of progress.



Develop a centralised platform for EU-level RD&I funding for CDR to make it easier to find available EU funding options and track CDR funding flows.

Whilst the EU can lead by example on carbon removal and provide support where needed, the development of carbon removal in Europe will require collective efforts. Member states should prioritise CDR in national research funding schemes, boosting their commitments to RD&I whilst leveraging funding from the private sector.

Dedicated deployment incentives will be needed as of 2025 to help mature carbon removal methods make the transition from the lab to deployment in the field.

BRINGING CARBON REMOVAL FROM THE LAB TO THE FIELD WITH DEPLOYMENT INCENTIVES



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BRINGING CARBON REMOVAL FROM THE LAB TO THE FIELD WITH DEPLOYMENT INCENTIVES

- What the EU can do to make sure that mature high-durability CDR gets deployed.
- How policies for the EU procurement of CDR can be designed to attract and encourage private investment in the sector.
- How EU initiatives can be complemented and combined with national initiatives to maximise the deployment and scale up of CDR in Europe.

Some CDR methods already have, or will soon reach, a stage of maturity where there is more to learn in the field through deployment than in the lab. Such methods can no longer rely solely on the RD&I pilot funding addressed in Pillar 1 and will instead need a blend of public and private capital to motivate deployment and exploratory scale-up. Dedicated policies should be put in place to allow for such deployment to take place.

DEFINING DEPLOYMENT INCENTIVES

Deployment incentives are a broad category of policies and financial instruments, such as feed-in-tariffs, procurement programmes and contracts for difference. They have historically been instrumental in scaling up and bringing down the costs of critical climate technologies including wind and solar. Whilst these technologies had the benefit of inherent demand for clean electricity, they nonetheless required the trust inspired by publicly funded incentives to drive investment. Specific CDR methods stand to benefit even more from deployment incentives, since there is not always an intrinsic market value attributed to the underlying benefits they provide. Accordingly, policy will be needed

to require or incentivise the purchase of higher cost removals.

Effective deployment incentives share three characteristics. They:

- 1 provide a predictable price covering some or all the cost of the activity;
- 2 are available over a suitably long time-horizon;
- 3 have a high degree of credibility, trust and political durability.



Deployment incentives further serve to:

- 1 unlock immediate support for CDR by creating a demand-pull;
- 2 build European experience and expertise with these new technologies;
- 3 serve to enshrine good practices for CDR deployment;
- 4 unleash private funding by providing a secure, financeable guarantee of offtake for CDR and build trust in the value and bankability of these technologies.

THE CASE FOR DEDICATED DEPLOYMENT INCENTIVES FOR CDR

CDR methods that can provide high-durability removals are relatively well-understood, but still high cost. Such is the case for direct air capture with storage (DACCS), bio-CCS, and other novel methods, which are prime candidates for deployment incentives. Targeted policies can reveal with precision how much these activities cost, and how quickly those costs may fall with continued scale-up (so-called “learning rates”). An effective *EU CDR Strategy* should therefore foresee a series of deployment incentives at EU level and encourage complementary action at the member state level to drive these novel, predominately higher-durability CDR methods out of the lab and into the field.

EU deployment incentives would serve to complement, rather than replace, member states’ initiatives to incentivise the deployment of higher-durability CDR at the national level. These national initiatives target specific removal methods of national strategic importance, such as the Swedish reverse auction scheme for bio-CCS¹⁹ and the Danish negative

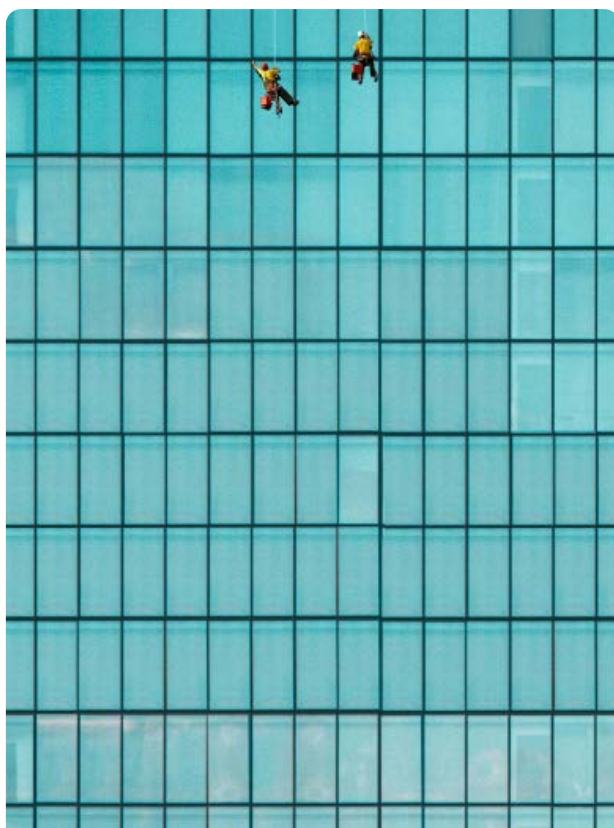


emission subsidy pool (NECCS).²⁰ An *EU CDR Strategy* should take a bird’s eye view of these collective member state-level activities, helping to unlock cooperation, plan for necessary enabling infrastructure, ensure compatibility of EU-level deployment incentives, facilitate the sharing of experience among policymakers, and ensure that national schemes make use of the EU CRCF to certify the removal activities they promote.

Most importantly, the *EU CDR Strategy* should consolidate member state and EU-level planning and determine whether EU-wide carbon removal targets are on track or if additional ambition will be needed. Pillar 3 shows one possible scenario for how stacked efforts from member states and EU-level regulation can collectively contribute to an EU higher-durability removals target.

INTRODUCING TWO SEPARATE PROCUREMENT POLICIES

Whilst any kind of effective deployment incentive governed and supported by the EU would help support the deployment and scale-up of carbon removal, our proposed policies focus on a public procurement programme that would allow the EU full control of the scope, scale and governance of CDR deployment. Such a programme has several advantages; a single high-credibility off-taker inspires trust whilst creating efficiencies through demand-aggregation, whilst the procurement programme would allow the EU the flexibility to procure a variety of high-durability CDR methods. Other types of deployment incentives should also be considered as part of motivating the scale-up of CDR. Although contracts for difference have proven an effective deployment incentive instrument for renewable energy, the challenge for CDR lies in determining the suitable price ranges for various solutions. We therefore propose two separate procurement policies to help bring CDR solutions to market whilst scaling up the capacity of existing technologies to deliver high-quality removals.



1. EU procurement programme

First, an EU procurement programme would help ensure the deployment of a portfolio of CDR methods spanning a wide range of high-durability CDR solutions. The focus is on modelling good behaviour, kickstarting the supply of a variety of higher-durability CDR methods by introducing predictable demand. The procurement programme should proceed in two phases:

Pilot phase 1

In a pilot Phase I of the procurement programme, a modest volume of higher-durability removals would be purchased across a representative array of methods, to reveal “first of a kind” costs, set standards and gain experience with the unique features of each method. Beginning in 2025 and proceeding over 5 years, the programme would award multi-year (e.g., 5-10) offtake agreements to providers of various forms of permanent carbon removal based on transparent, outcome-based criteria. The pilot phase would rely on EU funds, such as repurposing pilot project funding allocated under the Innovation Fund. Based on a EUR 200-400/tCO₂ range of blended cost for higher-durability removals, a hypothetical EUR 50 million procurement programme awarding 5-year offtake agreements could finance 25-50ktCO₂/year of higher-durability removals capacity.



By 2025, the Commission should kick-start the demand for CDR by launching a pilot procurement programme, or other comparable deployment incentive, for high-durability and high-cost CDR methods with dedicated EU funding.

Pilot phase 2

Phase 2 of the procurement programme should be launched in the latter half of the 2020s as a second wave of procurement, this time mixing public and private funding to scale up CDR supply and to leverage private investment. This phase would focus on revealing “next of a kind” project costs, to gauge how quickly costs are likely to decline and inform onward investment priorities under the EU CDR Strategy. The goal would be to deliver multi-MtCO₂-scale volumes during the 2030s, taking inspiration from successful private procurement initiatives such as Frontier and NextGen.²¹ Its design could resemble that of an advance market commitment,²² with the EU committing a certain amount of funding in advance to be matched or ideally surpassed by private sector commitments. Private contributions could be made on a voluntary basis or to substantiate net zero claims in line with EU regulations.



Based on the success of the first pilot procurement programme, a second wave of procurement mixing public and private funding would significantly boost the scale-up CDR supply and leverage private investments.

2. Carbon Clearing-house

Second, a Carbon Clearing-house* should be introduced by 2030 to help ensure that a functioning industry and bankable set of CDR projects can emerge. At this later stage, the priority is to aggregate funds to purchase CDR at scale and to increase the supply of CDR units. The EU-administered Clearing-house could manage the procurement and disbursement of CRCF-certified carbon removal at the necessary scale by pooling funds from a variety of sources. The Clearing-house could for instance enter into offtake agreements with carbon removal providers, mirroring the purported role of the EU Hydrogen Bank.²³

* see page 34

Whilst the Clearing-house might initially be used to boost demand for CDR, in the longer term it could conceivably allow any EU or member state policy to delegate execution of carbon removal purchasing to the Clearing-house. Private stakeholders, such as corporate purchasers or EU-ETS-regulated emitters could also seek approval to channel their funds via the Clearing-house, specifying the removals they require or contributing to a central portfolio. On the supply side, CDR suppliers would benefit from a highly creditworthy counterparty, enabling them to finance projects with debt. Eventually, we envision the Clearing-house operationalising delivery on binding carbon removal targets for member states (see Pillar 3).



By 2030, a Carbon Clearing-house should be launched to enable the aggregation of demand and procurement of carbon removal at scale, setting the stage for an enduring EU policy framework for CDR.

The experience and learning gathered from the introduction of deployment incentives will help the EU rapidly prove or disprove the viability of specific CDR methods, increase the capacity of EU suppliers to remove carbon at scale, and enshrine guardrails and high standards for CDR. Whilst deployment incentives will be necessary to kick-start the deployment and scale-up of CDR, they must be accompanied by a framework governing how and to what end CDR is used in Europe. Pillar 3 of this proposal sets out the need for an enduring EU policy framework to embed CDR in European climate action over the long term.



Since carbon removal is not intrinsically profitable, the EU needs to put in place an enduring policy framework that can deliver sufficient volumes of removed carbon by 2050 and beyond.

DEVELOPING AN ENDURING POLICY FRAMEWORK FOR CDR

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3 DEVELOPING AN ENDURING POLICY FRAMEWORK FOR CDR

- How a binding overall target for carbon removal with dedicated sub-targets for land-based and high-durability removals will be crucial to guide and encourage CDR.
- Why the EU needs to create an enduring policy framework to make sure that carbon removal scales up enough to help deliver climate neutrality by 2050 and net negative emissions thereafter.
- Which existing policies the EU should consider reviewing to mainstream CDR, and what new initiatives will be needed.

To achieve its climate goals and ensure global competitiveness in the green transition, the EU can benefit from funding research and development across an array of CDR methods, whilst fostering EU and member state-level deployment incentives to begin scale-up. However, unlike solar and wind energy where deployment incentives alone drove down costs to a level where public subsidies and incentives became less necessary, scaling CDR will require the creation of an enduring EU policy framework to ensure long-term sustained supply and demand even after the EU achieves net negative emissions. By integrating removals across a wide range of policies and private funding channels, the EU can mobilise tens to hundreds of billions of euros over decades and create lasting incentives to remove carbon.

CRAFTING AN ENDURING COMPLIANCE FRAMEWORK FOR CARBON REMOVAL

Efforts to enshrine removals within an enduring, long-term policy framework can be pursued across three parallel areas:

- 1 safeguarding the land carbon sink;

- 2 Integrating removals into existing EU legislation;

- 3 Developing mechanisms to support the deployment of higher-durability removal methods.

Policies considered include:

- 3a the integration of higher-durability removals into the EU Emissions Trading Scheme;

- 3b the creation of a Removals Trading System;

- 3c formalising a Removals Target under the Effort Sharing Regulation.

1. Safeguarding the land carbon sink

To meet Union-wide climate targets, the EU must first reverse the current degradation of its land sink and then improve its ability to sequester carbon.²⁴ Under existing and planned additional measures, the EU is expected to fall 50 MtCO₂e/yr short of its legally binding 2030 land use, land-use change and forestry (LULUCF) net removals target of 310 MtCO₂e/yr,²⁵ which could derail Europe's efforts to reach climate neutrality by 2050. Policymakers have five key levers at their disposal to bridge this gap (see

Figure 4). In contrast to the nascent regulatory landscape for novel removal methods, a mosaic of existing EU legislation already governs land management decisions across agriculture, forestry and beyond. An *EU CDR Strategy* should assess the ability of these policies to drive the required emissions reductions and removals and revise them where possible to fortify the land sink. In building demand for these removals, the EU would benefit from a comprehensive approach that balances multiple land-based services and priorities to resist “carbon tunnel vision”.²⁶

 Revise policies governing land management to halt the decline of, and hasten the restoration of, the land sink.

Both before and beyond 2030, EU-wide and member state-level measures can be leveraged to motivate LULUCF emissions reductions and increased removals (figure 4).²⁷ Interest in increasing land-based removals through private sector purchases of CRCF-sanctioned “carbon farming” is growing. We urge caution, since regulation for high-integrity climate claims is not yet in place to prevent the practice of erroneously claiming to compensate for fossil fuel emissions using

An illustrative pathway for growing the EU's land carbon sink to reach required capacity by 2050

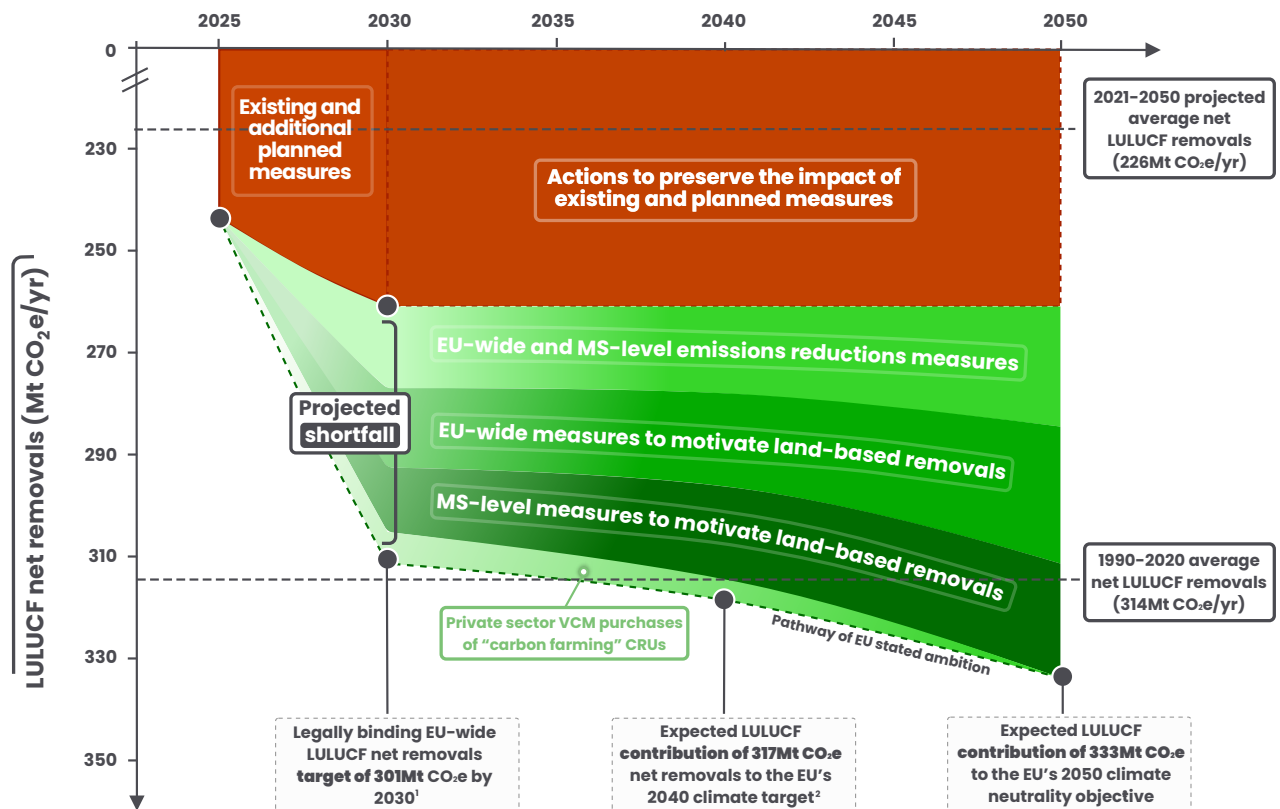


Figure 4: An illustrative pathway for growing the EU's land carbon sink to reach required capacity by 2050. This figure is an illustration of the EU's LULUCF net removals gap from 2025 to 2050 shown alongside five levers for policymakers to bridge the projected shortfall. “LULUCF net removals” (y-axis) combine the emissions and removals of the EU's LULUCF sector and are assumed to reach $-243 \text{ MtCO}_2\text{e}$ by 2025 based on linear growth between the last reported value of $-230 \text{ MtCO}_2\text{e}$ in 2021 and an estimated $-260 \text{ MtCO}_2\text{e}$ reached in 2030 based on member state projections.³⁸ Between 2025 and 2030, we show two possible trajectories: linear growth to $-260 \text{ MtCO}_2\text{e}/\text{year}$ and reaching the binding target of $-310 \text{ MtCO}_2\text{e}/\text{year}$,³⁹ which will require taking additional measures. To meet existing and expected targets outlined in the LULUCF Regulation and the 2040 Target impact assessment for 2030 and 2040–2050 time frames⁴⁰, five interventions can be pursued in tandem. These interventions (depicted in wedges of roughly estimated size) collectively preserve the land sink achieved by 2030, drive LULUCF emissions reductions and increase land-based removals through EU, member state, and private sector action. An *EU CDR Strategy* should ensure that current and new policy approaches cohere and that emissions reductions and carbon removal measures are complementary. For context, average LULUCF net removals are shown in dashed horizontal lines for past (1990–2020) and future projected averages (2021–2050; based on member state projections).⁴¹

carbon with lower durability and higher risk of reversal stored in the biosphere.²⁸ After 2030, measures should be put in place to protect the increased LULUCF net removals capacity that has been reached up until that point. Introducing such measures will be crucial, as the 2021-2050 projected average of LULUCF net removals indicates that Europe's land carbon sink may substantially shrink in the upcoming decades in the absence of concerted preventive action.²⁹

2. Integrating removals into existing EU legislation

Following land-sink preservation efforts, a comprehensive *EU CDR Strategy* should survey the full array of EU legislation to uncover low-resistance opportunities to deliver removals at a large scale, low cost, and with minimal burden on existing economic activities. Wherever policies contain an existing mandate to reduce net emissions – e.g. in sectors as diverse as the built environment, aviation and public procurement – there is an opportunity to motivate carbon removal through compliance with revisions to existing policy frameworks. Hypothetical examples include:

- **Public procurement** – Public procurement accounts for upwards of 14% of EU GDP,⁴² and changes to public procurement criteria at the EU, member state, regional and local levels could shift some purchasing of materials, products and services toward direct or indirect use of carbon removal.
- **Built environment** – The EU can explore updating guidance to drive the uptake of building materials using removed carbon. For example, building demolition should require recarbonation* of concrete before landfilling.

* see page 35

➤ **Permitting of strategic infrastructure** – The EU may be able to model behaviour or shape member state approaches to the permitting of, for example, materials procurement⁴³ for inter-member state infrastructure, mining concessions (e.g., requiring mine tailing recarbonation by default), or expansions of ports and other large-scale infrastructure.

➤ **Sustainable food systems** – The EU could model behaviour or provide guidance on food purchasing patterns, for example inspiring public institutions to source a rising percentage of products from “carbon farming”-certified supply chains.

A thorough examination of how carbon removal can play a role in policy frameworks across different sectors of the EU's economy will help disperse the costs of CDR across society and ensure a diversity of removal methods are incentivised where it makes the most sense. For example, this examination could identify new high-integrity ways of driving the scale-up of emerging CDR methods to more precisely quantify climate benefits. Such methods may otherwise struggle to credibly demonstrate one-for-one, high-durability and high-certainty “compensation” for a tonne of fossil emissions, an important prerequisite for incorporation into compliance instruments such as the ETS. Above all, if policies in this area are considered by the *EU CDR Strategy*, it would relieve pressure on EU-wide emissions trading and compliance instruments, potentially delivering a large share of both the LULUCF net removals target and a higher-durability removals target. What is key, however, is that carbon removal be integrated across all EU policies to create a market for a portfolio of methods.



Embed removals across existing EU legislation, going beyond compensation to drive organic demand for a wide range of carbon removal.

3. Developing mechanisms to support the deployment of higher-durability removal methods

Support mechanisms for higher-durability removals are the third and last area considered as part of integrating CDR into an enduring policy regime. While it is envisaged that the land sink will be the largest contributor to the EU's removals target, it will also be necessary to deploy higher-durability removals such as bio-energy with carbon capture and storage (BECCS), DACCS and enhanced rock weathering. Just as a LULUCF net removals target is explicitly defined, a separate and binding target for higher-

durability removals must also be set to ensure delivery. A comprehensive *EU CDR Strategy* should empower the Commission to monitor overall progress towards a comprehensive target for carbon removal that combines sub-targets for both LULUCF and higher-durability removals. Figures 4 and 5 show how multiple EU and member state-level policies might stack up to collectively motivate the scale-up of land sink and higher-durability removals, respectively, delivering on these twin removals targets.



Set a binding overall target for carbon removal with dedicated sub-targets, including for the LULUCF sector and higher-durability removals.

Proposed combination of different *EU CDR Strategy* policies toward a higher-durability removals target

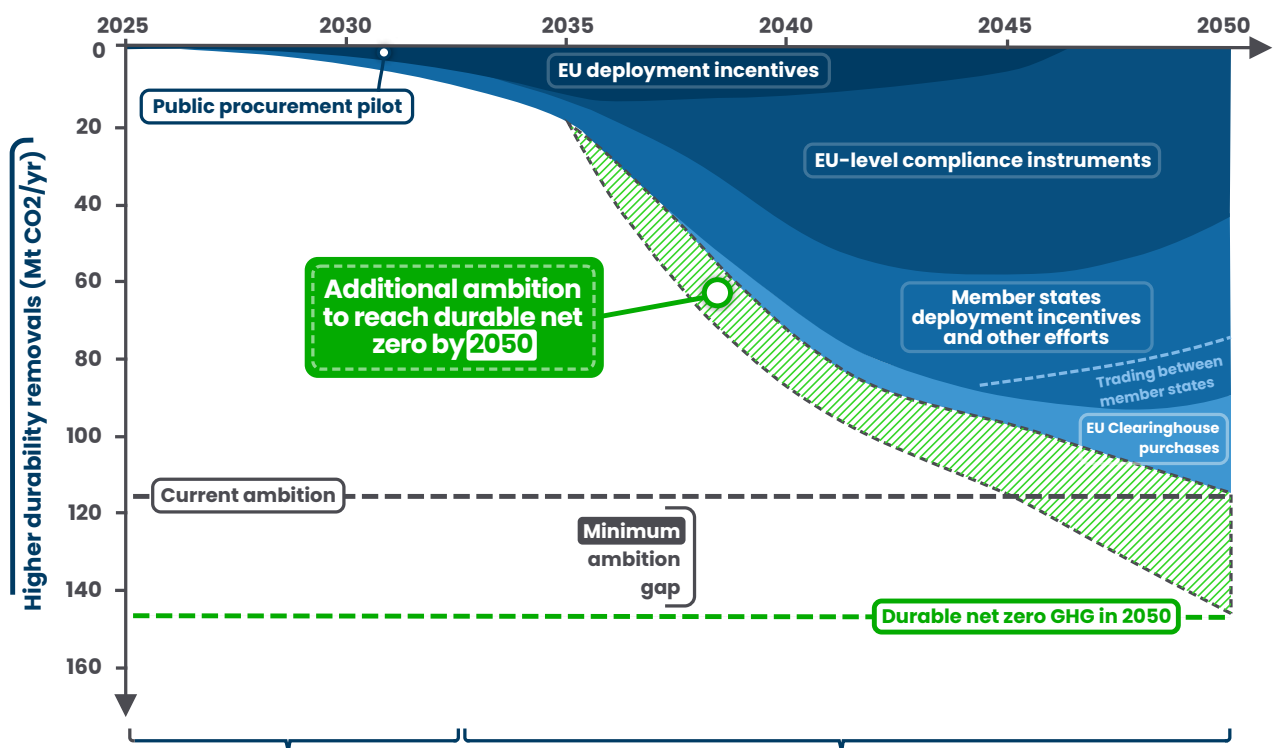


Figure 5 – Proposed combination of different *EU CDR Strategy* policies toward a higher-durability removals target. This figure shows a non-prescriptive, hypothetical depiction of relative contributions from different components of an *EU CDR Strategy* toward meeting a hypothetical higher-durability removals target. The higher-durability removals target (green dashed line) is taken from the EU 2040 targets proposal (scenario 3). Total higher-durability removals needed to reach durable net zero in 2050 (green dashed line) represent the required volume to fully compensate for remaining EU-wide fossil emissions. The initial scale-up of permanent removal capacity in the 2020s is driven by a mix of EU- and member state-level deployment incentives. Beginning in the early 2030s, CDR could be integrated into EU-wide compliance mechanisms, such as an RTS, delivering an increasing amount of removals until the mid-2040s, before declining as absolute decarbonisation of industry proceeds. Member state incentives and policies, such as deployment incentives targeting specific preferred methods and implementation of EU regulation (see above discussion of embedding CDR throughout EU legislation), could increase throughout the 2030s and 2040s. In parallel, a modest volume of removals is traded from overperforming to underperforming member states through the ESR. Finally, the EU collects contributions from member states into a Carbon Clearing-house which purchases the requisite volume of carbon removal units (CRUs) to bridge any shortfall. The ambition gap to deliver durable net zero CO₂ emissions by 2050 (full balancing of fossil emissions with higher-durability removals) would need to be addressed by ramping up policy support across the existing wedges.

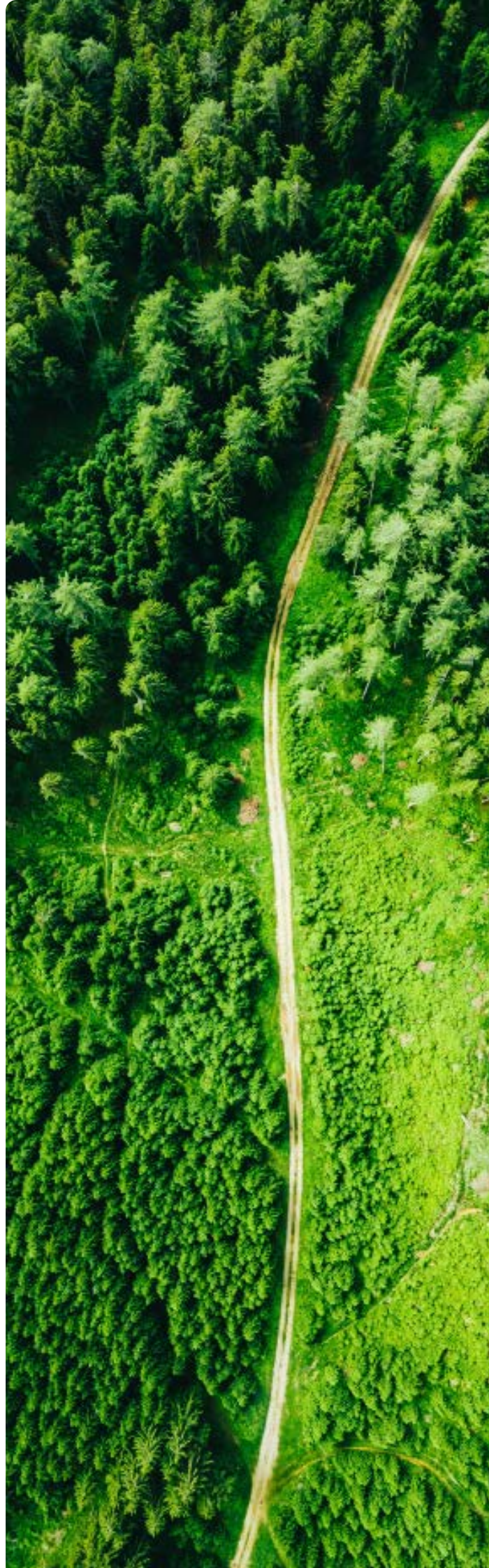


We discuss below three policies that would collectively ensure delivery of the overarching higher-durability removals target, including 3a) establishing EU-wide compliance mechanisms for higher-durability CDR in the form of ETS integration or 3b) a separate RTS, and 3c) adjusting the Effort Sharing Regulation³⁰ to allocate a portion of the removal targets to each member state whilst leveraging a CDR Clearing-house to allow for easier procurement of CDR towards delivering the target.

3a - Integration of higher-durability removals into the EU ETS

Industrial emitters may find it increasingly difficult to eliminate remaining “residual” emissions in the mid to late 2030s as EU ETS emission allowances are expected to dwindle.³¹ Ongoing policy discussions are concerned with identifying options for addressing this dearth of allowances, raising the possibility of integrating CDR into the ETS.^{32,33,34}

If the direct integration of CDR into the ETS is indeed determined to be the EU’s preferred policy option, this integration would need to establish and adhere to strong guardrails to ensure that the introduction of CDR does not impede the ETS’s integrity nor its core aim of driving emissions reductions. If CDR integration is considered, only removal methods that can provide high durability and precisely measurable climate benefits would be appropriate for matching against fossil emissions in the ETS. An initial quantitative limit on CDR supply should be introduced to test the effects of CDR integration on the ETS in a pilot phase. An adjustment of the regulatory cap on tradable allowances should also be considered to avoid CDR units substituting for necessary emissions reductions. Integrating CDR





into the ETS would furthermore require an appropriate adjustment to the Carbon Border Adjustment Mechanism (CBAM), supporting the competitiveness of covered entities.

From the perspective of scaling up carbon removal, however, the ETS would be unlikely to deliver the consistent and high-confidence price signal necessary to drive substantial volumes of higher-durability carbon removal in the requisite time. In short, higher-durability CDR could benefit the ETS depending on the parameters of integration, but the ETS is unlikely to address on its own the need for substantial scale-up of predictable demand for a portfolio of CDR methods. When shaping the pathway to meet a higher-durability CDR target, the EU should therefore deprioritise direct integration into the ETS and consider a comprehensive, longer-term policy framework instead.

3b – Creation of a Removals Trading System

An alternative proposal to ETS integration would be to introduce a new EU-wide Removals Trading System (RTS).^{35,36} A separate RTS would allow the EU to set a trajectory for the scaling up of CDR through a dedicated compliance system designed specifically for this purpose. The system would oblige a set of entities to either directly perform or purchase a minimum-and-gradually-escalating volume of CRCF-certified removals. The obligation to remove CO₂ would start at a minimal level, reflecting limited supplies of CDR in the shorter term and increase in scale over time in line with the requisite trajectory of CDR deployment.

A dedicated RTS would benefit the scale-up and governance of CDR through several characteristics. A separate removal

trading system would not require the injection of CDR certificates directly into the ETS, thereby reducing the risk of CDR certificates being used in lieu of reducing avoidable emissions. The new RTS might also reduce the need to establish an equivalence or “exchange rate” between emissions reductions and carbon removal if the removals purchased under the RTS are considered non-compensatory. It would also have the ability to go beyond net zero, continuing to drive CDR scale-up as part of achieving net negative emissions in the EU. Most importantly, it would ensure that the compliance pathway for removals is not tied to the future of the ETS.



Integrate removals into an EU-wide compliance mechanism to enlist private entities in carbon removal scale-up, such as via direct integration of CDR into the ETS under strict guardrails, or the creation of a separate RTS.

Additional advantages of a separate RTS depend on its design and implementation. A RTS could potentially cover entities both within the ETS and those that currently fall outside of the ETS, including entities that have a higher ability to pay for higher-durability removals. Responsibility to perform or purchase CDR could be tailored to different sectors, potentially motivating a wider array of removal methods. For entities currently covered under the ETS, however, carbon removal motivated by an RTS would need to remain highly durable and precisely quantified, again to avoid undesirable substitution of emissions reductions with carbon removal.

In forgoing direct integration of CDR into the ETS and instituting a separate RTS, the combined burden of the two instruments would need to be gauged, monitored or capped, depending on the extent to which there is overlap between the entities covered by each. Such an approach would serve to ensure that decarbonisation can proceed in an orderly way, in line with EU



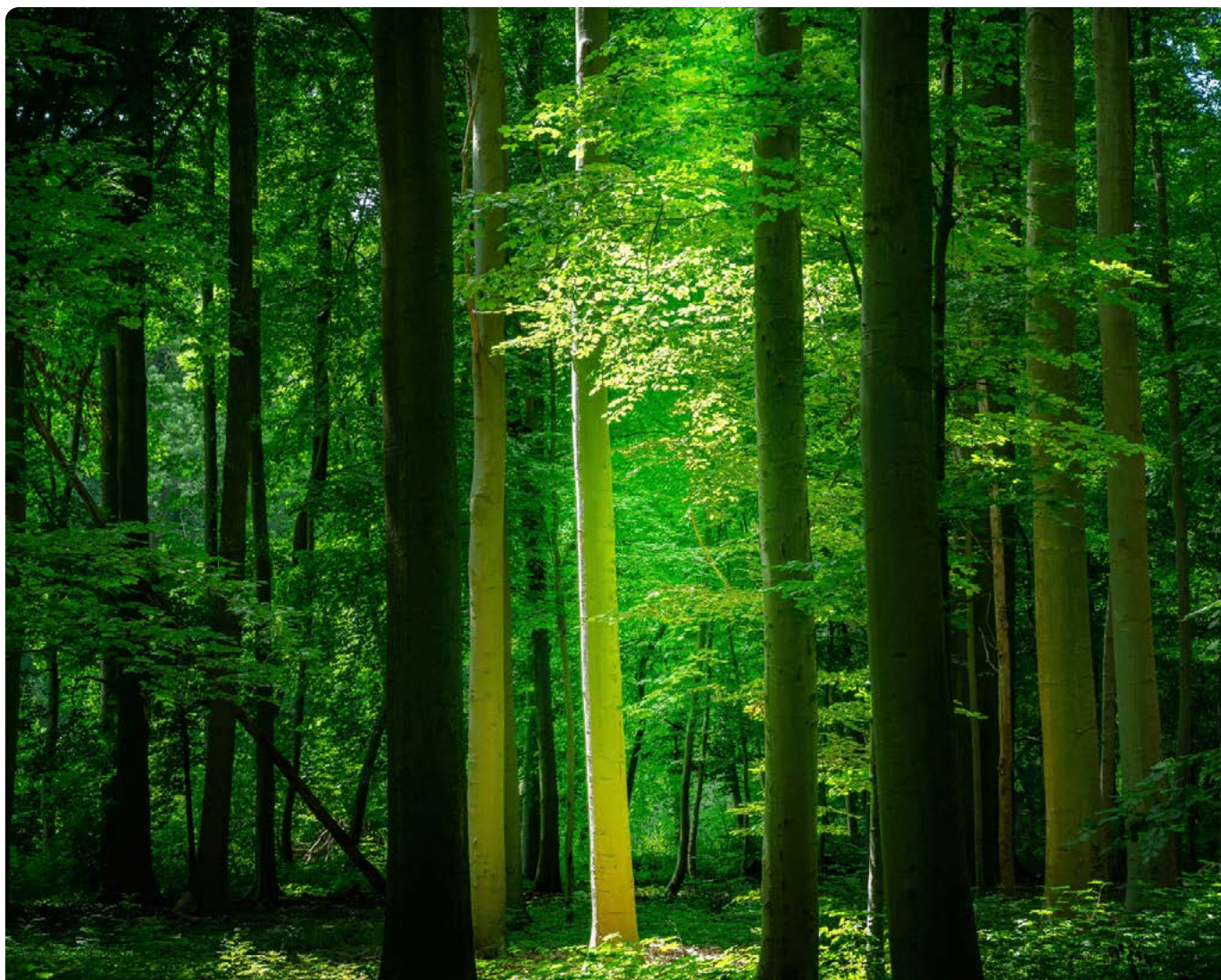
priorities and climate targets. If an RTS covers some or all of the same entities currently obliged under the ETS at the same moment in time, it could impose a “double burden” on entities that would need to both comply with ETS-motivated emissions reductions obligations and purchase CDR under an RTS concurrently. This double burden could be potentially averted by phasing in the removal obligation while phasing out obligations under the ETS in the mid-2030s. Doing so would allow an orderly, gradual handover from the ETS to an RTS as the principal EU-level decarbonisation compliance instrument.

An *EU CDR Strategy* should assess the pros and cons of these compliance mechanism options, including an RTS to harness individual economic entities across the EU to contribute to the scale-up of carbon removal. However, sustainably scaling higher-durability removals in line

with overall climate targets will also require the EU to enlist additional contributions from member states.

3c – Formalising a Removals Target under the Effort Sharing Regulation

To drive delivery of higher-durability carbon removal, the EU will need to send a clear signal by establishing a legally binding EU-wide sub-target for higher-durability removals, for example through revision to the European Climate Law.³⁷ The Commission communication on 2040 targets is a welcome step in this direction. Any removals already delivered to comply with EU-wide entity-obliging instruments such as the ETS or an RTS, and volumes already delivered by EU deployment incentives (see Pillar 2) would count towards the overall target. Figure 5 shows how these different policy instruments could motivate different volumes of deployed higher-durability



removals capacity. The EU CRCF, with its single Union-wide registry, would harmonise the quantification of climate benefit from removals delivering toward the overall target. Its registry would become the mechanism by which the Commission could track progress under the overarching *EU CDR Strategy*.

The higher-durability removals sub-target could be operationalised under the Effort Sharing Regulation (ESR), making use of the existing EU policy framework to apportion the remaining shortfall after the volumes delivered by an EU compliance mechanism (ETS or RTS) have been accounted for. Member states would then be collectively responsible for delivering the remaining portion of the overall carbon removal targets, with individual shares of the overall binding carbon targets allocated to each. Every member state would have multiple ways of fulfilling its respective share, including by launching its own deployment incentives or enacting national legislation to incentivise removals domestically in line with EU guidance (see Pillar 2, and above examples in Pillar 3). The ESR could also be used to set removal targets beyond 2050, setting targets higher than countries' residual emissions to deliver net negative emissions for the EU.

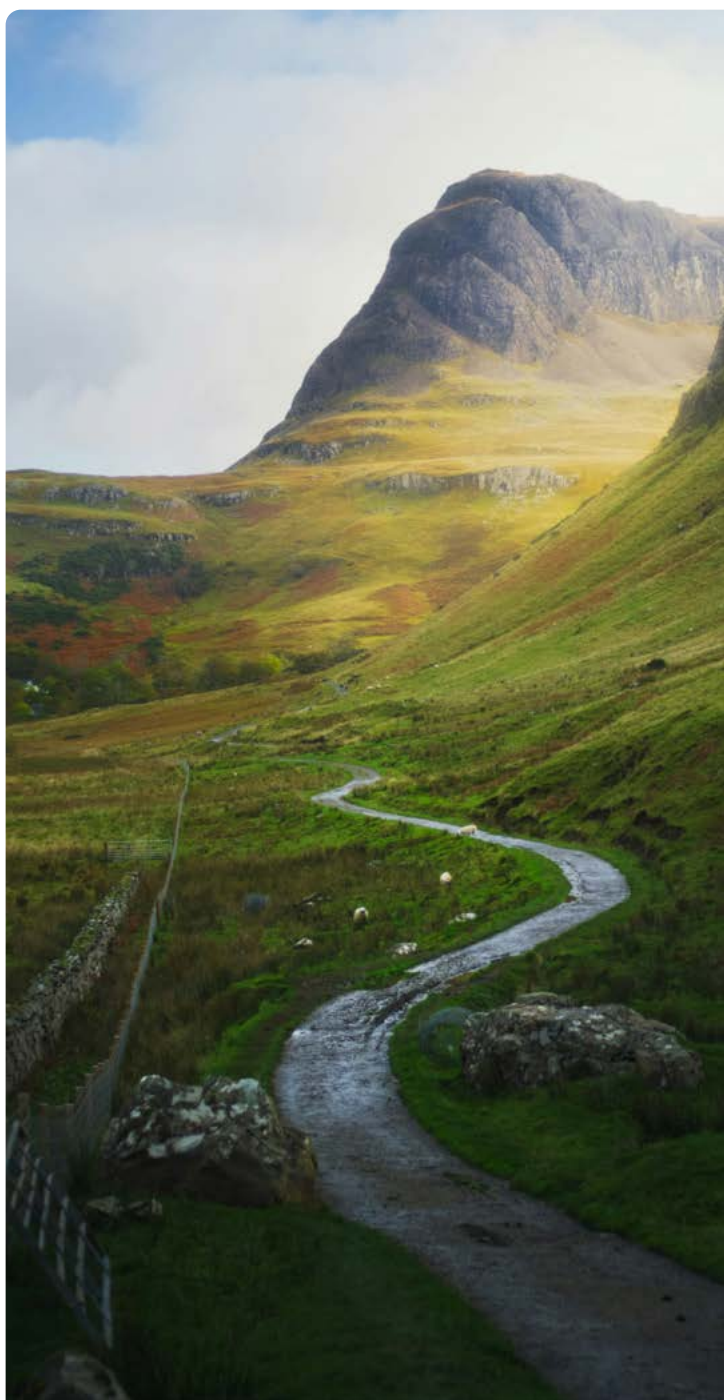


Allocate the remainder of the binding removal targets to the member states using the ESR, sharing responsibility commensurately among member states

Under the ESR, member states could also have the option of buying CRUs from other member states that have a surplus, just as the ESR currently envisions trading to balance emissions reduction efforts. Member states not able to meet their share of the removals target domestically or through trading would contribute commensurately to the Carbon Clearing-house, thereby delegating procurement

of the remaining removals to the EU entity to bridge the shortfall.

The ability of the proposed policies to support the development, deployment and governance of CDR hinges on more than their ability to deliver high-quality removals. The success of an *EU CDR Strategy* will depend on whether it can help reach EU climate targets whilst contributing in a meaningful way to a just transition in society at large. For this reason, the fourth and last pillar makes the case for ensuring just governance and deployment of carbon removal by having CDR actively contribute to a just transition that leaves no one behind.



To build trust and ensure that the scale up of CDR is done in a responsible way, the EU should strive to make the governance and deployment of CDR fair, just and inclusive.

ENSURING FAIR AND INCLUSIVE GOVERNANCE & DEPLOYMENT



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4

ENSURING FAIR AND INCLUSIVE GOVERNANCE AND DEPLOYMENT

- Why the deployment and governance of CDR in the EU should be fair, just and inclusive.
- How dedicated policies should be foreseen to enable the responsible scale-up of CDR, including considering social and environmental aspects in the funding criteria for CDR.
- How empowering stakeholders and local communities in the deployment of CDR can help build trust and create better outcomes.

The EU has shown its willingness to commit to a just and inclusive transition in the European Green Deal through policies such as the Social Climate Fund and the Just Transition Mechanism.⁴⁴ The EU has also acknowledged the importance of justice principles globally in the Paris Agreement.⁴⁵ An EU CDR Strategy should build on these positive precedents, ensuring carbon removal scales in a just, transparent and inclusive way.

CRAFTING A JUSTICE-FOCUSED LENS FOR CDR GOVERNANCE

At this early stage in the development of CDR governance, the EU needs to build the institutional capacity necessary to engage a wide range of stakeholders in a constructive way. According to the 'State of Carbon Dioxide Removal' report, awareness of CDR among the general population is low, and "how CDR is perceived will play a critical role in its future prospects".⁴⁶ It will therefore be paramount for policymakers and civil society to raise awareness around the role carbon removal could play in meeting EU and international climate goals and support the development of informed public opinions on what is a socially and technically complex topic. At the same time, as some CDR methods near deployment,

clear engagement processes should be developed to empower communities at key junctures of project development. Figure 6 shows how the four dimensions of justice could be applied to CDR.

Ensuring just governance and the fair deployment of carbon removal will be an ongoing and iterative process. The EU can both leverage existing policies and design new ones where needed to ensure that CDR is not scaled at any cost and that social and environmental guardrails are used to moderate possible impacts on society and the environment. Building on our previous work on reducing mitigation deterrence risk,⁴⁷ we propose five recommendations to enable communities, developers and policymakers to collaboratively shape the governance of carbon removal.



Four dimensions of justice applied to carbon removal

Description	Policy example	CDR considerations
PROCEDURAL Fair and transparent decision-making processes	Article 9 of the European Climate Law emphasises the key role of public participation in realising a socially fair and just transition	When and how should the public be included in CDR policy decisions, and communities be included in project-level decisions? 
DISTRIBUTIVE Fairly allocated benefits and burdens	The EU's Social Climate Fund and Just Transition Mechanism both aim to reduce the negative socio-economic impacts of Europe's green transition	How should the responsibility for carbon removal be distributed across EU member states? 
REPARATIVE Efforts to address historical injustices and prevent them from reoccurring ⁵²	The United States' Justice40 Initiative requires 40% of overall benefits from federal investments into CDR go to communities that are "marginalized, underserved, and overburdened by pollution" ⁵³	Could the removal of historical emissions constitute a form of climate reparations? ⁵⁴ 
TRANSFORMATIVE Commitment to redressing structural power imbalances at the heart of the climate crisis	The Just Transition Commission , an independent advisory body to the Scottish government, ensures just transition plans are co-designed with communities and society at large ⁵⁵	How can CDR scale in a way that does not reproduce or reinforce dynamics that led to or exacerbate climate change? 

Figure 6. Four Dimensions of justice applied to carbon removal. This table explores how four types of justice can be applied to CDR efforts to help guide the sector toward just outcomes at the local to global level.

FIVE WAYS TO ENSURE FAIR, INCLUSIVE AND JUST CDR GOVERNANCE

First, the EU should boost the European Scientific Advisory Board's capacity to engage with CDR. Doing so would ensure the Board can consult a broad range of stakeholders and fulfil their existing remit to evaluate the contribution of CDR policies towards the EU objectives stated in the European Climate Law such as "fairness and solidarity".⁴⁸ As CDR scales, the EU should establish a bespoke independent advisory body to take over these functions and monitor the development of the sector in line with social, environmental and climate mitigation principles.

 Boost the European Scientific Advisory Board's capacity to advise EU policymakers on developing CDR in a just way.

With the help of the Advisory body, the EU should help ensure that individual CDR projects meet social and environmental standards by embedding the evaluation of potential impacts into its funding criteria and specifying indicators to be monitored throughout a project's life cycle.

 Earmark funding for research into the social and ethical dimensions of CDR.

Not only should monitoring and evaluation be increased, the EU should commit to spending a share of the dedicated CDR research budget proposed in Pillar 1 on social science research, including place-based analyses to gauge localised effects of specific methods.⁴⁹



Evaluate and monitor social and environmental impacts of CDR projects as part of EU funding criteria.

In parallel to increased funding, the EU should consider launching a Carbon Removal Communities Initiative that empowers local actors to help drive CDR innovation. Like the EU's Energy Communities Initiative,⁵⁰ this programme could enable citizens to seize opportunities where their local needs align with a broader public good by providing funding to overcome upfront investments and a directory of experts to navigate legal and technical aspects.



Consider establishing a Carbon Removal Communities Initiative that empowers local actors to deploy CDR from the bottom-up.

Lastly, expanding on the model of the CCUS Forum,⁵¹ the EU should convene a CDR Forum that assembles a diversity of stakeholders including civil society and community representatives to shape carbon removal governance. A Community Code of Conduct should be co-developed by the Forum to guide CDR developers and local stakeholders in their engagement by featuring a spectrum of engagement models that can flexibly apply across projects and local contexts.



Convene a CDR Forum and support the co-development of a Community Code of Conduct for CDR.

By integrating justice principles and some of these recommendations into an *EU CDR Strategy*, the EU can cement its leading role in climate action as part of a green transition that is just, inclusive and fair.



CONCLUSION

The EU is a global leader in climate action. It has achieved this position by moving quickly and decisively to reduce emissions as part of a holistic and thorough approach. It has been consulting broadly, laying out clear objectives, and then backing up those objectives with detailed regulation. However, achieving the goals set out in the European Climate Law will require not only steep emissions reductions, but also the removal of significant quantities of carbon dioxide from the atmosphere. The EU should therefore replicate for CDR the process that enabled it to become a leader in emissions reductions. The EU now has the opportunity to extend its leadership in the climate space by taking the lead in the responsible development and deployment of carbon removal.

We hope that this document will be the start of a conversation that will lead to the creation of a comprehensive *EU Carbon Dioxide Removal Strategy* that would help guide policymakers, investors and developers alike in the years leading up to 2050. To that end, this report details 18 recommendations which we ask policymakers to consider. Collectively these would:

- 1 strategically target EU funding where it is most needed, boosting innovation and social science research, as well as de-risking investment into CDR through procurement;

- 2 make funding more accessible for CDR researchers, developers, and other stakeholders, and more transparent for civil society to scrutinise;
- 3 leverage the EU's existing climate governance regime to grow the land carbon sink, instigate demand for removals, crowd in private finance into the sector, raise urgency around RD&I, and ensure the CDR sector develops in line with EU-wide justice ideals;
- 4 develop new governance infrastructure to scale up CDR supply, aggregate demand over the long term and further galvanise private investment;
- 5 Boost the EU's institutional capacity to foster public engagement and citizen empowerment across CDR policy and project development.

An EU Carbon Dioxide Removal Strategy would create the conditions for a thriving new green sector and the achievement of EU climate goals. We encourage policymakers to develop such a strategy urgently, helping the EU shape a global approach to carbon removal that is responsible, sustainable and effective.

CONTRIBUTORS

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Carbon Gap is an independent, philanthropically funded, non-profit organisation focused on responsibly scaling up carbon dioxide removal in Europe, as an important complement to emissions reductions. We work across all carbon removal methods, bringing the best technical expertise to inform European policymaking. Our advocacy efforts are focused in Brussels, with additional staff presence in France, Germany, and the UK.

➤ GLOSSARY OF KEY TERMS

Cement recarbonation

Cement recarbonation refers to the process where part of the CO₂ emitted during cement production is re-absorbed by concrete in use through carbonation. Carbonation is a slow process that occurs in concrete where lime (calcium hydroxide) in the cement reacts with carbon dioxide from the air and forms calcium carbonate. At the end of their useful life, buildings and infrastructure (reinforced concrete structures) are demolished. If the concrete is then crushed, its exposed surface area increases, which in turn increases the recarbonation rate.⁵⁶

Clearing-house

We use the term “Clearing-house” to encompass any centralised entity performing these functions, since there may be many means of creating, hosting and empowering such an entity ranging from fully EU-controlled to a public-private partnership to a tendered 3rd party operator. An *EU CDR Strategy* should consider an array of options, including existing proposals for a “Central Carbon Bank”.⁵⁷

Deployment incentives

Deployment incentives are a broad category of financial instruments such as feed-in tariffs, procurement programmes and contracts for difference, which have all been historically instrumental in scaling up and bringing down the costs of critical climate technologies.

Durability

Durability describes a physical characteristic of stored carbon. It indicates the risk of physical reversal of the stored carbon back into the atmosphere, expressed as an annual risk. Durability is a spectrum from very high (e.g., 0.01% annual reversal risk approximates to 10,000 years expected storage time) to low (e.g., 10% annual reversal risk approximates 100 years of expected storage). In practice, we must maintain a high-level distinction between “biospheric” carbon storage, generally exposed to the constant moderate-to-high reversal risks of the short-term carbon cycle (e.g. forests, soils, peatlands, and short-lived wood building materials), and “geospheric” carbon storage which is isolated from the short-term carbon cycle.⁵⁸

Green Claims

Green claims are claims made to consumers about the environmental sustainability of a product. The proposed EU Green Claims Directive is currently being negotiated by EU co-legislators. The Directive introduces rules for the substantiation and communication of voluntary environmental claims from businesses to consumers, including climate-related claims.⁵⁹

Direct EU contribution to CDR

Direct contribution comprises resources targeted directly towards developing a removal method. Indirect contributions produce spillovers to removals methods and the ecosystem, such as developing CO₂ transport and storage or strengthening MRV systems. Carbon Gap mapped a total of EUR 613 million of direct EU funding for CDR between 2021–2023. It includes projects awarded within Horizon Europe, the Innovation Fund, and the European Innovation Council. Notable examples include the Innovation Fund awarding a grant of EUR 180 million to the Stockholm Exergi's BECCS Stockholm⁶⁰ project and the EUR 3.8 million awarded to Carbfix's Silverstone project in 2021.⁶¹

Global CDR Funding

Current estimates for total global funding need are between EUR 16–32.3 Billion based on the "Applied Innovation Roadmap"⁶² by RMI, which estimates the investment needed for research, development and demonstration (RD&D), adjusted per inflation using the Consumer Price Index 2022 (World Bank). It includes pre-demonstration (TRL 1–6) and demonstration needs (TRL 7–9); technical viability at scale is reached at TRL 9.

US direct contribution to CDR

US estimates for 2016–2023 are based on Carbon 180 CDR Funding Tracker⁶³ and include only direct and targeted funding for CDR and the share of committed funding that has been effectively disbursed to date, but excludes adjacent funding that can indirectly contribute to CDR development and the rest of the committed bills to be disbursed in the future.

- 1 [Copernicus: 2023 is the hottest year on record, with global temperatures close to the 1.5°C limit \(2024\)](#)
- 2 [Paris Agreement \(2015\)](#)
- 3 [EU Hydrogen Strategy \(2020\)](#)
- 4 [Mitigation of Climate Change. Summary for Policymakers \(2015\)](#)
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- 7 [Guide to certifying carbon removal \(2022\)](#)
- 8 [The meaning of net zero and how to get it right \(2022\)](#)
- 9 [Carbon Removal Certification Framework – Carbon Gap EU CDR Policy Tracker \(2023\)](#)
- 10 [Greens Claims Directive – Carbon Gap EU CDR Policy Tracker \(2023\)](#)
- 11 [Paris Agreement Crediting Mechanism \(no date\)](#) & [Article 6.4 Mechanism – Carbon Gap EU CDR Policy Tracker \(2023\)](#)
- 12 [Industrial Carbon Management Strategy, Net Zero Industry Act & CCS Directive – Carbon Gap EU CDR Policy Tracker \(2023\)](#)
- 13 [Securing our future Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society \(2024\)](#)
- 14 [Swiss long-term strategy \(2023\)](#) and [Fossil and biogenic CO₂ from waste incineration based on a yearlong radiocarbon study \(2012\)](#).¹⁵ [Article 6 of Paris Agreement \(2015\)](#).
- 16 [Climate Mainstreaming \(2023\)](#)
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- 18 [Carbon Removals: How to scale a new gigaton industry \(2023\)](#)
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- 24 [Greenhouse gas emissions from land use, land use change and forestry in Europe \(2023\)](#)
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- 62 [Applied Innovation Roadmap \(2023\)](#)
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ABOUT US

Carbon Gap

Carbon Gap is an independent, philanthropically funded, non-profit organisation focused on responsibly scaling up carbon dioxide removal in Europe, as an important complement to emissions reductions. We work across all carbon removal methods, bringing the best technical expertise to inform European policymaking. Our advocacy efforts are focused in Brussels, with additional staff presence in France and the UK.

www.carbongap.org

Carbon Gap

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Carbon Gap is a registered charity (charity number 1200562) and a private company limited by guarantee (company number 13357860), registered in England and Wales.

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